Appendix A. Panel meeting minutes

SUMMARY OF ACTIONS AND DECISIONS
Urban Tree Canopy Expert Panel
Wednesday, March 25, 2015, 12:00PM-2:00PM EST
Conference Call

Name	Affiliation	Present? Y/N
Karen Cappiella	Center for Watershed Protection	Y
Sally Claggett	US Forest Service, CBPO	Y
Keith Cline	Fairfax County (VA)	Y
Susan Day	Virginia Tech	Y
Michael Galvin	SavATree	Y
Neely Law (Chair)	Center for Watershed Protection	Y
Jeremy Hanson (Coord.)	Virginia Tech, CBPO	Y
Peter MacDonagh	Kestrel Design Group	Y
Jessica Sanders	Casey Trees	N
Thomas Whitlow	Cornell University	Y
Qingfu Xiao	University of California-Davis	Y
Non-panelists/Support		
Brian Benham	Virginia Tech (Project Director)	Y
Marcia Fox	DE DNREC (WTWG rep)	Y
Ken Hendrickson	EPA Region 3 (Regulatory Support)	Y
David Wood	CRC, CBPO (CBP modeling team rep)	Y

Welcome and Introduction

- Neely convened the call and reviewed the agenda. Neely thanked everyone for agreeing to serve on the panel. She looked forward to hearing everyone's input throughout the process as the panel develops and evaluates the nutrient and sediment reductions for urban tree cover and trees. She asked everyone to introduce themselves to the group.
    - Neely Law is the Panel Chair and will be guiding the panel in that role. She has coordinated and served on BMP panels for the CBP before, and will draw on that experience to benefit this group.
    - Jeremy Hanson explained his role as the Panel Coordinator. Since August 2014 he has been Virginia Tech's Project Coordinator for expert panels like this one. He is located at the Chesapeake Bay Program Office in Annapolis, MD.
    - Karen Cappiella noted she has expertise and experience with literature reviews and work related to water quality and urban forestry, including a number of past Center for Watershed Protection (CWP) projects. She noted CWP has a similar project to evaluate the water quality benefits of urban trees at the national level.
    - Brian Benham: Professor and Extension Specialist in the Biological Systems Engineering Department at Virginia Tech. His role as Project Lead is to help this and other panels under the Virginia Tech cooperative agreement as they perform their work. He works closely with Jeremy to ensure the panel has any assistance it

needs to perform as effectively as possible. He is located at the Blacksburg campus.

- o Sally Claggett works for the US Forest Service and coordinates forestry activities and efforts at the Chesapeake Bay Program, including the Forestry Workgroup that requested this BMP review panel.
- o Keith Cline is the Director of Urban Forestry Management Division in Fairfax County, VA. The division is housed in the stormwater unit for the county, and he will bring his years of government experience and a local perspective to the panel. For previous 10 years worked for US Forest Service in DC and was involved in development of iTree.
- o Susan Day helps run the urban forestry programs at Virginia Tech. Research background includes work on urban soils and how it affects tree health and pollution mitigation.
- o Mike Galvin: Director at SavATree, formerly with MD Department of Natural Resources. While at DNR he worked extensively with local governments as they began to develop urban tree canopy goals and strategies. He went to CaseyTrees after DNR, and helped DC develop its own UTC strategy.
- o Peter MacDonagh: With Kestrel Design Group in Minnesota, and also serve as adjunct faculty at University of Minnesota. Consulting experience as an arborist and general green infrastructure specialist.
- o Tom Whitlow is with the horticulture department and a part of the Urban Horticulture Institute there. His research experience covers a range of disciplines and targets, including work to assess air quality reductions around urban tree cover.
- o Qingfu Xiao is a research faculty member at UC-Davis. Research background includes urban forestry and urban hydrology. He looks forward to contributing his experience to the panel.
- o Marcia Fox is the Chesapeake Bay Nonpoint Source Data Coordinator for Delaware Department of Natural Resources and Environmental Control (DNREC), where she works to report all of the state's nonpoint source BMP data to the CBP. Previously she worked as an urban forester with the Delaware Department of Forestry, so she is excited to be involved as the Watershed Technical Workgroup representative for this panel.
- o Ken Hendrickson works as the Green Infrastructure Lead for the Office of State and Watershed Partnerships at EPA Region III in Philadelphia. His background includes hydrology and landscape architecture and he has been with EPA for about 5 years.
- o David Wood staffs the Water Quality Goal Implementation Team (WQGIT) and Watershed Technical Workgroup (WTWG) for the CBP, which the panel will learn more about those groups later on. He explained his role as the CBP Modeling Team representative for the panel, serving as a resource on issues relating to the Watershed Model and associated modeling tools.

