AGENDA ITEM 5B
July 23, 2013
Action

MEMORANDUM

TO: County Council

FROM: Michael Faden, Senior Legislative Attorney
Amanda Mihill, Legislative Attorney

SUBJECT: **Action:** Bill 35-12, Trees – Tree Canopy Conservation

Transportation, Infrastructure, Energy & Environment Committee recommendation: enact with comprehensive amendments.

Bill 35-12, Trees – Tree Canopy Conservation, sponsored by the Council President at the request of the County Executive, was introduced on November 27, 2012. A public hearing was held on January 17, 2013, along with Bill 41-12. Transportation, Infrastructure, Energy and Environment Committee worksessions were held on January 28, February 25, April 1, June 24 and July 8.

Bill 35-12 would broadly:

- establish a fee-based program to minimize and compensate for the loss and disturbance of tree canopy as a result of development;
- provide for County mitigation when tree canopy is lost or disturbed; and
- establish a fund that the County can spend for tree canopy conservation projects, including plantings of individual trees, groups of trees, or forests, on private and public property.

Background

How do other jurisdictions handle tree canopy protections? At the February 25 worksession, Committee members asked Executive staff to research other jurisdictions that have tree canopy laws and compare them to Bill 35-12. The response from DEP staff is on ©103-115. As DEP staff noted when it transmitted this material:

> This was not any easy task due to the wide variability and complexity of laws in other jurisdictions (imagine someone trying to interpret our Forest Conservation Law, which still sometimes confuses County staff). However, we hope this gives an indication that (1) other jurisdictions have enacted tree protection programs and (2) the approach to doing this varies greatly.

DEP staff also transmitted a USDA Forest Service Study on urban tree canopy retention (see ©93-102). DEP staff noted that:

> This study analyzed the recent change in the urban tree canopy in 20 jurisdictions across the country. Clearly, some of the results of this study would not be applicable to more rural areas of the County, but I think it is applicable in the more urbanized areas (which are increasing). The conclusion notes "Despite various and likely limited tree planting and protection campaigns, tree cover tends to be on the decline in U.S. cities while impervious cover is on the increase. While these individual campaigns are helping to increase or reduce the loss of urban tree cover, more widespread, comprehensive and integrated programs that focus on sustaining overall tree canopy may be needed to help reverse the trend of declining tree cover in cities."

DEP also transmitted information on several comparable jurisdictions (see ©119-131), showing that fees charged elsewhere would substantially exceed those proposed in this Bill.

How would Bill 35-12 as introduced manage the County's tree canopy? Many organizations and speakers questioned different aspects of the regulatory approach behind Bill 35-12. Committee members discussed various aspects of the introduced bill, including:

- Why does Bill 35-12 apply only to properties that must obtain a sediment control permit? Why not apply the Bill to all properties? Or trigger the restrictions after a particular amount of tree canopy is disturbed?
- How would this Bill overlap the forest conservation law? Will most properties that are subject to the forest conservation law also be subject to the tree canopy law? Should properties subject to the forest conservation law be exempt from the tree canopy law? Under Bill 35-12, any tree canopy that is identified as part of a forest in a natural resources inventory/forest stand delineation and subject to a forest conservation plan would not have to pay mitigation fees.
- Bill 35-12 would not require replacing tree canopy where it is removed (i.e., the bill does not require on-site replacement when possible). Should it?
- Bill 35-12 would set a fee based on all canopy within the limits of disturbance, regardless of how much canopy is actually removed. Should the fee structure be set according to how much canopy is removed?
- What is the appropriate fee level? As introduced, the fee would not be applied to the first 5% of the area of tree canopy disturbed. When Committee members pressed for proposed fee levels, DEP staff offered a fee scale based on the forest conservation law's fee-in-lieu payment ($1.05 at 40,000 square feet).
- What mitigation credits should be available?

Renewing Montgomery proposal

As an alternative to the fee and credit structure that DEP advocated, a group of small builders, Renewing Montgomery, proposed an **option for smaller lots (less than 20,00 square feet)** that in their view would be less expensive, fairer, less subject to administrative discretion, and result in more trees being replanted onsite. For the RM option, see ©147-153. Maryland-

National Capital Building Industry Association (BIA) endorsed their approach (see BIA letter, ©154.)

Essentially Renewing Montgomery would allow, at the owner/builder's option, the applicant to commit to plant a certain number of trees onsite, regardless of whether any trees were previously there or were removed. The applicant would have the option to pay a set in-lieu fee, somewhat lower than DEP proposed, that would be based on the cost to plant a replacement tree. Proceeds from that fee (as with the fee originally proposed) would be used to plant trees somewhere in the County. Renewing Montgomery's formula for trees on-site and in-lieu fees is shown on ©149, and site-specific examples are shown on ©150-153.

Renewing Montgomery representatives and DEP staff met and maintained a dialogue about the RM proposal. This dialogue is shown in the messages and letters on ©155-160. In its notes of a June 27 meeting (see ©160), DEP staff conceded that RM's option could be a "potentially workable alternative" if the required number of trees to be planted on a specific-sized lot were increased to account for the mortality rates of newly-planted trees. At the July 8 worksession, DEP presented 2 options that in their view were adequate alternatives to RM's option (see ©161-163). The Committee recommended DEP option 2, which would require 3 times the number of shade trees planted than under the RM option.

Committee redraft

At its fifth worksession on this Bill on July 8, the Transportation, Infrastructure, Energy, and Environment (T&E) Committee recommended enactment of a comprehensive redraft. **The Committee redraft is shown on ©1-29.** *(The text from ©2, line 2 to ©18, line 449, that is double-bracketed and italicized, was deleted in the Committee redraft.)*

This redraft, which incorporates DEP option 2 (discussed above), would:

- apply to any person required to obtain a sediment control permit, with no minimum or maximum lot size;
- exempt activity that is subject to Article II of the Forest Conservation law. Article II is the part of the FCL that requires mitigation in a long-term forest conservation plan; it does not apply to many residential single-family lots larger or smaller than 40,000 square feet;
- give each applicant for a sediment control permit the option to plant the required number of shade trees on site or pay an in-lieu fee into a tree canopy fund;
- the amount of the in-lieu fee would be based on DPS' current bonding requirement for trees in the right-of-way;
- require 400 square feet of open space per shade tree planted onsite, or a smaller amount set by Council-approved regulation;
- direct DEP to maintain a comprehensive County-wide shade tree planting plan;
- direct DEP to collect data on shade trees planted;
- direct DEP, after consulting with various government, civic, and other organization, to develop recommendations regarding tree canopy goals and a strategy to increase the number of trees planted;

- establish a Tree Canopy Conservation Account and require funds deposited into that account to be used only to plant and maintain shade trees and not be used to hire additional staff or supplant funds otherwise appropriated to plant and maintain shade trees and enhance tree canopy; and
- exempt ("grandfather") any project if DPS accepted a sediment control permit application before March 1, 2014.

Issues/Committee Recommendations

1) How much mitigation should be required? As noted above, as an alternative to Bill 35-12, Renewing Montgomery would allow, at the owner/builder's option, the applicant to commit to plant a certain number of trees onsite, regardless of whether any trees were previously there or were removed. The applicant would have the option to pay a set in-lieu fee, somewhat lower than DEP proposed, that would be based on the cost to plant a replacement tree. In response, DEP offered 2 options for the Committee's consideration. DEP option 1 would double the number of shade and ornamental trees from the RM proposal; DEP option 2 would triple the number of shade trees required, and eliminate the ornamental tree requirement. In DEP's view, triple the number of shade trees is appropriate because it takes into account tree mortality factors. Builder representatives dispute DEP's tree mortality estimates. The chart on ©163 compares the plantings required under each option. **Committee recommendation: DEP option 2.** The tree planting (or in-lieu payment) that would be required under this option for different areas of limit of disturbance is:

Area (sq. ft.) of the Limits of Disturbance		Number of Shade Trees
From	To	Required
1	6,000	3
6,001	8,000	6
8,001	12,000	9
12,001	14,000	12
14,001	40,000	15

2) How much space should be required for each tree planted? As DEP advised, the Committee redraft would require that 400 square feet be available per tree for planting purposes, or a smaller amount set by Method 1 (Council-approved) regulation (see ©23, lines 572-576). BIA and other builders argued that a smaller square footage per tree would be adequate. **Committee recommendation: require 400 square feet per tree, unless the Council approves a smaller amount by regulation.**

3) Should the Parks Department be subject to a tree planting requirement? The County Planning Board and many environmental organizations expressed concern that Bill 35-12 would cover the Parks Department in its requirements. As Board Chair Carrier noted in a letter to the Council, many park capital projects involve work under tree canopy and the Department strives to avoid, minimize, and mitigate the negative effects of park projects on native tree canopy. At the February 25 worksession, Executive staff noted that although they were willing

to amend Bill 35-12 to assure that the fee the Parks Department pays would be directed back to the Parks system, they concluded that the Parks Department should not be exempt entirely from the bill. The Committee disagreed. **Committee recommendation: exempt the County Parks Department from this tree planting requirement.**

4) What other exemptions (if any) should be allowed? Several organizations or individuals requested exemptions from the Bill's original fee requirement:

- As drafted, Bill 35-12 would exempt any tree nursery activity performed with an approved Soil Conservation and Water Quality Plan. The Soil Conservation District and the Agricultural Advisory Committee would broaden this exemption to include any agricultural or conservation activity performed with an approved Soil Conservation and Water Quality Plan. Because agricultural activities are normally not required to apply for a sediment control permit, Council staff concurs with Executive branch staff that this exemption would be unnecessary.
- Bill 35-12 would exempt any non-coal surface mining conducted in accordance with applicable state law. Tri-State Stone and Building Supply would amend the law to specifically exclude quarry operations. Council staff sees no reason to do so; the same requirements should apply to a development in a quarry as elsewhere.
  Committee recommendation: do not adopt either amendment.
- Pepco asked for an amendment, similar to language in the redraft of Bill 41-12, to clarify that utility vegetation management activities are not subject to this Bill. While Council staff concurs with Executive branch staff that those activities likely would not be covered by this Bill because, among other reasons, those activities don't require a sediment control permit, the Committee decided to make this point clear. **Committee recommendation: insert language similar to language in Bill 41-12** (see ©22, lines 535-539).
- BIA requested that Bill 35-12 exempt lots covered by the Forest Conservation Law (FCL) in order to "avoid double indemnity" and promote tree conservation. BIA argued that a property owner may have a disincentive to planting trees on potential lots because they would not be given any credit for those trees and the later lot owner would still be required to plant trees on their lot in spite of the compliance with the FCL. **Committee recommendation: exempt any activity that is subject to Article II of the Forest Conservation Law.** Article II is the part of the FCL that requires mitigation in a long-term forest conservation plan; it does not apply to many residential single-family lots.

5) Should Bill 35-12 set canopy goals? Many organizations, including Conservation Montgomery and West Montgomery County Citizens Association, urged that Bill 35-12 be amended to include specific tree canopy goals. Some individuals suggested establishing a no-net loss tree canopy goal; other organizations suggested setting a countywide goal of 55%, with a minimum goal of 40% in all areas evaluated in a county tree canopy assessment. The Bill does neither. **Committee recommendation: direct DEP, after consulting with various government, civic, and other organization, to develop recommendations regarding tree canopy goals and a strategy to increase the number of trees planted.**

6) Should the uses of the Tree Conservation Fund be restricted? Environmental and builder representatives raised concerns about the Tree Conservation Fund. Conservation Montgomery and Ashton Manor Environmental urged that the Bill be amended to assure that the

fund is not used for salaries and other administrative expenses. **Committee recommendation (3-0): add language to specify that money deposited into the Fund can't be used to fund additional County staff or supplant existing programs.**

7) Which if any projects should be grandfathered? Both attorney Timothy Dugan and Larry Cafritz requested that Bill 35-12 grandfather existing projects. The Bill did not specifically provide when it would take effect or how it would apply to projects that filed applications for sediment control permits or forest conservation law approvals before the Bill takes effect. **Committee recommendation: exempt ("grandfather") projects in which a sediment control permit application was accepted by Permitting Services before March 1, 2014.**

Councilmember Floreen amendment

Councilmember Floreen expects to offer an amendment to the Committee redraft to replace DEP Option 2, the Committee recommendation, with DEP Option 1. (See Floreen amendment, ©166, highlighted in gray.) The difference between those options is that Option 1 would require each applicant to plant 2 rather than 3 shade trees on the basic (<6000sf) lot, with that ratio maintained on larger lots, and also to plant 2 ornamental trees on the basic lot (also with the ratio maintained on larger lots). Under Option 2, no ornamental trees were required.

This packet contains:

F:\LAW\BILLS\1235 Tree Canopy Conservation Program\Action Memo.Doc

Bill No. 35-12
Concerning: Trees - Tree Canopy Conservation
Revised: 7/18/13 Draft No. 3
Introduced: November 27, 2012
Expires: May 27, 2014
Enacted:
Executive:
Effective:
Sunset Date: None
Ch. ____, Laws of Mont. Co. ____

COUNTY COUNCIL
FOR MONTGOMERY COUNTY, MARYLAND

By: Council President at the Request of the County Executive

AN ACT to:

(1) save, maintain, and establish tree canopy for the benefit of County residents and future generations;
(2) [[maximize tree canopy retention and establishment;
(3) establish procedures, standards, and requirements to minimize the loss and disturbance of tree canopy as a result of development;
(4)]] provide for mitigation [[when tree canopy is lost or disturbed]] to offset the environmental impacts of development and address the loss of environmental resources, including trees and potential growing space for shade trees;
[[(5)]] (3) establish [[a fund]] an account for shade tree [[canopy conservation]] planting projects, including plantings of individual trees[[,]] or groups of trees[[, or forests,]] on private and public property; and
[[(6)]] (4) generally revise County law regarding tree canopy conservation.

By adding
Montgomery County Code
Chapter 55, Tree Canopy
Sections 55-1, 55-2, 55-3, 55-4, 55-5, 55-6, 55-7, 55-8, 55-9, 55-10, and 55-11.

Boldface	***Heading or defined term.***
Underlining	***Added to existing law by original bill.***
[Single boldface brackets]	***Deleted from existing law by original bill.***
Double underlining	***Added by amendment.***
[[Double boldface brackets]]	***Deleted from existing law or the bill by amendment.***
* * *	***Existing law unaffected by bill.***

The County Council for Montgomery County, Maryland approves the following Act:

Sec. 1. Chapter 55 is added as follows:

[[Article 1. Purpose and General Provisions.

55-1. Short title.

This Chapter may be cited as the Montgomery County Tree Canopy Conservation Law.

55-2. Findings and purpose.

(a) Findings. The County Council finds that trees and tree canopy constitute important natural resources. Trees filter groundwater, reduce surface runoff, help alleviate flooding, and supply necessary habitat for wildlife. They cleanse the air, offset the heat island effects of urban development, and reduce energy needs. They improve the quality of life in communities by providing for recreation, compatibility between different land uses, and aesthetic appeal. The Council finds that tree and tree canopy loss as a result of development and other land disturbing activities is a serious problem in the County.

(b) Purpose. The purposes of this Chapter are to:

(1) save, maintain, and establish tree canopy for the benefit of County residents and future generations;

(2) maximize tree canopy retention and establishment;

(3) establish procedures, standards, and requirements to minimize the loss and disturbance of tree canopy as a result of development;

(4) provide for mitigation when tree canopy is lost or disturbed; and

(5) establish a fund for tree canopy conservation projects, including plantings of individual trees, groups of trees, or forests, on private and public property.

55-3. Definitions.

In this Chapter, the following terms have the meanings indicated:

Critical Root Zone means the minimum area beneath a tree. The critical root zone is typically represented by a concentric circle centering on the tree trunk with a radius equal in feet to 1.5 times the number of inches of the trunk diameter.

Development plan means a plan or an amendment to a plan approved under Division 59-D-1 of Chapter 59.

Director of Environmental Protection means the Director of the Department of Environmental Protection or the Director's designee.

Director of Permitting Services means the Director of the Department of Permitting Services or the Director's designee.

Forest conservation plan means a plan approved under Chapter 22A.

Forest stand delineation means the collection and presentation of data on the existing vegetation on a site proposed for development or land disturbing activities.

Land disturbing activity means any earth movement or land change which may result in soil erosion from water or wind or the movement of sediment into County waters or onto County lands, including tilling, clearing, grading, excavating, stripping, stockpiling, filling, and related activities, and covering land with an impermeable material.

Limits of disturbance means a clearly designated area in which land disturbance is planned to occur.

Limits of tree canopy disturbance *means all areas within the limits of disturbance where tree canopy or forest exists.*

Lot *means a tract of land, the boundaries of which have been established by subdivision of a larger parcel, and which will not be the subject of further subdivision, as defined by Section 50-1, without an approved forest stand delineation and forest conservation plan.*

Mandatory referral *means the required review by the Planning Board of projects or activities to be undertaken by government agencies or private and public utilities under Section 20-302 of the Land Use Article of the Maryland Code.*

Natural resources inventory *means a collection and presentation of data on the existing natural and environmental information on a site and the surrounding area proposed for development and land disturbing activities.*

Person *means:*

(a) To the extent allowed by law, any agency or instrument of the federal government, the state, any county, municipality, or other political subdivision of the state, or any of their units;

(b) An individual, receiver, trustee, guardian, executor, administrator, fiduciary, or representative of any kind;

(c) Any partnership, firm, common ownership community or other homeowners' association, public or private corporation, or any of their affiliates or subsidiaries; or

(d) Any other entity.

Planning Board *means the Montgomery County Planning Board of the Maryland-National Capital Park and Planning Commission, or the Planning Board's designee.*

Planning Director *means the Director of the Montgomery County Planning Department or the Director's designee.*

Preliminary plan of subdivision *means a plan for a proposed subdivision or resubdivision prepared and submitted for approval by the Planning Board under Chapter 50 before preparation of a subdivision plat.*

Project plan *means a plan or an amendment to a plan approved under Division 59-D-2 of Chapter 59.*

Public utility *means any water company, sewage disposal company, electric company, gas company, telephone company, or cable service provider.*

Qualified professional *means a licensed forester, licensed landscape architect, or other qualified professional who meets all of the requirements under Section 08.19.06.01A of the Code of Maryland Regulations or any successor regulation.*

Retention *means the deliberate holding and protecting of existing trees and forests on the site.*

Sediment control permit *means a permit required to be obtained for certain land disturbing activities under Chapter 19.*

Site *means any tract, lot, or parcel of land, or combination of tracts, lots, or parcels of land, under a single ownership, or contiguous and under diverse ownership, where development is performed as part of a unit, subdivision, or project.*

Site plan *means a plan or an amendment to a plan approved under Division 59-D-3 of Chapter 59.*

Special exception *means a use approved under Article 59-G of Chapter 59.*

Subwatershed *means the total drainage area contributing runoff to a single point, and generally refers to the 8-digit hydrologic unit codes.*

Technical Manual *means a detailed guidance document adopted under Section 55-13 and used to administer this Chapter.*

Tree *means a large, woody plant having one or several self-supporting stems or trunks and numerous branches that can grow to a height of at least 20 feet at maturity.* ***Tree*** *includes the critical root zone.*

Tree canopy *means the area of one or many crowns of the trees on a site including trees in forested areas.*

Tree Canopy Conservation Fund *means a special fund maintained by the County to be used as specified in Section 55-14.*

Tree canopy cover *means the combined area of the crowns of all trees on the site, including trees in forested areas.*

Tree canopy cover layer *means the Geographic Information System (GIS) layer, or shape file, that contains polygons outlining the aerial extent of tree canopy in the County or any portion of the County.*

55-4. Applicability.

Except as otherwise provided under Section 55-5, this Chapter applies to any person required by law to obtain a sediment control permit.

55-5. Exemptions.

This Chapter does not apply to:

(a) any tree nursery activity performed with an approved Soil Conservation and Water Quality Plan as defined in Section 19-48;

(b) any commercial logging or timber harvesting operation with an approved exemption from the requirements under Article II of Chapter 22A;

(c) cutting or clearing trees in a public utility right-of-way for the construction or modification of electric generation facilities approved under the Maryland Code Public Utilities Article if:

(1) the person cutting or clearing the trees has obtained a certificate of public convenience and necessity required under Sections 7-207 and 7-208 of the Public Utilities Article; and

(2) the cutting or clearing of forest or tree canopy is conducted so as to minimize the loss of both;

(d) routine maintenance or emergency repairs of any facility located in public utility rights-of-way;

(e) routine or emergency maintenance of an existing stormwater management facility, including an existing access road, if the person performing the maintenance has obtained all required permits;

(f) any stream restoration project if the person performing the work has obtained all necessary permits;

(g) the cutting or clearing any tree by an existing airport currently operating with all applicable permits to comply with applicable provisions of any federal law or regulation governing the obstruction of navigable airspace if the Federal Aviation Administration has determined that the trees create a hazard to aviation;

(h) cutting or clearing any tree to comply with applicable provisions of any federal, state, or local law governing the safety of dams; or

(i) any non-coal surface mining conducted in accordance with applicable state law.

Article 2. Tree Canopy Conservation Requirements, Procedures, and Approvals.

55-6. Tree Canopy – General.

(a) Submissions. A person that is subject to this Chapter must submit to either the Director of Permitting Services or the Planning Director the following information on the amount of disturbance of tree canopy.

(1) Any person required by law to obtain a sediment control permit for land disturbing activity that is not subject to Chapter 22A must submit a limits of tree canopy disturbance concurrently with the sediment control permit application to the Director of Permitting Services under Section 55-7.

(2) Any person engaging in activity that is subject to Chapter 22A must submit a limits of tree canopy disturbance concurrently with any other plan required under Chapter 22A to the Planning Director under Section 55-8.

(b) Timing of submissions. The person must submit the limits of tree canopy disturbance for review in conjunction with the review process for a sediment control permit, forest conservation plan, development plan, project plan, preliminary plan of subdivision, site plan, special exception, or mandatory referral. If a natural resources inventory/forest stand delineation is required, the person must include the aerial extent of the tree canopy with the natural resources inventory/forest stand delineation as specified in Section 22A-10.

(c) Incomplete submissions. The Director of Permitting Services or the Planning Director must not approve an incomplete submission.

(d) Review of submissions. Each submission required under this Chapter must be reviewed concurrently with the review of any submission required under Article I of Chapter 19 or Chapter 22A.

(e) Coordination of review. The Director of Permitting Services and the Planning Director may coordinate the review of any information submitted under subsection (a) with other agencies as appropriate. The reviews may be performed concurrently, and in accordance with, any review coordination required under Chapter 19 or Chapter 22A.

(f) *Time frame of validity. An approved limits of tree canopy disturbance submission remains valid for:*

(1) *not more than 2 years unless the Planning Director has approved either a final forest conservation plan or preliminary forest conservation plan that includes the limits of tree canopy disturbance;*

(2) *not more than 2 years unless a sediment control permit has been issued by the Director of Permitting Services and remains valid; or*

(3) *5 years if the accuracy of the limits of tree canopy disturbance has been verified by a qualified professional.*

(g) *Issuance of sediment control permit. The Director of Permitting Services must not issue a sediment control permit to a person that is required to comply with this Article until:*

(1) *the Planning Board or Planning Director, as appropriate, or the Director of Permitting Services has approved an applicant's limits of disturbance; and*

(2) *the applicant pays any fee required under this Article.*

55-7. Tree Canopy – Submissions to the Director of Permitting Services.

(a) *General. The limits of tree canopy disturbance information submitted to the Director of Permitting Services must document the extent of the existing area of tree canopy and the total area of tree canopy to be disturbed by the proposed activity.*

(b) *Incorporation of limits of tree canopy disturbance. The limits of tree canopy disturbance information for the subject property must be incorporated in a sediment control permit or the site plan submitted for a building permit.*

(c) *The limits of tree canopy disturbance. The limits of tree canopy disturbance information for the subject site must include:*

(1) *a map delineating:*

(A) *the property boundaries;*

(B) *the proposed limits of disturbance including any off-site areas;*

(C) *the aerial extent of existing tree canopy cover on the subject site, up to 45 feet beyond the proposed limits of disturbance;*

(D) *the intersection of aerial extent of existing tree canopy cover and the limits of disturbance; and*

(E) *any additional information specified by regulation; and*

(2) *a table summarizing the square footage of:*

(A) *the property;*

(B) *the limits of disturbance of the proposed activity;*

(C) *the aerial extent of existing tree canopy cover;*

(D) *the limits of tree canopy disturbance; and*

(E) *any additional information specified by regulation.*

(d) *Modification to limits of tree canopy disturbance. The Director of Permitting Services may approve a modification to an approved limits of tree canopy disturbance if:*

(1) *the modification is consistent with this Chapter, field inspections or other evaluations reveal minor inadequacies of the plan, and modifying the plan to remedy the inadequacies will not increase the amount of tree canopy removed as shown on the final approved plan; or*

(2) *the action is otherwise required in an emergency.*

(e) *Qualification of preparer. If a tree canopy cover layer developed by the County is available and is used without alteration, a professional engineer, land surveyor, architect, or other person qualified to prepare erosion and sediment control plans under Chapter 19 is also qualified to prepare the limits of tree canopy disturbance information under this Section. Otherwise, the limits of tree canopy disturbance information must be prepared by a qualified professional as defined in Section 08.19.06.01 of the Code of Maryland Regulations or any successor regulation.*

55-8. Tree Canopy – Submission to the Planning Director.

(a) *General. The limits of tree canopy disturbance information submitted to the Planning Director must document the extent of existing tree canopy and the total area of tree canopy to be disturbed by the proposed activity. The Planning Director may use the information to identify the most suitable and practical areas for tree conservation and mitigation.*

(b) *Limits of tree canopy disturbance. A person that is subject to this Section must submit the same limits of tree canopy disturbance information as required under Section 55-7.*

(c) *Incorporation of the limits of tree canopy, the natural resources inventory/forest stand delineation, and forest conservation plan. If an applicant is required to submit a natural resources inventory/forest stand delineation, the extent of tree canopy must be incorporated into that submission for the same area included in the natural resources inventory/forest stand delineation. If an applicant is required to submit a forest conservation plan, both the extent of tree canopy and the limits*

of tree canopy disturbance must be incorporated into that submission for the same area included in the forest conservation plan.

(d) Modification to limits of tree canopy disturbance. The Planning Director may approve a modification to an approved limits of tree canopy disturbance that is consistent with this Chapter if:

(1) field inspection or other evaluation reveals minor inadequacies of the plan, and modifying the plan to remedy those inadequacies will not increase the amount of tree canopy removed as shown on the final approved plan; or

(2) the action is required because of an emergency.

(e) Submission for special exception. If a special exception application is subject to this Chapter, the applicant must submit to the Planning Board any information necessary to satisfy the requirements of this Chapter before the Board of Appeals considers the application for the special exception.

55-9. Tree Canopy – Fee to Mitigate Disturbance.

(a) Objectives. The primary objective of this Section is the retention of existing trees. Every reasonable effort should be made to minimize the cutting or clearing of trees and other woody plants during the development of a subdivision plan, grading and sediment control activities, and implementation of the forest conservation plan.

(b) Fees paid for mitigation. Mitigation required to compensate for the loss of, or disturbance to, tree canopy must take the form of fees set by regulation under Method 3, which the applicant pays to the Tree Canopy Conservation Fund. Mitigation fees are based on the square footage of tree canopy disturbed and, therefore, increase as the amount of tree canopy disturbance increases. To provide credit for on-site

landscaping, mitigation fees must not be applied to the first 5 percent of the area of tree canopy disturbed. Canopy identified as part of any forest delineated in an approved natural resources inventory/forest stand delineation and subject to a forest conservation plan is not subject to mitigation fees under this Chapter.

Article 3. Enforcement and Appeals.

55-10. Inspections and notification.

(a) Permission to gain access. The Director of Permitting Services or the Planning Director may enter any property subject to this Chapter to inspect, review, and enforce.

(b) Plan to be on site; field markings. A copy of the approved limits of tree canopy disturbance must be available on the site for inspection by the Director of Permitting Services or the Planning Director. Field markings must exist on site before and during installation of all tree protection measures, sediment and erosion control measures, construction, or other land disturbing activities.

(c) Inspections.

(1) The Director of Permitting Services must conduct field inspections concurrently with inspections required for a sediment control permit under Article I of Chapter 19 for any activity subject to Section 55-7.

(2) The Planning Director must conduct field inspections concurrently with inspections required for a forest conservation plan for any activity subject to Section 55-8.

(3) The Director of Permitting Services or the Planning Director may authorize additional inspections or meetings as necessary to administer this Chapter.

(d) *Timing of inspections. The inspections required under this Section must occur:*

(1) *after the limits of disturbance have been staked and flagged, but before any clearing or grading begins;*

(2) *after necessary stress reduction measures for trees and roots have been completed and the protection measures have been installed, but before any clearing or grading begins; and*

(3) *after all construction activities are completed, to determine the level of compliance with the limits of tree canopy disturbance.*

(e) *Scheduling requirements. A person must request an inspection by:*

(1) *the Director of Permitting Services within the time required to schedule an inspection under Section 19-12; or*

(2) *the Planning Director within the time required to schedule an inspection under Section 22A-15.*

(f) *Coordination. The Department of Permitting Services and the Planning Department must coordinate their inspections to avoid inconsistent activities relating to the limits of tree canopy disturbance.*

55-11. Penalties and enforcement.

(a) *Enforcement authority. The Department of Permitting Services has enforcement authority for any activity approved under Section 55-7 and the Planning Board has enforcement authority for any activity approved under Section 55-8.*

(b) *Enforcement action. The Director of Permitting Services or the Planning Director may issue a notice of violation, corrective order, stop-work order, or civil citation to any person that causes or allows a violation of this Chapter.*

(c) *Civil penalty. The maximum civil penalty for any violation of this Chapter or any regulation adopted under this Chapter is $1,000. Each day that a violation continues is a separate offense.*

(d) *Other remedy. In addition to any other penalty under this Section, the Planning Board may seek any appropriate relief authorized under Section 22A-16.*

55-12. Administrative enforcement.

(a) *Administrative order. In addition to any other remedy allowed by law, the Planning Director may at any time, including during the pendency of an enforcement action under Section 55-11, issue an administrative order requiring the violator to take one or more of the following actions within the time specified by the Planning Director:*

(1) *stop the violation;*

(2) *stabilize the site to comply with a forest conservation plan;*

(3) *stop all work at the site;*

(4) *restore or reforest unlawfully cleared areas;*

(5) *submit a limits of tree canopy disturbance, forest conservation plan, or tree save plan for the net tract area;*

(6) *place forested land, reforested land, or land with individual significant trees under long-term protection by a conservation easement, deed restriction, covenant, or other appropriate legal instrument; or*

(7) *submit a written report or plan concerning the violation.*

(b) *Effectiveness of order. An order issued under this Section is effective when it is served on the violator.*

Article 4. Administration

55-13. General.

(a) *Regulations. The County Executive must adopt regulations, including technical manuals, to administer this Chapter, under Method 2. The regulations must include procedures to amend a limits of tree canopy disturbance.*

(b) *Technical manual. The technical manual must include guidance and methodologies for:*

(1) *preparing and evaluating maps of the aerial extent of the tree canopy and the limits of tree canopy disturbance;*

(2) *providing protective measures during and after clearing or construction, including root pruning techniques and guidance on removing trees that are or may become hazardous;*

(3) *monitoring and enforcing the limits of disturbance and the limits of tree canopy disturbance; and*

(4) *other appropriate guidance for program requirements consistent with this Chapter and applicable regulations.*

(c) *Administrative fee. The Planning Board and the County Executive may each, by Method 3 regulation, establish a schedule of fees to administer this Chapter.*

(d) *Reports. On or before March 1 of each year, the Department of Permitting Services, the Planning Board, and the Department of Environmental Protection each must submit an annual report on the County tree conservation program to the County Council and County Executive.*

(e) *Comprehensive plan for mitigation. The Department of Environmental Protection must develop and maintain a comprehensive County-wide plan to mitigate disturbance to tree canopy. The Department of Environmental Protection should develop the plan in consultation*

with the Planning Department, the Department of Transportation, the Department of General Services, the Department of Economic Development, the Soil Conservation District, and other agencies as appropriate.

(f) Sediment control permit application. To prevent circumvention of this Chapter, the Planning Director and the Director of Permitting Services may require a person to submit an application for a sediment control permit enforceable under this Chapter if that person:

(1) limits the removal of tree canopy or limits land disturbing or construction activities to below requirements for a sediment control permit; and

(2) later disturbs additional tree canopy or land on the same property, or by any other means, such that in total, a sediment control permit would be required.

55-14. Tree Canopy Conservation Fund.

(a) General. There is a County Tree Canopy Conservation Fund. The Fund must be used in accordance with the adopted County budget and as provided in this Section.

(b) Mitigation fees paid into the Tree Canopy Conservation Fund. Money deposited in the Tree Canopy Conservation Fund to fulfill mitigation requirements must be spent on establishing and enhancing tree canopy, including costs directly related to site identification, acquisition, preparation, and other activities that increase tree canopy, and must not revert to the General Fund. The Fund may also be spent on permanent conservation of priority forests, including identification and acquisition of a site within the same subwatershed where the disturbance occurs.

(c) Fines paid into the Tree Canopy Conservation Fund. Any fines collected for noncompliance with a limits of tree canopy disturbance or forest conservation plan related to tree canopy disturbance must be deposited in a separate account in the Tree Canopy Conservation Fund. The Fund may be used to administer this Chapter.

(d) Use of the Tree Canopy Conservation Fund.

(1) Any fees collected for mitigation must be used to:

(A) establish tree canopy;

(B) enhance existing tree canopy through non-native invasive and native invasive species management control, supplemental planting, or a combination of both;

(C) establish forest; and

(D) acquire protective easements for existing forests or areas with existing tree canopy that are not currently protected, including forest mitigation banks approved under Section 22A-13.

(2) The canopy established under paragraph (1)(A) should shade impervious surfaces, manage stormwater runoff, and generally increase tree canopy coverage. Trees native to the Piedmont area of the County should be used, if feasible, to meet the mitigation requirements of this Chapter.

(3) The establishment of tree canopy to satisfy the mitigation requirements of a project must occur in the subwatershed where the project is located. Otherwise the tree canopy may be established anywhere in the County.]]

Article 1. Purpose and General Provisions.

55-1. Short title.

This Chapter may be cited as the Montgomery County Tree Canopy Law.

55-2. Findings and purpose.

(a) *Findings.* The County Council finds that it is in the public interest to offset the environmental impacts of development and address the loss of environmental resources, including trees and potential growing space for shade trees, and conserve tree canopy throughout the County. Trees and tree canopy constitute important environmental resources. Trees cleanse the air, offset the heat island effects of urban development, reduce energy needs, and provide oxygen. They improve the quality of life in communities by providing for a greater sense of well-being and increasing esthetic appeal and compatibility between different land uses. Trees filter groundwater, reduce surface runoff and soil erosion, help alleviate flooding, and supply necessary habitat for a diversity of wildlife. The Council finds that the damage to or loss of environmental resources as a result of development and other land disturbing activities is a serious problem in the County, and that establishing shade trees and tree canopy helps mitigate these losses and increase the diversity of species and age classes of trees. The Council finds that, given the expected survival rate of newly planted shade trees, at least 3 new shade trees should be planted to produce the canopy coverage of one mature shade tree.

(b) *Purpose.* The purposes of this Chapter are to:

(1) save, maintain, and establish tree canopy for the benefit of County residents and future generations; and

(2) provide for mitigation when environmental resources, including trees and potential growing space for shade trees, are lost or disturbed as a result of development, by establishing:

(A) shade and ornamental tree planting requirements and standards; and

(B) a program to plant shade trees, including planting individual trees or groups of trees, on private and public property.

55-3. Definitions.

In this Chapter, the following terms have the meanings indicated:

Department means the Department of Permitting Services.

Director means the Director of the Department of Permitting Services or the Director's designee.

Limits of disturbance means a clearly designated area where land disturbance is expected to occur.

Person means:

(a) to the extent allowed by law, any agency or instrument of the federal government, the state, any county, municipality, or other political subdivision of the state, or a unit of any of them;

(b) an individual, receiver, trustee, guardian, executor, administrator, fiduciary, or representative of any kind;

(c) any partnership, firm, common ownership community or other homeowners' association, public or private corporation, or a affiliate or subsidiary of any of them; or

(d) any other entity.

Public utility means any water company, sewage disposal company, electric company, gas company, telephone company, or cable service provider.

Sediment control permit means a permit required to be obtained for certain land disturbing activities under Chapter 19.

Shade tree means a tree of large stature that is capable of growing to heights greater than 50 feet.

Site means any tract, lot, or parcel of land, or combination of tracts, lots, or parcels of land, under a single ownership, or contiguous and under diverse ownership.

Subwatershed means the total drainage area contributing runoff to a single point, and generally refers to the 8-digit hydrologic unit codes.

Technical Manual means a detailed guidance document that may be adopted under Section 55-9 and used to administer this Chapter.

Tree canopy means the area covered by the crown of one or more trees.

Tree Canopy Conservation Account means a special account maintained by the County to be used as specified in Section 55-10.

55-4. Applicability.

Except as otherwise provided in Section 55-5, this Chapter applies to any person required by law to obtain a sediment control permit.

55-5. Exemptions.

This Chapter does not apply to:

(a) any activity that is subject to Article II of Chapter 22A;

(b) any commercial logging or timber harvesting operation with an approved exemption from Article II of Chapter 22A;

(c) any tree nursery activity performed with an approved Soil Conservation and Water Quality Plan as defined in Section 19-48;

(d) cutting or clearing trees in a public utility right-of-way for the construction or modification of electric generation facilities approved under the Maryland Code Public Utilities Article if:

(1) the person cutting or clearing the trees has obtained a certificate of public convenience and necessity required under Sections 7-207 and 7-208 of the Public Utilities Article; and

(2) the cutting or clearing of forest or tree canopy is conducted so as to minimize the loss of both;

(e) routine maintenance of a public utility right-of-way, and cutting or clearing any tree by a public utility as necessary to comply with applicable vegetation management requirements, to maintain, repair, replace, or upgrade any public utility transmission or distribution line, or for a new transmission or distribution line;

(f) any activity conducted by the County Department of Parks;

(g) routine or emergency maintenance of an existing stormwater management facility, including an existing access road, if the person performing the maintenance has obtained all required permits;

(h) any stream restoration project if the person performing the work has obtained all necessary permits;

(i) cutting or clearing any tree by an existing airport currently operating with all applicable permits to comply with applicable provisions of any federal law or regulation governing the obstruction of navigable airspace if the Federal Aviation Administration has determined that the trees create a hazard to aviation;

(j) cutting or clearing any tree to comply with applicable provisions of any federal, state, or local law governing the safety of dams;

(k) any development activity permitted as a small land disturbing activity under Section 19-5B; or

(l) any non-coal surface mining conducted in accordance with applicable state law.

Article 2. Mitigation Requirements and Review.

55-6. Shade Tree Planting.

(a) *Alternatives*. An applicant for a sediment control permit must plant shade trees on the affected property or, if the applicant opts not to plant the required number of trees, pay a fee under subsection (d).

(b) *Quantity*. The number of shade trees required to be planted under this Section must be based on the square footage of the area in the limits of disturbance.

(1) Unless modified or superseded by applicable regulations adopted under Method 1, the number of shade trees planted must comply with the following schedule:

Area (sq. ft.) of the Limits of Disturbance		Number of Shade Trees Required
From	To	
1	6,000	3
6,001	8,000	6
8,001	12,000	9
12,001	14,000	12
14,001	40,000	15

(2) If the area in the limits of disturbance exceeds 40,000 square feet, the minimum number of shade trees required must be prorated using the ratio of 15 trees per 40,000 square feet.

(c) *Planting*. Each planting of shade trees under this Section must conform to the following requirements:

(1) Each shade tree must be allowed at least 400 square feet, unless applicable regulations adopted under Method 1 specify a smaller amount, of open surface area free of any impervious surface, utility, stormwater management system, or other impediment to root growth and development.

(2) Shade trees may be planted anywhere on the subject property, including outside the limits of disturbance if sufficient open surface area is available entirely within the property boundaries. Open surface area on an adjacent County right-of-way may be included if no utility, public utility easement, or impervious surface is located in that part of the right-of-way and the tree is located on the affected property so that its stem will not grow into the right-of-way.