Review of BMP Protocol, statement of work and panel timeline
- Jeremy described the Chesapeake Bay Program and provided background on the BMP review process. He and Neely noted that the context for these BMP panels is important to

be aware of. Jeremy noted that the introductory memo and BMP Protocol provide additional detail about the CBP and the BMP review process, and he encouraged the panelists to read them if they have not already.

- Tom asked if there are any empirical measurements in the context of the model, or if everything is simulated or estimated using the models.
    - Jeremy noted that Watershed Model is calibrated to actual monitoring data over many years, so it is calibrated to those empirical data points. As a management tool it is used to simulate progress for subsequent years.
- There was additional discussion about the model. Susan asked for a clarification of the bar chart that Jeremy had on one of his slides, asking if the loads in that chart were simulated loads from the Watershed Model.
    - Jeremy confirmed she was correct, and that the model simulations are used to track progress over time controlling for factors like precipitation. Actual loads in the watershed will vary from year to year due to precipitation and other variables. The Watershed Model has to make a number of simplifying assumptions to serve as a management tool across a 64,000 square mile watershed, so he thanked Susan for that point.
- Neely reviewed the statement of work with the panel, and focused on the questions and topics raised under task #2. She noted there may be secondary questions that arise, but the panel will focus on the two primary questions described under that task:
    - What is the effectiveness of urban tree canopy on reducing runoff, nutrients and sediment?
    - How does effectiveness vary by species, over time, with differences in planting sites (e.g., distance from impervious cover or other trees, soil conditions, geographic location) and with different maintenance strategies?
- She reviewed tasks #3 and #4, noting that the panel report will need to address the list of items under task #4, which was adapted from the BMP Protocol.
- Sally raised the issue about tree cover as a land use layer in the modeling tools. Susan asked for clarification about double counting issues. Neely explained that the panel does need to be careful about potential double counting issues. For example, the same trees planted for a riparian buffer BMP are not also counted for a tree planting or tree canopy BMP.
    - Keith: For that example if a tree is credited for a riparian buffer credit. What determines when that tree or project is counted as a buffer versus another tree canopy?
        - Neely: As an example, the CBP recently approved urban filter strips as a BMP. Virginia had pointed out that they have vegetated filter strips. In their stormwater manual there are different credits based on the vegetative. These are all great questions that will help us work through important issues that should be discussed and resolved. Jeremy noted that Keith's and Susan's questions illustrate the importance of clear and explicit BMP definitions so that locals and state data analysts are certain about how to label a certain practice when they report it to the CBP.
- Xingfu: what scale are we talking about for this review? Sally noted the panel can look at science or literature at any scale. All the information is useful whether it looks at an individual tree, acres, or a watershed segment.

- Neely reviewed the timeline for the panel. She noted it's an ambitious timeline, but it is doable especially with the support from Virginia Tech and CWP. This panel will also try to pick up where the previous panel left off. She noted that CWP will provide a synthesis of its literature review by June. It will focus on summarizing and highlighting findings and data from the literature. Will try to have a fully-approved report by the end of the year. April will be spent getting more background on the CBP modeling tools.
    - She noted that they would like panelists to travel for a face-to-face meeting in the May timeframe, which will include a public stakeholder session. Travel expenses will be reimbursable through CWP. In June the panel will be discussing crediting approaches based on the review and similar efforts in other states, working to wrap up and finalize a report in the July and August timeframe. Hope to have panel consensus on the report in September and then work through the review process from October to December. Neely and Jeremy will work to draft short pieces and write-ups of the report to solicit specific input from the panel members.

Panel roles and responsibilities
- Neely noted the time and asked for questions or comments from the panel about their roles or responsibilities.
- Jeremy noted that the handout describes the general roles and that the introductions touched on this issue, but it is an evolving process so people will probably adapt their contributions to fit the needs of the group.
- Tom noted he has a good database of literature atmospheric deposition sources and sinks, primarily with particulate matter and atmospheric nitrogen. Jeremy and Neely asked Tom to discuss the database offline in more detail with Karen and Neely.

Discussion: Public stakeholder forum
- Neely and Jeremy explained that the panel will need to host an open session where outside stakeholders are invited and welcome to attend. The general goal is to interact with the wider stakeholder community, including private firms, federal/state/local agencies, academic researchers, or nonprofits. Similar to National Academies of Science panels, other meetings and calls are closed for deliberation among the panelists only, or invited guests. The panel has some leeway in crafting the forum agenda, which will ideally allow for extended discussion and mutual information exchange between the panelists and stakeholders.
- The open session would be for a morning or afternoon, and could coincide with another half-day or full day of panel-only meetings. The extended meeting would allow for
- **ACTION**: Jeremy will distribute a Doodle poll to help schedule the face-to-face meeting in late May or the first week of June.

Demo: Virginia Tech Scholar
- Jeremy demonstrated basic use of the Scholar site.
- **ACTION**: Jeremy will add the panelists to the Scholar site. Panelists should expect an automated email by COB 3/26 with instructions on how to log-in to the site. If they do not receive this email by the end of the week (3/27), they should contact him so he can ensure they gain access.

Next steps and confirm next call date/time
- It was pointed out that April 22 is Earth Day, so there will be conflicts for multiple panel members.
  - o **Post-meeting note:** The next panel call is now scheduled for Wednesday, April 29th, 12:00PM-2:00PM EST.
- Neely noted that panelists should expect to receive a preliminary literature review database with the set of materials for the April call, so the panelists can provide additional studies or sources for the list.

Wrap-up and review action items
- Neely noted that the Chesapeake Bay Program and the Forestry Workgroup has a management strategy out for public comment and review. Jeremy will provide a link to draft management strategy when he distributes the minutes to the panel.

Adjourned

SUMMARY OF ACTIONS AND DECISIONS
Urban Tree Canopy Expert Panel
Wednesday, April 29, 2015, 12:00PM-2:00PM EST
Conference Call

Name	Affiliation	Present? Y/N
Karen Cappiella	Center for Watershed Protection	Y
Sally Claggett	US Forest Service, CBPO	Y
Keith Cline	Fairfax County (VA)	Y
Susan Day	Virginia Tech	Y
Michael Galvin	SavATree	Y
Neely Law (Chair)	Center for Watershed Protection	Y
Jeremy Hanson (Coord.)	Virginia Tech, CBPO	Y
Peter MacDonagh	Kestrel Design Group	N
Jessica Sanders	Casey Trees	Y
Thomas Whitlow	Cornell University	Y
Qingfu Xiao	University of California-Davis	Y
Non-panelists/Support		
Brian Benham	Virginia Tech (Project Director)	Y
Marcia Fox	DE DNREC (WTWG rep)	N
Ken Hendrickson	EPA Region 3 (Regulatory Support)	Y
David Wood	CRC, CBPO (CBP modeling team rep)	N
Ari Daniels	CWP	Y
Invited guests: Matt Johnston (UMD, CBPO modeling team), Peter Claggett (USGS, CBPO)		

Welcome and Introduction

- Neely and Jeremy convened the call and verified participants. Neely asked for any corrections or comments on the minutes for the March call; none were raised.
- **DECISION**: The March conference call minutes were accepted as written.