(d) *Fees.* If the applicant concludes that any required shade tree cannot be planted on the affected property because sufficient open surface area is not available or for any other reason, the applicant must pay into the Tree Canopy Conservation Account a fee for each required shade tree that is not planted on the affected property. The fee must be equal to the applicable rate the Department sets for bonding trees in the right-of-way.

55-7. Submissions.

(a) *Required submissions.* A person subject to this Chapter must submit to the Director the following information with each application for a sediment control permit:

(1) a plan delineating:

(A) the property boundaries;

(B) the proposed limits of disturbance, including any off-site areas;

(C) any shade tree planting locations and the required open surface area for each planting location;

(2) a table summarizing:

(A) the square footage of the property;

(B) the square footage of the limits of disturbance of the proposed activity;

(C) the number of shade trees required under Section 55-6(b), the number of shade trees to be planted, and the amount of fees to be paid under Section 55-6(d); and

(D) the open surface area surrounding each shade tree planting location; and

(3) any additional information specified by regulation.

(b) *Qualification of preparer.* A professional engineer, land surveyor, architect, or other person qualified to certify an erosion and sediment control plan under Chapter 19 is also qualified to submit the information required under this Chapter.

(c) *Incomplete submissions.* The Director must not accept an incomplete submission.

(d) *Review of submissions.* Each submission required under this Chapter must be reviewed along with any submission required under Article I of Chapter 19.

(e) *Coordination of review.* The Director may coordinate the review of any information submitted under subsection (a) with one or more other agencies as appropriate. If the Director coordinates the review with other agencies, the reviews must be performed concurrently and in accordance with any review coordination required under Chapter 19.

(f) *Issuance of sediment control permit.* The Director must not issue a sediment control permit to a person that is subject to this Chapter until:

(1) the Director has approved the applicant's planting plan;

(2) the applicant pays any fee required under this Article; and

(3) the applicant has satisfied all applicable requirements under Article I of Chapter 19.

(g) *Validity period.* An approved shade tree planting plan remains valid for the length of the associated sediment control permit.

(h) *Application requirement.* To prevent circumvention of this Chapter, the Director may require a person to apply for a sediment control permit if that person limits the removal of tree canopy or limits land disturbing or construction activities below the requirements for a sediment control permit and within the next 10 years disturbs additional tree canopy or land on the same property, or conducts other activities, such that in the aggregate a sediment control permit would have been required.

55-8. Inspections.

(a) *Permission to gain access.* The Director may enter any property permitted under this Chapter to inspect the property and enforce this Chapter while the permit is in effect.

(b) *Plan to be on site; field markings.* A copy of the approved limits of disturbance, including shade tree species, planting locations and minimum open surface areas, must be available on the site for inspection by the Director. Field markings must exist on site before and during installation of all newly planted shade trees, sediment and erosion control measures, construction, or other land disturbing activities.

(c) *Inspections.* The Director must conduct field inspections for any activity subject to this Chapter along with any inspection required for a sediment control permit under Article I of Chapter 19. The Director

may authorize additional inspections or meetings as necessary to administer this Chapter.

(d) *Timing of inspections.* The inspections required under this Section must occur after all construction activities are completed to determine the level of compliance with shade tree planting requirements.

Article 3. Administration.

55-9. General.

(a) *Regulations.* Except as otherwise provided, the County Executive must adopt regulations, including a technical manual, to administer this Chapter, under Method 2.

(b) *Technical manual.* The technical manual must include guidance and methods to:

(1) identify, map, and evaluate the suitability of planting site locations, including acceptable shapes of open surface areas and the use of County rights-of-way;

(2) identify criteria for acceptable species, sizes, and health of newly planted shade trees;

(3) identify criteria for acceptable installation techniques; and

(4) otherwise comply with program requirements, consistent with this Chapter and applicable regulations.

(c) *Administrative fee.* The County Executive may, by Method 2 regulation, adopt a schedule of fees to administer this Chapter.

(d) *Reports.* On or before March 1 of each year, the Directors of Permitting Services and Environmental Protection must jointly submit an annual report on the County shade tree planting program to the County Council and County Executive.

(e) *Comprehensive planting plan.* The Director of Environmental Protection must adopt and maintain a comprehensive County-wide shade tree planting plan to specify appropriate uses for funds in the Tree Canopy Conservation Account. The Director should develop the plan after consulting other County agencies and the Planning Department.

(f) *Survival and mortality analysis.* The Department of Environmental Protection must collect data on shade trees planted under this Chapter, and those planted under other programs, to evaluate and provide guidance to the County's tree canopy programs.

(g) *Tree canopy plan.* The Director of Environmental Protection, after consulting other County agencies, the Planning Department, the Forest Conservation Advisory Committee, organizations representing development and environmental interests, and the public, must propose to the Executive and Council recommendations regarding:

(1) tree canopy goals for the County; and

(2) a comprehensive strategy to increase the number of trees planted in the County.

55-10. Tree Canopy Conservation Account.

(a) *Established.* A Department assigned by the Executive must create a County Tree Canopy Conservation Account. The Account must be used as provided in this Chapter and the adopted operating budget.

(b) *Use of funds.* The assigned Department must use funds deposited in the Tree Canopy Conservation Account only to plant and maintain shade trees, including costs directly related to site identification, preparation, and other activities that increase tree canopy. Funds deposited into the Account must not revert to the General Fund and must not be used to

hire additional County staff or to supplant funds otherwise appropriated to plant and maintain shade trees and enhance tree canopy.

(c) *Fines.* Any fines collected for noncompliance with shade tree planting requirements must be deposited in a separate account in the Tree Canopy Conservation Account and must be used to administer this Chapter.

(d) *Plantings.*

(1) Shade trees native to the Piedmont area of the County should be used, if feasible, to meet the mitigation requirements of this Chapter.

(2) The planting of shade trees under this Chapter must occur in the subwatershed where the project is located if feasible. Otherwise the shade trees may be planted anywhere in the County.

55-11. Enforcement.

(a) *Compliance.* The Director may issue a notice of violation, corrective order, stop-work order, or civil citation to any person that causes or allows a violation of this Chapter.

(b) *Civil penalty.* A violation of this Chapter is a Class A violation. The maximum civil penalty for any violation of this Chapter or any regulation adopted under this Chapter is $1,000. Each day that a violation continues is a separate offense.

Sec. 2. Effective date; transition.

This Act takes effect on March 1, 2014. County Code Chapter 55, as inserted by this Act, does not apply to any application for a sediment control permit accepted by the Director of Permitting Services before that date.

LEGISLATIVE REQUEST REPORT

Bill 35-12
Tree Canopy Conservation

DESCRIPTION: This bill introduces requirements for fees when tree canopy is disturbed. Generally, it applies when a sediment control permit is required under Chapter 19 of the Montgomery County Code and the trees are not subject to Article II of Chapter 22A. The bill requires the fees to be used to plant new trees to mitigate for the loss of benefits provided by the tree canopy. The new trees will be located using a comprehensive approach to enhancing tree canopy across the County.

PROBLEM: Currently, the Forest Conservation Law (FCL) does not apply to most disturbances to individual trees outside of forests during development. Also, it does not apply to development activity on lots less than approximately one acre. In recent years, a significant increase in development activity on small lots that are not subject to the FCL has raised awareness of the value of trees to all residents, as well as the need to provide communities some compensation for the loss of trees when development occurs.

GOALS AND OBJECTIVES: This bill is designed to provide mitigation for the loss or disturbance to tree canopy not currently regulated by the FCL, as well as specifying that the fees will be used to plant trees across the county using a comprehensive approach that will enhance the existing canopy.

COORDINATION: Department of Permitting Services, Maryland-National Capital Park & Planning Commission, Department of Environmental Protection

FISCAL IMPACT: See Fiscal and Economic Impact Statement

ECONOMIC IMPACT: See Fiscal and Economic Impact Statement

EVALUATION:

EXPERIENCE ELSEWHERE: The Forest Conservation Law, Chapter 22A of the Montgomery County Code, requires mitigation when forest land and/or champion trees, as well as certain other vegetation, are disturbed.

SOURCE OF INFORMATION: Stan Edwards, Division Chief, Division of Environmental Policy and Compliance, Department of Environmental Protection (7-7748)

APPLICATION WITHIN MUNICIPALITIES: This bill applies to all municipalities if the land disturbing activity requires a sediment control permit under Chapter 19 of the Montgomery County Code that is approved and enforced by the Department of Permitting Services.

PENALTIES: Class A

OFFICE OF THE COUNTY EXECUTIVE
ROCKVILLE, MARYLAND 20850

Isiah Leggett
County Executive

MEMORANDUM

October 25, 2012

TO: Roger Berliner, President
County Council

FROM: Isiah Leggett
County Executive

SUBJECT: Proposed Legislation: Tree Canopy Conservation Program

I am transmitting for Council introduction a bill that creates a Tree Canopy Conservation Program which is intended to protect and enhance the County's valuable tree canopy. I am also transmitting a Legislative Request Report, Fiscal Impact Statement, and Economic Impact Statement.

This bill introduces requirements for fees when tree canopy is disturbed as a result of development activity. Generally, the bill applies when a sediment control permit is required under Chapter 19 of the Montgomery County Code and the trees are not subject to the County's Forest Conservation Law (FCL). The bill requires the fees to be used to plant new trees to mitigate the loss of benefits that were provided by the disturbed tree canopy.

When the FCL was adopted, the majority of development in the County was occurring on large, previously undeveloped parcels, much of which was forested. The FCL was intended to provide compensation for the loss of forested land through the long-term protection of undisturbed forest or the planting of new forests. As the amount of undeveloped land in the County has diminished, the majority of development is now occurring on smaller, previously undeveloped "in-fill" properties or as the result of redevelopment of previously built-out sites. While these parcels contain few forests, they often contain significant tree canopy due to the presence of individual trees or clusters of trees not meeting the definition of a forest. These trees provide significant benefits to communities, including helping to reduce ambient temperatures, clean the air, manage stormwater, and generally increasing the economic value of the property. However, the majority of these trees are not covered under the FCL and, as a result, there is no mechanism requiring compensation for the loss of these trees.

The Tree Canopy Conservation Program would be implemented by the Department of Permitting Services or the Montgomery County Planning Department, depending on the nature of the development activity. The process has been designed to be as streamlined as possible by incorporating tree canopy review into the existing sediment control permitting process or the existing FCL review process. The bill outlines the process for determining the extent of disturbed tree canopy subject to regulation, but the specific fee structure would be set by regulation.

If you have any questions about this bill, please contact Bob Hoyt, Director of the Department of Environmental Protection, at 240-777-7730 or bob.hoyt@montgomerycountymd.gov.

Attachments (4)

c. Bob Hoyt, Director Department of Environmental Protection
Joe Beach, Director, Finance Department
Kathleen Boucher, Assistant Chief Administrative Officer
Marc Hansen, County Attorney
Diane Jones, Director, Department of Permitting Services
Jennifer Hughes, Director, Office of Management and Budget

ROCKVILLE, MARYLAND

MEMORANDUM

September 25, 2012

TO: Timothy L. Firestine, Chief Administrative Officer

FROM: Jennifer A. Hughes, Director, Office of Management and Budget
Joseph F. Beach, Director, Department of Finance

SUBJECT: Bill XX-12 – Tree Canopy Conservation

Please find attached the fiscal and economic impact statement for the above-referenced legislation.

JAH:ms

Attachment

c: Kathleen Boucher, Assistant Chief Administrative Officer
Lisa Austin, Offices of the County Executive
Joy Nurmi, Special Assistant to the County Executive
Patrick Lacefield, Director, Public Information Office
Michael Coveyou, Department of Finance
David Platt, Department of Finance
Stan Edwards, Department of Environmental Protection
Barbara Comfort, Department of Permitting Services
Reginald Jetter, Department of Permitting Services
Alex Espinosa, Office of Management and Budget
Amy Wilson, Office of Management and Budget
Matt Schaeffer, Office of Management and Budget
Naeem Mia, Office of Management and Budget

Fiscal Impact Statement
Bill XX-12 – Tree Canopy Conservation

1. **Legislative Summary**
The proposed bill revises County law regarding tree canopy conservation in an effort to save, maintain, and establish tree canopy for the benefits of County residents and future generations. The bill would maximize tree canopy retention and establishment by establishing fees to be assessed when disturbance to the tree canopy occurs; these fees would then fund mitigation activities to restore the disturbed tree canopy.

The Department of Permitting Services (DPS) and the Maryland National Capital Park and Planning Commission (M-NCPPC) will administer the law; the Department of Environmental Protection (DEP) will have oversight of tree canopy restoration activities.

2. **An estimate of changes in County revenues and expenditures regardless of whether the revenues or expenditures are assumed in the recommended or approved budget. Includes source of information, assumptions, and methodologies used.**
DEP has indicated that new work created as a result of this legislation (tree canopy restoration activities) will have costs that will correlate to the amount of received fees. While the cost of future work is not known, DEP has asserted that any future costs related to tree canopy restoration activities will not exceed collected fees.

A. M-NCPPC has estimated a cost of $12,480 annually and a one-time first-year expenditure of $3,600 related to planning the tree canopy restoration policies outlined in the bill. Some of the specific planning activities related to tree canopy restoration conducted by MNCPPC[1] include:

- Development of a planting plan (One-time investment of 20 work hours)
- Annual Report development (20 work hours)
- Development of a Fee Schedule (One-time investment of 40 work hours)
- Annual adjustment of fee schedules (8 work hours)
- Plan Review Time (60 forest conservation plans per year @ 3 hours per plan)

B. DPS has indicated fiscal impacts relating to the inspection and fine assessments of tree canopy disturbance of approximately $67,118 annually in the following work areas:

500 additional inspection and assessment projects ($25,752/annually)

- **Permit Technicians (250 work hours): $8,878**
(.5 Hrs each project @ Grade 19 midpoint salary of $56,828 plus benefits[2] or $35.51/hr)
- **Permit Services Specialists/Plan Reviewers (125 work hours): $6,166**
(.25 Hrs each project @ Grade 26 midpoint salary of $78,929 plus benefits or $49.33/hr)
- **Inspectors (250 work hours): $10,708**
(.5 Hrs each project @ Grade 23 midpoint salary of $68,531 plus benefits or $42.83/hr)

200 additional complaints relating to tree loss ($41,366/annually)

- **Permit Technicians (200 work hours): $7,102**
(1 Hr each project @ Grade 19 midpoint salary of $56,828 plus benefits or $35.51/hr)

[1] Cost estimates are based on a rate of $60 per hour.
[2] Benefit calculation is 30 percent of base pay.

- **Inspectors (800 work hours): $34,264**
  (4 Hrs each project @ Grade 23 midpoint salary of $68,531 plus benefits or $42.83/hr)

Revenues resulting from this legislation will depend on the determination of a rate model for tree canopy disturbance fees. The rate model will be established via method 2 regulation.

3. **Revenue and expenditure estimates covering at least the next 6 fiscal years.**
DEP has indicated that new work created as a result of this legislation (tree canopy restoration activities) will have costs that will correlate to the amount of received fees. While the cost of future work is not known, DEP has asserted that any future costs related to tree canopy restoration activities will not exceed collected fees.

DPS reports future expenditures of approximately $62,118 annually (as explained above). The total six-year expenditures for DPS are approximately **$402,708**.

M-NCPPC reports annual expenditures of $12,480 with a one-time startup charge of $3,600 to implement the planning and implementation plan for the bill (as explained above). Total six-year expenditures for M-NCPPC are approximately **$78,480**.

Revenues resulting from this legislation will depend on the determination of a rate model for tree canopy disturbance fees. The rate model will be established via method 2 regulation.

4. **An actuarial analysis through the entire amortization period for each bill that would affect retiree pension or group insurance costs.**
Not applicable. This bill does not affect retiree pension or group insurance costs.

5. **Later actions that may affect future revenue and expenditures if the bill authorizes future spending.**
The bill authorizes the creation of a Tree Canopy Conservation Fund that would fund tree canopy restoration activities in the future.

6. **An estimate of the staff time needed to implement the bill.**
While DEP does not expect the need for additional staff time to implement the bill, future staff needs could change depending on the extent of tree canopy restoration activities resulting from the bill.

DPS reports the need for an additional 1,625 work hours annually in different job classes to implement the bill.

MNCPPC reports the need for an additional 208 hours annually and 60 hours to start up the program in the first year of implementation.

7. **An explanation of how the addition of new staff responsibilities would affect other duties.**

While DEP does not expect the need for additional staff time to implement the bill, the actual impact on staff will depend on the extent of tree canopy restoration activities as a result of implementing the bill.

DPS reports that the bill would impact both the workload of permitting staff and permit reviewing staff. Estimates for costs of additional work are provided above.

M-NCPPC reports that the bill would impact the workload of forest conservation planners. Estimates for costs of addition work are provided above.

8. **An estimate of costs when an additional appropriation is needed.**
Not applicable.

9. **A description of any variable that could affect revenue and cost estimates.**
DEP has indicated that costs and revenues relating to tree canopy restoration will be dependent on the amount of fees received. The rate model for fees will be established by method 2 regulation.

Article IV, Section 55-13(c) allows for the establishment of a fee for administering the program; this fee would be adopted under method 3. An administrative fee has not been established but could impact revenue and cost estimates.

Article III, Section 55-11(c) establishes a maximum $1,000 civil penalty for violation of the proposed legislation. Fines would be deposited into the Tree Canopy Conservation Fund and could be used to implement any part of the bill. Estimates of revenue from these fines are difficult to predict without knowing the extent of the violations.

10. **Ranges of revenue or expenditures that are uncertain or difficult to project.**
DEP has indicated that costs and revenues relating to tree canopy restoration will be dependent on the amount of fees received. The rate model for fees will be established by method 2 regulation.

Article IV, Section 55-13(c) allows for the establishment of a fee for administering the program; this fee would be adopted under method 3. An administrative fee has not been established but could impact revenue and cost estimates.

Article III, Section 55-11(c) establishes a maximum $1,000 civil penalty for violation of the proposed legislation. Fines would be deposited into the Tree Canopy Conservation Fund and could be used to implement any part of the bill. Estimates of revenue from these fines are difficult to predict without knowing the extent of the violations.

11. **If a bill is likely to have no fiscal impact, why that is the case.**
Not applicable.

12. Other fiscal impacts or comments.
This bill creates a Tree Canopy Conservation Fund as the account for fees collected as a result of tree canopy disturbance and the source of funds for tree canopy restoration projects. DEP would manage this fund.

13. The following contributed to and concurred with this analysis:
Stan Edwards, Department of Environmental Protection
Barbara Comfort, Department of Permitting Services
Reginald Jetter, Department of Permitting Services
Rose Krasnow, MNCPPC
Amy Wilson, Office of Management and Budget
Matt Schaeffer, Office of Management and Budget
Naeem Mia, Office of Management and Budget

Jennifer A. Hughes, Director
Office of Management and Budget

9/21/12
Date

Economic Impact Statement
Council Bill XX-12, Tree Canopy Conservation

Background:

The purpose of this legislation is to: 1) save, maintain, and establish tree canopy for the benefit of County residents and future generations; 2) maximize tree canopy retention and establishment; 3) establish procedures, standards, and requirements to minimize the loss and disturbance of tree canopy as a result of development; 4) provide for mitigation when tree canopy is lost or disturbed; and 5) establish a fund for tree canopy conservation projects, including plantings of individual trees, groups of trees, or forests, on private and public property. The proposed legislation generally revises County law regarding tree canopy conservation.

The requirements of this bill are applicable when a sediment control permit is required under Chapter 19 of the Montgomery County Code and the trees are not subject to Article II of Chapter 22A. The bill supplements the Forest Conservation Law (FCL). The FCL does not apply to most disturbances to individual tress outside of forests during development, and it does not apply to development activity on lots less than approximately one acre.

1. The sources of information, assumptions, and methodologies used.

Not applicable

2. A description of any variable that could affect the economic impact estimates.

The economic impact of the bill will vary based on a number of factors including the amount of acreage that is the subject of the sediment control permit, the area of tree canopy on land covered by such a permit, the amount of the fee imposed per square foot of tree canopy disturbed as a result of the development activity subject to the permit, and the market conditions at the time of development. The cost of development for each property will be affected by the amount of tree canopy disturbed times the fee.

3. The Bill's positive or negative effect, if any on employment, spending, saving, investment, incomes, and property values in the County.

The bill may increase the cost for developing some properties, and those costs may affect the gross profit margin to the developers or the price of the property. However, some studies indicate that property with trees can have a higher value than property that is cleared of trees. To the extent that the proposed legislation encourages developers to retain trees, they may realize a higher return than if they clear the site. However, this analysis would vary by property and market conditions and would need to factor in the cost of removing trees as well as the impact of the cost of the fee. With a specific fee structure it will be possible to estimate these potential costs.

Economic Impact Statement
Council Bill XX-12, Tree Canopy Conservation

4. If a Bill is likely to have no economic impact, why is that the case?

Not applicable; see item 3.

5. The following contributed to and concurred with this analysis: David Platt and Mike Coveyou, Finance and Stan Edwards, Environmental Protection.

Joseph F. Beach, Director
Department of Finance

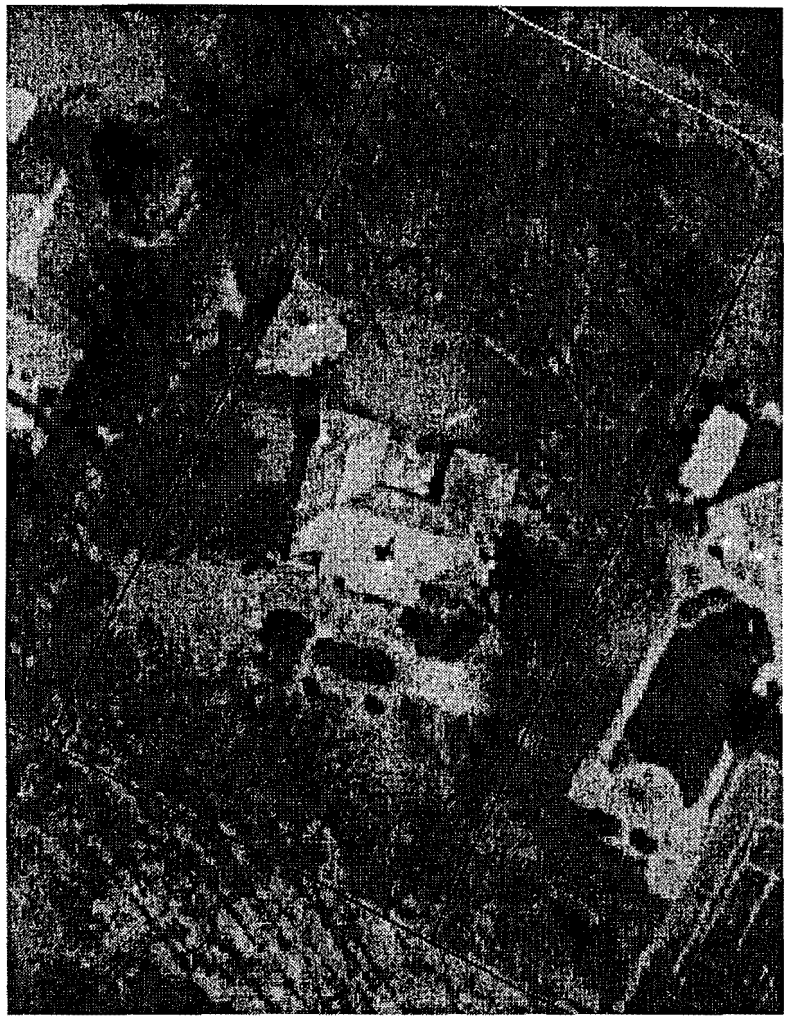
9/12/12
Date

Bill 35-12
Tree Canopy Conservation

Why is a tree canopy bill needed?

- Development patterns have been changing
  - Fewer large parcels are left to subdivide
  - More previously built lots are being redeveloped
- The County is losing canopy during redevelopment, particularly in residential neighborhoods
- Local benefits provided by tree canopy include
  - increased property values
  - increased revenues for businesses
  - cleaner and cooler air and water
  - lower heating and air conditioning bills
  - many social benefits

2004



1.19 acre lot

2011

Redeveloped in 2006

1998

1.02 acre lot

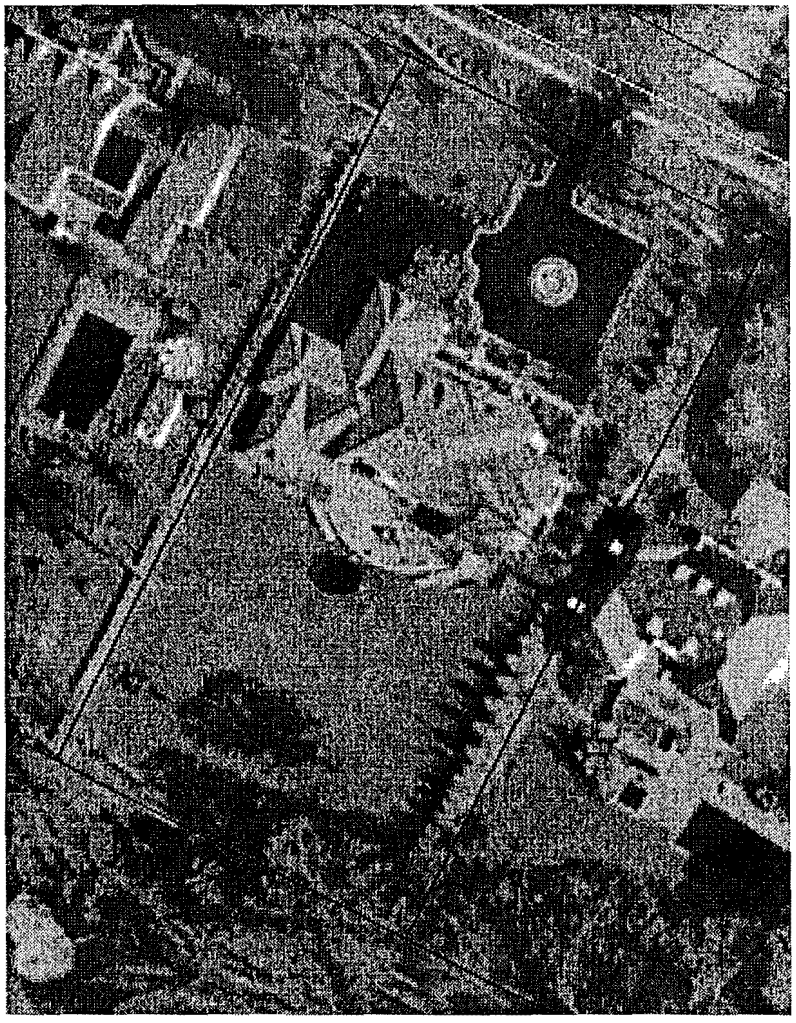
2011

Redeveloped in 2002

2004

1.02 acre lot

2011

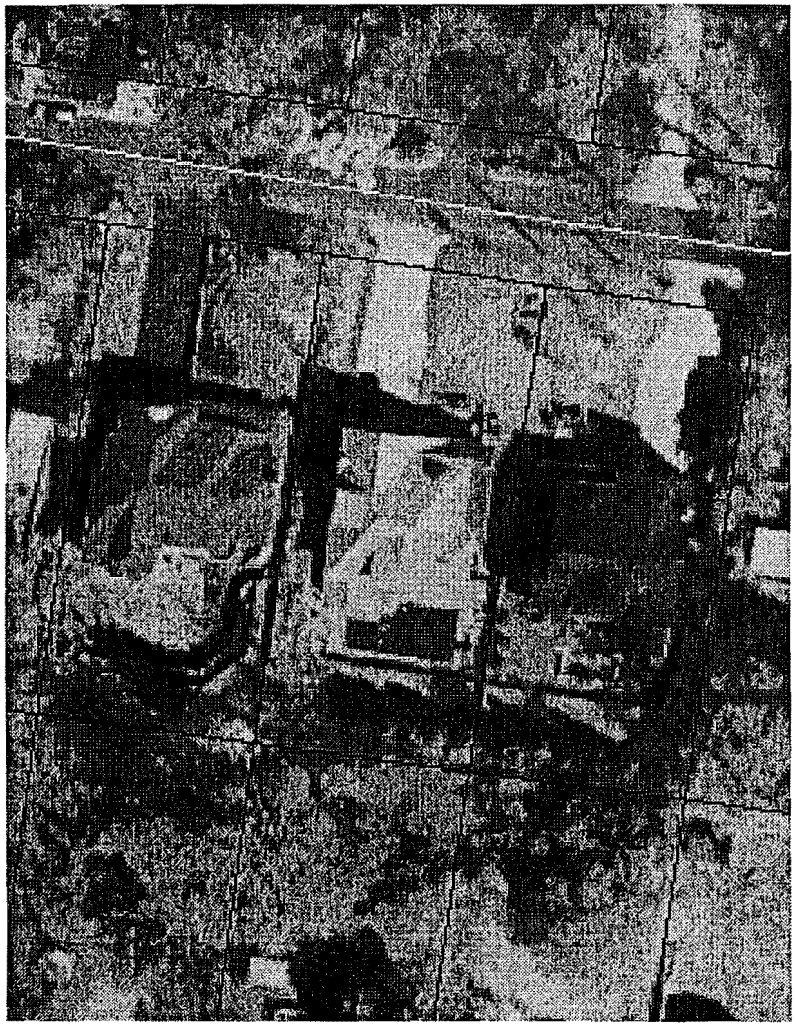


Redeveloped in 2009

1998

13,000 sq. ft. lots

2011



Redeveloped in 2004-2009

2006

10,800-13,200 sq. ft. lots

2011

Redeveloped in 2004-2011

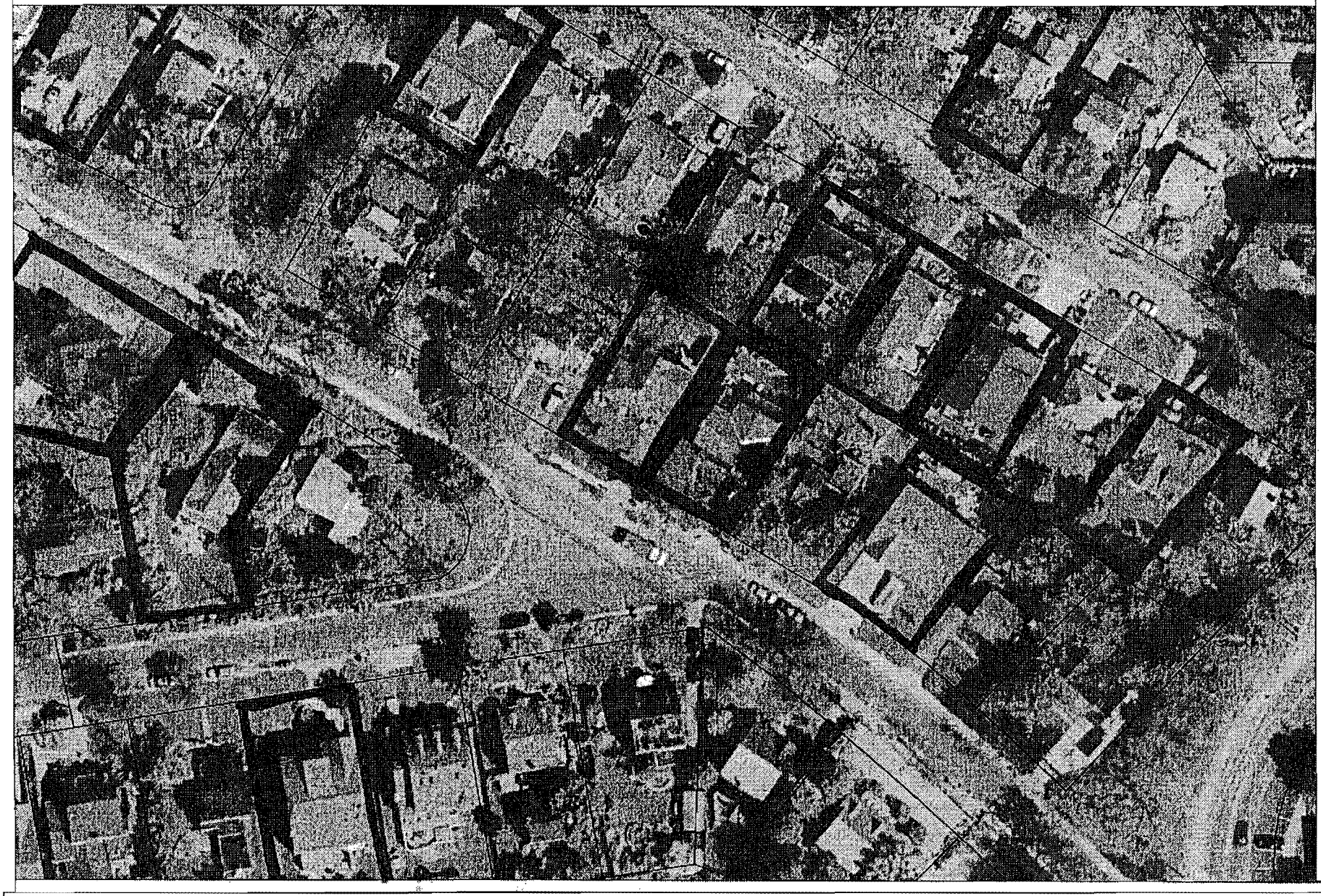
1998

6,100-7,200 sq. ft. lots

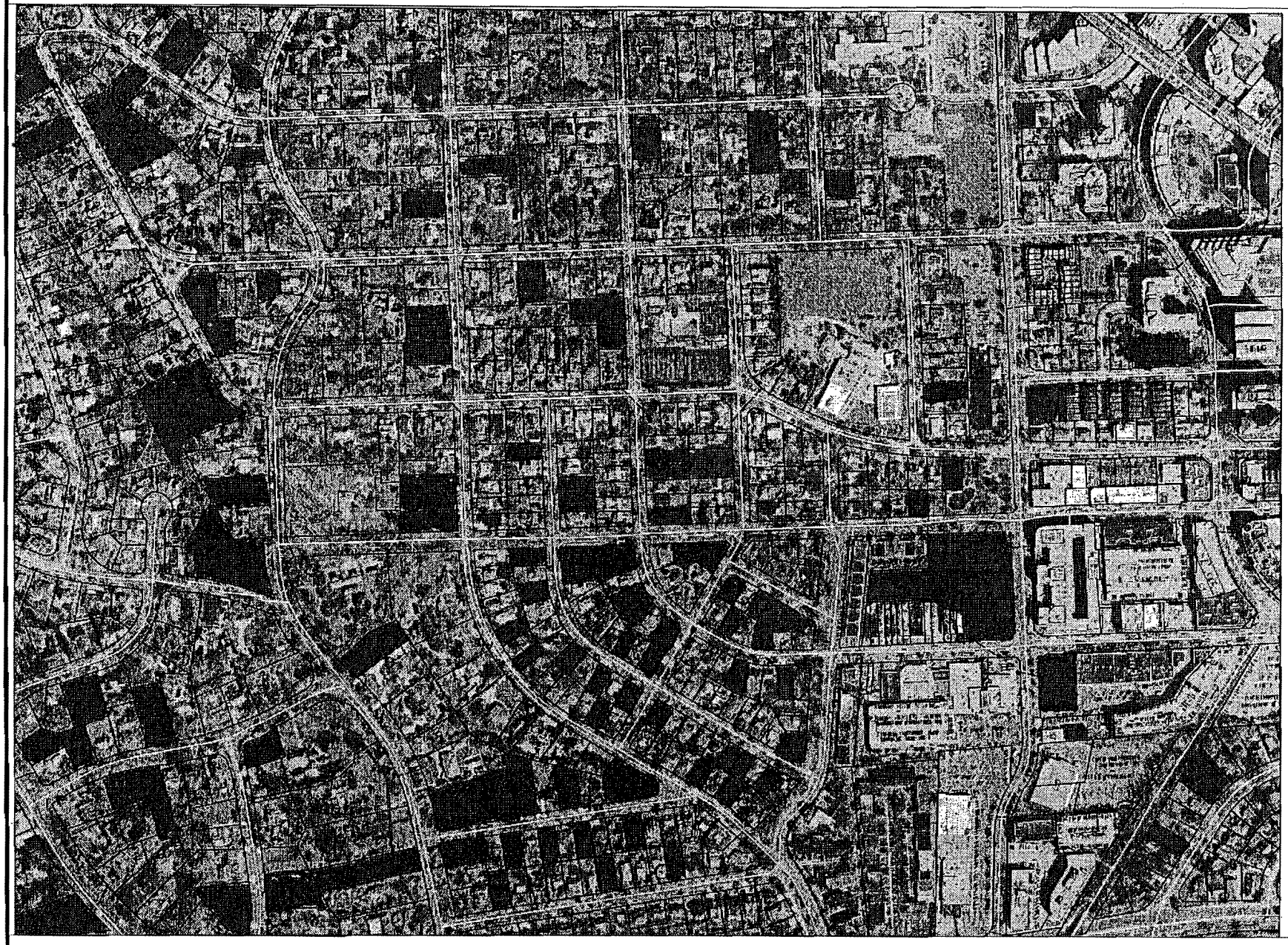
2011

Redeveloped in 2002-2004

Residential neighborhood in 2002; Lots are 5,000 – 10,000 sq. ft.



Residential neighborhood in 2012; Lots are 5,000 – 10,000 sq. ft.



Redeveloped in 2002 – 2011; Lots are 5,000 sq. ft. and greater

The Forest Conservation Law

- The Forest Conservation Law (FCL) was designed to slow the loss of forest at a time when large tracts were subdivided into small lots
- The FCL requires mitigation when forests are lost due to development
- The FCL generally applies to properties over 40,000 square feet when a sediment control permit is required, or when subdivision activity occurs
- The FCL applies to large trees (over 24" dbh) outside of forests and to all Champion trees

Little of this activity is regulated by the Forest Conservation Law.

Tree Canopy Bill – Guiding Principles

As requested by the County Executive, the Tree Canopy Bill was designed to be:

- An approach that could be easily understood by the regulated community
- A streamlined process for the development community
- Something that could be implemented with minimal costs to both the applicants and the County

When does the Tree Canopy Bill apply?