Overview of the Chesapeake Bay Modeling Framework, land uses and BMPs
- Neely explained the bulk of the call would cover background about the Watershed Model and how urban tree canopy fits in as a land use and BMP for the current (Phase 5.3.2) and future (Phase 6) Chesapeake Bay Watershed Model (Model). (Presentation provided)
- Jeremy described how the current Model simulates BMPs and land uses in general, and how a land use change like the current tree planting BMP is simulated. When 100 trees are planted and reported for an area, one acre of urban-pervious land is converted to forest. He noted that the average loading rate for urban pervious is significantly higher than forest, which is the lowest loading land use in the Model. So the current reduction is very large.
    - Susan asked how the current BMP might apply to areas with different understories like impervious surfaces. Jeremy explained that the current definition only allows for a conversion from urban-pervious to forest, but the next Model will likely include different land uses that could be modified or changed by tree planting, as will be discussed later.
- Neely reviewed the proposed Phase 6 land uses for tree canopy. She explained how the Watershed Model uses satellite imagery and other data (e.g., Ag Census) to generate land cover and land uses for the watershed to create a digital landscape at a county scale. She noted the digital landscape of land uses is calibrated to monitored loads to create the Model.
- Neely described the proposed tree canopy land use for the Phase 6 Model, which are still pending approval, but may include separate land uses or categories for tree canopy over a variety of land uses, including 3 land uses for developed (i.e. urban) areas: turf/herbaceous, impervious roads, or impervious non-roads. Each tree canopy land use could potentially be given its own unique loading rate, or a reduction factor applied to modify the loading rate of the understory land use land cover (e.g. pervious, impervious).
    - **ACTION**: Add Tetra Tech 2014 analysis of urban land use loading rates to the Scholar site in reference to higher EMC from impervious transportation land use
- Tom: Looking forward to model development post Phase 6; additional consideration may be given to BMPs installed under tree cover. For example, in Montgomery County there is a lot of work being done with bioretention, permeable pavers, and other practices that are installed under tree cover.
- Peter mentioned that the data currently used for a baseline land use for the next version of the Model represents 2012 land uses and imagery. Next year the CBP will get new data that represents 2013-2014 that will be used for the final calibration of the Model.
- Susan: It seems we are asking if we are capturing trees planted as a land use change BMP or as canopy that is mapped through imagery data.
    - Neely: Correct. We still have to decide what the best way to capture, track and report tree canopy is.
    - Jessica: To clarify, it doesn't matter what the size of the project is? If I plant 200 larger trees it is the same as 200 trees of a smaller or different set of species?

- Neely explained the panel can consider qualifying conditions and differences that could affect the reduction or benefit, e.g. density or size of the trees.
- Matt thanked Neely for the point about qualifying conditions. He explained that the Model is used to evaluate what the cumulative estimated benefit is from the sum of implemented BMPs reported by the states. In that way it is a management tool.
  - Peter agreed with Mike's interpretation of how fine-scale data from high resolution imagery (1-m) is aggregated to CBWM, where the finer scale data is essentially represented as a fraction of land cover within a larger grid cell
- Neely directed panelists' to one of the discussion questions. How does a tree canopy land use affect the implementation of an urban tree canopy BMP? Are they the same or are they separate? By same, we mean the methods to estimate their water quality benefits and reporting their extent in the model (e.g. acreages).
  - Peter explained the way the CBP distinguish forest from tree canopy is using the size of the clump of trees, and whether it is an acre or larger clump, or a line of trees in a median or along a road. If the trees are not clumped together in a large enough clump or they are spread in a line or along a street, then they will be captured as tree canopy. One acre, or larger, clumps can be represented as forest.
    - Peter also noted they may not detect planted trees in the imagery for 5 or 10 years. At that time we would want to make sure we aren't double counting between the trees reported as a BMP and the added tree canopy based on imagery.
  - Keith: in our county we have a table that developers can use to estimate their canopy after 10 years. That might be a pertinent way to capture or estimate canopy coverage.
  - Neely: the CBP has been developing a verification process with the jurisdictions. The overarching goal of the verification effort it to ensure that BMPs reported for credit are actually installed and functioning as intended.
  - There was discussion about the need to have estimated tree canopy. Matt noted that from the modeling perspective, the Model needs to know what the tree canopy coverage was in 1985 and through time.
  - Peter: we don't have a grip on the rate of change for tree canopy is over time to date. Moving forward, with high resolution data every 3-5 years, we will be able to track and understand the rates of change for tree canopy over time, not just forest.
  - Tom noted he sent a couple images to the panel to illustrate the small scale complexity issue he mentioned earlier, specifically in Montgomery County.
    - Neely pointed out the image seems to show a proprietary practice or technology where the tree is planted in a system that has an underdrain and other features installed under the canopy. The tree, when it grows, could be captured by imagery but how would this be credited? Important for recommendations to be clear what is or is not counted as tree canopy for jurisdictions to report
  - Mike liked the idea of the tree canopy modifier that would be applied to the land uses. Neely asked the rest of the panelists for their thoughts on that approach,

noting that the panel can always change its mind or make adjustments down the road. No commitments at this time.

- ▪ Susan: it makes sense, but it is predicated that we are making sufficient distinctions in the landscape when we are actually lumping a lot of things together, e.g. managed and unmanaged lawns, hedgerows, compacted soils and well drained soils, etc. That's the only caveat at this time.
    - • Matt: Those many flavors of BMPs can easily be reflected as individual BMP efficiencies, but not as individual land uses. For example, maybe trees planted on road medians reduce runoff by 5% and trees planted on managed turf reduce the runoff load by 10%. There could be a large number of BMPs in that way, which would be reported and applied to appropriate land uses.
- ▪ Neely: After we review the literature there may be gaps or areas where the panel explore the use of models to help supplement or inform the panel's analysis in cases where the literature is very limited.
    - • Sally: There is a lot of work involved with tracking and reporting practices like this, so we need to consider what will be required of people who will report these practices into the Model.
    - • Mike: I like the approach because it lets a tree be a tree. Land cover is a big factor and trees are a modifier, but it doesn't necessarily make a night-and-day difference like changing an acre into forest.
    - • Susan: if we look at this in 2-phases, a BMP phase and a land use phase, then after a tree matures it is captured by imagery and transitions from BMP phase to the land use phase. That seems fair and reasonable.
- ▪ Mike: There are a lot of variables and details that can affect the water quality impact of a tree or set of trees, but at the end of the day someone has to set rules of the road. Having clear and simple rules will help ensure programmatic success.
- ▪ Qingfu suggested that looking longer term the panel may need to consider changes in water volume or precipitation. Matt and Jeremy noted that the CBP partnership is looking at longer term effects of climate change on things like precipitation, but those questions and considerations are outside the scope of this panel.
- • Neely summarized that the panel was not quite at consensus, but there seems to be some general support for having tree canopy as its own land use, or modifier. Also some support for having it as a BMP and then transitioning it to a land use or modifier after a certain amount of time, perhaps 5-10 years. We'll continue to discuss these approaches going forward.

Catalogue of research studies
- • Karen described the database that the CWP had compiled so far, noting that Jeremy had previously distributed the spreadsheet of studies to the panelists. It is also uploaded to the Scholar site. They have two worksheets, one for Tree Benefits (65 studies so far) and one

for Urban Tree Health and Longevity (44 studies). She explained the organization and fields in the spreadsheet.