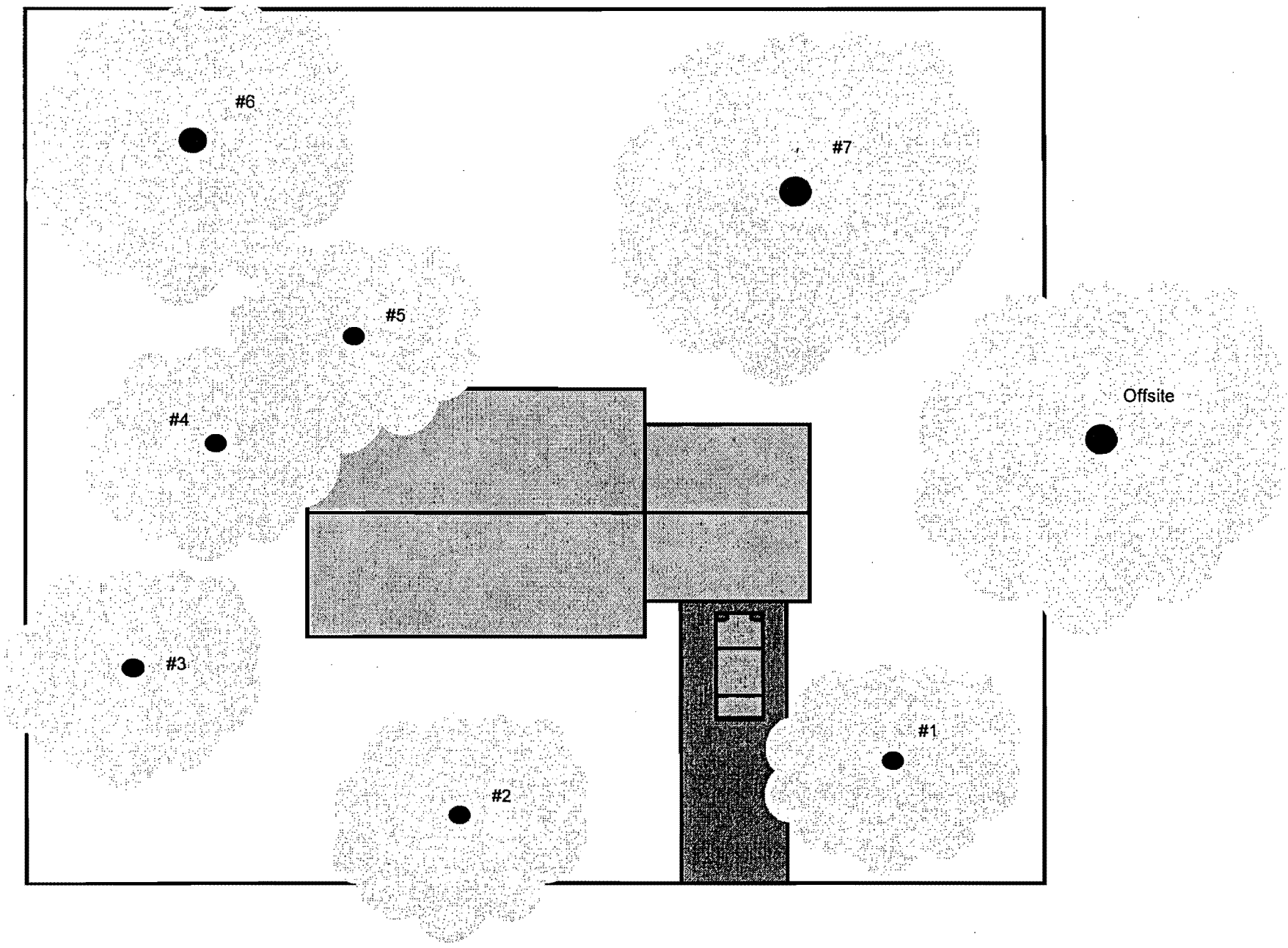
- Applies to any activity requiring a sediment control permit:
  - New residential or commercial building;
  - 5,000 square feet or more of ground disturbance; or
  - 100 cubic yards or more of earth movement.
- The cutting of 5,000 square feet or more of canopy is considered ground disturbance

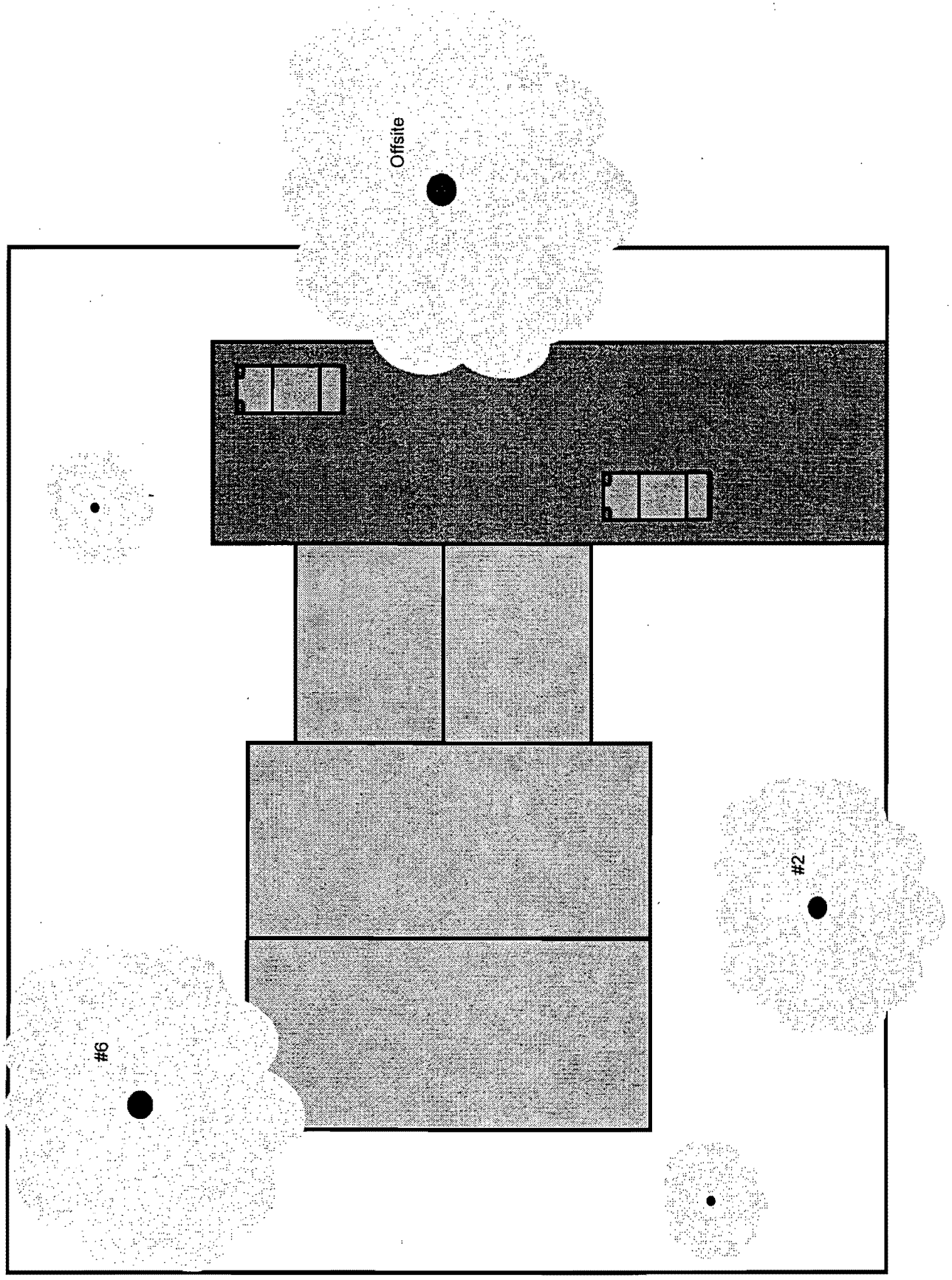
Activities not covered by the Tree Canopy Bill

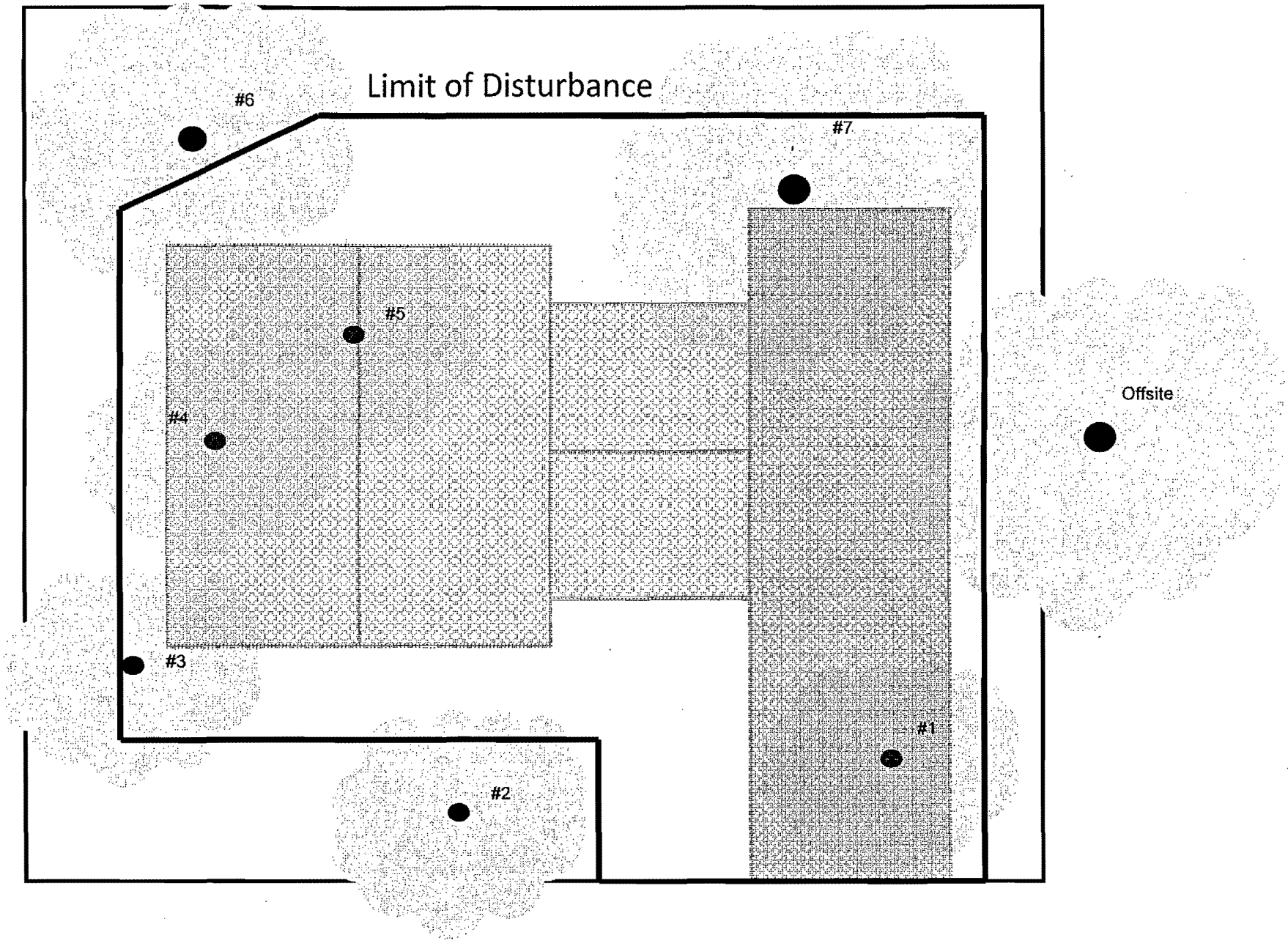
- The removal of an individual tree or group of trees less than 5,000 square feet in canopy area
- Any agricultural activity where a sediment control permit is not required
- Routine tree maintenance activities of electric utilities where a sediment control permit is not required
- Stream restoration and stormwater facility maintenance activities with all appropriate permits

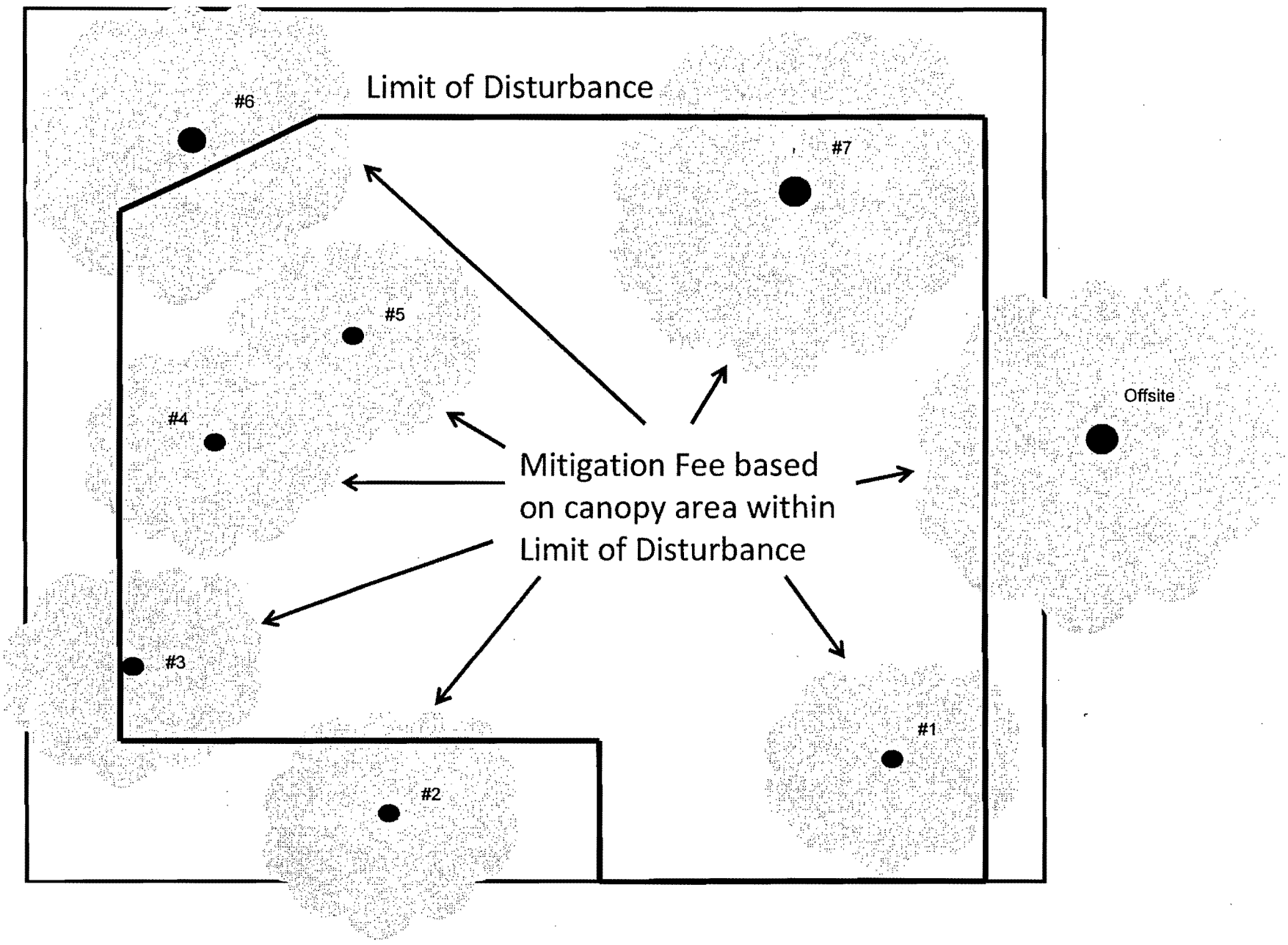
Who implements the Tree Canopy Bill?

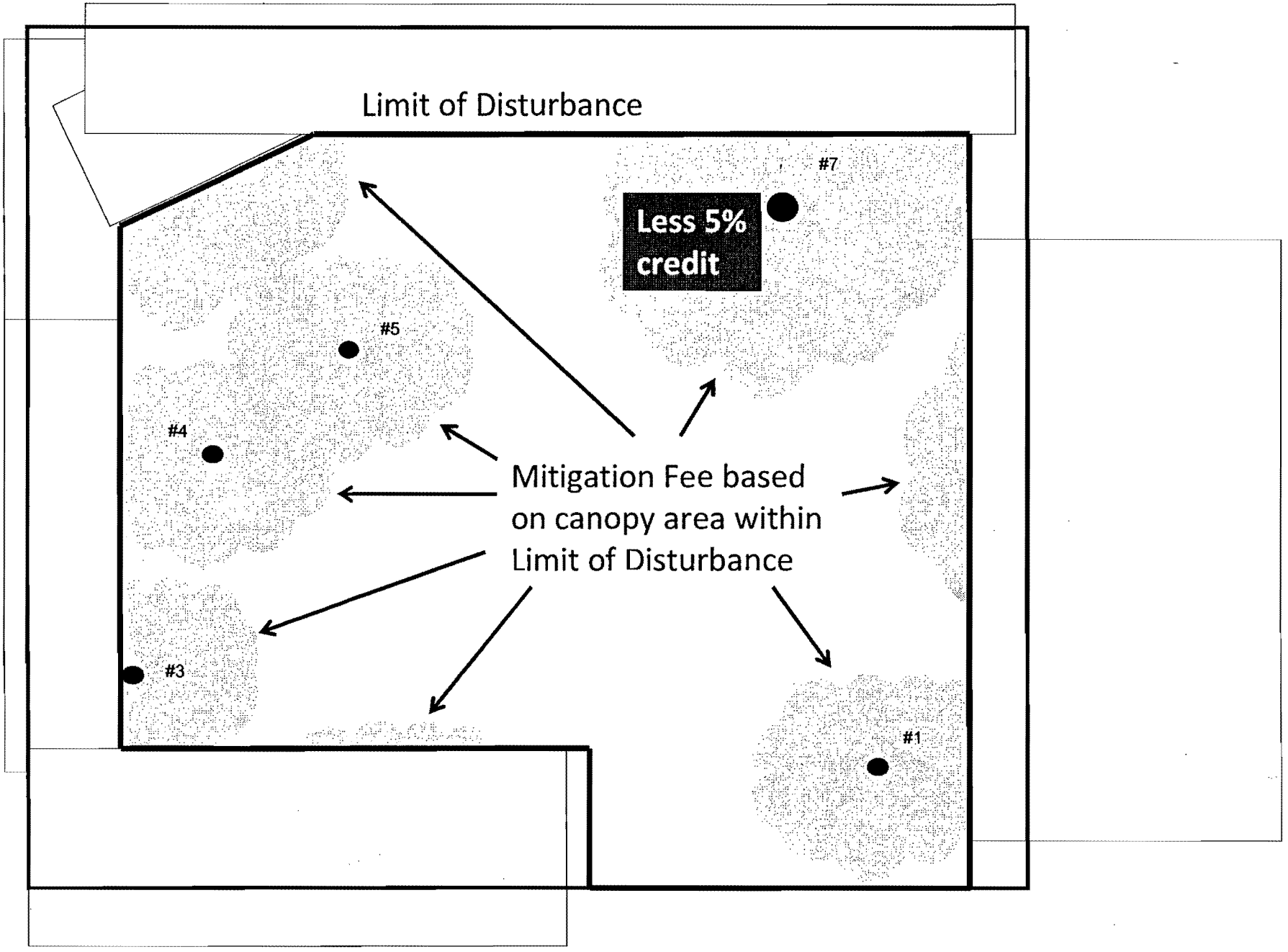
- The requirements of the bill are implemented during existing review processes:
  - The Montgomery County Planning Department implements the bill for all development activities subject to the Forest Conservation Law (FCL)
  - The Department of Permitting Services implements the bill for all other applicable activities during the Sediment Control Permit process

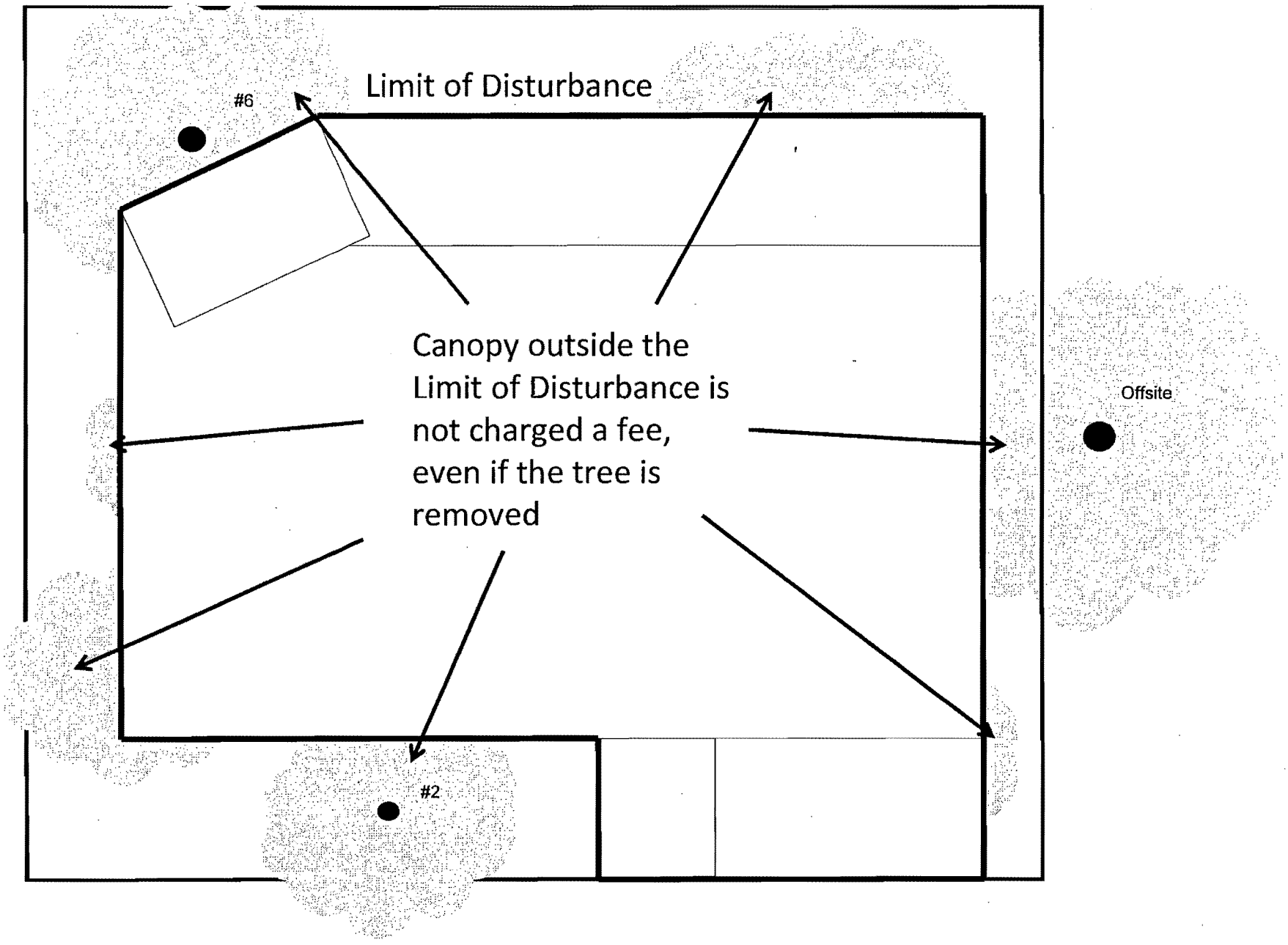

#6
#7
#5
Offsite
#4
#3
#1
#2

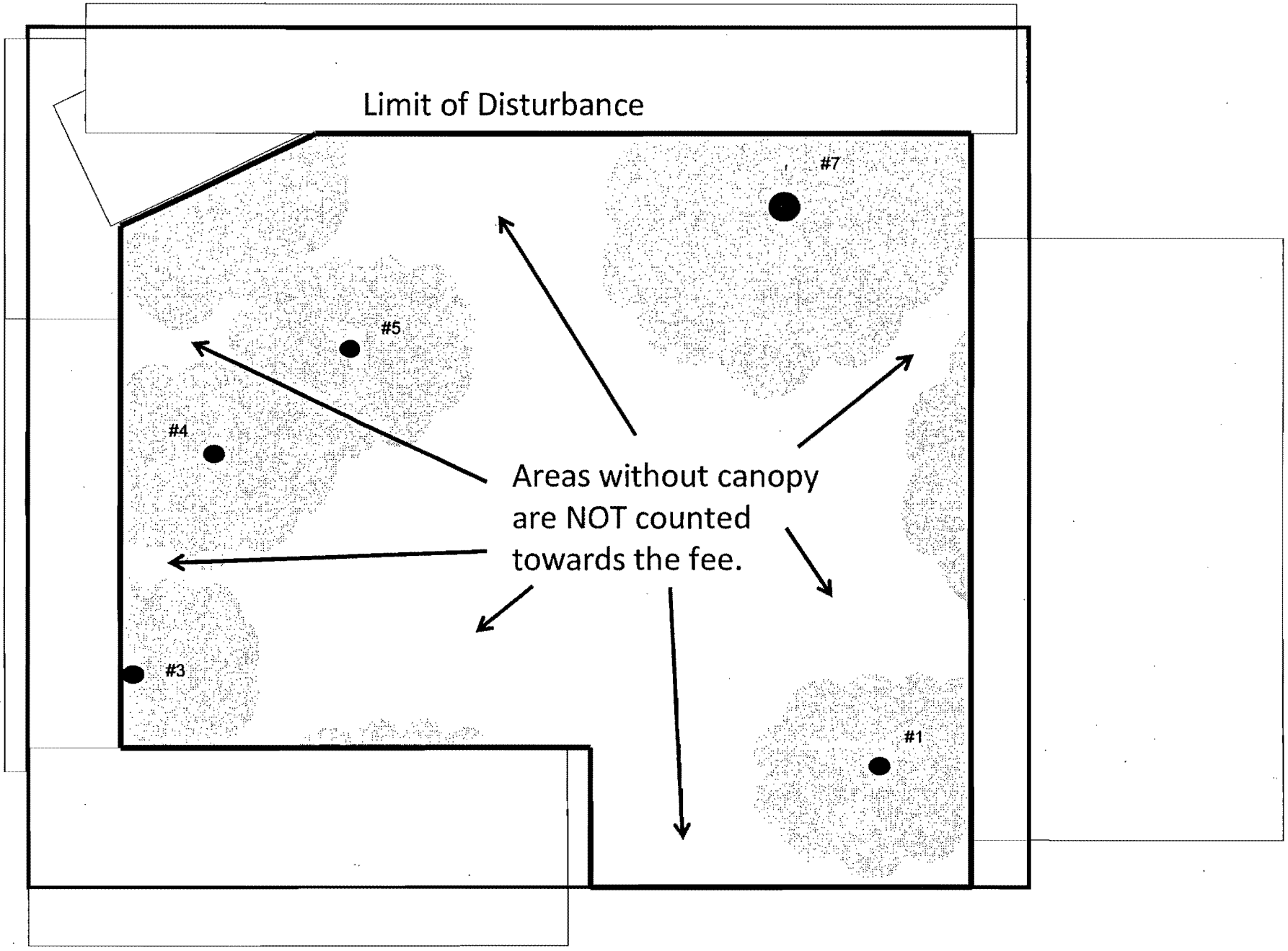

Offsite
#2
#6


Limit of Disturbance
#6
#7
#5
#4
#3
#2
#1
Offsite


Limit of Disturbance
#6
#7
#5
#4
Offsite
Mitigation Fee based
on canopy area within
Limit of Disturbance
#3
#1
#2


Limit of Disturbance
#7
Less 5% credit
#5
#4
Mitigation Fee based on canopy area within Limit of Disturbance
#3
#1


Limit of Disturbance
#6
Canopy outside the Limit of Disturbance is not charged a fee, even if the tree is removed
Offsite
#2


Limit of Disturbance
#7
#5
#4
#3
#1
Areas without canopy
are NOT counted
towards the fee.

Issue: Mitigation credit for on-site planting

Proposed Approach

- Payment of canopy fee satisfies mitigation requirements
- Fees will be used to establish trees close to the disturbance
- No fee charged for first 5% of canopy within LOD in recognition of on-site planting

Rationale

- Minimizes cost of administering program
- Minimizes delays to development process
- Many sites cannot accommodate canopy trees after development
- Comprehensive planning and economies of scale enable planting that addresses community needs
- Without extended maintenance agreements, performance bonds, and long-term easements, survival rates of trees significantly lower

Issue: Mitigation credit for on-site planting

Alternative Approaches

- Require planting of specified number of trees based on disturbance
- Require planting to the extent the site allows, and payment of fee for balance of mitigation requirement
- Increase percentage of canopy within LOD not charged a fee

Issues to Address

- When is a planting successful? Would maintenance agreements, performance bonds, and long-term easements be required?
- What is correct number of trees to plant? Is it based on disturbance, lot size, available space, etc.?
- What additional County resources would be needed to implement this approach?
- What additional resources would be needed by the applicant?

Issue: Mitigation credit for protected trees

Proposed Approach

- Canopy within LOD assumed to be disturbed and is factored into fee calculation
- Canopy outside of LOD lost due to removal of tree not factored into mitigation fee

Rationale

- Under big tree variance procedures of FCL, any activity within critical root zone of a tree is assumed to be disturbance to the tree
- If tree is truly undisturbed, LOD may be adjusted
- Particularly on small lots, not enough space for adequate tree protection measures
- Minimizes implementation costs for both the County and applicants
- Minimizes delays to development process

Issue: Mitigation credit for protected trees

Alternative Approaches

- Provide mitigation credit for all canopy associated with trees subject to approved protective measures
- Provide mitigation credit only on lots above a certain size or for certain activities (e.g. park restoration activities)

Issues to Address

- What protective measures are acceptable? Who sets the standards?
- What lot sizes and activities are suitable for allowing credit for protective measures?
- What County resources would be needed to implement this approach?
- What additional resources would be needed by the applicant?

Issue: Mitigation credit for meeting on-site stormwater management requirements

Proposed Approach

- Canopy within LOD disturbed as a result of installing stormwater management features treated the same as any other canopy disturbed

Rationale

- Provision of stormwater management part of the development process
- Under the FCL, forest lost due to installation of stormwater management features treated like all other forest
- Not rational to allow the disturbance of one environmental resource in order to address the requirements associated with another environmental resource

Issue: Mitigation credit for meeting on-site stormwater management requirements

Alternative Approaches

- Provide mitigation credit for all canopy associated with trees disturbed as a result of the installation of stormwater management measures
- Provide stormwater credit for trees left undisturbed

Issues to Address

- What additional County resources would be needed to implement this approach?
- What additional resources would be needed by the applicant?
- State law currently does not allow stormwater credit for trees left undisturbed; County cannot provide this credit without state approval

Issue: Fees for Mitigating Loss of Canopy

Proposed Approach

- The fees must increase as disturbance increases
- Fees are not charged to the first 5% of canopy within the LOD
- Fees will not revert to the general fund
- Uses are specified and limited in the bill to establishing and enhancing tree canopy
- Specific fees are not in the bill (will be set by Method 2 Regulations)

Rationale

- Focus on the approach to determining mitigation

Use of Mitigation Fees

- The fees "must be spent on establishing and enhancing tree canopy"
- Potential opportunities include:
  - Street trees
  - "Paper" streets
  - Backyard programs
  - Parking lots
  - Community buildings (e.g., places of worship)
  - County facilities (e.g., community centers, libraries)
  - Businesses

Issue: Can the proposed law be circumvented?

- The bill includes language to limit circumvention to the degree possible (See proposed Chapter 55-13(f))
- This is a concern for the existing Forest Conservation Law
- The cost of removing trees prior to redevelopment to avoid the bill is likely to be more expensive than the fees imposed by the bill

Issue: Does the bill create hazardous trees?

- Retention of hazardous trees along property lines is currently a problem on small lots, as well as those covered by the FCL
- The bill will increase opportunities to review and address these trees during field inspections
- Guidelines for when to remove trees will be developed in the regulations and will likely follow the guidelines currently used by the Planning Department
- There is no financial incentive to remove or leave trees.

Isiah Leggett
County Executive

Marc P. Hansen
County Attorney

OFFICE OF THE COUNTY ATTORNEY

MEMORANDUM

February 19, 2013

TO: Michael Faden
Montgomery County Council

FROM: Walter E. Wilson
Associate County Attorney

VIA: Marc P. Hansen
County Attorney

RE: Tree Canopy Disturbance Mitigation Fees

QUESTION

You have requested an opinion from this office concerning the fee that any person subject to the legislation proposed as Bill 35-12 would be required to pay into a Tree Canopy Conservation Fund to compensate for the loss of, or disturbance to, tree canopy caused by that person's land disturbing activities. Specifically, you ask whether this required payment, which the legislation refers to as a mitigation fee, is actually an excise tax or whether it is in fact a regulatory fee.

SHORT ANSWER

The tree canopy disturbance mitigation fee that would be imposed under Bill 35-12 is in the nature of a regulatory fee because its primary purpose is to minimize the tree canopy disturbance and loss attributable to construction activity. The fee/charge is part of the overall regulatory scheme to minimize tree canopy loss, and is intended to defray the costs that the County would incur to replace the trees canopy lost through development and other land disturbing activities. We acknowledge that this conclusion might not be beyond question. Therefore, we suggest that the Bill's regulatory intent be strengthened by an amendment that would require (to the extent practical) on-site mitigation in the form of protective measures for the remaining trees; the payer would in turn be credited based on the degree to which those mitigation measures attenuate the on-site tree canopy disturbance.

BACKGROUND

Bill 35-12 is designed to maximize the retention of tree canopy on small lots that are not otherwise subject to County Code Chapter 22A (Forest Conservation—Trees) when land disturbing activities occur on those lots. It establishes procedures, standards, and requirements to minimize the disturbance or loss of tree canopy as the result of development and other land disturbing activities. In accordance with Section 55-9 of the proposed legislation, the applicant for a sediment control permit whose planned activities will involve the cutting or clearing of trees must mitigate the resulting on-site disturbance or loss of tree canopy by paying into a special fund, the Tree Canopy Conservation Fund, whose purpose would essentially be to pay for the County's off-site replacement of those trees as part of the overall regulatory scheme designed to maximize tree canopy retention and enhancement throughout the County. The amount of the "mitigation fee" would be directly tied to the square footage of on-site tree canopy disturbance. Not only would any monies deposited into the Tree Canopy Conservation Fund be statutorily prohibited from reverting to the County's General Fund; they must be expended exclusively to cover County costs associated with establishing and enhancing tree canopy, including the identification and acquisition of suitable sites, as needed, to replace the disturbed tree canopy.

DISCUSSION

Distinguishing between Regulatory Fees and Taxes

In a nutshell, taxes are compulsory payments imposed by legislative authority on persons or property to raise money for public purposes. *United States v. Maryland*, 471 F. Supp. 1030, 1036 (D. Md. 1979) (citing *United States v. LaFranca*, 282 U.S. 568, 572, 51 S. Ct. 278 (1931)). There is generally no requirement that any connection exist between the property or activities taxed and the use of the proceeds. Nor is there any mandatory connection between the taxpayer burdened and the person or group benefited. *Allied American Mut. Fire Ins. Co. v. Commissioner of Motor Vehicles*, 219 Md. 607, 616, 150 A.2d 421 (1959). Unless the legislative body enacting the taxes chooses to earmark the payments, tax revenue may be used for any governmental function that the lawmakers reasonably determine is a public purpose. Hugh D. Spitzer, *Taxes vs. Fees: A Curious Confusion*, 38:2 Gonz. L. Rev. 335, 338-39 (2002/03). The basic principle followed by Maryland courts in distinguishing between taxes and fees is that a tax is a revenue raising measure enacted under the government's taxing power for the benefit of the general public; whereas a fee, adopted under the government's police power, is imposed to cover the cost of a government program or regulatory scheme that benefits in a special way the payer of the fee. *See Maryland Theatrical Corporation v. Brennan*, 180 Md. 377, 381, 24 A.2d 911 (1942).

Although the Maryland Court of Appeals has consistently recognized a distinction between the imposition of fees as an essential part of a regulatory measure and the imposition of a tax for revenue purposes, *see, e.g., Campbell v. City of Annapolis*, 289 Md. 300, 304-05, 424 A.2d 738 (1981), it should be noted that the practical application of the that distinction to specific legislation is not always as clear-cut as these widely accepted definitions of taxes and fees might suggest. Regardless of how a particular charge might be designated in the statute, categorizing it correctly requires focusing on the purpose of the legislation rather than simply the label given to the charge in the text of the statute. *Eastern Diversified Properties, Inc. v. Montgomery County*, 319 Md. 45, 53, 570 A.2d 850 (1990). Although the Court of Appeals has acknowledged that there is no set rule by which it can always be determined in which category a particular statute primarily belongs, the Court nonetheless stated in *Eastern Diversified Properties, Inc. v. Montgomery County, supra,* that "[a] regulatory measure may produce revenue, but in such a case the amount must be reasonable and have some definite relation to the purpose of the Act." A revenue measure, on the other hand, may also provide for regulation, but if the raising of revenue is the primary purpose, the amount of the tax is not subject to review by the courts. *Id.*

In determining whether revenue generation rather than regulation is the main objective of a charge designated in legislation as a fee, Maryland courts take into account the amount of the charge imposed and whether the statute requires compliance with certain conditions in addition to the payment of the prescribed sum. This is because one characteristic of a regulatory measure is that it generally requires the person subject to the charge to comply with certain conditions beyond mere payment of the charge. *County Comm'rs of Anne Arundel County v. English*, 182 Md. 514, 520, 35 A.2d 135 (1943). If so, the payment is considered to be a fee imposed by virtue of the police power; assuming, of course, that the revenue generated by the payment is reasonable—i.e., not more than what is necessary to pay for implementation and enforcement—and and bears "some definite relation" to the purpose of the regulatory scheme. *Ocean City v. Purnell-Jarvis, Ltd.*, 86 Md. App. 390, 405-06, 586 A.2d 816 (1991).

Payments for Tree Canopy Disturbance Mitigation under Bill 35-12

There is nothing in the language of Section 55-9 of Bill 35-12 from which one can automatically infer that revenue generation is the primary objective of the mitigation fee imposed under that provision. Minimizing the loss of existing tree canopy is the clearly stated objective of that section, and all of the plans and submittals required under the legislation along with payment of the fee are consistent with that stated objective.

The mitigation fee could be described as a sort of burden offset charge in that the charge allocates and recovers the cost of handling the negative impacts on public resources from those who cause them. Yet it differs from the type of development impact "fee" that was at issue in *Eastern Diversified, supra*, because of its direct connection to, and payment for, a system of dealing with the the negative public impacts of the private activities that Bill 35-12 seeks to

regulate. In that regard alone, the mitigation fee can be viewed as a tool of regulation. By contast, one of the findings that led the Court of Appeals in *Eastern Diversified* to conclude that the County's development impact "fee" was in reality a tax was that the required payment was not directly correlated to any demand for roads created by the development being charged. *Eastern Diversified*, 319 Md. at 51. Nor would the revenue generated by the charge necessarily be directed to roads that would benefit the development that paid the charge. The Court also noted that nothing in the language of the impact fee statute suggested that the impact fees were charged on the basis of any service provided that benefited the payer any differently than the public generally, or to defray the expenses associated with the development regulatory process. *Id.* at 54-55. The mitigation fee imposed under Section 55-9 (b), however, appears to be sufficiently earmarked under Section 55-14 (b) to establish the type of legal nexus required to confirm the charge as a regulatory fee. Not only does that section specify how the mitigation fees paid into the Tree Canopy Conservation Fund must be spent; it also prohibits those payments from reverting to the General Fund. The permissible expenditures are directly related to the purpose of Bill 35-12 and are an essential component of the legislation's comprehensive approach to protecting and enhancing the the County's existing tree canopy.

It should also be noted that as part of that comprehensive approach the payer of the fee must also submit detailed limits of tree canopy disturbance information and plans to either the Department of Permitting Services or Department of Planning for concurrent review with the submissions required to obtain a sediment control permit. In that respect, the mitigation fee also differs from the impact tax in *Eastern Diversified, supra.* The same can be said when comparing the mitigation fee with, for example, the Water Quality Protection Charge (WQPC), whose sole purpose is to generate the revenue needed to support the County's stormwater management and water quality programs. Similar to the impact tax, the WQPC does not require compliance with any conditions in particular that go beyond mere payment of the charge.

Finally, although the amount of the fee is to be set by regulation, the regulatory parameters contained in Bill 35-12, which require that the amount charged be tied to the square footage of tree canopy disturbed, are intended to ensure that a payment does not exceed the cost to the County of mitigating the loss of tree canopy caused by the payer's land disturbing activities. This can also be read as an indication that revenue generation is not the main purpose of the obligation to pay mitigation fees when certain land disturbing activities will result in the County's loss of tree canopy. The payer also directly benefits by not being burdened with the responsibility of identifying and acquiring a suitable mitigation site to replace the lost tree canopy from the disturbed site. The payer is simply required to defray the costs incurred by the County for undertaking those responsibilities based on a pre-determined formula. Of course, the regulations will need to be written so that they are consistent with the legislative intent that they not be excessive when the formula is applied to specific dollar amounts.

CONCLUSION

For the foregoing reasons, it is our opinion that the charge designated as a tree canopy disturbance mitigation fee is more likely than not a regulatory fee. While this conclusion might not be beyond question, we believe that the charge can be defended as a regulatory measure under the County's police power as long as the legislative history makes clear the regulatory intent of the Bill and the amount imposed does not clearly exceed what is needed to defray the cost to the County of mitigating the loss or disturbance of tree canopy. To accomplish this, the regulatory intent underlying the charge can be made clearer by amending the Bill in a way that requires the owner to provide, to the extent practical, for on-site mitigation in the form of protective measures for the remaining trees. The payer would in turn be credited based on the degree to which those mitigation measures attenuate the on-site tree canopy disturbance. This is a change that we would recommend to replace the current provision in the legislation that takes on-site landscaping into account, but simply credits the payer for the first 5 percent of tree canopy disturbed.

Finally, we note that even if a court were to rule that the mitigation fee is actually a tax, the County's authority to enact it as a tax can be found in Section 52-17 of the County Code. This would allow the County to cure any defect in imposing this charge as a fee by retroactively imposing the charge as a tax. *See, e.g., Montgomery County v. Waters Landing Ltd. Partnership*, 99 Md. App. 1, 26, 635 A.2d 48 (1994) (citing *U.S. v. Heinszen*, 206 U.S. 370, 27 S.Ct. 742 (1907). Of course, the effect of imposing this charge as a tax would be that the charge would be applicable within the County's municipalities unless language is added to the legislation that explicitly exempts them.

We trust that this memorandum has been fully responsive to your inquiry. Please let us know if we might be of further assistance.

cc: Kathleen Boucher, Office of the County Executive
Mac Spicer, Office of the County Attorney
Robert Hoyt, Department of Environmental Protection
Stan Edwards, Department of Environmental Protection
Laura Miller, Department of Environmental Protection
Diane Jones, Department of Permitting Services
Rick Brush, Department of Permitting Services

Different Approaches to Mitigating Tree Loss

- Plant certain number of trees/canopy area based on property size
  - Fairfax, VA; Chesapeake, VA; Athens-Clarke County, GA
- Forest Conservation Law fee-in-lieu
  - Counties and municipalities in MD
- Pay, or plant certain number of trees, based on tree size
  - District of Columbia

Determining the Tree Canopy Fee - Factors to Consider

Factor 1 – The trees/canopy to be replaced

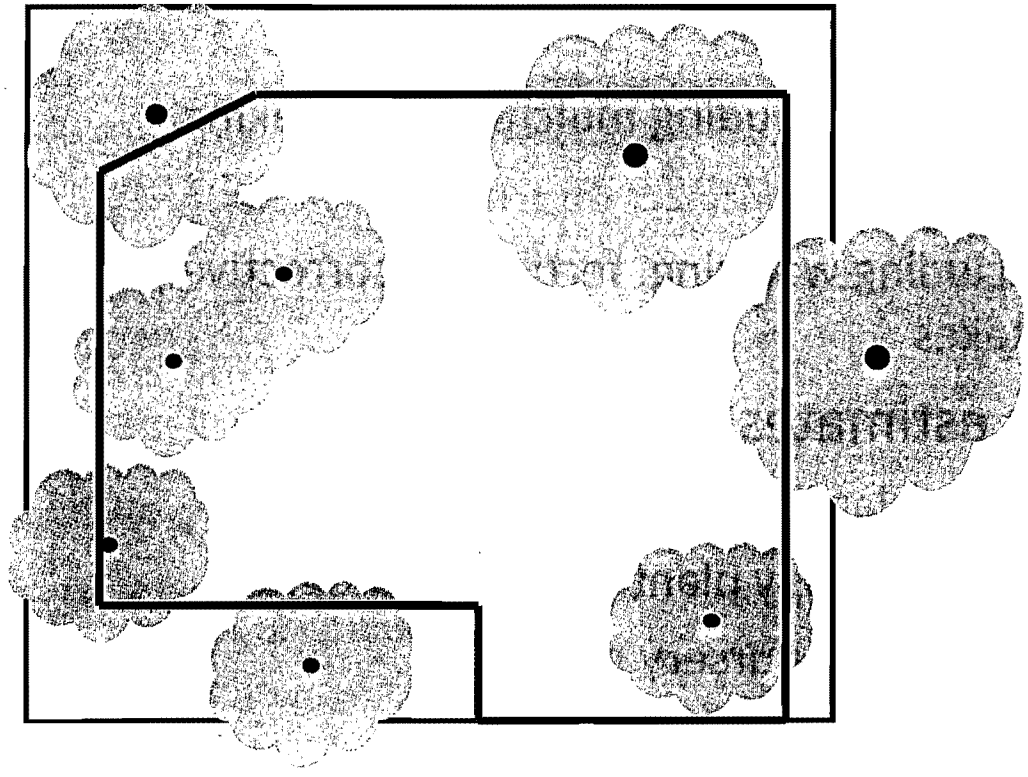
Factor 2 – The cost to plant trees

Factor 3 – Tree mortality, i.e., the number of trees that must be planted to have the desired number of living trees

Factor 4 – The timeframe for consideration

Factor 1: Trees/canopy area to be replaced

- Canopy within *Limit of Disturbance*



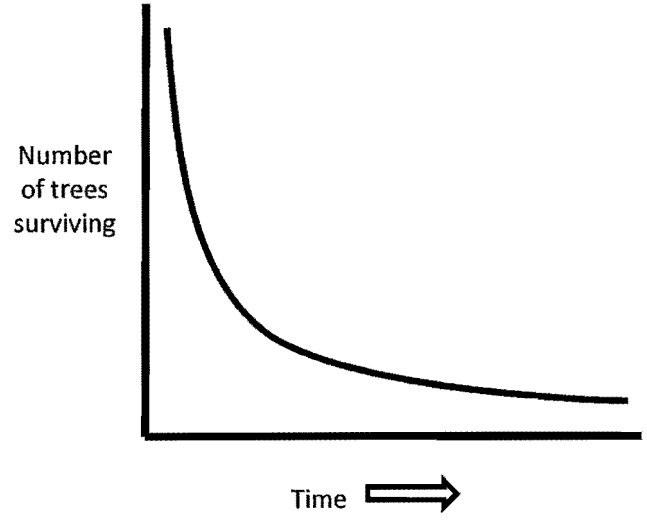
18

Factor 2: The cost to plant trees

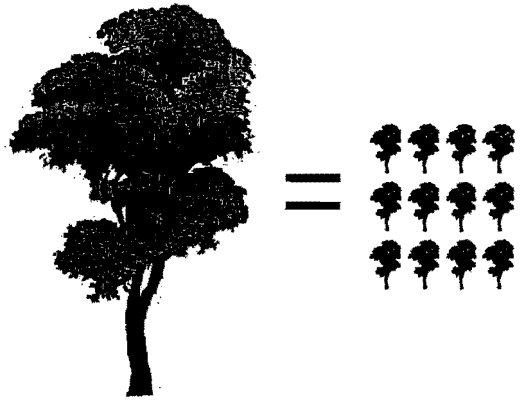
- The cost to plant a tree is based on:
  - Optimal size of new tree
  - Cost of nursery stock
  - Cost of installation including mulching and staking
  - Deer protection
  - Aftercare including watering, fertilizing, corrective pruning, and removing stakes
- Current price estimates include:
  - DOT street tree planting contract
  - Rainscapes tree canopy planting rebate program
  - Retail and wholesale nursery prices

Factor 3: Tree mortality

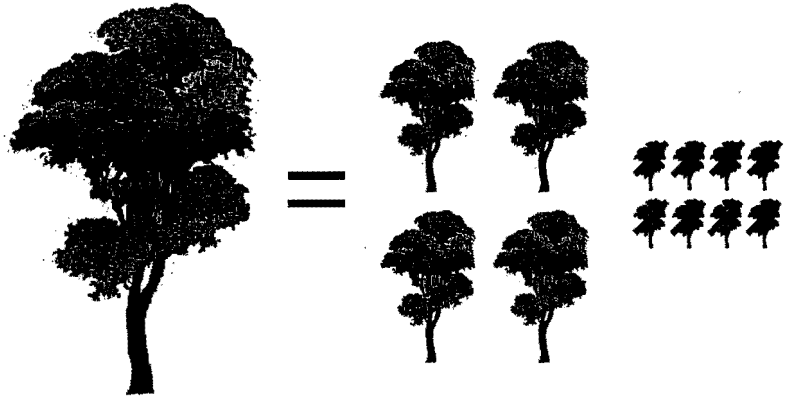
- The mortality rate of trees depends on a number of variable factors. Generally, mortality decreases with time since planting.
  - Quality of plant material
  - Size of plant material
  - Species
  - Planting technique
  - Season of planting
  - Unusual weather conditions
  - Soil conditions
  - Quality and consistency of aftercare



Factor 3: Tree mortality



At the time of planting



5 years after planting

10 years after planting

20 years after planting

78

Determining the Mitigation Fee

High

Low

- Full replacement
- Maximum deterrent
- More options for credit for protection/planting

- Partial replacement
- Minimal deterrent
- Fewer options for credit for protection/planting

Determining the Mitigation Fee

High

Low

Fee to cover full replacement of lost canopy

Based on high FCL fee-in-lieu ($5.00 @40,000 sf)

Based on County FCL fee-in-lieu ($1.05 @40,000 sf)

98

Proposed Mitigation Fees

Incremental Area (sq. ft.)		Increment
From	To	Fee ($/sq. ft.)
0	2,000	$0.25
2,001	4,000	$0.35
4,001	6,000	$0.45
6,001	8,000	$0.55
8,001	10,000	$0.65
10,001	15,000	$0.75
15,001	20,000	$0.85
20,001	30,000	$0.95
30,001	40,000	$1.05
40,001	55,000	$1.15
55,001	70,000	$1.25
70,001	and above	$1.35

2010

2011

Canopy within LOD

Size of lot (sq. ft.)	19,565
Assessed Value	$928,800
Canopy within LOD (sq. ft.)	1,385
Proposed Fee	$346

88

2004	2008	Canopy within LOD

Size of lot (sq. ft.)	13,819	13,819
Assessed Value	Unknown	$1,991,800
Canopy within LOD (sq. ft.)	5,490	1.272
Proposed Fee	$1,871	$318

1998

2011

Canopy within LOD

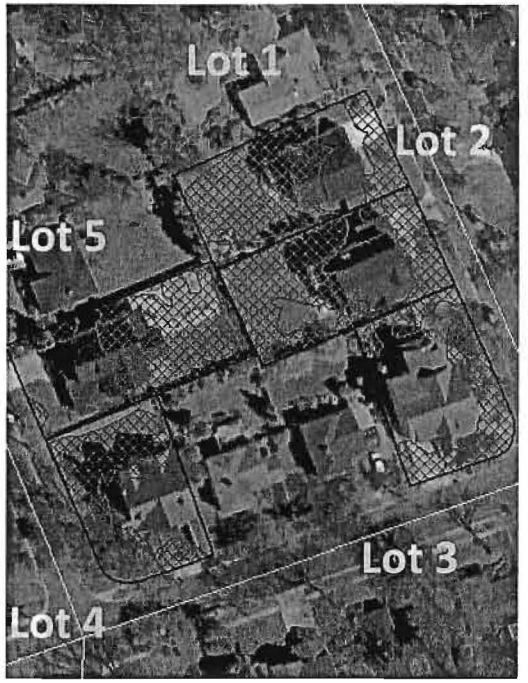
	Lot 1	Lot 2	Lot 3
Size of lot (sq. ft.)	8,552	7,566	7,405
Assessed Value	$1,225,700	$1,314,700	$1,320,400
Canopy within LOD (sq. ft.)	6,574	5,902	6,677
Proposed Fee	$2,416	$2,056	$2,472

(96)

2006

2011

Canopy within LOD



	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5
Size of lot (sq. ft.)	12,878	12,578	11,225	10,763	13,223
Assessed Value	$1,394,600	$1,616,200	$1,581,500	$1,603,800	$1,709,500
Canopy within LOD (sq. ft.)	8,689	8,871	4,822	5,335	8,202
Proposed Fee	$3,648	$3,766	$1,570	$1,801	$3,331

(9)

1998	2002	Canopy within LOD

Size of lot (sq. ft.)	45,299
Assessed Value	$3,993,000
Canopy within LOD (sq. ft.)	24,964
Proposed Fee	$17,216

Urban Forestry & Urban Greening 11 (2012) 21–30

Contents lists available at SciVerse ScienceDirect

Urban Forestry & Urban Greening

journal homepage: www.elsevier.de/ufug

Tree and impervious cover change in U.S. cities

David J. Nowak*, Eric J. Greenfield

USDA Forest Service, Northern Research Station, 5 Moon Library, SUNY-ESF, Syracuse, NY 13210, United States

ARTICLE INFO

Keywords:
City trees
Ecosystem services
Forest monitoring
Urban forestry
Urban greening
Urban trees

ABSTRACT

Paired aerial photographs were interpreted to assess recent changes in tree, impervious and other cover types in 20 U.S. cities as well as urban land within the conterminous United States. National results indicate that tree cover in urban areas of the United States is on the decline at a rate of about 7900 ha/yr or 4.0 million trees per year. Tree cover in 17 of the 20 analyzed cities had statistically significant declines in tree cover, while 16 cities had statistically significant increases in impervious cover. Only one city (Syracuse, NY) had a statistically significant increase in tree cover. City tree cover was reduced, on average, by about 0.27 percent/yr, while impervious surfaces increased at an average rate of about 0.31 percent/yr. As tree cover provides a simple means to assess the magnitude of the overall urban forest resource, monitoring of tree cover changes is important to understand how tree cover and various environmental benefits derived from the trees may be changing. Photo-interpretation of digital aerial images can provide a simple and timely means to assess urban tree cover change to help cities monitor progress in sustaining desired urban tree cover levels.

Published by Elsevier GmbH.

Introduction

Tree cover in cities is constantly changing due to various natural and anthropogenic forces. Natural forces for change include natural regeneration, tree growth and tree mortality from insects and diseases or old age. Anthropogenic factors that influence tree cover include tree planting and tree mortality or removal from either direct or indirect human actions such as development and air pollution (Nowak, 1993). The combination of these factors through time determines existing and future tree cover levels.

An important question for city managers is how their local tree cover is currently changing as present-day benefits derived from urban forests are related to the amount of tree cover in cities. As many urban forest ecosystem services are directly related to the amount of healthy and functioning leaves, tree cover becomes a simple measure of the extent of the urban forest and consequently the magnitude of services provided by the forest. To help sustain tree cover in cities, various city programs are planting large numbers of trees (e.g., City of New York, 2011; City of Los Angeles, 2011), protecting existing trees (e.g., Town of Chapel Hill, 2011; City of Pasadena, 2011) and developing tree canopy goals (e.g., City of Seattle, 2011; Maryland Department of Natural Resources, 2011).

Though tree cover in cities is constantly changing, limited studies have investigated how overall tree cover in cities has or is changing. Nowak (1993) illustrated through an analysis of historical imagery and documents that the tree cover in Oakland, CA, has increased from a presettlement tree cover of approximately 2 percent in 1850s to 19 percent in 1991. Land cover maps have been used to quantify how various cover classes have changed through time, but assessments of tree cover change within cities are limited (e.g., Zhou et al., 2008). In Seattle, tree cover was estimated to change from 22.5 percent in 2002 to 22.9 percent in 2007 by comparing digital land cover maps developed from 0.6 m resolution imagery (Parlin, 2009). However, the accuracy of the map classification is unknown and comparing cover maps to estimate change can lead to false changes due to misclassification of cover types on either map.

Various land cover change analyses have been conducted using satellite-based approaches. Moderate Resolution Imaging Spectroradiometer (MODIS) data (250-m) and Landsat data (30-m) have and are being used to estimate changes in land cover and impervious surface cover (e.g., Yang et al., 2003; Lunetta et al., 2006; U.S. EPA, 2011). MODIS data (500-m) also has the ability to estimate change in percent tree cover across the globe (Hansen et al., 2003; Schwarz et al., 2006). These satellite-based approaches have limitations based on image resolution and inaccuracies of image classifications. Photo-interpretation of high resolution images to detect cover changes has the ability to overcome these limitations, but lacks the ability to develop detailed comprehensive cover change maps.

Trees and impervious surfaces provide numerous ecosystem services and values to a community, but also have various economic or environmental costs. Trees provide various benefits associated

* Corresponding author. Tel.: +1 315 448 3212; fax: +1 315 448 3216.
E-mail addresses: dnowak@fs.fed.us (D.J. Nowak), ejgreenfield@fs.fed.us (E.J. Greenfield).

1618-8667/$ – see front matter. Published by Elsevier GmbH.
doi:10.1016/j.ufug.2011.11.005

with air and water quality, building energy conservation, cooler air temperatures, reductions in ultraviolet radiation, and many other environmental and social benefits (e.g., Dwyer et al., 1992; Kuo and Sullivan, 2001; Westphal, 2003; Wolf, 2003; Nowak and Dwyer, 2007). Costs associated with trees are both economic (e.g., planting and maintenance and increased building energy costs) and environmental (e.g., pollen and volatile organic compound emissions) (Nowak and Dwyer, 2007).

Likewise, impervious cover plays an important role in the landscape, particularly in urban areas. These surfaces, such as roads, buildings, sidewalks, and parking lots, facilitate transportation and provide shelter, but also can negatively impact the environment. Increased impervious surfaces enhance local temperatures and heat islands (Oke, 1989; Heisler and Brazel, 2010), which consequently affects building energy use, human comfort and health, ozone production, and pollutant emissions in cities. In addition, impervious surfaces significantly affect urban hydrology (e.g., stream flow and water quality) (e.g., U.S. EPA, 1983; National Research Council, 2008).

As development occurs in forests, tree cover will decrease to make space for buildings and other impervious surfaces. In non-forest regions, tree cover can increase due to urbanization (unpublished data). Thus, urbanization as a process will alter regional tree cover. As tree cover changes in cities, so will the associated ecosystem services and their effects on environmental quality and human health. Unfortunately, within existing cities, rates and direction of change in tree and impervious cover are largely unknown. This paper investigates tree and impervious cover change in urban areas and select cities across the United States using a simple and repeatable measure that can be used worldwide where paired multi-year digital aerial imagery exists. The objective of this paper is to determine the current direction and rate of tree and impervious cover change in U.S. cities to help guide cities in sustaining desired tree cover levels and associated ecosystem services.

Methods

To determine the percent tree/shrub cover (hereafter referred to as tree cover or canopy) and impervious cover change in cities in the United States, 20 cities from across the nation were selected (Table 1). Some cities were selected based on existing projects (Syracuse, NY; Baltimore, MD; Spokane, WA). Other cities were selected by picking major cities scattered throughout the conterminous United States where paired imagery could be obtained. Two cities were specifically selected to determine the effect of recent suspected tree cover change: (1) New Orleans, LA (effect of 2005 Hurricane Katrina), and (2) Detroit, MI (effect of recent infestation of emerald ash borer (*Agrilus planipennis*)). For each city, paired digital aerial photographs were obtained for the most recent date possible and imagery as close to 5 yr prior to the most current date as possible.

In 18 of the 20 cities, 1000 random points were laid and interpreted across the city to provide a maximum standard error of 1.6 percent if all points are classified (Lindgren and McElrath, 1969). In two cities, more points were laid and interpreted (Baltimore: 2500 points; Spokane, WA: 2000 points). City geographic boundaries were determined using census incorporated or designated places boundaries (U.S. Census Bureau, 2007). Each point was laid in the same geographic position on both sets of temporal images in the city, and paired image interpretation was conducted (i.e., interpreter classified each point pair by contrasting and classifying the image points in sequence). In cases of misregistration of the image or point, the interpreter corrected the point location to ensure the exact same location was interpreted. For example, sometimes the points would shift position slightly between images due to issues of image misregistration. In these cases, the interpreter moved the point on the most recent image back to the position on the oldest image to make the interpretation of change at the same point on both images.

In some cases, not all of the points could be classified. Non-classification occurred when one of the images were missing part of the city area (incomplete imagery) or had cloud cover. All cities had greater than 97.2 percent of the points interpreted. As some cities have substantial amounts of water within their city boundary (Table 1), cover estimates were only based on points that were not classified as water in both years. That is, permanent water points were deleted from the sample so that cover estimates were based on city land area, not city total area.

For the photo-interpretation, trained photo interpreters with experience interpreting leaf-off and leaf-on imagery classified each point as to either: trees/shrubs (woody vegetation), grass

Table 1
Resolution and year of imagery for 20 analyzed cities. Percent of city area classified as water in both years (%Water) was removed from analysis so that cover estimates could be based on land area. Human population density change (#/ha) between year 1 and year 2 is based on U.S. Census estimates (1).

City	Year 1	Res.[a] (m)	Leaf on/off	Year 2	Res.[a] (m)	Leaf on/off	%interp[b]	%Water	*n*	Change (#/ha)
Albuquerque, NM	2006	0.15	Off	2009	1	On	100	0.2	998	0.6
Atlanta, GA	2005	2	On	2009	1	On	99.5	0.4	991	1.7
Baltimore, MD	2001	1	On	2005	1	On	99.9	12.6	2184	−0.2
Boston, MA	2003	1	On	2008	1	On	99.9	13.6	863	2.3
Chicago, IL	2005	2	On	2009	1	On	100	0.8	992	0.5
Denver, CO	2005	1	On	2009	1	On	100	1.6	984	1.2
Detroit, MI	2005	1	On	2009	1	On	99.9	0.3	996	−0.3
Houston, TX	2004	1	On	2009	1	On	99.5	1.6	979	1.4
Kansas City, MO	2003	1	On	2009	1	On	100	1.5	985	0.4
Los Angeles, CA	2005	1	On	2009	1	On	100	0.2	998	0.3
Miami, FL	2003	1	On	2009	0.3	On	100	9.3	907	6.3
Minneapolis, MN	2003	1	On	2008	1	On	98.9	7.1	919	0.3
Nashville, TN	2003	0.15	Off	2008	0.15	Off	100	0.7	993	0.3
New Orleans, LA	2005	2	On	2009	1	On	97.2	38.4	563	−2.1
New York, NY	2004	0.15	On	2009	1	On	98.1	2.9	953	2.8
Pittsburgh, PA	2004	1	On	2008	1	On	99.5	4.8	947	−0.6
Portland, OR	2005	1	On	2009	1	On	100	1.6	984	1.0
Spokane, WA	2002	0.15	On	2007	0.15	On	100	1.0	1980	0.3
Syracuse, NY	2003	0.3	Off	2009	0.3	Off	99.6	2.0	976	−0.7
Tacoma, WA	2001	0.15	On	2005	0.15	On	100	8.6	914	−0.1

[a] Image (pixel) resolution.
[b] Percent of original points (land and water) that were able to be classified on both images. *n* – sample size – number of points not classified as permanent water points (classified as water in both years).

or herbaceous cover, bare soil, water, impervious (buildings), impervious (roads), or impervious (other). For the analysis of Albuquerque, NM, only, an eighth class of scrub/shrub was added due to the different vegetation cover morphology of that region. This class was included in the tree/shrub cover classification, but the scrub/shrub class results were also reported separately. Within Syracuse, which was one of the first cities analyzed, impervious other and impervious road categories were combined by the interpreter as was the grass/herbaceous and soil categories. In subsequent city analyses these categories were separated.

In interpreting change from aerial imagery, image parallax (tall objects appearing to lean on the image) and seasonal changes can appear to cause changes, but in fact are not actual changes. In these cases the interpreter could use judgment to determine if actual change did occur. In cases of tall object parallax, the interpreter's classification was based on the oldest image and if there was no change, both dates of imagery were classified the same. For example, tall objects (e.g., buildings and trees) may lean to the left in the first image, but lean to the right in the second image and a point may land on the object in the first image, but miss the object in the second image. The point classification would appear to change class, but no actual change would have occurred. Also agricultural fields can change cover class depending on time of year (herbaceous cover vs. bare soil depending upon time of imagery). These types of seasonal changes were classified as no change and classified as herbaceous cover. By conducting paired-point image analysis, the interpreter can correct these false changes to no change in the analysis. A five-percent random sample of points was reinterpreted by another photo-interpreter to check for classification accuracy. Overall, the two interpreters were in agreement on 97 percent of the classifications.

Within each city, the percentage of each cover class (p) was calculated as the number of sample points (x) hitting the cover attribute divided by the total number of interpretable sample points (n) within the area of analysis ($p = x/n$). The standard error of the estimate (SE) was calculated as $SE = \sqrt{p \times (1-p)/n}$ (Lindgren and McElrath, 1969). This method has been used to assess canopy cover in many cities (e.g., Nowak et al., 1996).

If changes in cover classes were observed at any point on the image then it is known that cover classes are changing within the city (i.e., no statistical test is needed to determine if change is greater than zero). However, as a cover class can both gain and lose cover through time and space, the McNemar test (Sokal and Rohlf, 2003) was used to determine if the net change in cover was different from zero (alpha levels 0.90 and 0.95). Pearson product moment correlation was used to test for a relationship between change in percent tree cover and change in population density among the 18 cities.

As the overall time frame of change in cover varied among cities from between 3 and 6 yr, change results were annualized for comparative purposes among cities. Results were combined with city area and population data from the year of the oldest photo date (U.S. Census Bureau, 2011) to determine actual tree and impervious cover change (ha) and cover change per capita in each city. Results of percent change were reported as absolute change (percent of city area that changed = cover change/city area) and relative change (percent of existing cover class that changed = cover change/original cover area). For example, a city with 30 percent tree cover that changed to 20 percent tree cover would have a 10 percent absolute change, but a 33 percent relative change.

As the 20 analyzed cities are not a truly random sample, an analysis of change in tree and impervious cover in urban areas across the conterminous United States was conducted using Google Earth® (Google, 2011) imagery to determine the relative magnitude of net change in urban tree and impervious cover. Urban land was defined based on population density as delimited using the U.S. Census Bureau's (2007) definition: all territory, population, and housing units located within urbanized areas or urban clusters. Urbanized area and urban cluster boundaries encompass densely settled territories, which are described by one of the following:

- one or more block groups or census blocks with a population density of at least 386.1 people/km^2 (1000 people/mile^2),
- surrounding census blocks with a minimum population density of 193.1 people/km^2 (500 people/mile^2), or
- less densely settled blocks that form enclaves or indentations, or are used to connect discontinuous areas.

In the conterminous United States, 1000 points randomly located within urban land were interpreted based on paired imagery from Google using the images with the most recent date and the next oldest interpretable imagery with the goal of trying to get the second set of imagery about 5 yr apart from the first set. Imagery date along with cover class was recorded for each point. This type of analysis of change with Google imagery has varying date issues that were not encountered with the paired city imagery, but does give a general indication of direction and magnitude of change nationally. Analysis of Google imagery was similar to the city imagery in terms of non-interpretable images and adjusting for misregistered images. However, Google imagery could also not be interpreted in some locations due to poor image resolution. Overall, 97 percent of the points could be interpreted using Google imagery.

Results

Of the 20 cities analyzed, tree cover ranged from 53.9 percent in Atlanta to 9.6 percent in Denver; building impervious cover ranged from 27.1 percent in Chicago to 4.8 percent in Kansas City; road and other impervious cover ranged from 36.2 percent in Miami to 12.3 percent in Nashville; and total impervious cover varied from 61.1 percent in New York City to 17.7 percent in Nashville (Table 2). Two cover classes – tree/shrub and bare soil generally exhibited a reduction in percent cover, while the other land classes generally exhibited an increase in cover.

Change in tree cover during the varying periods of analysis ranged from reduction in percent tree cover of −9.6 in New Orleans to an increase in percent tree cover of 1.0 in Syracuse (Table 3). Nineteen of the 20 cities analyzed showed a reduction in tree cover, 17 of those cities had a statistically significant net reduction. Average change was calculated for all 20 cities and for 18 cities – excluding the two cities (New Orleans and Detroit) that were targeted due to an expected loss in tree cover. Percent tree cover dropped on average by 1.1 percent during the varying periods of analysis (1.5 percent for 20 city average) with the greatest decreases in percent tree cover in New Orleans (−9.6 percent), Houston (−3.0 percent) and Albuquerque (−2.7 percent). The relative reduction in tree cover was as high as −29.2 percent in New Orleans, but averaged −3.8 percent (−5.0 percent for 20 city average).

Cities with the greatest annual loss in tree cover were New Orleans (average of −1120 ha/yr), Houston (−890 ha/yr) and Albuquerque (−420 ha/yr) (Table 3). Tree cover losses per capita were greatest in New Orleans (−24.6 m^2/person/yr), Albuquerque (−8.3 m^2/person/yr) and Nashville (−5.3 m^2/person/yr) with an average loss of −1.9 m^2/person/yr (−3.0 m^2/person/yr for 20 city average). Average annual loss in percent tree cover was −0.27 percent/yr (−0.37 percent/yr for 20 city average). Relative annual loss in tree cover was −0.90 percent/yr (−1.29 percent/yr for 20 city average). Loss of tree cover was slightly correlated to increased population density in the 18 cities (Pearson product moment correlation coefficient (r) = −0.31).

Table 2
Change of percent of city land area occupied by various cover classes in 20 U.S. cities.

City	1st year cover class	2nd year cover class							1st year	
		Grass/herb[a]	Tree/shrub	Imp. bldg[b]	Imp. road[c]	Imp. other[d]	Water	Soil	Total	SE
Albuquerque, NM (2006–2009)[e]	Grass/herb	8.8	0.1	0.1	0.0	0.1	0.0	0.0	9.1	0.9
	Tree/shrub	0.4	38.0	0.0	0.0	0.4	0.0	2.0	40.8	1.6
	Imp. bldg	0.1	0.0	11.9	0.0	0.0	0.0	0.0	12.0	1.0
	Imp. road	0.0	0.0	0.0	9.4	0.0	0.0	0.0	9.4	0.9
	Imp. other	0.0	0.0	0.0	0.0	13.9	0.0	0.0	13.9	1.1
	Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Soil	0.4	0.0	0.5	0.3	0.5	0.0	13.0	14.7	1.1
	2nd year total	9.7	38.1	12.5	9.7	14.9	0.0	15.0		
	2nd year SE	0.9	1.5	1.0	0.9	1.1	0.0	1.1		
	Net (2006–2009)	0.6	−2.7	0.5	0.3	1.0	0.0	0.3		
Atlanta, GA (2005–2009)	Grass/herb	15.1	0.4	0.1	0.0	0.3	0.0	0.6	16.5	1.2
	Tree/shrub	1.0	51.6	0.4	0.1	0.3	0.0	0.5	53.9	1.6
	Imp. bldg	0.0	0.0	9.6	0.0	0.1	0.0	0.1	9.8	0.9
	Imp. road	0.0	0.0	0.0	7.4	0.0	0.0	0.0	7.4	0.8
	Imp. other	0.0	0.0	0.1	0.0	9.2	0.0	0.0	9.3	0.9
	Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Soil	1.3	0.1	0.2	0.2	0.2	0.0	1.1	3.1	0.6
	2nd year total	17.5	52.1	10.4	7.7	10.1	0.0	2.3		
	2nd year SE	1.2	1.6	1.0	0.8	1.0	0.0	0.5		
	Net (2005–2009)	0.9	−1.8	0.6	0.3	0.8	0.0	−0.8		
Baltimore, MD (2001–2005)	Grass/herb	22.2	0.1	0.2	0.0	0.7	0.0	0.3	23.5	0.9
	Tree/shrub	0.9	28.4	0.4	0.1	0.5	0.0	0.1	30.4	1.0
	Imp. bldg	0.0	0.0	15.3	0.0	0.0	0.0	0.3	15.6	0.8
	Imp. road	0.0	0.0	0.0	10.9	0.0	0.0	0.0	11.0	0.7
	Imp. other	0.0	0.0	0.0	0.0	16.8	0.0	0.2	17.1	0.8
	Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Soil	0.1	0.0	0.3	0.0	0.3	0.0	1.6	2.3	0.3
	2nd year total	23.2	28.5	16.3	11.0	18.5	0.0	2.5		
	2nd year SE	0.9	1.0	0.8	0.7	0.8	0.0	0.3		
	Net (2001–2005)	−0.4	−1.9	0.7	0.0	1.3	0.0	0.2		
Boston, MA (2003–2008)	Grass/herb	17.8	0.5	0.1	0.0	0.6	0.0	0.1	19.1	1.3
	Tree/shrub	0.6	27.1	0.6	0.2	0.1	0.0	0.2	28.9	1.5
	Imp. bldg	0.1	0.0	16.5	0.0	0.1	0.0	0.0	16.7	1.3
	Imp. road	0.0	0.0	0.0	12.5	0.0	0.0	0.0	12.5	1.1
	Imp. other	0.2	0.2	0.0	0.1	18.4	0.0	0.0	19.0	1.3
	Water	0.1	0.0	0.0	0.0	0.0	0.0	0.7	0.8	0.3
	Soil	0.5	0.1	0.1	0.1	0.5	0.0	1.7	3.0	0.6
	2nd year total	19.4	27.9	17.3	13.0	19.7	0.0	2.8		
	2nd year SE	1.3	1.5	1.3	1.1	1.4	0.0	0.6		
	Net (2003–2008)	0.2	−0.9	0.6	0.5	0.7	−0.8	−0.2		
Chicago, IL (2005–2009)	Grass/herb	20.0	0.0	0.0	0.0	0.3	0.1	0.4	20.8	1.3
	Tree/shrub	0.3	18.0	0.1	0.0	0.0	0.0	0.1	18.5	1.2
	Imp. bldg	0.4	0.0	26.5	0.0	0.1	0.0	0.1	27.1	1.4
	Imp. road	0.0	0.0	0.0	12.1	0.0	0.0	0.0	12.1	1.0
	Imp. other	0.0	0.0	0.2	0.0	19.1	0.0	0.0	19.3	1.3
	Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Soil	0.0	0.0	0.0	0.0	0.1	0.1	2.0	2.2	0.5
	2nd year total	20.7	18.0	26.8	12.1	19.6	0.2	2.6		
	2nd year SE	1.3	1.2	1.4	1.0	1.3	0.1	0.5		
	Net (2005–2009)	−0.1	−0.5	−0.3	0.0	0.3	0.2	0.4		
Denver, CO (2005–2009)	Grass/herb	41.1	0.0	0.1	0.0	0.3	0.0	0.9	42.4	1.6
	Tree/shrub	0.1	9.6	0.1	0.0	0.1	0.0	0.0	9.9	1.0
	Imp. bldg	0.0	0.0	12.8	0.0	0.0	0.0	0.1	12.9	1.1
	Imp. road	0.0	0.0	0.1	12.5	0.0	0.0	0.0	12.6	1.1
	Imp. other	0.2	0.0	0.2	0.1	13.9	0.0	0.1	14.5	1.1
	Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Soil	0.8	0.0	0.1	0.1	1.0	0.2	5.5	7.7	0.9
	2nd year total	42.2	9.6	13.4	12.7	15.3	0.2	6.6		
	2nd year SE	1.6	0.9	1.1	1.1	1.1	0.1	0.8		
	Net (2005–2009)	−0.2	−0.3	0.5	0.1	0.8	0.2	−1.1		
Detroit, MI (2005–2009)	Grass/herb	27.9	0.1	0.0	0.0	0.2	0.0	0.3	28.5	1.4
	Tree/shrub	0.1	22.3	0.1	0.2	0.4	0.0	0.1	23.2	1.3
	Imp. bldg	0.1	0.0	17.1	0.0	0.0	0.0	0.0	17.2	1.2
	Imp. road	0.0	0.0	0.0	14.7	0.0	0.0	0.0	14.7	1.1

Table 2 (*Continued*)

City	1st year cover class	2nd year cover class							1st year	
		Grass/herb[a]	Tree/shrub	Imp. bldg[b]	Imp. road[c]	Imp. other[d]	Water	Soil	Total	SE
	Imp. other	0.0	0.0	0.1	0.0	14.5	0.0	0.0	14.6	1.1
	Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Soil	0.2	0.1	0.1	0.0	0.3	0.0	1.2	1.9	0.4
	2nd year total	28.3	22.5	17.4	14.9	15.4	0.0	1.6		
	2nd year SE	1.4	1.3	1.2	1.1	1.1	0.0	0.4		
	Net (2005–2009)	−0.2	−0.7	0.2	0.2	0.8	0.0	−0.3		
Houston, TX (2004–2009)	Grass/herb	28.7	0.0	0.5	0.0	0.5	0.2	0.2	30.1	1.5
	Tree/shrub	1.4	27.4	0.3	0.1	0.2	0.1	0.8	30.3	1.5
	Imp. bldg	0.0	0.0	13.5	0.0	0.0	0.0	0.2	13.7	1.1
	Imp. road	0.0	0.0	0.0	12.0	0.0	0.0	0.0	12.0	1.0
	Imp. other	0.1	0.0	0.1	0.0	11.8	0.0	0.1	12.2	1.0
	Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Soil	0.4	0.0	0.0	0.0	0.1	0.0	1.2	1.7	0.4
	2nd year total	30.6	27.4	14.4	12.1	12.7	0.3	2.6		
	2nd year SE	1.5	1.4	1.1	1.0	1.1	0.2	0.5		
	Net (2004–2009)	0.5	−3.0	0.7	0.1	0.5	0.3	0.8		
Kansas City, MO (2003–2009)	Grass/herb	48.5	0.5	0.2	0.3	0.7	0.1	0.3	50.7	1.6
	Tree/shrub	1.1	27.5	0.0	0.1	0.0	0.0	0.5	29.2	1.4
	Imp. bldg	0.0	0.0	4.6	0.0	0.2	0.0	0.0	4.8	0.7
	Imp. road	0.0	0.0	0.0	6.3	0.0	0.0	0.0	6.3	0.8
	Imp. other	0.0	0.0	0.2	0.1	6.8	0.0	0.0	7.1	0.8
	Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Soil	0.2	0.0	0.0	0.0	0.7	0.0	1.0	1.9	0.4
	2nd year total	49.8	28.0	5.0	6.8	8.4	0.1	1.8		
	2nd year SE	1.6	1.4	0.7	0.8	0.9	0.1	0.4		
	Net (2003–2009)	−0.8	−1.2	0.2	0.5	1.3	0.1	−0.1		
Los Angeles, CA (2005–2009)	Grass/herb	21.0	0.0	0.3	0.0	0.2	0.0	0.3	21.8	1.3
	Tree/shrub	0.4	20.6	0.2	0.0	0.3	0.0	0.0	21.5	1.3
	Imp. bldg	0.0	0.0	21.0	0.0	0.2	0.0	0.0	21.2	1.3
	Imp. road	0.0	0.0	0.0	14.7	0.0	0.0	0.0	14.7	1.1
	Imp. other	0.0	0.0	0.4	0.0	15.8	0.0	0.1	16.3	1.2
	Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Soil	0.3	0.0	0.5	0.2	0.2	0.0	3.1	4.3	0.6
	2nd year total	21.7	20.6	22.4	14.9	16.7	0.0	3.5		
	2nd year SE	1.3	1.3	1.3	1.1	1.2	0.0	0.6		
	Net (2005–2009)	−0.1	−0.9	1.2	0.2	0.4	0.0	−0.8		
Miami, FL (2003–2009)	Grass/herb	14.2	0.2	0.1	0.1	0.6	0.0	0.1	15.3	1.2
	Tree/shrub	1.1	21.2	0.4	0.2	0.1	0.1	0.1	23.3	1.4
	Imp. bldg	0.3	0.0	23.5	0.0	0.0	0.0	0.1	23.9	1.4
	Imp. road	0.0	0.0	0.0	18.0	0.0	0.0	0.0	18.0	1.3
	Imp. other	0.2	0.2	0.6	0.0	17.0	0.0	0.1	18.1	1.3
	Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Soil	0.0	0.0	0.2	0.0	0.2	0.0	1.0	1.4	0.4
	2nd year total	15.9	21.6	24.8	18.3	17.9	0.1	1.4		
	2nd year SE	1.2	1.4	1.4	1.3	1.3	0.1	0.4		
	Net (2003–2009)	0.6	−1.7	0.9	0.3	−0.2	0.1	0.0		
Minneapolis, MN (2003–2008)	Grass/herb	18.6	0.2	0.0	0.0	0.3	0.0	0.4	19.6	1.3
	Tree/shrub	1.0	33.7	0.1	0.2	0.1	0.0	0.0	35.1	1.6
	Imp. bldg	0.0	0.0	14.4	0.0	0.1	0.0	0.1	14.6	1.2
	Imp. road	0.0	0.1	0.0	12.3	0.0	0.0	0.0	12.4	1.1
	Imp. other	0.0	0.0	0.3	0.0	15.6	0.0	0.0	15.9	1.2
	Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Soil	0.2	0.0	0.1	0.0	0.1	0.2	1.7	2.4	0.5
	2nd year total	19.8	34.1	14.9	12.5	16.2	0.2	2.3		
	2nd year SE	1.3	1.6	1.2	1.1	1.2	0.2	0.5		
	Net (2003–2008)	0.2	−1.1	0.3	0.1	0.3	0.2	−0.1		
Nashville, TN (2003–2008)	Grass/herb	28.3	0.4	0.1	0.1	0.0	0.0	0.3	29.2	1.4
	Tree/shrub	0.7	49.4	0.1	0.2	0.1	0.0	0.5	51.1	1.6
	Imp. bldg	0.0	0.0	5.4	0.0	0.0	0.0	0.0	5.4	0.7
	Imp. road	0.0	0.0	0.0	5.6	0.0	0.0	0.0	5.6	0.7
	Imp. other	0.0	0.0	0.0	0.0	6.7	0.0	0.0	6.7	0.8
	Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Soil	0.4	0.0	0.2	0.0	0.3	0.1	0.9	1.9	0.4
	2nd year total	29.4	49.8	5.8	5.9	7.2	0.1	1.7		