- Karen explained some of the factors used to evaluate the studies, based on Table 1 in the BMP Protocol, e.g. year published, applicability, variability, references, etc. She reviewed some of the (preliminary) key findings:
  - Majority of studies are from 2000 or later. 42 of Benefits studies focus on urban.
  - Most (32) document hydrologic benefits, most commonly interception
  - Some (13) evaluate water quality
    - 7 field studies; only 3 of these use unplanted controls and only 1 provides useable results. Variable in terms of N and P species and methods used to calculate removal.
    - Other studies not as applicable because of difficulty scaling results because of their scale, focus or methods.
- Karen described some of the gaps in the literature so far. Need more studies specific to nutrient and sediment reduction of urban trees/forests. Given this gap the panel could potentially use hydrologic studies to develop credit if we can document the link between runoff and pollutant reduction. The CWP will also include review of current crediting systems as models
- Karen: The database is on the Scholar site. She asked panelists to download the spreadsheet on their own computer, add new studies, and upload a new version of the spreadsheet with their name added to the file. Neely pointed out that she uploaded a newer version of the spreadsheet earlier that day, along with a blank version that panelists could use to add new studies to the list.
- **ACTION**: Panel members should upload studies or references not listed in the database to the Scholar folder. Populate the blank version of the spreadsheet for each study or article added. Leave green columns blank, they will be filled out by the CWP (note the CWP will need the full text article uploaded to Scholar to review it).
- **ACTION**: Request for panel members to review the database and add & upload publications to the Scholar site. Neely will contact panel members the week of May 15th to identify what 1-2 papers panelists will present at the June 3rd meeting
- **ACTION**: Neely and Jeremy will provide additional guidance to panel members about presentations for the June meeting.

Travel plan for June 3rd meeting
- Neely: It will be a full day meeting in Annapolis. Funds are available to reimburse panel members for travel. Forms and instructions were sent to the panel. Contact Neely or Jeremy with questions about the meeting.

Wrap-up and review action items and next steps
- Neely noted the panel will have its June 3rd meeting and a conference call later in June. No call in May.

Adjourned

SUMMARY OF ACTIONS AND DECISIONS
Urban Tree Canopy Expert Panel
Wednesday, June 3, 2015, 8:30AM-12:00PM EST
Meeting in Annapolis, MD

Name	Affiliation	Present? Y/N
Karen Cappiella	Center for Watershed Protection	Y
Sally Claggett	US Forest Service, CBPO	Y
Keith Cline	Fairfax County (VA)	Y
Susan Day	Virginia Tech	Y
Michael Galvin	SavATree	Y
Neely Law (Chair)	Center for Watershed Protection	Y
Jeremy Hanson (Coord.)	Virginia Tech, CBPO	Y
Peter MacDonagh	Kestrel Design Group	Y
Jessica Sanders	Casey Trees (remotely)	Y
Thomas Whitlow	Cornell University	Y
Qingfu Xiao	University of California-Davis	N
Non-panelists/Support		
Brian Benham	Virginia Tech (Project Director)	N
Marcia Fox	DE DNREC (WTWG rep) (remotely)	Y
Ken Hendrickson	EPA Region 3 (Regulatory Support) (remotely)	Y
David Wood	CRC, CBPO (CBP modeling team rep)	Y
Ari Daniels	CWP	Y

Welcome and Introduction
- Neely convened the meeting and reviewed the day's agenda.
- **DECISION**: April minutes were accepted as written.