Table 2 (*Continued*)

City	1st year cover class	2nd year cover class							1st year	
		Grass/herb[a]	Tree/shrub	Imp. bldg[b]	Imp. road[c]	Imp. other[d]	Water	Soil	Total	SE
	2nd year SE	1.4	1.6	0.7	0.8	0.8	0.1	0.4		
	Net (2003–2008)	0.2	−1.2	0.4	0.3	0.4	0.1	−0.2		
New Orleans, LA (2005–2009)	Grass/herb	22.7	0.0	0.0	0.0	0.2	0.4	0.7	24.0	1.8
	Tree/shrub	6.6	23.3	0.0	0.9	1.1	0.4	0.7	32.9	2.0
	Imp. bldg	1.4	0.0	14.6	0.0	0.4	0.0	0.4	16.7	1.6
	Imp. road	0.0	0.0	0.0	15.5	0.0	0.0	0.0	15.5	1.5
	Imp. other	0.2	0.0	0.0	0.0	9.1	0.0	0.0	9.2	1.2
	Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Soil	0.2	0.0	0.0	0.0	0.2	0.0	1.4	1.8	0.6
	2nd year total	31.1	23.3	14.6	16.3	10.8	0.7	3.2		
	2nd year SE	2.0	1.8	1.5	1.6	1.3	0.4	0.7		
	Net (2005–2009)	7.1	−9.6	−2.1	0.9	1.6	0.7	1.4		
New York, NY (2004–2009)	Grass/herb	14.9	0.1	0.2	0.0	0.6	0.1	0.6	16.6	1.2
	Tree/shrub	1.2	19.3	0.0	0.2	0.2	0.0	0.0	20.9	1.3
	Imp. bldg	0.0	0.0	24.4	0.0	0.1	0.0	0.0	24.6	1.4
	Imp. road	0.0	0.0	0.0	16.1	0.0	0.0	0.0	16.1	1.2
	Imp. other	0.0	0.3	0.2	0.1	18.5	0.0	0.0	19.1	1.3
	Water	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
	Soil	0.5	0.0	0.3	0.0	0.1	0.0	1.8	2.7	0.5
	2nd year total	16.6	19.7	25.2	16.4	19.5	0.1	2.5		
	2nd year SE	1.2	1.3	1.4	1.2	1.3	0.1	0.5		
	Net (2004–2009)	0.0	−1.2	0.6	0.3	0.4	0.0	−0.2		
Pittsburgh, PA (2004–2008)	Grass/herb	16.9	0.0	0.0	0.0	0.1	0.0	0.1	17.1	1.2
	Tree/shrub	0.2	41.6	0.1	0.0	0.0	0.0	0.0	41.9	1.6
	Imp. bldg	0.0	0.0	14.7	0.0	0.1	0.0	0.1	14.9	1.2
	Imp. road	0.0	0.0	0.0	13.3	0.0	0.0	0.1	13.4	1.1
	Imp. other	0.0	0.0	0.1	0.0	11.6	0.0	0.0	11.7	1.0
	Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Soil	0.1	0.0	0.0	0.0	0.0	0.0	0.8	1.0	0.3
	2nd year total	17.2	41.6	14.9	13.3	11.8	0.0	1.2		
	2nd year SE	1.2	1.6	1.2	1.1	1.0	0.0	0.3		
	Net (2004–2008)	0.1	−0.3	0.0	−0.1	0.1	0.0	0.2		
Portland, OR (2005–2009)	Grass/herb	21.4	0.3	0.3	0.1	0.3	0.0	0.2	22.7	1.3
	Tree/shrub	0.7	30.4	0.1	0.0	0.3	0.0	0.0	31.5	1.5
	Imp. bldg	0.2	0.1	14.4	0.0	0.0	0.0	0.0	14.7	1.1
	Imp. road	0.0	0.0	0.0	12.5	0.0	0.0	0.0	12.5	1.1
	Imp. other	0.0	0.1	0.1	0.0	15.8	0.0	0.0	16.0	1.2
	Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Soil	0.6	0.0	0.2	0.1	0.5	0.0	1.2	2.6	0.5
	2nd year total	23.0	30.9	15.1	12.7	16.9	0.0	1.4		
	2nd year SE	1.3	1.5	1.1	1.1	1.2	0.0	0.4		
	Net (2005–2009)	0.3	−0.6	0.4	0.2	0.9	0.0	−1.2		
Spokane, WA (2002–2007)	Grass/herb	24.0	0.7	0.2	0.1	0.4	0.0	1.7	27.1	1.0
	Tree/shrub	0.5	20.6	0.2	0.0	0.1	0.0	1.1	22.4	0.9
	Imp. bldg	0.0	0.0	12.0	0.0	0.1	0.0	0.0	12.1	0.7
	Imp. road	0.0	0.0	0.0	11.1	0.0	0.0	0.1	11.1	0.7
	Imp. other	0.1	0.0	0.0	0.0	10.5	0.0	0.1	10.6	0.7
	Water	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1
	Soil	1.3	0.5	0.5	0.2	0.7	0.0	13.6	16.7	0.8
	2nd year total	25.9	21.8	12.8	11.4	11.6	0.0	16.5		
	2nd year SE	1.0	0.9	0.8	0.7	0.7	0.0	0.8		
	Net (2002–2007)	−1.2	−0.6	0.8	0.3	1.0	−0.1	−0.2		
Syracuse, NY (2003–2009)[f]	Grass/herb	21.7	1.6	0.1	0.6	na	0.0	na	24.1	1.4
	Tree/shrub	0.5	25.0	0.1	0.3	na	0.0	na	25.9	1.4
	Imp. bldg	0.7	0.0	18.9	0.1	na	0.0	na	19.7	1.3
	Imp. road	0.6	0.3	0.2	29.2	na	0.0	na	30.3	1.5
	Imp. other	na	na	na	na	na	0.0	na	na	na
	Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Soil	na	na	na	na	na	0.0	na	na	na
	2nd year total	23.6	26.9	19.3	30.2	na	0.0	na		
	2nd year SE	1.4	1.4	1.3	1.5	na	0.0	na		
	Net (2003–2009)	−0.5	1.0	−0.4	−0.1	na	0.0	na		
Tacoma, WA (2001–2005)	Grass/herb	24.8	1.2	0.1	0.1	0.8	0.0	0.1	27.1	1.5
	Tree/shrub	1.8	21.3	0.1	0.0	0.8	0.0	0.4	24.4	1.4

Table 2 (*Continued*)

City	1st year cover class	2nd year cover class							1st year	
		Grass/herb[a]	Tree/shrub	Imp. bldg[b]	Imp. road[c]	Imp. other[d]	Water	Soil	Total	SE
	Imp. bldg	0.2	0.0	13.2	0.0	0.3	0.0	0.2	14.0	1.1
	Imp. road	0.0	0.0	0.0	12.5	0.0	0.0	0.0	12.5	1.1
	Imp. other	0.0	0.1	0.1	0.1	13.8	0.0	0.1	14.2	1.2
	Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Soil	1.3	0.3	0.3	0.1	2.0	0.3	3.4	7.8	0.9
	2nd year total	28.1	23.0	13.9	12.8	17.6	0.3	4.3		
	2nd year SE	1.5	1.4	1.1	1.1	1.3	0.2	0.7		
	Net (2001–2005)	1.0	−1.4	−0.1	0.3	3.4	0.3	−3.5		
Average 20 cities[g]	Grass/herb	23.0	0.3	0.1	0.0	0.4	0.0	0.4	24.3	na
	Tree/shrub	1.1	27.8	0.2	0.1	0.3	0.0	0.4	29.9	na
	Imp. bldg	0.2	0.0	15.2	0.0	0.1	0.0	0.1	15.6	na
	Imp. road	0.0	0.0	0.0	12.1	0.0	0.0	0.0	12.1	na
	Imp. other	0.1	0.1	0.1	0.0	13.6	0.0	0.0	13.9	na
	Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	na
	Soil	0.5	0.1	0.2	0.1	0.4	0.1	3.0	4.3	na
	2nd year total	24.7	28.2	15.9	12.3	14.8	0.1	4.0		
	2nd year SE	na	na	na	na	na	na	na		
	Average net	0.5	−1.5	0.3	0.3	0.8	0.1	−0.3		
Average 18 cities[h]	Grass/herb	22.7	0.3	0.2	0.0	0.4	0.0	0.4	24.0	na
	Tree/shrub	0.8	28.4	0.2	0.1	0.2	0.0	0.4	30.0	na
	Imp. bldg	0.1	0.0	15.1	0.0	0.1	0.0	0.1	15.4	na
	Imp. road	0.0	0.0	0.0	11.7	0.0	0.0	0.0	11.7	na
	Imp. other	0.1	0.1	0.2	0.0	13.8	0.0	0.0	14.2	na
	Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	na
	Soil	0.5	0.1	0.2	0.1	0.4	0.1	3.2	4.6	na
	2nd year total	24.2	28.8	15.9	12.0	15.0	0.1	4.2		
	2nd year SE	na	na	na	na	na	na	na		
	Average net	0.1	−1.1	0.4	0.2	0.8	0.0	−0.4		

SE – standard error. Net – net difference between the years (2nd year – 1st year).

[a] Grass and other herbaceous ground cover.

[b] Impervious cover occupied by buildings.

[c] Impervious cover occupied by roads.

[d] Other impervious cover (e.g., sidewalks, driveways, and parking lots).

[e] Scrub/shrub/chaparral was a cover class only measured in Albuquerque, NM, and is included in tree/shrub cover. This cover class occupied 31.6 percent of the city area in 2006 and dropped to 29.4 percent in 2009, a loss of 2.2 percent of the city area.

[f] Soil cover is included in grass and herbaceous cover; impervious other is included in impervious road.

[g] Results from Syracuse are not included in average of grass/herbaceous, impervious road, impervious other or soil (see table footnote f).

[h] Average result not including New Orleans or Detroit as these cities were specifically selected due to expected losses from hurricane and emerald ash borer damage respectively. Results from Syracuse are not included in average of grass/herbaceous, impervious road, impervious other or soil (see table footnote f).

Most of the loss of tree cover converted to grass/herbaceous cover (47 percent), followed by conversions to impervious cover (29 percent) and bare soil (23 percent) (Table 2). Likewise, new cover most often converted from grass/herbaceous cover (68 percent), followed by impervious cover (17 percent) and bare soil (14 percent). Only one city (Syracuse) exhibited an overall increase in tree cover, with most of this increase coming from grass/herbaceous cover.

Change in percent impervious cover during the varying periods of analysis ranged from an increase of 3.6 percent in Tacoma to a decrease in percent impervious cover of −0.5 in Syracuse (Table 3). Seventeen of the 20 cities analyzed showed an increase in net impervious cover, 16 of those cities had a statistically significant increase. Four cities exhibited small changes in net impervious cover that were not statistically significant from zero (Syracuse, Chicago, Pittsburgh, New Orleans). Percent impervious cover increased on average by 1.4 percent during the varying periods of analysis (1.3 percent for 20 city average) with the greatest increases in percent impervious cover in Tacoma (3.6 percent), Baltimore (2.1 percent) and Kansas City and Spokane (2.0 percent each). The relative increase in impervious cover was as high as 11.2 percent in Kansas City, but averaged 3.9 percent (3.7 percent for 20 city average).

Cities with the greatest annual increase in impervious cover were Los Angeles (average of 550 ha/yr), Houston (400 ha/yr) and Albuquerque (280 ha/yr) (Table 3). Impervious cover increases per capita were greatest in Tacoma (6.0 m^2/person/yr), Kansas City (5.9 m^2/person/yr) and Albuquerque (5.5 m^2/person/yr) with an average increase of 2.2 m^2/person/yr (2.1 m^2/person/yr for 20 city average). Average annual increase in percent impervious cover was 0.31 percent/yr (0.30 percent/yr for 20 city average). Relative annual increase in impervious cover was 0.87 percent/yr (0.82 percent/yr for 20 city average).

The analysis of the 20 cities shows a general loss in tree cover and increase in impervious cover in the mid to late 2000s. This overall trend of change was also exhibited in the results of national urban land cover change using Google Earth imagery. Of the 1000 random paired-points laid throughout the conterminous urban United States, 970 points were interpretable, with average length of time between points of 6.4 yr. The most recent imagery had an average year of 2009, but ranged between 2004 and 2011. The older paired image year averaged 2002 with a range of 1990–2006. Tree cover increases between images averaged 2.1 percent (SE = 0.5 percent) with average losses of −2.3 percent (SE = 0.5 percent) for an average net change in tree cover of −0.2 percent. Impervious cover increases between images averaged 3.2 percent (SE = 0.6 percent)

Table 3
Percent net and annualized net absolute and relative tree and impervious cover change in 20 U.S. cities. Absolute percent change is based on city land area between the years (percent of city land in year 1 minus percent of city land in year 2). Relative percent change is based on amount of cover in year 1 (percent of city in year 1 minus percent of city in year 2 divided by percent of city in year 1). Annualized change is percent change during time period on an annual basis. Per capita change estimates are based on population in the first year of analysis.

City	Net				Tree cover change		Impervious cover change		Annualized net			
	Absolute change		Relative change		ha/yr[c]	m²/cap/yr[d]	ha/yr[c]	m²/cap/yr[d]	Absolute change		Relative change	
	Tree[a]	Imp.[b]	Tree[a]	Imp.[b]					Tree[a]	Imp.[b]	Tree[a]	Imp.[b]
New Orleans, LA (2005–2009)	−9.6**	0.4	−29.2**	0.9	−1120	−24.6	40	0.9	−2.49	0.09	−8.27	0.21
Houston, TX (2004–2009)	−3.0**	1.3**	−9.8**	3.5**	−890	−4.3	400	1.9	−0.60	0.26	−2.03	0.69
Albuquerque, NM (2006–2009)	−2.7**	1.8**	−6.6**	5.1**	−420	−8.3	280	5.5	−0.91	0.60	−2.26	1.67
Baltimore, MD (2001–2005)	−1.9**	2.1**	−6.3**	4.7**	−100	−1.5	110	1.7	−0.48	0.51	−1.62	1.16
Atlanta, GA (2005–2009)	−1.8**	1.7**	−3.4**	6.5**	−150	−3.1	150	3.1	−0.46	0.43	−0.85	1.58
Miami, FL (2003–2009)	−1.7**	1.0*	−7.1**	1.7*	−30	−0.8	20	0.5	−0.28	0.16	−1.22	0.27
Tacoma, WA (2001–2005)	−1.4**	3.6**	−5.8**	8.9**	−50	−2.6	117	6.0	−0.36	0.89	−1.49	2.15
Kansas City, MO (2003–2009)	−1.2**	2.0**	−4.2**	11.2**	−160	−3.5	270	5.9	−0.20	0.34	−0.71	1.78
Nashville, TN (2003–2008)	−1.2**	1.1**	−2.4**	6.2**	−300	−5.3	270	4.8	−0.24	0.22	−0.48	1.21
New York, NY (2004–2009)	−1.2**	1.4**	−5.5**	2.3**	−180	−0.2	210	0.3	−0.23	0.27	−1.13	0.45
Minneapolis, MN (2003–2008)	−1.1**	0.8**	−3.1**	1.8**	−30	−0.8	20	0.5	−0.22	0.15	−0.63	0.35
Boston, MA (2003–2008)	−0.9*	1.7**	−3.2*	3.6**	−20	−0.3	40	0.7	−0.19	0.35	−0.65	0.71
Los Angeles, CA (2005–2009)	−0.9**	1.8**	−4.2**	3.4**	−270	−0.7	550	1.4	−0.23	0.45	−1.06	0.85
Detroit, MI (2005–2009)	−0.7**	1.2**	−3.0**	2.6**	−60	−0.7	110	1.2	−0.18	0.30	−0.77	0.64
Portland, OR (2005–2009)	−0.6	1.5**	−1.9	3.5**	−50	−0.9	130	2.4	−0.15	0.38	−0.49	0.87
Spokane, WA (2002–2007)	−0.6	2.0**	−2.5	5.8**	−20	−1.0	60	3.0	−0.11	0.39	−0.50	1.14
Chicago, IL (2005–2009)	−0.5**	0.0	−2.7**	0.0	−70	−0.2	0	0.0	−0.13	0.00	−0.69	0.00
Pittsburgh, PA (2004–2008)	−0.3*	0.0	−0.8*	0.0	−10	−0.3	0	0.0	−0.08	0.00	−0.19	0.00
Denver, CO (2005–2009)	−0.3*	1.4**	−3.1*	3.6**	−30	−0.5	140	2.5	−0.08	0.35	−0.78	0.88
Syracuse, NY (2003–2009)	1.0*	−0.5	4.0*	−1.0	10	0.7	−6	−0.4	0.17	−0.09	0.65	−0.17
20 city average	−1.5	1.3	−5.0	3.7		−3.0		2.1	−0.37	0.30	−1.29	0.82
18 city average[e]	−1.1	1.4	−3.8	3.9		−1.9		2.2	−0.27	0.31	−0.90	0.87

[a] Percent tree and shrub cover (including shrub/scrub/chaparral cover in Albuquerque, NM).
[b] Percent impervious surfaces (building, roads and other combined).
[c] Average annual change in hectares per year.
[d] Average annual change in square meters per capita per year.
[e] Average result not including New Orleans or Detroit as these cities were specifically selected due to expected losses from hurricane and emerald ash borer damage respectively.
* Change significantly different from zero at alpha = 0.90.
** Change significantly different from zero at alpha = 0.95.

with average losses of −0.4 percent (SE = 0.2 percent) for an average net change in impervious cover of +2.8 percent.

Discussion

While cities expend resources to plant millions of new trees, land development, storms, old age and other factors are reducing the number of older, established trees in cities. Though current planting campaigns may increase tree cover now and in the future, recent trends indicate that tree cover is decreasing in many U.S. cities. Tree cover is decreasing at a rate of about 0.27 percent of the city land area per year, which is equivalent to about 0.9 percent of the existing tree cover being lost annually.

The tree cover loss in the analyzed cities was higher than the average tree cover loss for urban land in the conterminous United States by a factor of about 6 (1.1 vs. 0.2 percent over the varying time frames). This difference is likely because these analyzed cities do not represent the entire urban area. The selected cities are relatively major cities with increased population densities and likely increased development pressures when compared with the average urban landscape, which includes many smaller, less densely populated areas. These city boundaries, which are often in forested regions, can also include non-urban lands that may have a high likelihood for development and therefore loss of tree cover and increased impervious cover. The change effects in these cities are likely more representative of change in major cities than the national urban change estimates.

Using the national tree cover loss estimate of 0.2 percent of urban land over about a 6 yr period, which equates to about 1/30 of a percent per year, a first order approximation of tree cover loss in urban areas of the conterminous United States is a loss rate of about 7900 ha of urban tree cover per year. Given an average tree density per unit of urban tree cover of approximately 508 trees/ha (average from Cumming et al., 2007; Nowak et al., 2007, in press-a, in press-b; Nowak and Greenfield, 2008; unpublished data), this loss equates to an annual net loss of about 4.0 million trees per year in urban areas of the conterminous United States. This estimate of number of trees lost may be excessive as much of canopy loss may be due to loss of mature trees that would have a lower tree density per unit canopy than the average urban forest, but further research is needed to understand the composition and size class distribution of the canopy loss. Although tree planting and natural regeneration are occurring in urban areas, net tree cover is on a general decline in urban areas of the United States. Tree canopy loss of mature trees, for whatever reason (storms, insects, development, old age), can create relatively large gaps in the canopy cover that will require new tree plantings or regeneration and time to fill.

It is apparent that tree planting and natural regeneration are insufficient to offset the current losses of established urban tree canopies. However, without various tree planting efforts in cities, tree cover loss would be higher. Efforts to facilitate more natural regeneration in cities (e.g., limits on mowing) may also be needed to sustain tree cover. Natural regeneration may not work in all locations (e.g., water limited areas) or produce desired tree species, but it can provide for relatively low cost tree/shrub establishment. Similarly, tree planting may not be appropriate in all cities (e.g., water limited areas) due to the resource costs of maintaining vegetation (e.g., water). Sustaining tree cover not only includes establishing new trees, but also limiting the loss of existing canopy, particularly

large trees that provide substantial amounts of canopy per tree. Sustaining tree health and protection of healthy tree canopies from human removal (e.g., development) or natural mortality forces (e.g., insects and diseases) can also help sustain existing tree cover and associated environmental services.

Though the current trend is a decline in canopy cover, not all cities are losing tree cover. One of the 20 cities analyzed (Syracuse, NY) had an absolute increase in canopy cover of one percent, or 0.2 percent increase per year, with most of the tree cover increase occurring in grass/herbaceous areas. This increase in tree cover matches field data estimates of urban forest change in Syracuse (U.S. Forest Service, unpublished data) that shows that the number of trees (woody plants with stem diameter at 1.37 m greater than 2.54 cm) are increasing. This increase is dominated by European buckthorn (*Rhamnus cathartica* L.), an invasive small tree/shrub from Europe. Thus, the cover increase in Syracuse is most likely due to natural regeneration in concert with limited development or activities that would tend to reduce regeneration.

New Orleans, as expected, had a significant reduction in tree cover (−9.6 percent absolute reduction or −29.2 percent relative reduction), which is most likely due to the devastation of Hurricane Katrina in 2005 (e.g., Chapman et al., 2008). In contrast, the loss in tree cover due to the emerald ash borer in Detroit was lower than expected. Since 2002, this beetle has killed more than 30 million ash trees in Southeastern Michigan (US Forest Service et al., 2011). However, the loss of tree cover in Detroit (−0.18 percent absolute annual reduction or −0.77 percent relative annual reduction) was less than the average loss from the sampled cities (−0.27 percent absolute annual reduction or −0.90 percent relative annual reduction). This difference could be due to ash trees not comprising a major component of overall tree cover in Detroit and/or new trees being established through tree planting programs or natural regeneration that help offset the loss of ash and other trees.

Overall, most of the tree losses converted to grass/herbaceous cover (47 percent) or impervious cover (29 percent), while most of the gain of new tree cover also came from grass/herbaceous cover (68 percent) or impervious cover (17 percent). Some of the conversions from tree to impervious cover are due to development, but are also due to impervious cover being beneath trees. When trees are removed, the ground surface beneath the trees switches to the new cover class. Likewise, as trees cover ground surfaces, additional tree cover can tend to reduce impervious cover estimates when trees grow over the impervious surfaces.

Of the overall average increase in impervious cover, about 29 percent of that change was due to changes with loss of tree cover. That 29 percent of newly classified impervious cover is a combination of new development and exposure of existing impervious cover beneath trees. However, at least 71 percent of the impervious cover increase was due to new development. Some cities (i.e., Chicago, Pittsburgh) exhibited no net change in impervious cover during the analysis period, but did exhibit increases and decreases in impervious cover that offset each other. Syracuse exhibited a decrease in impervious cover, which may be, in part, due to the overall increase in tree cover. However, most of the changes in impervious cover in Syracuse occurred with grass/herbaceous cover. New Orleans also lost a substantial amount of building cover (2.1 percent absolute reduction), most likely due to damage from Hurricane Katrina (e.g., Kates et al., 2006).

A better understanding of how tree cover and tree populations are changing can aid managers in developing regeneration or canopy protection plans to sustain adequate tree cover through time and space. Photo-interpretation of paired digital images offers a relatively easy, quick and low-cost means to statistically assess changes among various cover types. To help in quantifying the cover types within an area, a free tool (i-Tree Canopy) is available (www.itreetools.org) that allows users to photo-interpret a city using Google images. This program automatically quantifies the percent cover and associated standard error for each cover class based on user interpretations. Cover data on a city can provide a baseline for developing management plans, setting tree cover goals, and for monitoring change through time. Future analyses on cover distribution or change by land use type or geographic region are needed to investigate patterns and causes of tree and impervious cover changes between and within cities.

The paired digital image analysis offers a relatively quick, easy and cost-effective means to assess cover change, but it does have some limitations. Though Google offers high-resolution imagery in many parts of the world, paired image analysis with Google images is limited by the varying dates among images and varying image resolution. In urban areas, many of the Google images are of sufficient resolution for accurate photo-interpretation and images are continually updated. Obtaining local digital images with known and consistent dates across an area of analysis can overcome the problems associated with varying dates across a study area. Sometimes paired city data also had different image resolution between years, but most images were 1 m or less. As image interpretation was paired, information from the higher resolution image could aid in interpreting the lower resolution image. Another limitation of the paired image approach is the ability of the interpreter to correctly classify sample points. Interpreter error can lead to inaccurate results, but proper training and testing can produce accurate results. Satellite cover maps also have inherent inaccuracies due to classification errors and can cost tens of thousands of dollars to produce a cover map for a city. The paired photo-interpretation method offers a more cost effective means to assess change, but does not produce a detailed map of cover attributes or cover change across a city.

The results of this study illustrate recent changes in tree and impervious cover in cities and urban areas that can be used to inform planners and policy makers. To determine whether similar trends occurred in the 1990s or early 2000s, and whether these trends will continue in the future, more paired image analyses can be conducted using older paired imagery or by comparing future imagery with contemporary images. More paired image analyses can help better determine both spatial and temporal patterns and rates of landscape cover change. Photo-interpreted data on cover in urban areas and elsewhere can provide an accurate means of assessing cover types and changes in cover through time to help managers and planners make informed decisions on how to better improve local landscapes and the environment.

Conclusion

Tree cover provides a simple means to assess the magnitude of the overall urban forest and its environmental effects. Despite various and likely limited tree planting and protection campaigns, tree cover tends to be on the decline in U.S. cities while impervious cover is on the increase. While these individual campaigns are helping to increase or reduce the loss of urban tree cover, more widespread, comprehensive and integrated programs that focus on sustaining overall tree canopy may be needed to help reverse the trend of declining tree cover in cities. Net tree cover change is the result of the combined influences of tree planting and natural regeneration, tree growth and tree mortality. Developing coordinated healthy tree canopy programs across various land ownerships can help sustain desired tree cover levels and better manage cover change. Monitoring of tree cover changes is essential to determine current trends and whether desired canopy levels or program effects are being attained. Photo-interpretation of digital aerial images can provide a simple and timely means to assess urban tree cover and how it is changing.

Acknowledgments

Funding for this project was provided, in part, by the U.S. Forest Service's RPA Assessment Staff and State & Private Forestry's Urban and Community Forestry Program and the National Science Foundation (NSF grants DEB-0423476 and BCS-0948952) through the Baltimore Ecosystem Study-Long Term Ecological Research (BES-LTER) and the Syracuse Urban Long-term Research Area Exploratory Award (ULTRA-Ex). The use of trade, firm, or corporation names in this article is for the information and convenience of the reader. Such use does not constitute an official endorsement or approval by the U.S. Department of Agriculture Forest Service of any product or service to the exclusion of others that may be suitable. We thank Mike Boarman, Allison Bodine and Tian Zhou for photo-interpretation. We also thank John Stanovick for his statistical assistance and review, and Mike Galvin and Jackie Lu for their comments on a draft manuscript.

References

Chapman, E.L., Chambers, J.Q., Ribbeck, K.F., Baker, D.B., Tobler, M.A., Zeng, H., White, D.A., 2008. Hurricane Katrina impacts on forest trees of Louisiana's Pearl River basin. Forest Ecology and Management 256, 883–889.

City of New York, 2011. MillionTreesNYC (retrieved 01.06.11) http://www.milliontreesnyc.org/html/home/home.shtml.

City of Los Angeles, 2011. MillionTreesLA (retrieved 15.06.11) http://www.milliontreesla.org/.

City of Pasadena, 2011. Pasadena Tree Protection Ordinance (retrieved 15.06.11) http://ww2.cityofpasadena.net/publicworks/PNR/TreeOrdinance/default.asp.

City of Seattle, 2011. Seattle's Canopy Cover (retrieved 01.06.11) http://www.seattle.gov/trees/canopycover.html.

Cumming, A.B., Nowak, D.J., Twardus, D.B., Hoehn, R., Mielke, M., Rideout, R., 2007. Urban Forests of Wisconsin 2002: Pilot Monitoring Project 2002. USDA Forest Service, Northeastern Area State and Private Forestry Report, NA-FR-05-07. USDA Forest Service.

Dwyer, J.F., McPherson, E.G., Schroeder, H.W., Rowntree, R.A., 1992. Assessing the benefits and costs of the urban forest. Journal of Arboriculture 18 (5), 227–234.

Google Inc., 2011. Google Earth (retrieved 15.01.11) http://earth.google.com.

Hansen, M.C., DeFries, R.S., Townshend, J.R.G., Carroll, M., Dimiceli, C., Sohlberg, R.A., 2003. Global percent tree cover at a spatial resolution of 500 meters: first results of the MODIS vegetation continuous fields algorithm. Earth Interactions 7 (10), 1–15.

Heisler, G.M., Brazel, A.J., 2010. The urban physical environment: temperature and urban heat islands. In: Aitkenhead-Peterson, J., Volder, A. (Eds.), Urban Ecosystem Ecology (Agronomy Monograph). Soil Science Society of America, Madison, WI. pp. 29–56.

Kates, R.W., Colten, C.E., Laska, S., Leatherman, S.P., 2006. Reconstruction of New Orleans after Hurricane Katrina: a research perspective. PNAS 103 (40), 14653–14660.

Kuo, F.E., Sullivan, W.C., 2001. Environment and crime in the inner city: does vegetation reduce crime? Environmental Behavior 33 (3), 343–365.

Lindgren, B.W., McElrath, G.W., 1969. Introduction to Probability and Statistics. Macmillan, London.

Lunetta, R.L., Knight, F.K., Ediriwickrema, J., Lyon, J.G., Worthy, L.D., 2006. Land-cover change detection using multi-temporal MODIS NDVI data. Remote Sensing of Environment 105, 142–154.

Maryland Department of Natural Resources, 2011. Cheasapeake Bay Urban Tree Canopy Goals (retrieved 01.10.11) http://www.dnr.state.md.us/forests/programs/urban/urbantreecanopygoals.asp.

National Research Council, Committee on Hydrologic Impacts of Forest Management, 2008. Hydrologic Effects of a Changing Forest Landscape. The National Academies Press, Washington, DC.

Nowak, D.J., 1993. Historical vegetation change in Oakland and its implications for urban forest management. Journal or Arboriculture 19 (5), 313–319.

Nowak, D.J., Buckelew Cumming, A., Twardus, D., Hoehn, R.E., Brandeis, T.J., Oswalt, C.M. Urban Forests of Tennessee. Gen. Tech. Rep. U.S. Department of Agriculture, Forest Service, in press-a.

Nowak, D.J., Buckelew-Cumming, A., Twardus, D., Hoehn, R., Mielke, M., 2007. National Forest Health Monitoring Program, Monitoring Urban Forests in Indiana: Pilot Study 2002. Part 2: Statewide Estimates Using the UFORE Model. Northeastern Area Report, NA-FR-01-07.

Nowak, D.J., Dwyer, J.F., 2007. Understanding the benefits and costs of urban forest ecosystems. In: Kuser, J. (Ed.), Urban and Community Forestry in the Northeast. Springer Science and Business Media, New York, pp. 25–46.

Nowak, D.J., Greenfield, E.J., 2008. Urban and Community Forests of New England. USDA Forest Service, Northern Research Station, General Technical Report NRS-38. Newtown Square, PA.

Nowak, D.J., Hoehn, R., Crane, D.E., Bodine, A. Assessing urban forest effects and values in the Great Plains States: Kansas, Nebraska, North Dakota, South Dakota. USDA Forest Service, Northern Research Station, Resource Bulletin NRS, Newtown Square, PA, in press-b.

Nowak, D.J., Rowntree, R.A., McPherson, E.G., Sisinni, S.M., Kerkmann, E., Stevens, J.C., 1996. Measuring and analyzing urban tree cover. Landscape and Urban Planning 36, 49–57.

Oke, T.R., 1989. The micrometeorology of the urban forest. Philosophical Transactions of the Royal Society of London B 324, 335–349.

Parlin, M., 2009. Seattle, Washington Urban Tree Canopy Analysis. NCDC Imaging (retrieved 15.06.11) http://www.seattle.gov/trees/docs/NCDC_Final_Project_Report.pdf.

Schwarz, M., Waser, L.T., Zimmerman, N.E., 2006. Change detection based on fractional tree cover derived from MODIS data. In: Kerle, N., Skidmore, A.K. (Eds.), Proceedings of the ISPRS Mid-term Symposium. (retrieved 01.11.11) www.isprs.org/proceedings/XXXVI/Part7/PDF/022.pdf.

Sokal, R.R., Rohlf, F.J., 2003. Biometry: The Principles and Practices of Statistics in Biological Research. W.H. Freeman and Company, New York, NY.

Town of Chapel Hill, 2011. Tree Protection (retrieved 15.06.11) http://www.ci.chapel-hill.nc.us/index.aspx?page=879.

U.S. Census Bureau, 2007. U.S. Census Data (retrieved 15.01.11) www.census.gov.

U.S. Census Bureau, 2011. Population Estimates (retrieved 01.06.11) http://www.census.gov/popest/cities/SUB-EST2009-4.html.

U.S. Environmental Protection Agency, 1983. Results of the Nationwide Urban Runoff Program: Volume 1 – Final Report. U.S. Environmental Protection Agency, Water Planning Division, Washington, DC. NTIS Accession Number: PB84-185552.

U.S. Environmental Protection Agency, 2011. 2006 National Land Cover Data (NLCD 2006) (retrieved 01.11.11) http://www.epa.gov/mrlc/nlcd-2006.html.

US Forest Service, Michigan State University, Purdue University and Ohio State University, 2011. Emerald Ash Borer, Michigan Information (retrieved 15.06.11) www.emeraldashborer.info/michiganinfo.cfm.

Westphal, L.M., 2003. Urban greening and social benefits: a study of empowerment outcomes. Journal of Arboriculture 29 (3), 137–147.

Wolf, K.M., 2003. Public response to the urban forest in inner-city business districts. Journal of Arboriculture 29 (3), 117–126.

Yang, L., Xian, G., Klaver, J.M., Deal, B., 2003. Urban land-cover change detection through sub-pixel imperviousness mapping using remotely sensed data. Photogrammetric Engineering and Remote Sensing 69 (9), 1003–1010.

Zhou, W., Troy, A., Grove, M., 2008. Object-based land cover classification and change analysis in the Baltimore metropolitan area using multitemporal high resolution remote sensing data. Sensors 8, 1613–1636.

Summary of Selected Tree Laws in Other Jurisdictions

Fairfax County, VA
Chapter 122, Fairfax County Code
Section 12, Fairfax County Public Facilities Manual
http://www.fairfaxcounty.gov/dpwes/publications/pfm/chapter12.pdf

Overview	Requires the conservation or planting of trees on development sites such that, after ten years, minimum tree canopy ranging from 10-30% (depending on zoning) exists on the site.
Activities Covered	All land development requiring the submission of a site plan, preliminary subdivision plat, subdivision construction plan, conservation plan, grading plan, or a rough grading plan. Does not apply to construction of additions to existing residential structures or reconstruction of residential structures on existing foundations.
General Process	Requires the submission of a Tree Conservation Plan when a land disturbance has potential to destroy or degrade on-site trees or trees located on adjacent property. Tree Conservation Plans "shall contain all proposed engineering and layout information needed to conduct a thorough review of proposed tree preservation, tree planting and landscaping requirements," including information on: • the general composition and extent of existing vegetation • calculations and a statement of compliance with or a proposed deviation from the Tree Preservation Target requirements (and if necessary a narrative containing all the information and documentation to justify a deviation) • ten-year tree canopy calculations Example: The existing vegetation map shall accurately depict the location of the outer canopy edge of individual freestanding trees and forested areas at time of plan submission, and shall identify the percentage of the development site covered by tree canopy comprised of self-supporting tree and woody plants that exceed 5 feet in height at time of plan submission. The map shall provide a statement regarding the successional stage of the vegetation, a list of the primary tree species, and a statement regarding the general health and condition of the vegetation.
Mitigation	Subject to a variety of conditions, the tree canopy requirement may be met through the preservation or planting of trees on-site, or through off-site tree banking or through pro rata payment into the Tree Preservation and Planting Fund (currently $300 per 200 square feet of canopy required).

Attachment: 10-year Tree Canopy Calculation Worksheet

Table 12.10 10-year Tree Canopy Calculation Worksheet			
Step		Totals	Reference
A. Tree Preservation Target and Statement			
A 1	Place the Tree Preservation Target calculations and statement here preceding the 10-year tree canopy calculations		see § 12-0508.2 for list of required elements and worksheet
B. Tree Canopy Requirement			
B1	Identify gross site area =		§ 12-0511.1A
B2	Subtract area dedicated to parks, road frontage, and		§ 12-0511.1B
B3	Subtract area of exemptions =		§ 12-0511.1C(1) through § 12-0511.1C(6)
B4	Adjusted gross site area (B1 – B2) =		
B5	Identify site's zoning and/or use		
B6	Percentage of 10-year tree canopy required =		§ 12-0510.1 and Table 12.4
B7	Area of 10-year tree canopy required (B4 x B6) =		
B8	Modification of 10-year Tree Canopy Requirements requested?		Yes or No
B9	If B8 is yes, then list plan sheet where modification request is located		Sheet number
C. Tree Preservation			
C1	Tree Preservation Target Area =		
C2	Total canopy area meeting standards of § 12-0400 =		
C3	C2 x 1.25 =		§ 12-0510.3B
C4	Total canopy area provided by unique or valuable forest or woodland communities =		
C5	C4 x 1.5 =		§ 12-0510.3B(1)
C6	Total of canopy area provided by "Heritage," "Memorial," "Specimen," or "Street" trees =		
C7	C6 x 1.5 to 3.0 =		§ 12-0510.3B(2)
C8	Canopy area of trees within Resource Protection Areas and 100-year floodplains =		
C9	C8 x 1.0 =		§ 12-0510.3C(1)
C10	Total of C3, C5, C7 and C9 =		If area of C10 is less than B7 then remainder of requirement must be met through tree planting - go to D
D. Tree Planting			
D1	Area of canopy to be met through tree planting (B7-C10) =		
D2	Area of canopy planted for air quality benefits =		
D3	x 1.5 =		§ 12-0510.4B(1)
D4	Area of canopy planted for energy conservation =		

D5	x 1.5 =		§ 12-0510.4B(2)
D6	Area of canopy planted for water quality benefits =		
D7	x 1.25 =		§ 12-0510.4B(3)
D8	Area of canopy planted for wildlife benefits =		
D9	x 1.5 =		§ 12-0510.4B(4)
D10	Area of canopy provided by native trees =		
D11	x 1.5 =		§ 12-0510.4B(5)
D12	Area of canopy provided by improved cultivars and varieties =		
D13	x 1.25		§ 12-0510.4B(6)
D14	Area of canopy provided through tree seedlings =		
	x 1.0		§ 12-0510.4D(1)
D15	Area of canopy provided through native shrubs =		
	x1.0		§ 12-0510.4D(1)
D16	Percentage of D14 represented by D15=		Must not exceed 33% of D14
D17	Total of canopy area provided through tree planting =		
D18	Is an off-site planting relief requested?		Yes or No
D19	Tree Bank or Tree Fund?		§ 12-0512
D20	Canopy area requested to be provided through off-site banking or tree fund		
D21	Amount to be deposited into the Tree Preservation and Planting Fund		
E. Total of 10-year Tree Canopy Provided			
E1	Total of canopy area provided through tree preservation (C10) =		
E2	Total of canopy area provided through tree planting (D17) =		
E3	Total of canopy area provided through off-site mechanism (D19) =		
E4	Total of 10-year Tree Canopy Provided = (E1+E2+E3)		Total of E1 through E3. Area should meet or exceed area required by B7

http://www.fairfaxcounty.gov/dpwes/publications/pfm/chapter12.pdf

Summary of Selected Tree Laws in Other Jurisdictions

Washington, DC
District of Columbia Register LEXSEE 50 DE REG 888, D.C. ACT 4-614
http://ddot.dc.gov/DC/DDOT/Services/Tree+Services/Tree+Permits/Urban+Forest+Preservation+Act+of+2002

Overview	Requires fees or replacement of trees removed to mitigate for lost resources. Fees collected are used to plant trees on private and public property.
Activities Covered	Removal of trees 18 inches in diameter or larger and "special" trees on private property, or street tree of any size; as well as willful destruction of living trees.
General Process	Requires an application for permit and payment of mitigation fees based on diameter of trees. Applicant provides documentation from a qualified expert or request s inspection by DDOT arborists. Inspection must be completed prior to issuance of permit.
Mitigation	Fees to mitigate for lost resources are assessed. Fees collected are used to plant trees on private and public property. Mitigation options for trees 18" or larger and "special" trees removed from private property: • Plant a quantity of trees whose aggregated circumference equals or exceeds the circumference of the tree removed. For example, if a 20 inch diameter tree is removed, 10 trees of 2-inch caliper must be planted. • Pay $35 per inch of circumference • Any combination of both Mitigation fees when street trees removed: • For trees 2- to 6-inches, pay $90 per inch diameter • For trees 6.1- to 12-inches, pay $100 per inch diameter • For trees 12.1-inches and up, pay $110 per inch diameter Hazardous and non-native invasive species require a permit but are not subject to mitigation fees.

Attachments: District Department of Transportation Tree Permit Notice
Special Tree Permit Fund Planting Map

Summary of Selected Tree Laws in Other Jurisdictions

Tree Permits

tops.ddot.dc.gov | DDOT Permits Office - 1100 4th Street SW, 2nd Floor

Public Space Tree Permit

A Public Space Tree Permit is required to plant ($0 permit fee), prune ($75 permit fee) or remove ($100 permit fee) any tree in the public right-of-way. Once permitted, the fee schedule to remove a healthy tree, measured at 4.5 feet above grade, is as follows:

Total # of Inches Removed	Compensation
2-to-6 inch diameter	$90 per inch diameter
6.1-to-12 inch diameter	$100 per inch diameter
12.1 inch diameter and up	$110 per inch diameter

Special Tree Removal Permit

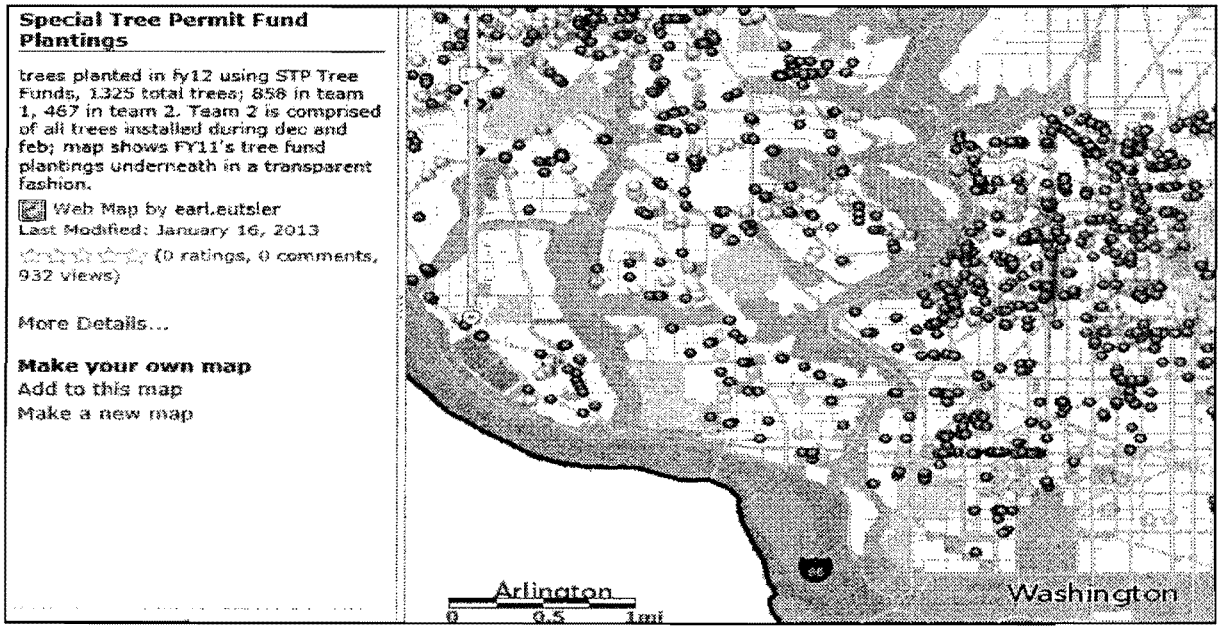
In order to protect the District's canopy and its largest trees, individuals must receive a permit to remove any tree in Washington, DC that is larger than 55 inches circumference (measured around the trunk at 4.5 feet from the ground). Permits are issued under at least one of the following conditions:

- An International Society of Arboriculture (ISA) arborist deems the tree is hazardous to life and/or property;
- The tree is of a species exempt from the law: Tree of heaven (Ailanthus altissima), mulberry (Morus species), or Norway maple (Acer platanoides);
- The property owner declares on the permit application to (a) plant a quantity of saplings whose aggregated circumference equals or exceeds the circumference of the Special Tree to be removed, (b) pay into the Tree Fund a tree replacement fee of $35 per inch of circumference for each Special Tree to be removed, or (c) perform a combination of both (a) and (b).

Failure to comply will result in a violation subject to a fine of not less than $100 per each inch of tree circumference.

For adjacent private property tree issues, contact the Multi-Door Dispute Resolution Division at DC Superior Court.

http://ddot.dc.gov/DC/DDOT/Publication%20Files/On%20Your%20Street/Urban%20Forestry/UFA_Laws-and-Permits.pdf



http://ddot.dc.gov/DC/DDOT/Services/Tree+Services/Tree+Permits/Special+Tree+Permit

Summary of Selected Tree Laws in Other Jurisdictions

City of Chesapeake, VA
CZO §19-600
http://www.cityofchesapeake.net/Assets/documents/departments/planning/ord-Landscape-Ordinance_adopted-0901608.pdf
Chesapeake Landscape Specification Manual:
http://vtod.frec.vt.edu/Documents/Chesapeake%20landscape_specifications_manual.pdf

Overview	The intent of the Landscape Ordinance is to provide minimum standards for the preservation, protection and enhancement of the ecologic and aesthetic environments of the City of Chesapeake.
Activities Covered	Any single-family or duplex residential construction requiring a building permit, any activity on a multifamily or nonresidential development requiring final or preliminary site plan, and major residential subdivision requiring a final subdivision plan.
General Process	Submissions and review require detailed information such as a site assessment; delineation of preservation areas; and details for preservation methods, planting locations, species, size and spacing of plants, and other treatments such as mulch, seed or sod. Approval by the City Arborist and field inspections are required. Requires the conservation or planting of trees on development sites to meet minimum tree canopy coverage ranging from 10-50% (depending on zoning). The area subject to a minimum percentage of canopy coverage does not include building footprints, sidewalks, patios, or driveways.
Mitigation	Canopy coverage requirements can be met through a combination of on-site conservation and on-site planting. Additional credit for protecting specimen trees and clusters of trees is provided. Planting requirements for lots larger than 36,000 sq ft are capped at 18 trees.

Attachments: Canopy Requirement Calculations

Summary of Selected Tree Laws in Other Jurisdictions

Non-CBPA Site Residential Tree Canopy Landscape Plan (CZO 19-01.A.2)

Lot Size _____sf X 20% =_____sf Canopy Required

Note: Canopy credit is 400 sf per Large Canopy Tree (LCT), 200 sf per Small Canopy Tree (SCT).

Canopy Provided (Number of LCT or SCT X sf Credit) = _____ sf

Note: A maximum of 18 LCT only for lots 36,000 square feet or larger. Total Canopy provided must meet or exceed canopy required. All trees must be a minimum 6' fall at planting, planted in accordance with CZO 19-600.

CBPA Site Residential Tree Canopy Plan (50% for RPA, 20% for RMA) (CZO 19-601.A.2)

Lot Size _____sf X (50% for RPA, 20% for RMA =_____sf Canopy Required

Note: Canopy credit is 400 sf per Large Canopy Tree (LCT), 200 sf per Small Canopy Tree (SCT).

Canopy Provided (Number of LCT or SCT X sf Credit) = _____ sf

Total Canopy provided must meet or exceed canopy required. All trees must be a minimum 6' tall at planting, planted in accordance with CZO 19-600.

http://www.cityofchesapeake.net/Assets/documents/departments/development_permits/SFR-Landscape-Plan-for-Tree-Canopy-Requirement-2009.pdf

Summary of Selected Tree Laws in Other Jurisdictions

Portland, OR (and portions of Multnomah County)
Title 11, Trees; Amendments to Other City Titles; Multnomah County IGA 2nd Amendment
http://www.portlandoregon.gov/bps/article/350786
Citywide Tree Policy and Regulatory Improvement Project FAQs
http://www.portlandoregon.gov/bps/article/353328

Overview	Portland adopted the Citywide Tree Project ordinance in April 2011. Included in the ordinance is a phased implementation strategy that defers the effective date of many of the adopted rules, including the new Title 11, Trees, until July 2013. The new ordinance standardizes tree laws in the city.
Activities Covered	For activities with no associated development (general removal of trees): • City and street trees 3 or more inches in diameter • Trees 12 or more inches in diameter on private lots (or 6 inches or greater in overlay zones and plan districts) For development activity: building permits, zoning permits, site development permits, public works permits and capital improvement projects.
General Process	For non-development activity on private property, a Type A or Type B permit may be required. Type A permits include pruning in certain overlay zones, as well as requests to remove dead, dangerous, or dying trees, requests for removals of nuisance species trees, trees located within 10' of a building, or 4 or fewer trees that are each smaller than 20" diameter. On developed single dwelling properties that cannot be further divided, a Type A permit is only required to remove trees at least 20 inches in diameter. Type B permits are required for the removal of trees at least 20 inches in diameter, or removal of more than four trees at least 12 inches in diameter. For development activity, required tree plans must include information on: • existing improvements • proposed alterations including structures, impervious area, grading, and utilities • existing trees, proposed tree activity including trees to be retained and proposed tree protection measures, trees to be removed, and trees to be planted Minimum projected canopy coverage of 10-40% (depending on zoning) is required, which may be met through tree preservation, tree planting, or payment into the Tree Planting and Preservation Fund.
Mitigation	Type A permits – tree-for-tree replacement for trees that are removed. Type B permits – up to inch for inch replacement; determined on case-by-case basis by City Forester Development activity – required tree protection, tree planting, or payment of fee in-lieu (expected to be about $600 per tree).

Attachments: Summary of Type A and Type B Permits
Example of Applying On-Site Density Requirements

Summary of Selected Tree Laws in Other Jurisdictions

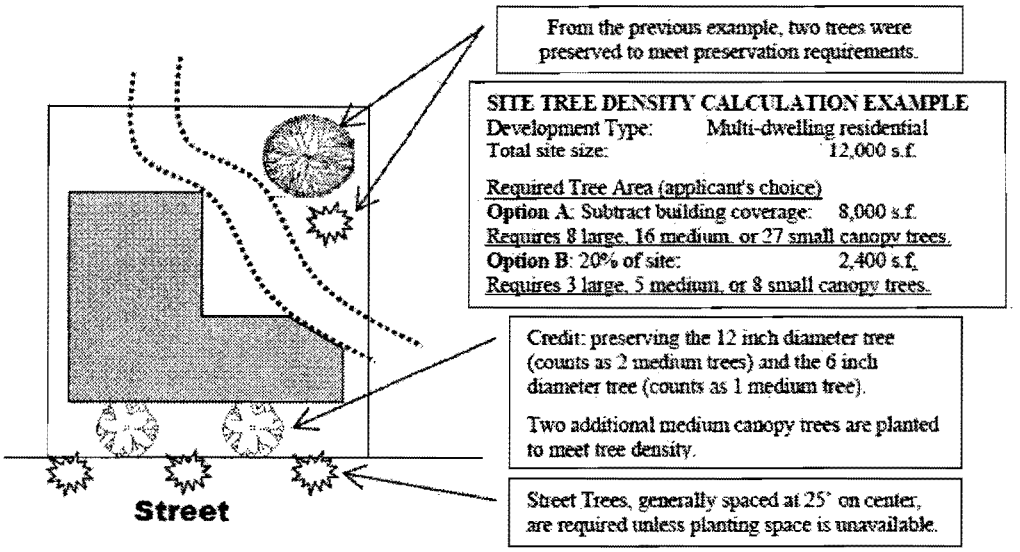
Summary of Permit Requirements for Private Trees

Permit Type Required	Activity	Required Replacement (See Section 11.40.060)	Public Notice Required?
No permit required	**Planting** **Pruning:** Outside of c, p, or v overlay zones **Removal:** Trees smaller than the size regulated by this chapter (see 11.40.020 B.) **Other:** Activities that are exempt from the requirements of this chapter (see 11.40.030)	None	No
A	**Pruning:** Native trees in c, p, or v overlay zones	n/a	No
	Removal [1]: Regulated trees that are: • Dead, dying, dangerous • Nuisance species • Within 10' of a building or attached structure • Up to four healthy non-nuisance trees per year that are less than 20" diameter.	1 tree for every tree removed	No
B	**Removal [1]:** Regulated trees that are: • Healthy non-nuisance trees ≥ 20" diameter • More than four healthy non-nuisance trees ≥ 12" diameter per site per year	Up to inch for inch replacement; determined on case-by-case basis by City Forester	Yes [2]

Note [1] Tree removal may be otherwise regulated by an overlay zone or plan district. See Table 40-1.
[2] No public notice or opportunity for public appeal is required for removal of one healthy non-nuisance tree ≥ 20" diameter per lot per year in any residential zone.

http://www.portlandoregon.gov/bps/article/350786

Applying On-site Tree Density and Street Tree requirements



http://www.portlandoregon.gov/bps/article/350786

Summary of Selected Tree Laws in Other Jurisdictions

Miami-Dade County, FL
http://www.miamidade.gov/development/permits/tree-removal.asp#5

Overview	Requires a permit to remove or move some trees. Standards are set for pruning.
Activities Covered	Privately-owned trees that are part of natural forest communities; some trees on lots larger than 1 acre; most specimen trees, or trees larger than 18 inches in diameter, wherever they stand; and street trees. Exemptions include individual trees on single-family lots including for construction; nurseries; and hazardous trees; as well as effective destruction of living trees. Fruit trees and mangroves are regulated separately.
General Process	Application for permit is followed by inspection by City/County Arborist. Follow up inspections occur when trees are moved. Mitigation fees are charged for each tree along with administrative fees for the permits and inspections.
Mitigation	A fee is charged for each tree removed. The fees are capped a $660 for an acre of canopy removed. Invasive species require a permit but are not subject to mitigation fees.

Attachment: Tree Removal/Relocation Permit Fee Schedule

Summary of Selected Tree Laws in Other Jurisdictions

MIAMI-DADE COUNTY

TREE REMOVAL/RELOCATION PERMIT FEE SCHEDULE

Zoning of Property	Before Inspection (insp.) (must be submitted with the tree removal/relocation application (appl.))	After Inspection (insp.) (must be paid before PERA signs/executes the tree removal/relocation permit)
Single-Family/Residential	$63 appl. + $35 initial insp. = $98	$35 final insp. + $12 per tree up to max. of $320
Multi-Family	$80 appl. + $35 initial insp. = $115	$35 final insp. + $12 per tree up to max. of $395/(acre)(canopy)
Business	$105 appl. + $35 initial insp. = $140	$35 final insp. + $12 per tree up to max. of $395/(acre)(canopy)
Commercial	$105 appl. + $35 initial insp. = $140	$35 final insp. + $12 per tree up to max. of $660/(acre)(canopy)
Agricultural	$55 appl. + $35 initial insp. = $90	$35 final insp. + $6 per tree up to max. of $265/(acre)(canopy)
Right-of-Way/Swale	$28 appl. + $35 initial insp. = $63	$35 final insp. + $6 per tree up to max. of $265/(acre)(canopy)

Inspection fees listed above are based on applications to remove and/or relocate and assess 20 trees or less. For projects with more than 20 trees, the inspection fees are adjusted as follows:

21 - 100 trees to be inspected: $65
101 - 200 trees to be inspected: $135
More than 200 trees to be inspected: $265

For all new application submittals, the application and the initial inspection fee are required for processing.

For After-the-Fact (ATF) tree removal/relocation permits, the application and the per tree(s) fee are doubled (x 2). The fees listed above are based on voluntary (not ATF) applications.

For relocation only permits, there is no per tree(s) fee charged, only the application and inspection fees.

In order to renew/extend a permit you will be required to pay the original application fee amount prior to the expiration of the current permit.

Please be advised that the application and the initial inspection fee are required upon permit application submission and are non-refundable if cancelled, withdrawn or denied.

http://www.miamidade.gov/development/library/fees/tree-permits.pdf

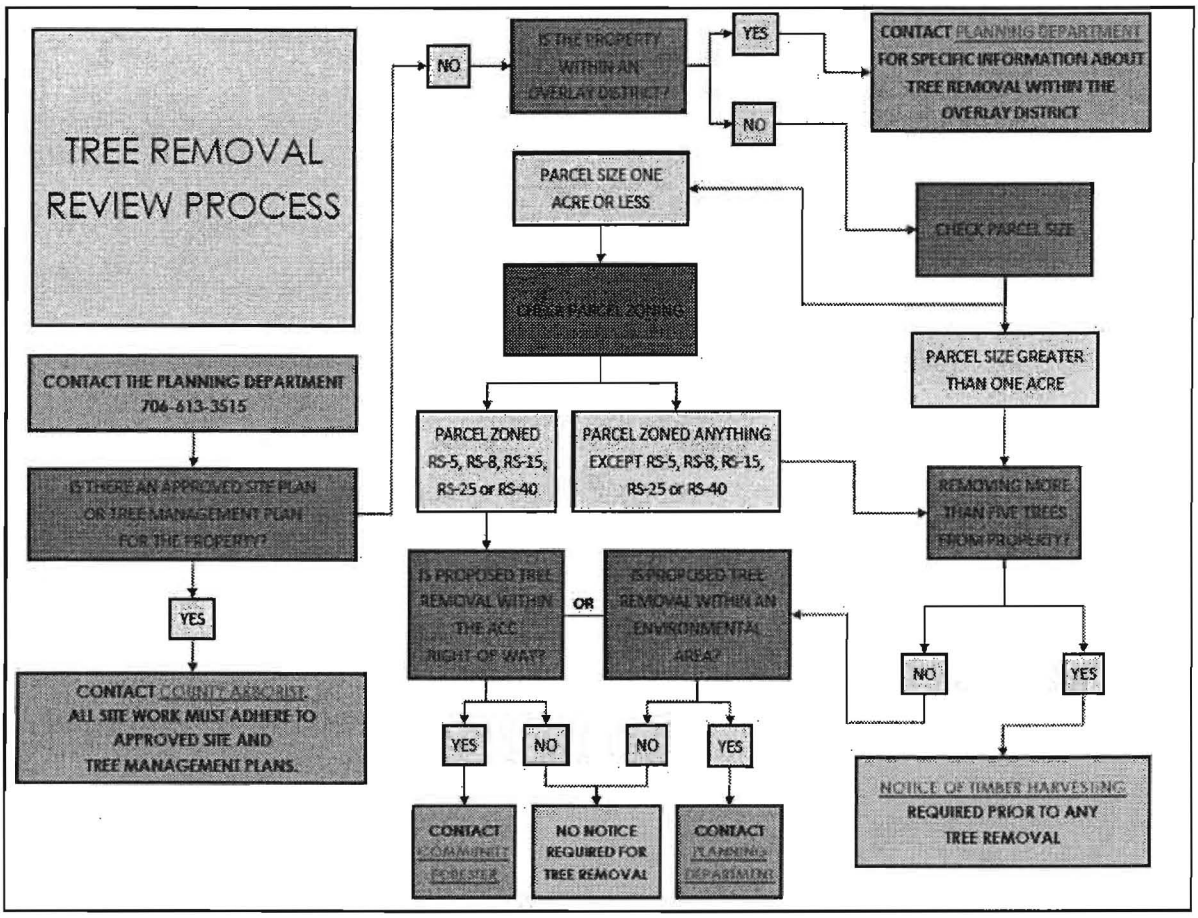
Summary of Selected Tree Laws in Other Jurisdictions

Athens-Clarke County, GA
Chapter 8-7, Athens-Clarke County Code of Ordinances
http://library.municode.com/HTML/12400/level3/PTIIICOOR_TIT8PL_CH8-7COTRMA.html
Section 12, Fairfax County Public Facilities Manual
http://www.fairfaxcounty.gov/dpwes/publications/pfm/chapter12.pdf

Overview	Athens-Clarke County tree laws are intended to "regulate the quantity, quality, and distribution of trees within Athens-Clarke County...through the establishment of minimum requirements for conserved and planted tree canopy, to regulate the quality of trees through adoption of technical standards for species selection, tree planting, tree maintenance, and tree protection, and to regulate the distribution of trees so that their function is maximized."
Activities Covered	New developments and existing developments under Sections 9-25-2 or 9-26-2 of the Athens-Clarke County Code (generally residential subdivisions, multi-family developments, and non-residential development), and developments for which a land development/land disturbance activity permit is required (disturbance of more than one acre).
General Process	Tree management plans are required prior to the issuance of a site review permit, the issuance of a land development/land disturbance activity permit, or the issuance of a building permit for lots that appear on a preliminary plat. The tree management must include the amount, location, and type of tree canopy cover currently existing on the site or lot, and that which is to be conserved and planted on the site, and the percent to be included on each individual lot within a subdivision. Minimum projected canopy coverage of 0-60% (depending on zoning) is required, which may be met through tree preservation, tree planting, or payment into the Tree Planting and Preservation Fund. On lots greater than 12,500 Square feet, a minimum percentage of existing tree canopy must be preserved unless an administrative waiver is granted.
Mitigation	Protection of existing canopy and planting of new trees to meet canopy coverage requirements. Variances can be granted via a hearing before the Athens-Clarke County Hearings Board.

Attachment: Tree Removal Review Process Flowchart

Summary of Selected Tree Laws in Other Jurisdictions



http://athensclarkecounty.com/DocumentCenter/Home/View/3107

Bill 35-12, Tree Canopy Conservation
General Outline of Proposed Tree Protection and Planting Credit Programs
March 28, 2013

(a) A credit may be given against the square footage of the tree canopy within the limits of disturbance (LOD) for qualifying tree protection and tree planting that occurs on site subject to the conditions below.

(b) All plans submitted to document qualifying tree protection and tree planting must be prepared by a qualified professional as defined in the proposed bill.

(c) Tree protection and tree planting plans must be submitted along with the information required to document the limits of tree canopy disturbance under proposed section 55-7(c).

Tree Protection Measures

(d) One square foot of credit shall be provided for each square foot of canopy within the LOD of a tree that is properly protected. Proper protection of a tree may include protection of the CRZ beyond the canopy.

(e) Credits may be given for up to 100 percent of the area of tree canopy within the limits of disturbance.

(f) Approved tree protection measures shall be consistent with the most current industry standard such as the ANSI A300 standards.

(g) Approved tree protection measures must be installed and maintained in accordance with sequence of construction on the approved sediment control plan.

(h) Inspections for compliance must be specified in the plan and completed by a qualified professional at critical times during construction.

(i) The applicant must submit a tree protection plan which includes:

(1) A map delineating:
- (A) the location of the stem of each tree to be protected
- (B) the aerial extent of the canopy of each tree to be protected
- (C) the diameter (dbh) of each tree to be protected
- (D) the critical root zone of each tree to be protected

(2) A table summarizing the following for each tree to be protected:
- (A) the area of canopy within the LOD
- (B) the percentage of the CRZ not protected
- (C) the diameter (dbh) of each tree to be protected
- (D) the tree protection measure(s) planned for each tree

(3) Plan details showing the tree protection measures for each tree to be protected.

(4) A table showing the sequence of events for installing, maintaining, and inspecting the tree protection measures for the entire period of time the sediment control permit is valid.

(j) Any tree with more than 30 percent of the entire CRZ not protected cannot be counted as a protected tree.

(k) The area counted for credit for any protected tree does not include any overlapping canopy from unprotected or removed trees.

Tree Planting

(l) Credit shall be provided for trees planted on-site subject to the conditions below.

(m) Credits may be given for up to 25 percent of the area of tree canopy within the limits of disturbance.

(n) Trees must be installed while the sediment control permit is valid.

(o) Planting shall be consistent with the most current ANSI A300 and ANSI Z60 standards.

(p) Only approved species and sizes of planting stock shall be used.

(q) Species of trees planted will be grouped into three size categories (small, medium, and large) consistent with current research and existing regulations. The amount of credit provided for a tree in each size category will be based on the expected size of the crown at a specified time (e.g. 20 years).

A minimum amount of open soil surface area, free from impervious cover or other obstructions, must be provided for each tree receiving credit to provide a reasonable expectation that the tree canopy will reach the anticipated size. The minimum amount of open soil surface area needed will be determined for three size categories of trees (small, medium, and large).

Category of Tree Size	Square Footage Credit	Minimum Open Soil Surface Area
Small	TBD	TBD
Medium	TBD	TBD
Large	TBD	TBD

(r) The applicant must submit a tree planting plan which identifies the tree(s) planted for which credit is being sought. The tree planting plan must include:

(1) A map delineating:
  (A) the location of the stem of each tree to be planted
  (B) the area of open soil surface needed for each tree to be planted
  (C) the location of any building, structure, or impervious surface existing on the post-development lot

(2) A table showing:

(A) the species of each tree to be planted

(B) the size of each tree to be planted

(C) the area of open soil surface around the tree unobstructed by any building, structure, or impervious surface existing on the post-development lot

(D) the assumed square footage credit for each tree to be planted

Jurisdictions Surveyed

- Prince George's County
- Fairfax County
- Washington, DC
- Athens-Clarke County, GA
- Austin, TX
- Portland, OR

6/11

Key Questions

Analysis included three general parameters:

- Scope – What types of properties and activities are covered?
- Process – What is the jurisdiction's review and approval process?
- Mitigation Requirements – How do the mitigation requirements in other jurisdictions compare to Bill 35-12?

Additional Questions

- How likely are to you review each scenario? In other words, do you see many plans that look like these?
- Does it matter whether or not the development is new construction or a tear-down and rebuild?
- Would it matter if these lots were developed as single-lots or as part of a subdivision?
- Would zoning have an impact on the outcomes?
- Would the condition of the trees make a difference?
- Are there any other aspects that influence the outcome (e.g., critical areas)?

(12)

Jurisdiction Overview – Washington, DC

- Special tree permitting system "requires fees to compensate for loss of community assets and maintain character of neighborhoods"
- Applies on residential and non-residential property
- Applies to removal of any tree 55" in circumference (17.5" in diameter) or greater
- Mitigation can be payment of a fee ($35/circumference inch) or planting the same number of inches removed
- No review process except to verify hazardous and nuisance trees

(122)

Jurisdiction Overview – Athens-Clarke County, GA

- Athens-Clarke County created the Community Tree Management Ordinance to "sustain and enhance the functions and benefits of trees and the community forest for its citizens"
- Applies on non-residential property and residential property when subdivision results in five or more lots (does not apply to pre-existing SF lots)
- Requires minimum canopy coverage through conservation of existing canopy and planting
- Review process with staff similar to MC's FCL process where reviewer discretion is required

Jurisdiction Overview – Austin, TX

- Austin's requirements are "designed to achieve a balance of re-forestation and preservation… to achieve the best long-term benefit for the community"
- Applies on residential and non-residential property, including trees potentially affected on adjacent properties
- No grading or other disturbance is allowed within ½ of the CRZ of all trees 19" or larger
- If trees are removed, standard mitigation is 100% diameter inch replacement, up to 300% diameter inch replacement for specimen trees
- Review process with staff similar to MC's FCL process where reviewer discretion is required

Jurisdiction Overview – Portland, OR

- Portland's Urban Forestry program regulates "236,000 street trees, 1.2 million park trees, and innumerable private property trees… to differing degrees"
- Applies on residential and non-residential property
- Requires minimum canopy coverage through conservation of existing individual trees and planting
- Requires 1/3 of all trees over 12" diameter to be preserved on site; if preservation cannot be met, then mitigation in form of planting or fee-in-lieu of $1,200 for each tree removed
- Review process with staff similar to MC's FCL process where reviewer discretion is required

Information Provided to Other Jurisdictions

- DEP obtained information from DPS for three sediment control applications (small, medium, and large lots) filed in Montgomery County.
- For each plan, DEP provided the other jurisdictions:
  - A site plan, with the extent of tree canopy delineated
  - A pre-development aerial photograph of the property
  - A table with data on the area of (1) the property, (2) the tree canopy, and (3) the tree canopy disturbed
  - Data on the diameter, location and family of individual trees on the site.

(126)

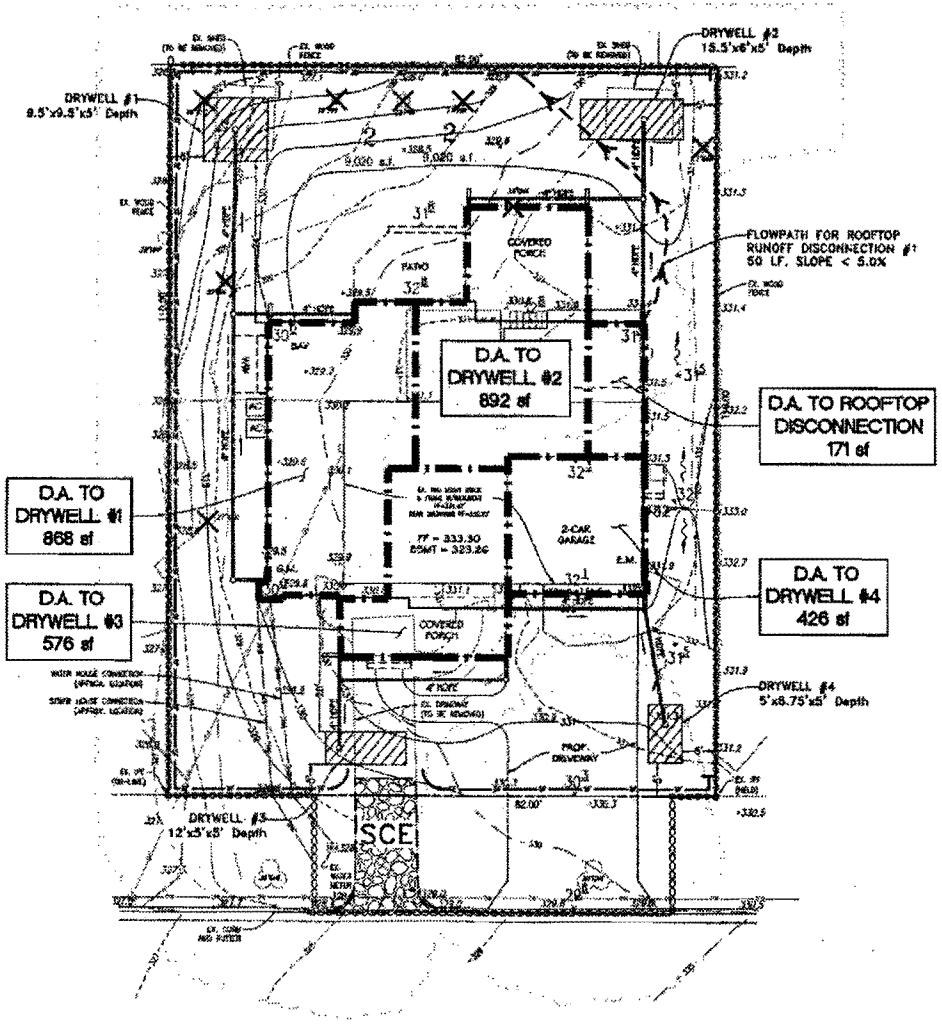
Summary of Plans Reviewed

	Plan 1	Plan 2	Plan 3
Area of Lot (ft^2)	9,023	26,694	158,976
Area of Canopy on Lot (ft^2)	5,658	14,015	58,105
% of Canopy on Lot	63%	53%	37%
Area of LOD (ft^2)	9,708	27,929	114,435
Area of Canopy within LOD (ft^2)	6,323	14,870	31,475

Plan 1

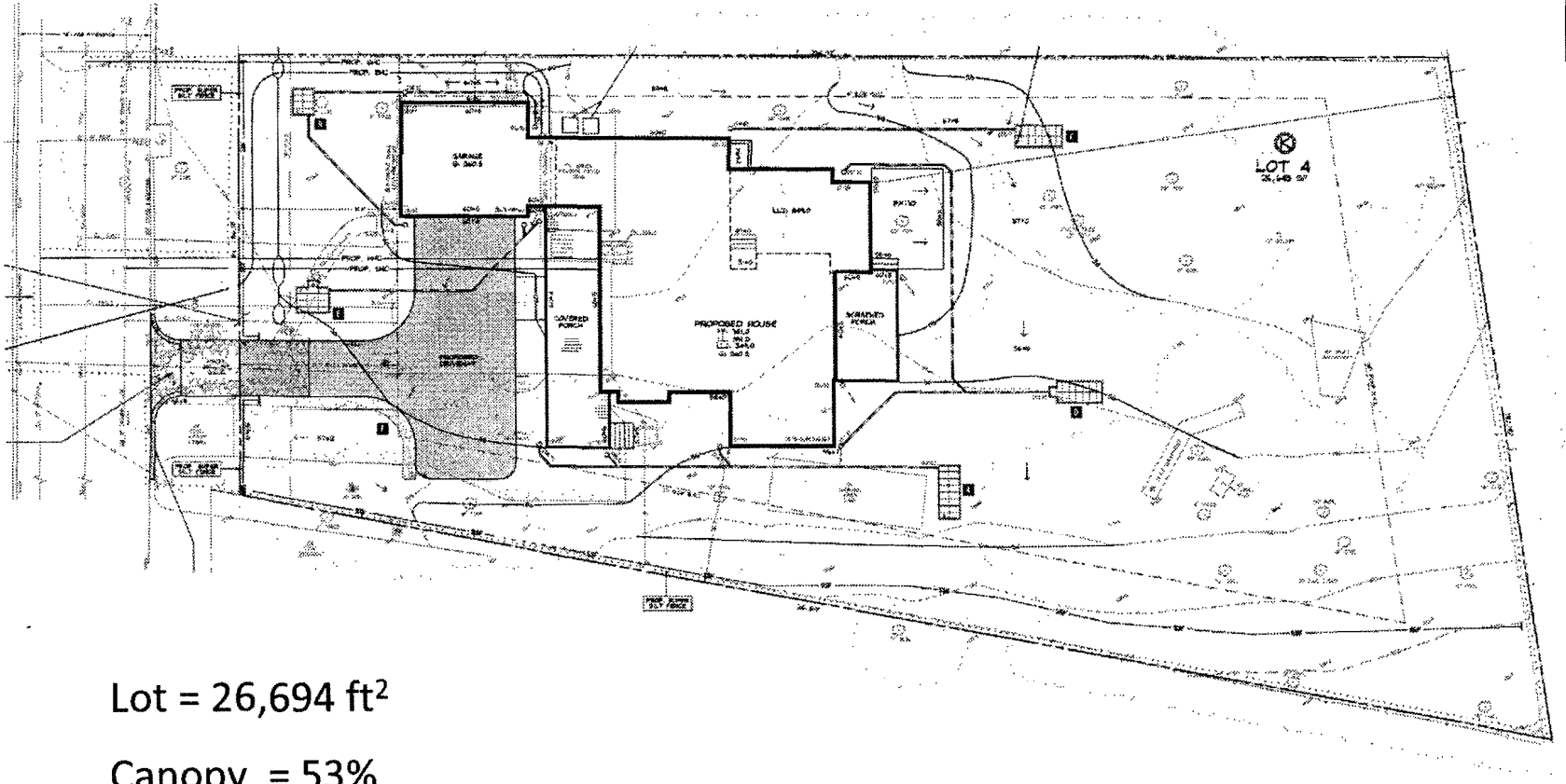
Lot = 9,023 ft^2

Canopy = 63%



128

Plan 2

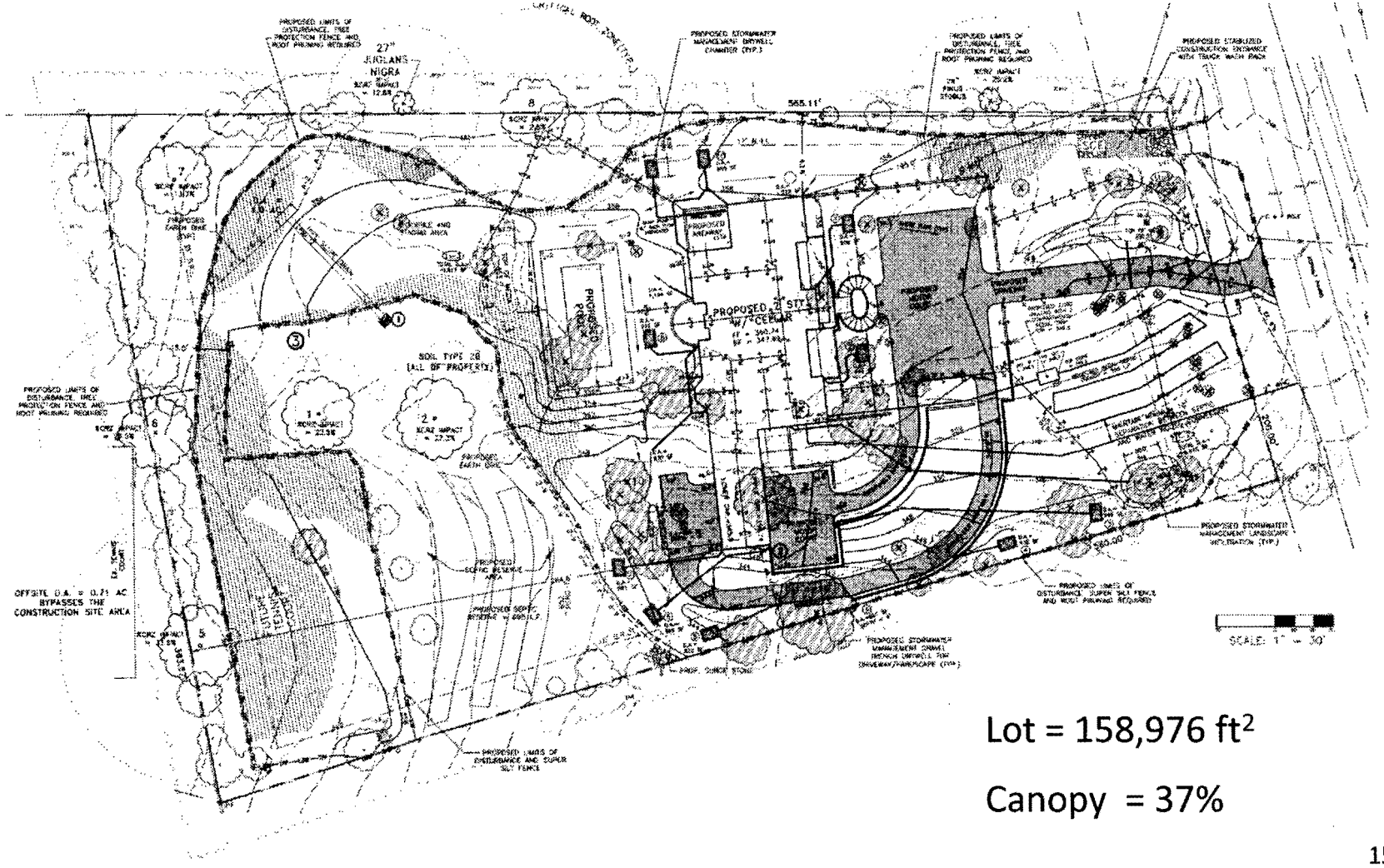


Lot = 26,694 ft^2

Canopy = 53%

129

Plan 3



Lot = 158,976 ft^2

Canopy = 37%

130

Jurisdiction Comparison

If the plans were implemented exactly as shown on these drawings, the fees would be:

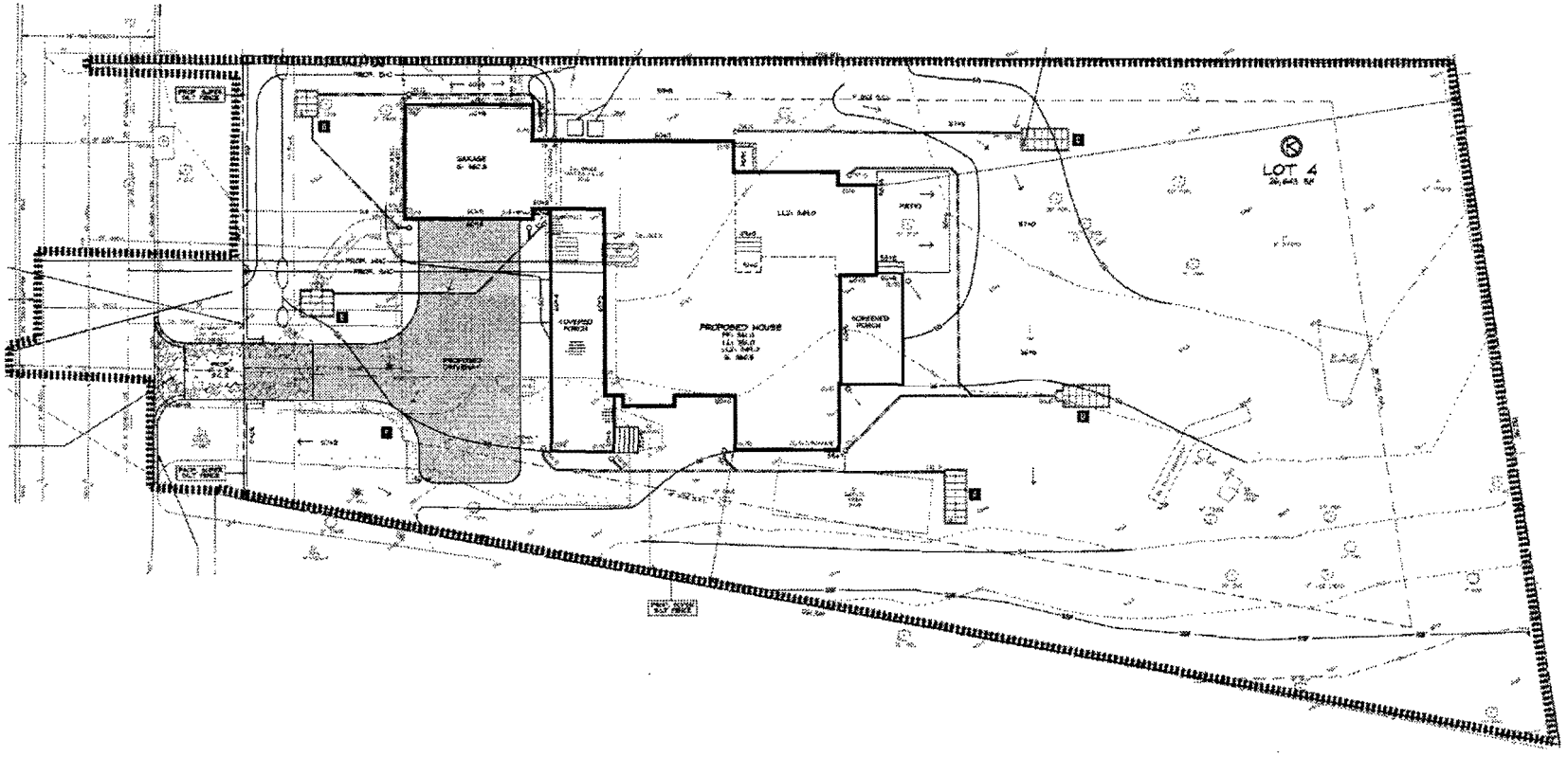
	Plan 1	Plan 2	Plan 3
Prince George's County			
Fairfax			
Washington, DC	$22,777	$23,860	$17,703
Athens-Clarke County, GA	n/a	n/a	n/a
Austin, TX	$36,600	$49,650	$32,550
Portland, OR	$8,400	$20,400	$86,400
Bill 35-12	$2,278	$8,153	$23,549

(131)

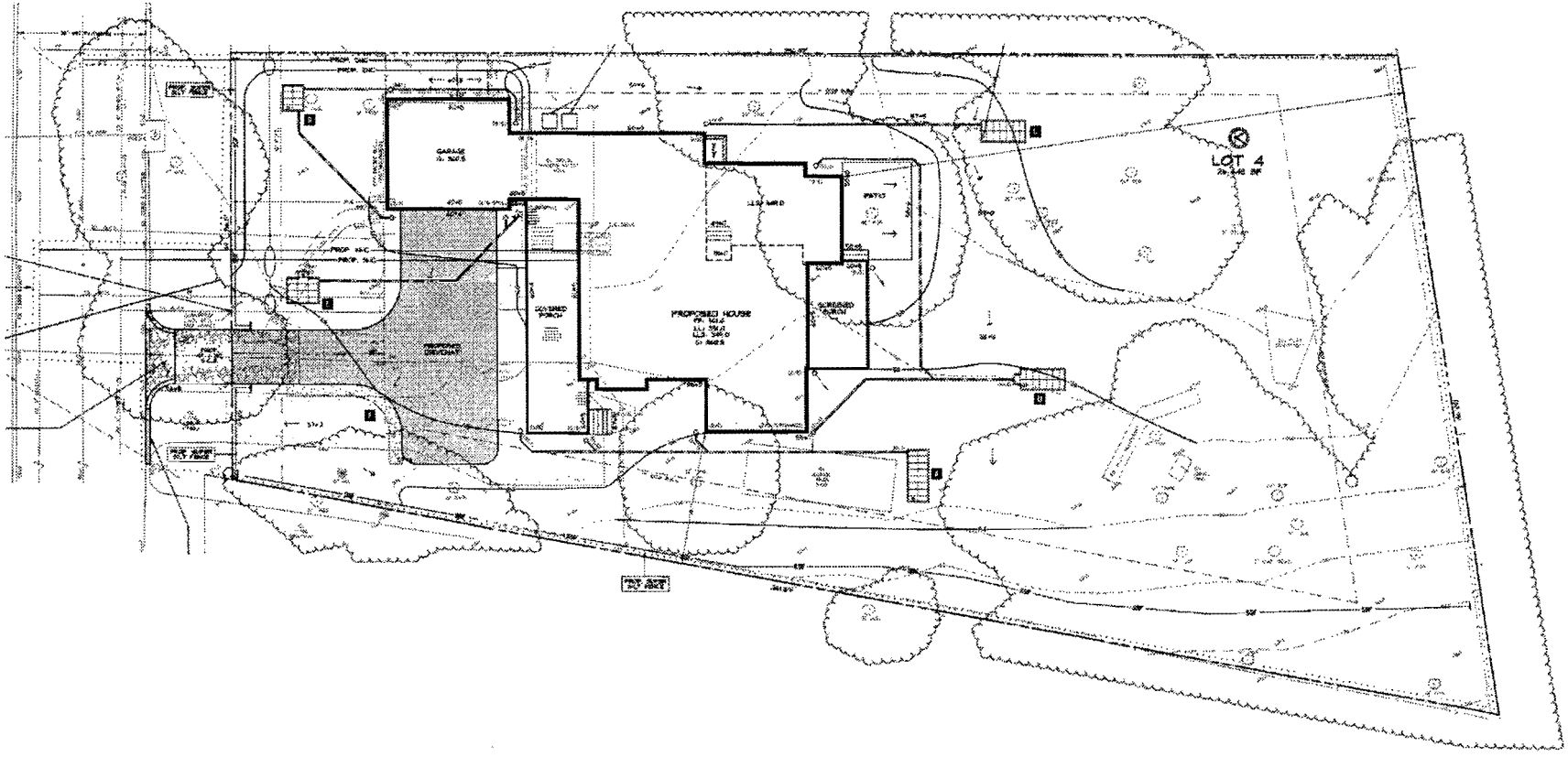
Process Summary

- Applicant submits plans and supporting data describing area of:
  - LOD
  - Predevelopment canopy
  - Canopy protected (optional)
  - Area for plantings (optional)
- DPS verifies calculations
- Fee is assessed
- DPS enforces LOD as they do now, and verifies certain aspects of tree protection and planting plans (e.g., protection measures are in place, trees have been planted, etc.)

Current Site Plan

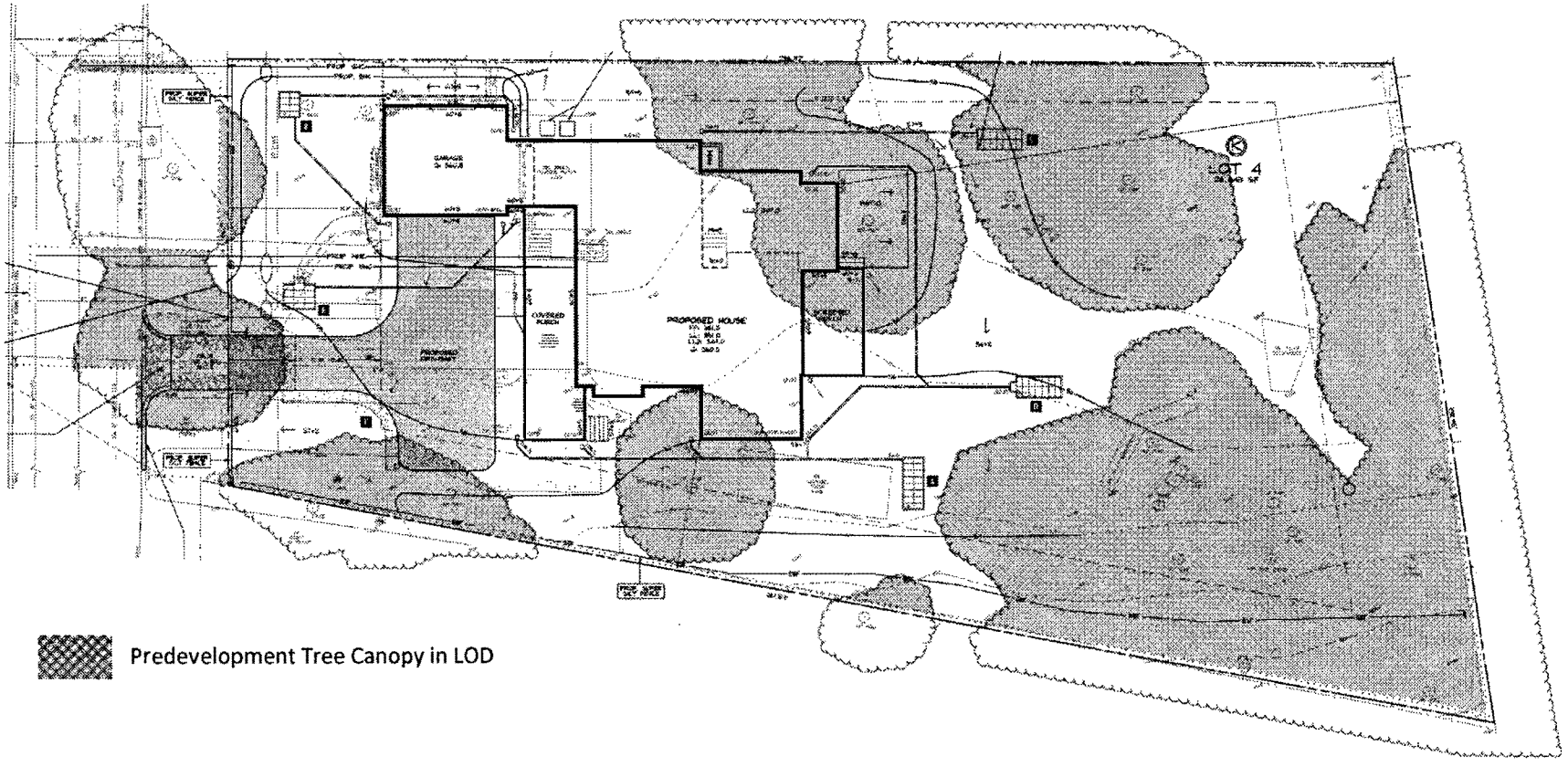


Site Plan with Tree Canopy Delineation



134

Site Plan with Tree Canopy Delineation



Data Table

Area of Lot (sq. ft.)	26,694
Area of LOD (sq. ft.)	27,929
Canopy within LOD (sq. ft.)	14,870

136

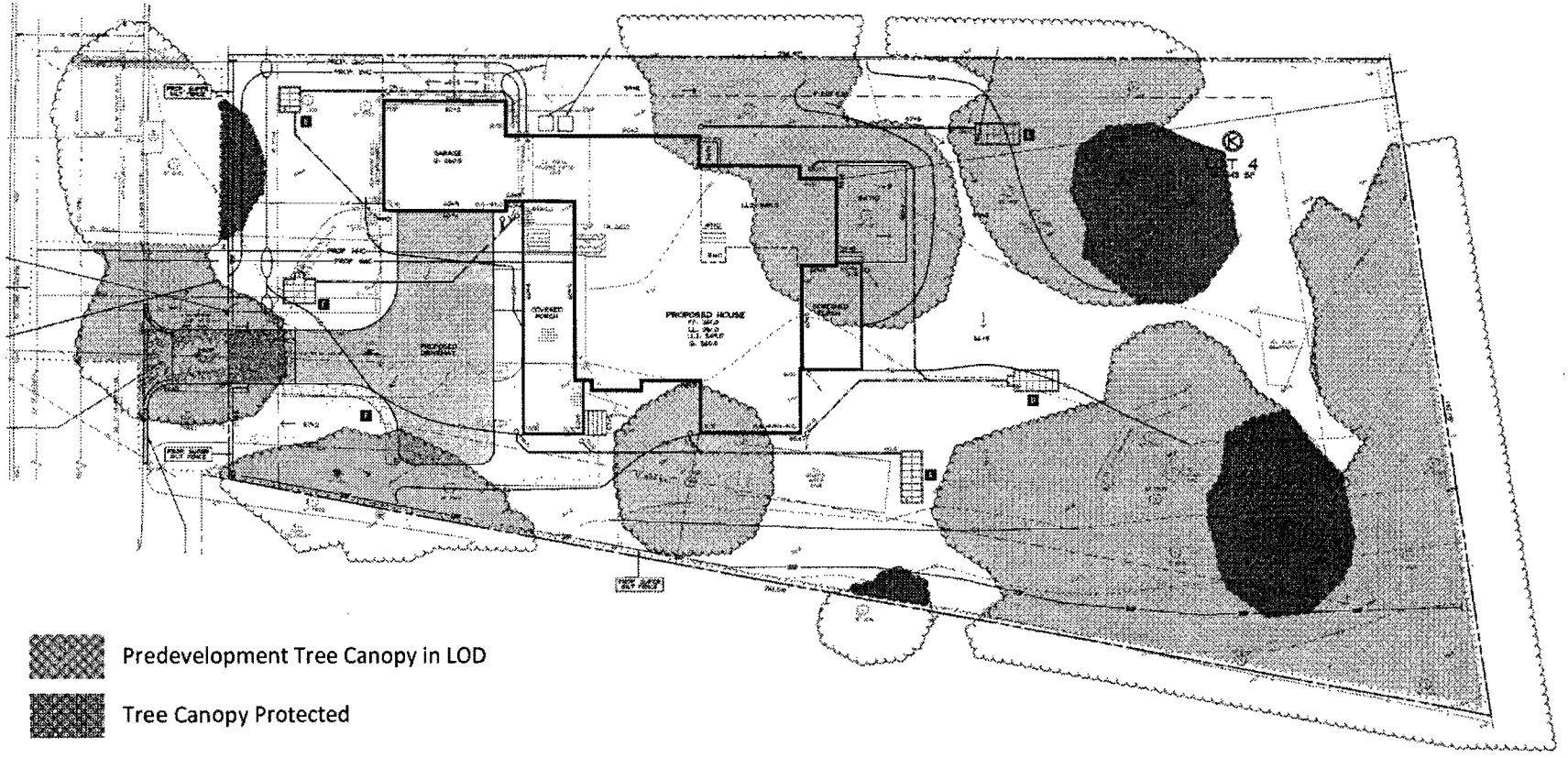
Calculation of Mitigation Fee

	Square Feet	Acres
Canopy within LOD	14,870	0.34
Less Canopy Protected		0.00
Less Canopy Planted x 0.25		0.00
Area Requiring Mitigation	14,870	0.34

Incremental Area (sq. ft.)		Increment	Mitigation
From	To	Fee ($/sq. ft.)	Fee
0	2,000	$0.25	$500
2,001	4,000	$0.35	$700
4,001	6,000	$0.45	$900
6,001	8,000	$0.55	$1,100
8,001	10,000	$0.65	$1,300
10,001	15,000	$0.75	$3,653
15,001	20,000	$0.85	$0
			$8,153

137

Site Plan with Tree Protection Measures



138

Data Table with Tree Protection Data

Area of Lot (sq. ft.)	26,694
Area of LOD (sq. ft.)	27,929
Canopy within LOD (sq. ft.)	14,870

Area of Canopy Protected (sq. ft.)	1,809

Area Requiring Mitigation (sq. ft.)	13,061

(139)

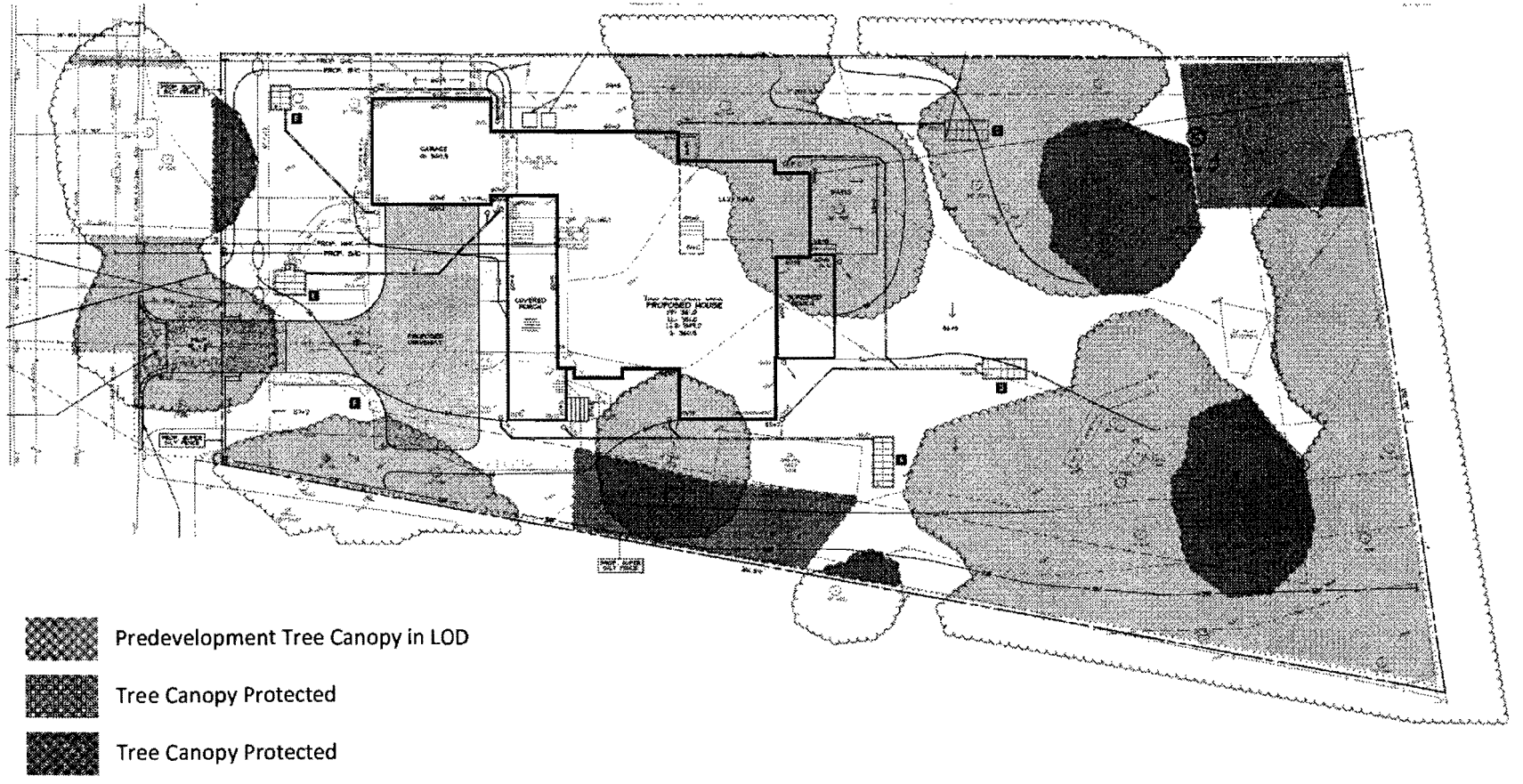
Calculation of Mitigation Fee

	Square Feet	Acres
Canopy within LOD	14,870	0.34
Less Canopy Protected	1,809	0.04
Less Canopy Planted x 0.25		0.00
Area Requiring Mitigation	13,061	0.30

Incremental Area (sq. ft.)		Increment	Mitigation
From	To	Fee ($/sq. ft.)	Fee
0	2,000	$0.25	$500
2,001	4,000	$0.35	$700
4,001	6,000	$0.45	$900
6,001	8,000	$0.55	$1,100
8,001	10,000	$0.65	$1,300
10,001	15,000	$0.75	$2,296
15,001	20,000	$0.85	$0
			$6,796

(140)

Site Plan with Tree Planting Areas



Determination of Trees to be Planted

Credits Factors Specified in Bill

Category of Tree Size	Assumed Area of Canopy at 20 Years	Minimum Open Soil Surface Area (ft^2)
Small	400	100
Medium	800	200
Large	1,600	400

Credits for Example Property

Planting Area	Tree Type	Canopy Area
1,170	Large	1,600
	Large	1,600
	Medium	800
860	Large	1,600
	Large	1,600
Total Assumed Canopy Area @ 20 Yrs		7,200
Canopy Credit (Canopy Area x 0.25)		1,800

(142)

Data Table with Tree Protection Data

Area of Lot (sq. ft.)	26,694
Area of LOD (sq. ft.)	27,929
Canopy within LOD (sq. ft.)	14,870
Area of Canopy Protected (sq. ft.)	1,809
Area of Canopy Planted (sq. ft.) x 0.25	1,800
Area Requiring Mitigation (sq. ft.)	11,261

(143)

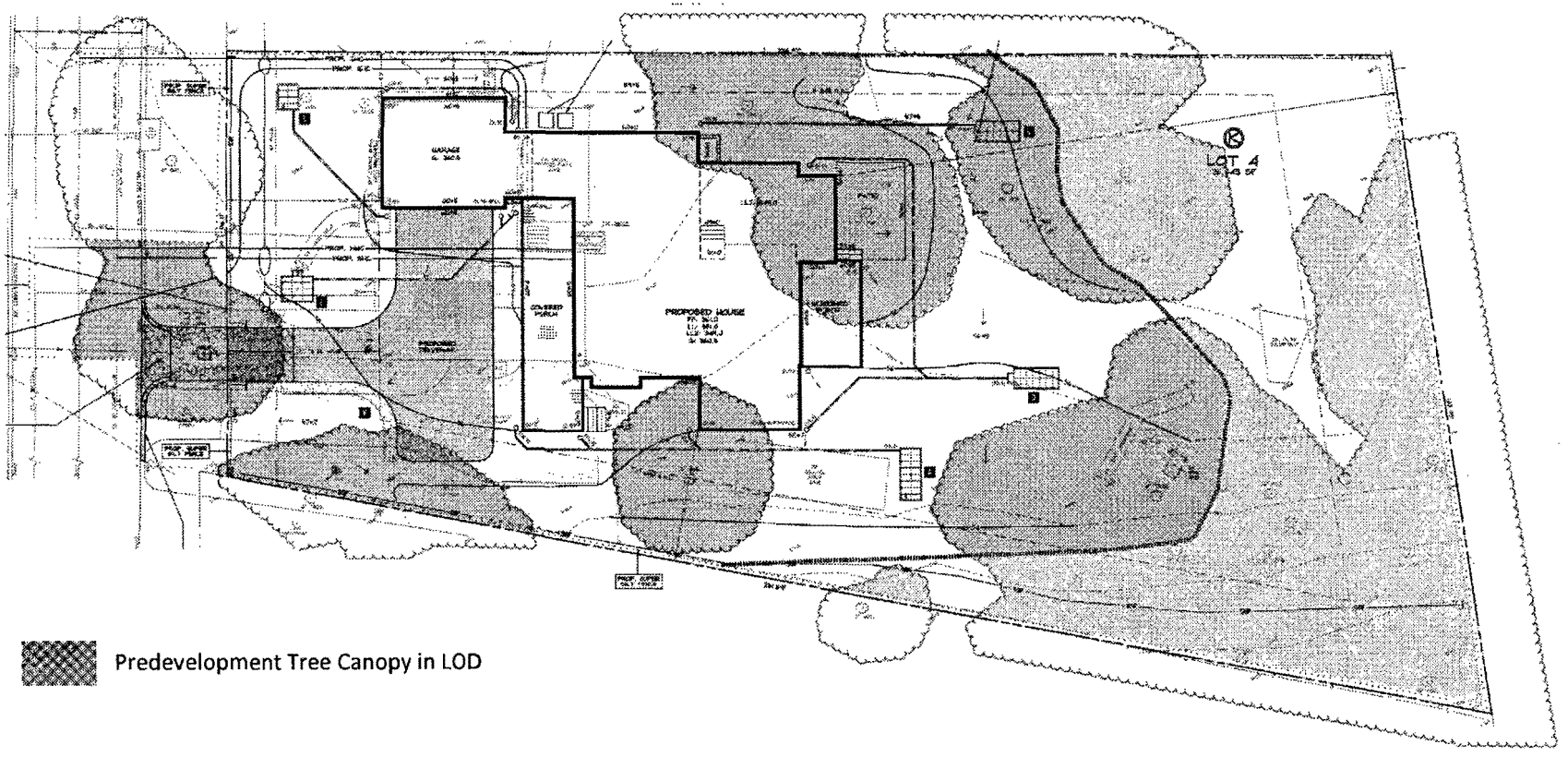
Calculation of Mitigation Fee

	Square Feet	Acres
Canopy within LOD	14,870	0.34
Less Canopy Protected	1,809	0.04
Less Canopy Planted x 0.25	1,800	0.04
Area Requiring Mitigation	11,261	0.26

Incremental Area (sq. ft.)		Increment	Mitigation
From	To	Fee ($/sq. ft.)	Fee
0	2,000	$0.25	$500
2,001	4,000	$0.35	$700
4,001	6,000	$0.45	$900
6,001	8,000	$0.55	$1,100
8,001	10,000	$0.65	$1,300
10,001	15,000	$0.75	$946
15,001	20,000	$0.85	$0
			$5,446

(#4)

Site Plan with Modified LOD



Predevelopment Tree Canopy in LOD

Calculation of Mitigation Fee

	Square Feet	Acres
Canopy within LOD	7,862	0.18
Less Canopy Protected	0	0.00
Less Canopy Planted x 0.25	0	0.00
Area Requiring Mitigation	7,862	0.18

Incremental Area (sq. ft.)		Increment	Mitigation
From	To	Fee ($/sq. ft.)	Fee
0	2,000	$0.25	$500
2,001	4,000	$0.35	$700
4,001	6,000	$0.45	$900
6,001	8,000	$0.55	$1,024
8,001	10,000	$0.65	$0
10,001	15,000	$0.75	$0
15,001	20,000	$0.85	$0
			$3,124

9H1

renewingmontgomery

Tree Canopy Bill 35-12 was introduced without including comments from the building industry so it is flawed beyond the ability to amend it. There has never been any study or data that demonstrates there is a problem that requires legislation. *The most recent MNCPPC study shows our canopy is thriving by any standard.* Why rush to this far reaching legislation that is based on anecdotal evidence. Renewing Montgomery has a better proposal.

Our proposal provides more incentives for the property owner to replant trees on their property and avoids devaluing properties that have trees. In addition our proposal increases the County canopy by requiring replanting even on properties without any trees. *County regulations require the removal of the trees so the focus should be on replanting a renewable resource.* In summary our proposal allows the property owner and their neighbors to benefit from replanting trees, thereby providing an incentive to replant.

<u>The following is a list of the specific improvements our proposal includes:</u>

1. The new trees will be planted where trees are removed and will thrive.
2. The new trees will add value to the property.
3. This alternative will both replace and increase the County tree canopy.
4. The fee in lieu is based on the value of a new tree – not satellite imagery of canopy square footage, which will include invasive species and canopy overhanging from adjacent properties. Basing the fee on the value of a tree will avoid establishing a fee that may be used as a deterrent to home improvements.
5. All properties subject to a sediment control plan will have a tree planting requirement - regardless if there were existing trees.
6. Tree replacement requirements will be based on a chart that accounts for the size of the property to establish a realistic replanting plan.
7. The required trees will be listed on the sediment control plan; therefore they will be bonded and inspected by the County – exactly like the trees planted in the right of way. No additional plans, plan review, or County inspections are needed.
8. We request the Council authorize a County canopy study to identify if there is a problem to address. The new state law requires the state to do a canopy coverage assessment for each county, every 5 years. The state goal is 40%, the current coverage is 50% for Montgomery County. Our County has 20% more canopy coverage than Fairfax County.
9. The County will educate the general public and citizen associations on the benefits of trees. The County will promote the various Tree Planting Tax Incentives that are contained within the new state tree bill before generating new fees, new regulations, and new staff positions.

We oppose this Bill because it will not result in planting trees or increasing the canopy where the trees are removed. Other than a deterrent for home improvements, it is just another fee that is unnecessary since the County already has over 6 million dollars to plant trees. The Bill will require additional engineering and consultant fees both on the private and public side, which will quickly negate any incentive to replant trees. The fee will add no value to the lot and effectively transfers the responsibility for replanting trees from the property owner to the County. The Bill will actually encourage property owners to remove trees to avoid the fee, and the general public will be outraged that the County is now regulating trees on their private property which they planted and maintained.

<u>The advantages of our alternative over the proposed Bill.</u>

1. Trees will be planted where they are removed – not somewhere else.
2. The private sector can plant a tree at a far less cost and faster than the County.
3. Trees will be planted even if no trees are removed thereby increasing the County canopy.
4. Will not regulate trees on private property which has historically been a basic inherent property right.
5. Will not penalize or devalue those who own properties with trees.
6. The new trees will have an immediate impact on those most affected by the removal of trees.
7. There are no fees that may act as a deterrent to home improvements or the removal of hazardous trees.
8. The required plan is simple and inexpensive and does not require additional costs for arborists or engineers.
9. The County has over 6 million dollars for trees. Why essentially tax only those property owners seeking to improve their property. The Bill will not produce much revenue but will act as a deterrent to those who want to improve their property.
10. No additional County staff, satellite overlays, or plans are needed to implement this alternative.
11. Will not penalize property owners for removing invasive species such as bamboo and mulberry trees.
12. Will not penalize or discourage property owners for removing dangerous trees prone to storm damage such as poplars and locust trees.
13. The current source of funding for County-Wide tree planting is appropriately tax revenue generated on a County-Wide basis. This Bill avoids targeting only property owners who remove trees on their private property.
14. A current canopy study will allow the County to evaluate the existing canopy and evaluate the effectiveness of our proposal.
15. Will allow time for community associations to be educated on the benefits of trees, incentives, and to provide input.

Tree Canopy Planting Requirement min 1.5" caliper trees for future canopy goals

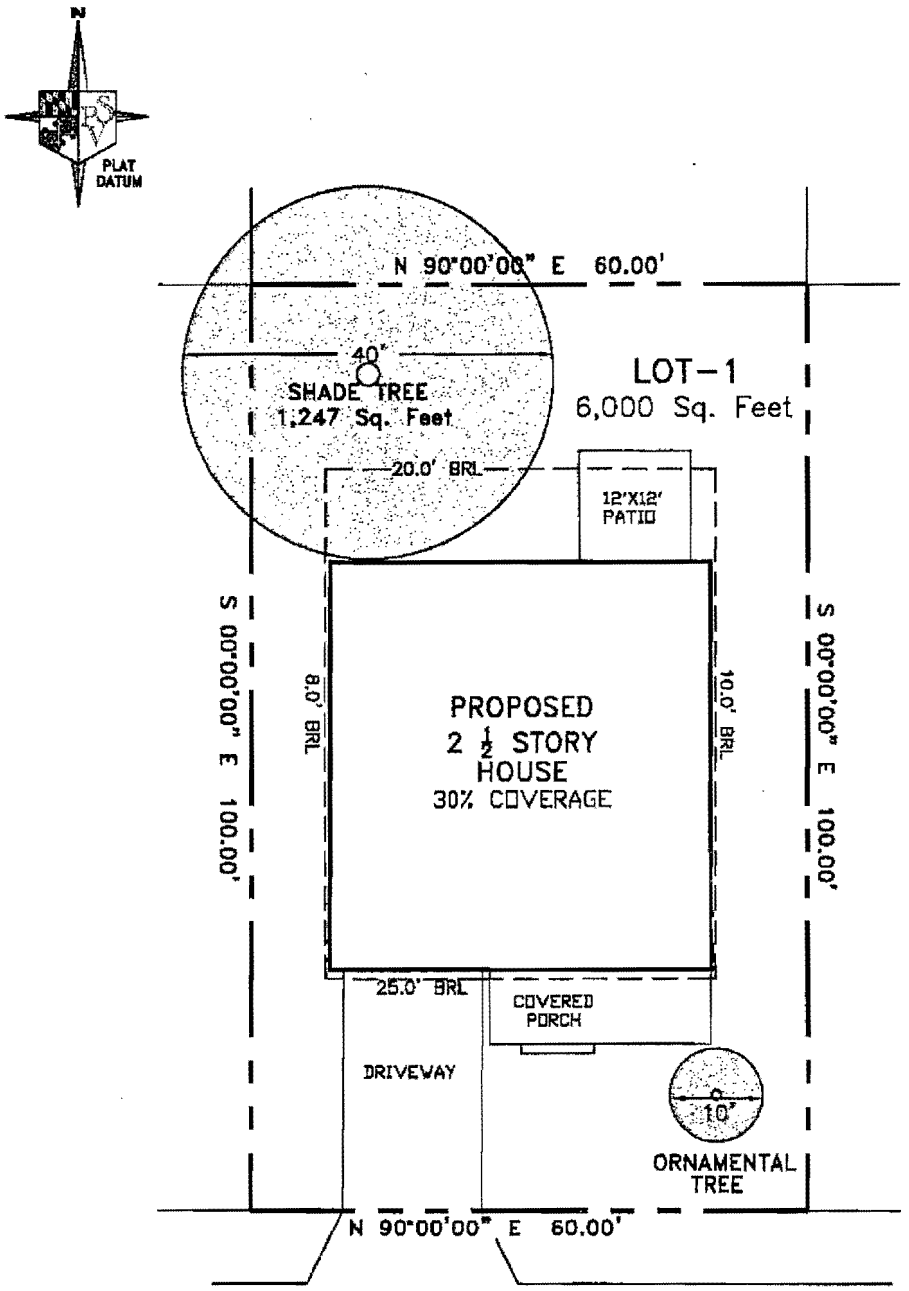
19-Jun-13							Optional	SF at Maturity	Canopy
			Total	# of	# of	Total	Fee in Lieu	Canopy	Coverage
		Lot Size	Trees Rqd	Shade	Ornamental	trees/acre	(2)	Planted (1)	(% of Lot)
-	to	6,000	2	1	1	17.4	$ 400.00	1,900	38%
6,001	to	8,000	3	2	1	18.7	$ 650.00	3,400	49%
8,001	to	10,000	4	3	1	19.4	$ 900.00	4,900	54%
10,001	to	12,000	5	3	2	19.8	$ 1,050.00	5,300	48%
12,001	to	14,000	6	4	2	20.1	$ 1,300.00	6,800	52%
14,001	to	16,000	7	5	2	20.3	$ 1,550.00	8,300	55%
16,001	to	20,000	7	5	2	16.9	$ 1,550.00	8,300	46%
			4.9 Avg.			18.9 Avg.			49% Avg.

1

Canopy Area, Diameter, Radius and Estimated DBH of Tree Trunk						
At Maturity		SF	Diameter	Radius	DBH	
Shade Tree	=	1500	43.71	21.86	29	
Orn. Tree	=	400	22.57	11.29	15	
Athens - Clarke County, Georgia: Mature Tree Canopy Sizes for Trees Growing in Urban Areas						
Very Small Canopy: 150 square feet (approximately 12 x 12 feet)						
Small Canopy: 400 square feet (20 x 20 feet)						
Medium Canopy: 900 square feet (30 x 30 feet)						
Large Canopy: 1600 square feet (40 x 40 feet)						

2 Cost for 1.5" caliper tree:Ornamental is $150 And Shade is $250.*
*Based on Montgomery County DPS Bond Estimate for a Street Tree - see link below
http://permittingservices.montgomerycountymd.gov/DPS/bond/BondsEstimate.aspx

file:v3(4)



ZONING:

- PROPERTY ZONED: R-60
- FRONT YARD: 25.0' OR EBL
- SIDE YARD: 8.0' MIN; TOTAL OF 18.0'
- REAR YARD: 20.0'
- MAXIMUM COVERAGE: 30%

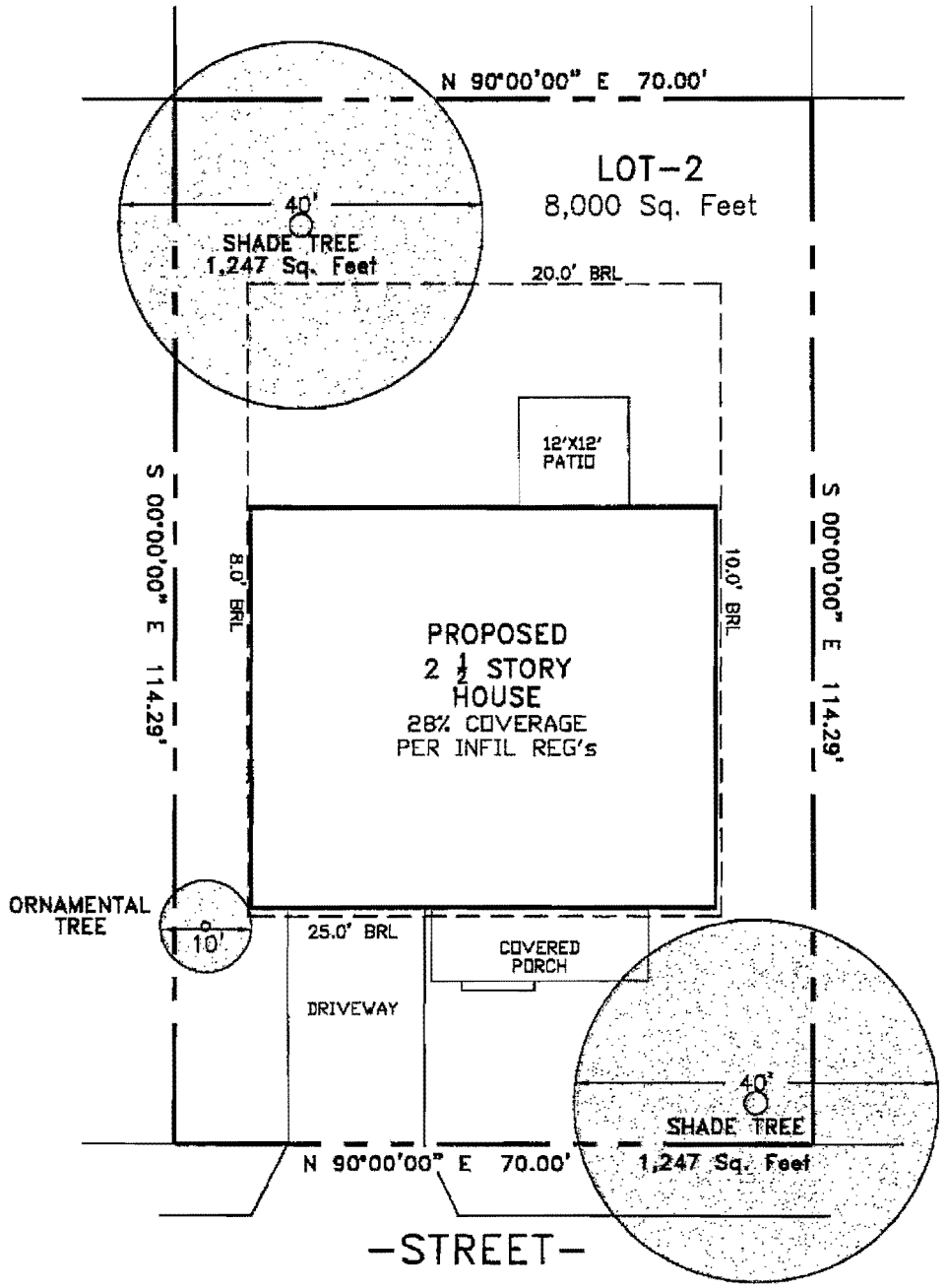
0' 20' 40' 60'

SCALE: 1"=20'

POTOMAC VALLEY SURVEYS
20010 FISHER AVENUE, SUITE F
POOLESVILLE, MARYLAND
1-888-349-5090

TREE CANOPY EXHIBIT-1
R-60 ZONE
6,000 SQ.FT. LOT

DATE:06-13-13



ZONING:

- PROPERTY ZONED: R-60
- FRONT YARD: 25.0' OR EBL
- SIDE YARD: 8.0' MIN; TOTAL OF 18.0'
- REAR YARD: 20.0'
- MAXIMUM COVERAGE:28.0% PER INFILL REG's

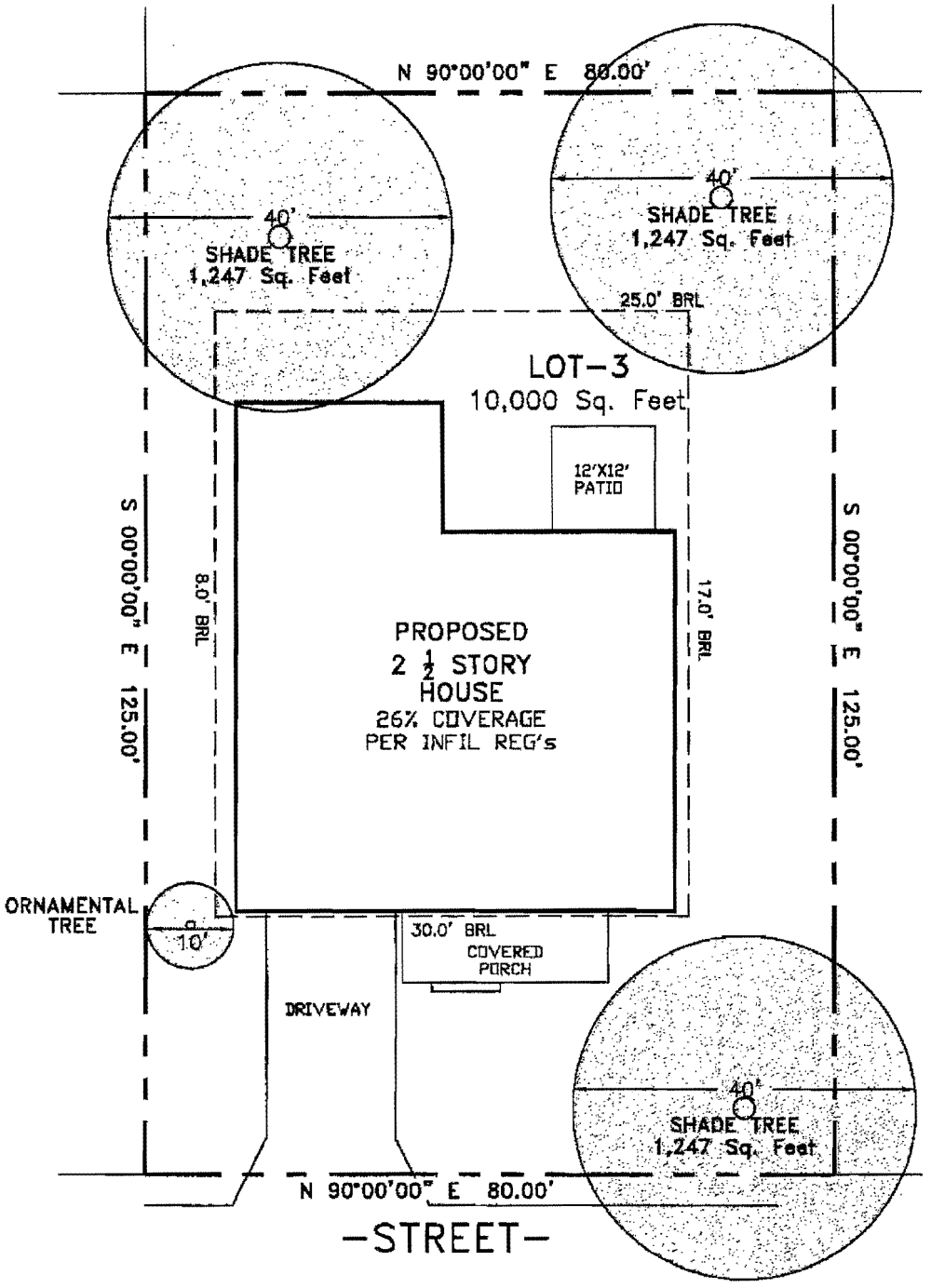
0' 20' 40' 60'

SCALE: 1"=20'

POTOMAC VALLEY SURVEYS
20010 FISHER AVENUE, SUITE F
POOLESVILLE, MARYLAND
1-888-349-5090

TREE CANOPY
EXHIBIT-2
R-60 ZONE
8,000 SQ.FT. LOT

DATE:06-13-13



ZONING:

- PROPERTY ZONED: R-90
- FRONT YARD: 30.0' OR EBL
- SIDE YARD: 8.0' MIN; TOTAL OF 25.0'
- REAR YARD: 25.0'
- MAXIMUM COVERAGE:26.0% PER INFILL REG's

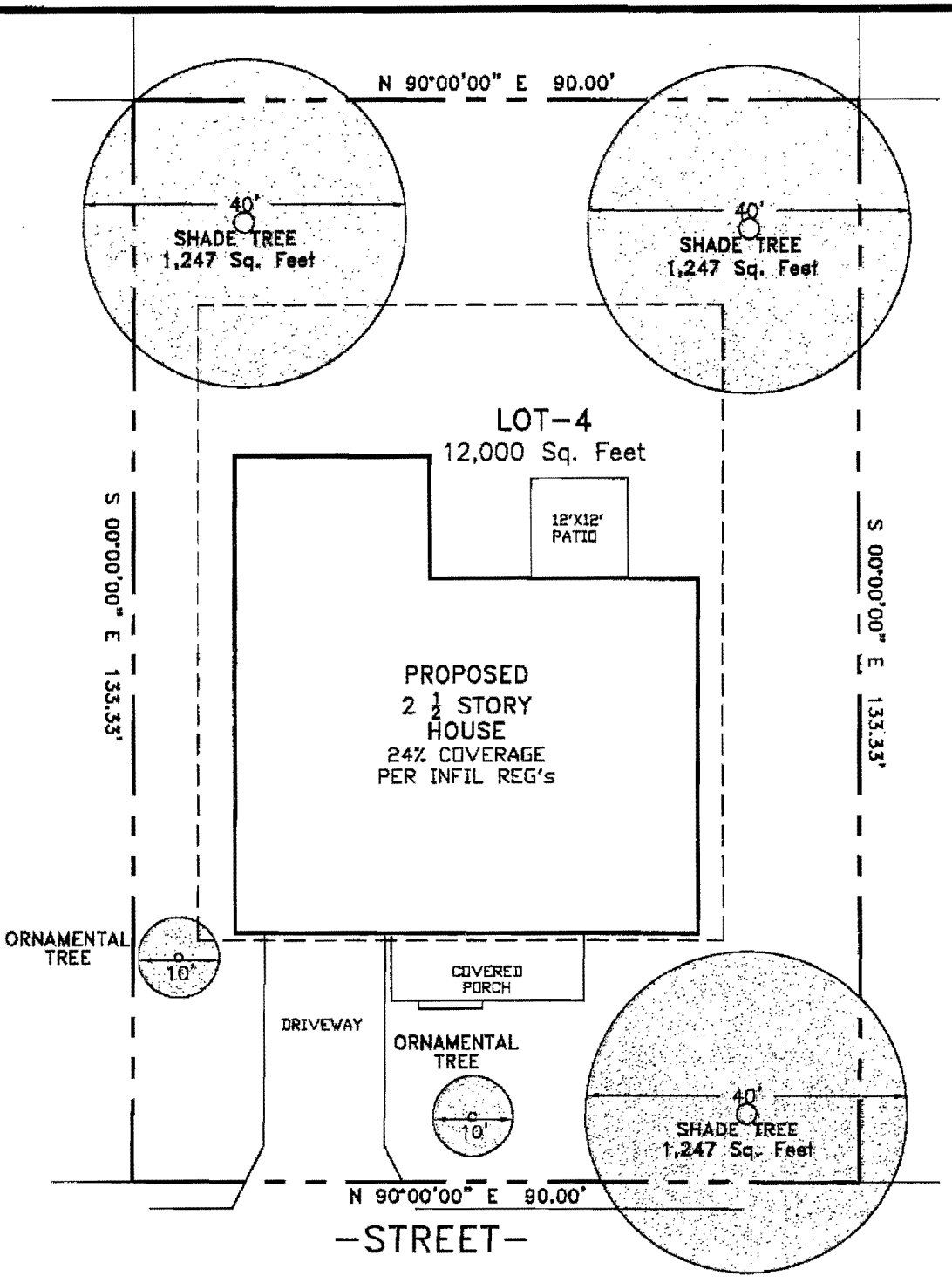
0' 20' 40' 60'

SCALE: 1"=20'

POTOMAC VALLEY SURVEYS
20010 FISHER AVENUE, SUITE F
POOLESVILLE, MARYLAND
1-888-349-5090

DATE:06-13-13

TREE CANOPY
EXHIBIT-3
R-90 ZONE
10,000 SQ.FT. LOT



ZONING:

- PROPERTY ZONED: R-90
- FRONT YARD: 30.0' OR EBL
- SIDE YARD: 8.0' MIN; TOTAL OF 25.0'
- REAR YARD: 25.0'
- MAXIMUM COVERAGE:24.0% PER INFILL REG's

0' 20' 40' 60'

SCALE: 1"=20'

POTOMAC VALLEY SURVEYS
20010 FISHER AVENUE, SUITE F
POOLESVILLE, MARYLAND
1-888-349-5090

TREE CANOPY
EXHIBIT-4
R-90 ZONE
12,000 SQ.FT. LOT

DATE:06-13-13

Faden, Michael

From: Robert Kaufman [rkaufman@mncbia.org]

Sent: Thursday, June 20, 2013 10:34 AM

To: Faden, Michael

Cc: Floreen's Office, Councilmember; Riemer's Office, Councilmember; Berliner's Office, Councilmember; larry@cafritzbuilders.com; todd@toddwood.com; Clark Wagner; cw@carterbuildersmd.com; mimibkress@aol.com; Chuck Sullivan

Subject: Tree Canopy Amendments

The Renew Montgomery organization, a separate organization unconnected to MNCBIA, recently submitted a proposal to amend the canopy bill that allows builders an alternative to the canopy calculation and fee recommended by the County Executive. Under their proposal, a property owner will be required to plant a specific number of trees on a lot that is being improved with a sediment control permit based on the size of the lot. The property owner can choose to plant the required number of trees or pay into a fund a fee based on the cost of a tree replacement using DPS calculations. The addition to the sediment control permit will include a bond amount for the tree and will include the cost of the tree in determining the application fee based on the Method 3 Regulations for Land Development permits.

The MNCBIA position has always been to support the canopy goals of the County with an effort to add, save or replace trees on a lot not covered by the existing Forest Conservation Law during development and if it is not feasible or desirable to plant the trees on site than to allow the builder/owner to pay into a fund for planting trees elsewhere in the community. The fee should be based on the actual costs of a planting a new tree selected from the list of acceptable trees. The high cost (can be up to $8000) of removing mature trees on in-fill sites serves as a natural deterrent to removing mature trees. Additionally, the value of the lot can be enhanced with healthy trees offering a further incentive to save trees and plant trees on site.

The alternative proposed by Renew Montgomery meets the objectives of the MNCBIA and therefore the MNCBIA removes our objection to the bill with the addition of this amendment. We note however that the proposal shows a gap between lots larger than 20,000 square feet and less than 40,000 square feet. Our recommendation is to allow the property owner the choice to follow the replacement chart for canopy disturbance below 20,000 sq. ft. and require the property owner to meet the canopy calculation and pay the fee for disturbances between 20,000 sq. ft. and 40,000 sq. ft. While there may be occasions where a property owner may need to clear a significant portion of the lot to meet storm water management grading requirements, this is likely to be rare and unusual. Perhaps DPS can consider an exemption for storm water management where the grading of the site may be necessary to clear cut the site to provide the best management of the flow.

The MNCBIA observes that the County, including the developed parts often called down-county, shows a significant canopy of over 49% throughout the County and over 60% in Bethesda. Perhaps the best it has been in the past 200 years. We also note, that the major reason that builders today clear trees on in-fill sites is to meet the recently passed storm water requirement for 100% management ON-SITE. Given the extraordinary existing canopy and the conflict with the County's own regulations, the canopy bill remains problematic at best. But we can still make a reasonable contribution to conserving our precious tree canopy. We can help by removing old trees or invasive species or trees inappropriate for urban environments and replace them with trees more appropriate. This can help minimize damage during severe storms and may help reduce maintenance costs and still add value to our neighborhoods. As an industry, we are proud of our contribution to the canopy of the County through the Forest Conservation Law and through our efforts to save or plant trees as part of our landscape designs. Trees clearly add value to a home, a community and a County.

S. Robert Kaufman

Faden, Michael

From: Edwards, Stan

Sent: Friday, June 21, 2013 2:35 PM

To: Berliner's Office, Councilmember; Riemer's Office, Councilmember; Floreen's Office, Councilmember; Faden, Michael; 'larry@cafritzbuilders.com'; 'todd@toddwood.com'; 'cw@carterbuildersmd.com'; 'mimibkress@aol.com'; 'cwagner@pleasants.org'; 'chuck.csh@verizon.net'

Cc: Hoyt, Bob; Miller, Laura; Boucher, Kathleen; Jones, Diane; Brush, Rick; Etheridge, Mark; Mihill, Amanda

All,

Thank you for the proposed canopy bill alternative offered by Renewing Montgomery. We have had a chance to do a quick review of it and offer the following initial thoughts:

1. One goal of Bill 35-12 was to encourage the retention of existing canopy by encouraging a reduction in the size of the LOD on the lot, to possibly avoid removing trees and to reduce the fee. The addition of a credit for protecting trees further encourages retention of existing canopy. There doesn't seem to be any incentive in the Renewing Montgomery proposal to retain trees because a developer that attempted to conserve trees on a lot would have the same planting/fee requirement as a developer who would clear the same lot.
2. Renewing Montgomery's proposal requires all lots to plant a minimum number of trees. This imposes requirements on lots with no trees to impact or on lots with trees even if none are impacted. Bill 35-12 imposes no requirements on activity that does not impact canopy.
3. The proposed credit for tree planting under Bill 35-12 included a requirement of a minimum amount of soil area to ensure that planted trees have a reasonable chance to grow to their expected size. Does the Renewing Montgomery proposal include such a requirement?
4. Builders have suggested (and we have not argued otherwise) that there is no room on many small lots to plant trees once the market required house/driveway, utilities, stormwater management features, etc. are taken into account. However, the drawings provided with the proposal don't include this infrastructure. In addition, while our experience may be limited, it seems there are very few new homes without at least a 2-car driveway, and most have much larger patios/decks than shown in the sample drawings. Inclusion of all of these features might alter the ability to plant the trees shown on the drawings, and would certainly affect the likelihood that the trees would grow to maturity.
5. The Renewing Montgomery proposal appears to require the planting of trees even where they may not be wanted by the ultimate owner of the property (which makes it unlikely that the tree once planted will survive). An important consideration of Bill 35-12 was that it did not mandate that property owners plant trees where they were not desired. Rather it provides for the development of a comprehensive canopy program along with the funds to plant and care for trees.
6. Given the issues noted in #4, it would appear in many cases the proposal would result in the payment of a fee in lieu as opposed to the plantings shown on the drawings. A quick analysis of the 9,000 square foot lot that we included in our presentation for the June 24 work session shows that the fees due under Bill 35-12, not including any credit for protecting existing trees or planting new ones, would be $2,278. The fee under the Renewing Montgomery proposal (assuming no trees are planted) would be $900.

We look forward to further discussion of these issues.

Stan Edwards
Division of Environmental Policy & Compliance
Department of Environmental Protection
Montgomery County, MD
240-777-7748

renewingmontgomery

July 2, 2013

Dear Council Members,

We would like to thank Councilmembers Hans Riemer and Nancy Floreen for their time and input in considering our alternative to Tree Canopy Bill 35-12. In addition we truly appreciate the meetings with Stan Edwards and Laura Miller as we reviewed newly constructed homes in Bethesda to resolve practical issues. The result of this collaboration is the attached truly progressive Tree Planting Plan that is designed to maintain the 50% canopy the County currently enjoys.

Through the process of these meetings we agreed on the following issues:

- The County and property owners seeking to improve their homes have a shared goal of maintaining tree canopy in the same areas where trees are removed.
- Tree preservation on lots under 20,000 sq ft is not feasible because of storm water management, driveways, utilities, and concerns over the long term safety of trees whose critical root zone may be impacted by development activity. Accordingly neither the Bill nor the Tree Planting Plan saves trees but instead focuses on planting trees.
- There is sufficient room on redeveloped lots for newly planted trees to have a reasonable chance to grow to maturity. DEP will allow the use of the right of way to be included in the needed tree planting area.
- No matter what legislation is adopted, or even if nothing is adopted, data on the existing canopy, the number and types of trees planted, location of trees planted, survival rates, etc. would be valuable information to evaluate tree concerns, goals, and progress.

The Tree Planting Plan will result in the following advantages over the Bill:

1. Trees will be planted by the Permittee immediately following construction on the property where the trees were removed.
2. The Renewing Montgomery proposal is more stringent than the Canopy Bill because it requires planting trees even on lots where no trees were removed.
3. The tree planting will be bonded as part of the sediment control plan.
4. No additional consultants, plans or permits are required; it is easy and inexpensive to implement.
5. A simple tree requirement chart will allow for the necessary flexibility to locate the tree after construction is completed.
6. Tree species and planting specifications will be determined by the County.
7. This plan will not cause some to either take down existing trees to avoid the fee, or discourage some from planting trees to avoid the fee.
8. If tree planting is not possible, a fee in lieu will be required before the bond is released.
9. The fee in lieu is based on the value of a tree as determined by County bonding requirements instead of an interpreted methodology.
10. Properties with existing trees are not devalued because of tree removal fees.
11. This plan avoids the concern that the regulation of trees on private property infringes on property rights.
12. This plan is not anti-business or anti-development and provides certainty so that infill development will continue to improve storm water management and triple tax revenue.

Modifications to the previously submitted Tree Planting Plan

- It is the experience of builders that over 85% of the trees we plant survive as they all come with a one-year warranty and homeowners do an excellent job at maintenance. DEP estimates only 25% of newly planted trees survive. However we both agree that there is no reliable data to know the survivability rate of trees planted on private property in down-County areas that are maintained by homeowners. In an effort to account for an 80% survival rate, we have increased our "shade tree" planting requirements by 25%.

- At the request of DEP we have also revised our chart to include all properties under 40,000 sq ft, which will address all properties not subject to the Forest Conservation Law. This addresses DEP's preference to have one regulation that applies to all properties instead of alternatives. Therefore the Tree Planting Plan would replace the proposed Tree Canopy Bill.

- In addition, we have specified a certain mandatory number of trees that must be planted on the improved property to ensure that some trees will be planted to start the next generation of tree canopy.

- In exchange for this compromise we request that no further tree legislation be considered until a tree canopy study can demonstrate over at least a 5-year period the effects of this progressive Tree Planting Plan.

These are complicated and far reaching issues that involve property rights, property values, and who pays for a public benefit. We believe this Tree Planting Plan achieves all the stated goals of the parties who participated in this collaboration. Your consideration of this request is greatly appreciated.

Sincerely,

Laurence Cafritz
Renewing Montgomery

Renewing Montgomery Proposed Tree Canopy Planting Requirement min 1.5" caliper trees for future canopy goals

7/2/2013				*			Optional	SF at Maturity	Canopy
			Total	# of	# of	Total	Fee in Lieu	Canopy	Coverage
		Lot Size	Trees Rqd	Shade	Ornamental	trees/acre	(2)	Planted (1)	(% of Lot)
-	to	6,000	2	1	1	17.4	$ 400.00	1,900	38%
6,001	to	8,000	3	2	1	18.7	$ 650.00	3,400	49%
8,001	to	10,000	4	3	1	19.4	$ 900.00	4,900	54%
10,001	to	12,000	5	3	2	19.8	$ 1,050.00	5,300	48%
12,001	to	14,000	6	4	2	20.1	$ 1,300.00	6,800	52%
14,001	to	16,000	7	5	2	20.3	$ 1,550.00	8,300	55%
16,001	to	20,000	7	5	2	16.9	$ 1,550.00	8,300	46%
20,001	<	40,000	7	5	2	10.2	$ 1,550.00	8,300	38%
			5.1 Avg.			17.8 Avg.			48% Avg.

1

Canopy Area, Diameter, Radius and Estimated DBH of Tree Trunk						
At Maturity		SF	Diameter	Radius	DBH	
Shade Tree	=	1500	43.71	21.86	29	
Orn. Tree	=	400	22.57	11.29	15	
Athens - Clarke County, Georgia: Mature Tree Canopy Sizes for Trees Growing in Urban Areas						
Very Small Canopy: 150 square feet (approximately 12 x 12 feet)						
Small Canopy: 400 square feet (20 x 20 feet)						
Medium Canopy: 900 square feet (30 x 30 feet)						
Large Canopy: 1600 square feet (40 x 40 feet)						

2 Cost for 1.5" caliper tree:Ornamental is $150 And Shade is $250.*
*Based on Montgomery County DPS Bond Estimate for a Street Tree - see link below
http://permittingservices.montgomerycountymd.gov/DPS/bond/BondsEstimate.aspx

* Increase shade tree planting count by 25% to account for survivability.
Then round up when reaching 0.5 above whole number.
On lots greater than 8000 SF, a minimum of 2 shade trees must be planted on site.

file:v3(5)

(8.51)

Notes Regarding June 27, 2013 DEP/Renewing Montgomery Meeting

Items where we appear to agree:

1. We have a shared goal of maintaining and improving the tree canopy in the County through the conservation of healthy trees where possible, the removal of unhealthy trees where prudent, and the planting and care of new trees where appropriate.

2. The public could benefit from information about (a) the benefits of trees, (b) procedures for proper tree care, and (c) the availability of incentives that support the planting of new trees.

3. There is a great deal of passion in the community about trees, but there is no consensus on the need for, or approach to, additional tree regulations.

4. The basis for mitigation under Bill 35-12 is the amount of canopy that is disturbed as a result of development activity. The basis for mitigation under the Renewing Montgomery proposal is the size of the lot where the development occurs.

5. It is difficult, if not impossible, to preserve trees during the approved redevelopment of smaller lots due to the new larger house, driveway, and other structural elements; gas, electric, water, and other utilities; requirements for stormwater management on the property; and concerns over the long-term safety of trees whose critical root zone may have been impacted by development activities.

6. Neither proposed Bill 35-12 nor the Renewing Montgomery alternative require the saving of trees during the development process.

7. Ideally, when canopy is lost due to development, new canopy of a similar character (e.g., new canopy trees to replace removed canopy trees) with a reasonable chance to grow to maturity would be planted on the same lot. This holds true with both the Renewing Montgomery proposal, as well as Bill 35-12.

8. There is sufficient room on some redeveloped lots for newly planted trees to have a reasonable chance to grow to maturity.

DEP believes:

1. There should be one tree canopy law that applies to lots of all sizes.

2. No matter what legislation is adopted (or even if nothing is adopted), we think data on the number and types of trees planted, location of trees planted, survival rates, etc. would be valuable information.

3. Property owners will not necessarily maintain new trees that they did not request. This is understandable as the property owner may want open space for a lawn, a place for children to play, sunlight to a garden, etc.

4. Trees are living things and, like most living things, have remarkable adaptations. Many trees grow, and even thrive, in harsh conditions. However, the presence of large trees does not mean that every tree will behave the same way. We cannot see the many trees that were planted (or grew naturally) that did not survive. This mortality rate varies due to a number of factors. The

proposed planting credit under Bill 35-12 assumes four trees must be planted to under reasonable conditions in order for one to reach maturity. However, there is scientific research that suggests a much higher number is needed and other jurisdictions, such as DC, require more trees. Renewing Montgomery suggests their proposal will result in 50% tree canopy coverage over time. This would only occur if 100% of the planted trees survive to maturity.

5. The relative stringency of Bill 35-12 and the Renewing Montgomery proposal, and the potential replacement of lost canopy under each, depends on the character of the lot being developed, as well as the nature of the redevelopment.

6. Bill 35-12 is a reasonable approach to replacing some of the canopy lost through the development process. Reasonable modifications could be considered, such as increasing the credit for planting trees, and allowing part of the ROW to be included in surface area requirements.

7. The Renewing Montgomery proposal is not DEP's preferred option but could be a potentially workable alternative if it including the following:
    a. A minimum required planting area specified for each type of tree (canopy, ornamental, etc.) planted, which may include the area in the ROW between the house and the sidewalk and outside of public utility easements.
    b. An increase in the required number of trees to be planted on each lot to account for mortality.

Note: The Renewing Montgomery proposal may raise legal issues that need to be reviewed by the County Attorney related to the relationship between the activity being conducted on the lot (i.e., the removal of trees) and the mitigation required.

DEP Response to the June 2, 2013 Renewing Montgomery Alternative to Bill 35-12

The Department of Environmental Protection (DEP) has reviewed the revised proposal submitted by Renewing Montgomery dated July 2, 2013 and offers the following comments. The dialogue we have had with Carter Willson, Chuck Sullivan, Todd Wood, Mimi Kress, Bob Kaufman and other representatives of the building community has been informative and has led to a shared understanding on a number of issues. Although the County Executive's original proposal remains our preferred option because it ties a property owner's obligation directly to the extent of the damage to the resource (tree canopy) caused by the development activity, the alternative approach offered by Renewing Montgomery is a potentially workable concept, as we have noted previously. Aside from making a property owner's obligations the same irrespective of whether trees are lost or damaged, the main stumbling block for DEP remains the concept's assumption that all newly planted trees will live to full maturity.

DEP has reviewed literature, discussed mortality with other jurisdictions, and had extensive discussions with the building community about tree mortality and the correct planting ratio to use to ensure that at least one tree grows to maturity. DEP cited Washington, DC's law, which may require up to 12 trees to be planted to replace one mature tree. Other jurisdictions use an "inch for inch" replacement philosophy, i.e., when a tree that is 20" in diameter is removed, 10 two-inch trees must be planted in its place. Renewing Montgomery's original proposal was essentially a one-to-one ratio, meaning they assume every tree that is planted will grow to maturity. Renewing Montgomery's revised proposal increases the number of shade trees required to be planted by 25% over their original proposal (because the numbers are small the effective increase is one additional tree per lot). This still does not provide a reasonable expectation that the trees that are planted will result in canopy that replaces the canopy that is lost as part of the development process.

To address this concern, DEP offers two alternative proposals. Option 1 would be to double the number of trees that would need to be planted under the original Renewing Montgomery proposal. Option 2 would be to triple the number of shade trees planted under the original Renewing Montgomery proposal and eliminate the required planting of ornamental trees. The attached spreadsheet provides the rationale for these options. There is a lot of data on this spreadsheet, and DEP will be prepared to discuss it in detail at the July 8, 2013 work session if necessary.

There are two tables on the spreadsheet. The first table shows the assumed canopy that would be achieved over time under the various proposals if all the planted trees grew to their assumed mature canopy size. Renewing Montgomery has stated that the goal of their proposal is to result in 50% canopy coverage, which we think is a reasonable objective. DEP's Option 1 results in approximately twice as much canopy as required to achieve 50% canopy coverage if all the planted trees grew to their assumed mature canopy size. In other words, under this proposal the expectation is that two trees would need to be planted to have one grow to maturity. Option 2 results in approximately three times as much canopy as required to achieve 50% canopy coverage if all the planted trees grew to their assumed mature canopy size. In other words, under this proposal the expectation is that three canopy trees would need to be planted to have one grow to maturity. While DEP believes both of these options realistically address mortality of small trees, Option 2 will result in the most potential for mature canopy.

The second table shows the fiscal implications of the various proposals, assuming fees were paid under each option.

July 5, 2013

A couple of other things should be noted:

- DEP thinks that it is best for the County to use one approach to regulating canopy not covered by the Forest Conservation Law. Our modifications to the Renewing Montgomery concept should, logically, be applied to properties of any size.

- DEP proposes that the limits of disturbance (LOD), rather than lot size, be used in these calculations. We believe this is a fairer approach, particularly for larger lots, where the development plan may be more easily altered to reduce the LOD and save trees. Not only would this provide a potential incentive to limit the disturbance to the minimum area necessary for the development activity, it would also be more reasonable, for example, in cases where a Sediment Control Permit is required to put in a pool. This activity might disturb 5,000 square feet on a 40,000 square foot lot. It would not be reasonable to expect the planting of trees as if the whole lot had been disturbed.

The alternatives proposed herein are DEP's. We have not had the opportunity to review them in detail with the Department of Permitting Services or the Planning Department, which would be the implementing agencies of Bill 35-12 as originally proposed. Nor have we had a chance to review this with the County Executive.

We look forward to continued discussion of these issues.

Suggested DEP Alternatives in Response to Renewing Montgomery's July 2, 2013 Proposal

Projected Canopy Coverage Assuming 100% Survival of All Trees Planted

LOD			Assumed LOD for Calculation	Assumed 50% Canopy Sq. Ft.	Assumed Bill 35-12 Canopy Sq. Ft.	Original RM			Revised RM Increase Shade Trees 25%			Proposed DEP 1 Double Original #'s for All Trees			Proposed DEP 2 Triple Original #'s Shade Trees		
						Shade	Orn.	Sq. Ft.	Shade	Orn.	Sq. Ft.	Shade	Orn.	Sq. Ft.	Shade	Orn.	Sq. Ft.
0	to	6,000	6,000	3,000	4,500	1	1	1,900	1	1	1,900	2	2	3,800	3	0	4,500
6,001	to	8,000	7,000	3,500	6,000	2	1	3,400	3	1	4,900	4	2	6,800	6	0	9,000
8,001	to	10,000	9,000	4,500	9,000	3	1	4,900	4	1	6,400	6	2	9,800	9	0	13,500
10,001	to	12,000	11,000	5,500	12,000	3	2	5,300	4	2	6,800	6	4	10,600	9	0	13,500
12,001	to	14,000	13,000	6,500	15,000	4	2	6,800	5	2	8,300	8	4	13,600	12	0	18,000
14,001	to	16,000	15,000	7,500	18,000	5	2	8,300	6	2	9,800	10	4	16,600	15	0	22,500
16,001	to	20,000	18,000	9,000	22,500	5	2	8,300	6	2	9,800	10	4	16,600	15	0	22,500
20,001	to	40,000	30,000	15,000	49,500	5	2	8,300	6	2	9,800	10	4	16,600	15	0	22,500

See Notes for LODs above 40,000 sq. ft.

Dollars

LOD			Assumed LOD for Calculation	Assumed 50% Canopy Sq. Ft.	Bill 35-12 Fee	Original RM			Revised RM Increase Shade Trees 25%			Proposed DEP 1 Double Original #'s for All Trees			Proposed DEP 2 Triple Original #'s Shade Trees		
						Shade	Orn.	In-Lieu	Shade	Orn.	In-Lieu	Shade	Orn.	In-Lieu	Shade	Orn.	In-Lieu
0	to	6,000	6,000	3,000	$850	1	1	$400	1	1	$400	2	2	$800	3	0	$750
6,001	to	8,000	7,000	3,500	$1,025	2	1	$650	3	1	$900	4	2	$1,300	6	0	$1,500
8,001	to	10,000	9,000	4,500	$1,425	3	1	$900	4	1	$1,150	6	2	$1,800	9	0	$2,250
10,001	to	12,000	11,000	5,500	$1,875	3	2	$1,050	4	2	$1,300	6	4	$2,100	9	0	$2,250
12,001	to	14,000	13,000	6,500	$2,375	4	2	$1,300	5	2	$1,550	8	4	$2,600	12	0	$3,000
14,001	to	16,000	15,000	7,500	$2,925	5	2	$1,550	6	2	$1,800	10	4	$3,100	15	0	$3,750
16,001	to	20,000	18,000	9,000	$3,850	5	2	$1,550	6	2	$1,800	10	4	$3,100	15	0	$3,750
20,001	to	40,000	30,000	15,000	$8,250	5	2	$1,550	6	2	$1,800	10	4	$3,100	15	0	$3,750

See Notes for LODs above 40,000 sq. ft.

Notes

(1) Planting may occur anywhere on the lot (including outside the LOD) as long as sufficient space is available.

(2) Assumes minimum open surface planting area of 400 sq. ft. for shade trees and 100 sq. ft. for ornamentals (area may include ROW between the house and the sidewalk outside of any public utility easement)

(3) Assumes Renewing Montgomery's proposed costs for trees based on DPS bond requirements ($250/shade tree, $150/ornamental tree)

(4) Assumes Renewing Montgomery's proposed canopy coverage for mature trees (1,500 sq. ft./shade tree @ 29" dbh, 400 sq. ft./ornamental tree @ 15" dbh)

(5) For LODs greater than 40,000 sq. ft., prorate the 40,000 sq. ft. rate to the total LOD. Example: 100,000 sq. ft. LOD requires 2.5 times the 40,000 sq. ft. rate (100,000 sq. ft. divided by 40,000 sq. ft. = 2.5; then 2.5 times the number of trees required under the 40,000 sq. ft. rate equals the number of required plantings)

TREES MATTER COALITION

July 8, 2013

Conservation Montgomery

Montgomery Countryside Alliance

Casey Trees Washington DC

Audubon Naturalist Society

Rock Creek Conservancy

Muddy Branch Alliance

West Montgomery County Citizens Association

Norbeck Meadows Civic Association

Chevy Chase West Neighborhood Association

The Honorable Roger Berliner, Chair, and Committee Members
Montgomery County Council Transportation & Environment Committee
100 Maryland Avenue
Rockville, MD 20850

Robert Hoyt, Director
Montgomery County Department of Environmental Protection
255 Rockville Pike
Rockville, MD 20850

Dear Chair Berliner, Councilmembers Riemer and Floreen and Director Hoyt:

Thank you for the exhaustive work the committee and Department of Environmental Protection (DEP) has done to date on the urban canopy bill, Bill 35-12. We are renewing our support for Bill 35-12. After years of discussions with opponents of this bill and many compromises and negotiations along the way, we stand in support of Bill 35-12, **Option 2** and the recommendations as outlined in the attached document: *DEP Response to the June 2, 2013 Renewing Montgomery Alternative to Bill 35-12.* We urge the committee to move forward, vote favorably on Bill 35-12 and recommend that the bill be moved out of the T&E Committee on July 8th and sent forward for Council action.

We agree with the concept of assigning financial value to the tree canopy we need for a healthy and sustainable quality of life in Montgomery County. As we have noted in the past, mature tree canopy offers not only a multitude of environmental services but provides economic return in terms of energy efficiency, efficient stormwater management and financial value added to residential and commercial property.

It is imperative that the Council pass Bill 35-12 in a form that will offer the highest level of replacement of mature over-story trees that are lost to new development. For too long, our county has relied solely on a Forest Conservation Law (FCL) that has shown modest results for forested areas but was never intended to address loss of tree canopy in urban areas as well as trends in development that have changed significantly since the FCL was drafted in the early 1990s. Therefore, our coalition stands behind the Executive's Bill 35-12 and the regulation that the bill provides for an important natural asset. In particular, we support a countywide tree planting plan as a component of Bill 35-12.

A well-coordinated countywide tree-planting plan must be incorporated into Bill 35-12. We hope to see language strengthened in the Bill that will address coordination between the DEP, the Department of Transportation street tree program, the Maryland-National Capital Parks and Planning Commission and the Department of Permitting Services.

Option 2 as described in the DEP response provides for a 3:1 planting ratio for shade trees and eliminates the required planting of ornamental -- under story -- trees. We believe this is a sound approach since over-story or major shade trees will provide the best canopy benefits over the years. DEP's rationale is correct for the 3:1 ratio as it considers survival rates that point to maintaining a 50% countywide canopy percentage, and notes that at least three canopy trees need to be planted in order for one newly planted shade tree to survive and grow to full size.

We also agree with DEP's proposal that limits of disturbance (LOD), rather than lot size, be used in calculations for canopy replacement. As DEP's response notes, using LOD will offer more opportunities to either save existing trees on a lot or replanting more and larger shade trees by reducing the LOD on a development plan. However, we would like to see regulations addressing options for

protecting tree roots on adjacent lots as part of a larger tree-save scenario if the LOD is used in the calculations. While using the LOD seems fair, we would like to point out that reducing the LOD should not mean damaging the critical root zone of mature shade on adjacent sites when a site is being developed.

In addition to DEP's "Option 2" for a replanting ratio in Bill 35-12 and the use of the LOD in calculations for replacement, we suggest that the bill language be amended to address the following:

- Instead of the tiered fee structure DEP proposes, we propose a flat fee of $1.00 per square foot for canopy removal. This will simplify the fee structure and streamline the collection of fees.
- A county-wide planting plan coordinated with DOT, DEP and Parks and Planning involved and reporting on an annual basis to the Council, the Executive and Planning Board Chair regarding progress.
- An arborist must be involved in the tasks that DPS will undertake to implement Bill 35-12. The legislation proposes to delegate DPS with a new role in implementation of tree canopy regulations, yet DPS is being assigned a role for which they presently have no experience or expertise. There must be an ISA-certified arborist within DPS who has the technical knowledge to determine what trees can be saved on a plan or should be saved, or what species and size should be replanted to replace canopy that is destroyed. Only an ISA-certified arborist and staff can fully implement the legislation and regulations in an accompanying technical manual for both tree bills.

The time has come for urban canopy legislation that will protect our canopy for future generations. Bill 35-12 must be adopted to cover what is not addressed in the existing FCL so that our tree legislation will keep pace with trends in development patterns.

Thank you for allowing us to comment on the DEP response. Before closing, we emphasize that this legislation must not be withdrawn or tabled to accommodate one small group of infill builders and that – rather than an alternative to no legislation – a coordinated county-wide planting plan be a component of Bill 35-12. We urge you to move Bill 35-12 forward to the Council.

Sincerely,

Caren Madsen

Caren Madsen
Conservation Montgomery, on behalf of the TREES MATTER coalition members

Cc: County Executive Isiah Leggett
Council President Nancy Navarro

AMENDMENT
To Bill 35-12
BY COUNCILMEMBER FLOREEN

PURPOSE: To revise the planting requirements by incorporating "DEP option 1".

Beginning on page 20, after line 490, add definition to read:

Ornamental tree means a tree cultivated for its beauty rather than for its natural use, typically of small stature not capable of growing to heights greater than 50 feet.

Beginning on page 23, line 562, change Section 55-6(b) to read:

(b) *Quantity.* The number of shade and ornamental trees required to be planted under this Section must be based on the square footage of the area in the limits of disturbance.

(1) Unless modified or superseded by applicable regulations adopted under Method 1, the number of shade and ornamental trees planted must comply with the following schedule:

Area (sq. ft.) of the Limits of Disturbance		Number of Shade Trees Required	Number of Ornamental Trees Required
From	To		
1	6,000	[[3]] 2	2
6,001	8,000	[[6]] 4	2
8,001	10,000	[[9]] 6	2
10,001	12,000	6	4
12,001	14,000	[[12]] 8	4
14,001	40,000	[[15]] 10	4

(2) If the area in the limits of disturbance exceeds 40,000 square feet, the minimum number of shade and ornamental trees required must be prorated using the ratio of 15 trees per 40,000 square feet.

Throughout Bill 35-12: replace "shade tree" with "shade and ornamental trees".