Literature review synthesis and discussion
- Neely asked panelists to consider how complete the write up and review is and where are the gaps. What are the initial thoughts on how it can inform the BMP crediting.
- Karen: Review the draft literature synthesis with participants. Reviewed 73 studies, only a handful looked at explicit water quality benefits and urban trees. Most of the studies were in semiarid regions or areas that may not be transferrable to the Chesapeake Bay watershed.
  o Most interception studies looked at stormwater volume. No explicit link to nutrients, but we can make that link.
  o Continuous simulation modeling would be most applicable modeling approach.
  o Most evapotranspiration studies looked at various monitoring or modeling approaches. Hard to transfer those results.
  o Runoff reduction studies are at the municipal scale and normally look at tree cover over time, using models or tools like CITYgreen or iTree. Some studies also looked at runoff reduction for non-urban areas.
  o Only 10 studies looked at water quality. Only Denman 2006 included unplanted controls to compare with tree planted areas. There was a study that measured

nitrate leaching from urban forest and urban turf and found higher nitrate leaching from the grassed areas than the forest plots. There is also the issue of leaf litter and leaves as a potential nutrient source in the urban landscape. Neely will present some research on that in the afternoon.

- o Jessica: there are some localities that have weekly sweeping
- o Neely explained the street sweeping panel is considering some different scenarios for seasonal sweeping that would capture more leaves or other material.
- Discussion of the credit and clarification of who would benefit from the BMP credit, and how local and state jurisdictions meet their nutrient targets.
  - o Jeremy clarified that the term "credit" can be applied in a number of contexts at a local or state level, e.g. stormwater utilities may credit volume reduction, rain barrels, etc. This panel and BMPs approved by the CBP are strictly concerned with credit for pounds of nitrogen, phosphorus and sediment that are applied toward the states' TMDL targets.
  - o David and Jeremy explained that BMP data is reported from the locasl to the state, and reported by the state to the CBP. Tools like CAST, MAST and VAST help the locals for planning purposes. So Fairfax can use VAST to get an idea of the reductions they can achieve through various BMP implementation scenarios.
  - o There are a lot of gaps in the BMP implementation data, e.g. NGOs or homeowners are doing a lot of implementation but we still have to develop mechanisms to track and verify those practices

Literature reports from panel members
- Each panel member gave a brief 10 minute presentation about their selected study followed by a couple quick follow up questions, with discussion following all the presentations.
- Tom looked at 4 studies that were all natural experiments, with no active manipulation. Replication for multiple locations over multiple years. Try to account for impervious and canopy cover.
  - o He discussed nitrogen fluxes illustrated by P.H. Templar et al (2015) who compares the fluxes in rural and urban settings. He ran some regressions between impervious cover and N yields using data reported by Groffman, and pointed out that the developed areas showed quite a bit of variation, while the natural Pond Branch area had virtually no interannual variation in N yields. If you remove Pond Branch the slope in the regression basically disappears. The regression for forest cover and N yields has a negative slope with largely the same effect when Pond Branch is removed.
  - o Nowak and Greenfield (2012) of 20 US cities, including Baltimore. Perhaps increasing urban tree cover probably cannot reduce N yield below ~7 kg per hectare-year. Perhaps 1% tree cover increase can translate to about 1% in N reduction? Forest cover is a relatively crude factor for estimating since it can be overwhelmed by other factors even in suburban areas, e.g. septics, precipitation, etc. (Note: 6.7 kg N /ha = 6 lbs N/year).
  - o 2007 National Engineering Handbook. Section on disturbed soils. One possible limitation of UFORE or iTree-Hydro may be they do not fully account for soil disturbance or compaction, and hydrologic properties of soils.

- Susan discussed infiltration in urban soils. Yang & Zhang (2011). 30 sites with soil samples and measurements for each site (Nanjing, China). It does look at a spectrum of what occurs in different parts of a city, so it gives a sense of the variation can be when you change vegetation type and management. Is it trees, or trees + soil? Suggest we have to consider both, not just trees alone. Soils at old developments are less compacted compared to new developments. There is a very dramatic difference in the infiltration rates of old developments compared to new ones, with more compacted soils. So if management actions can transition the soils from compacted to non-compacted it can have a very significant impact. Development practices continue to change rapidly, so it's difficult to say if tree planting or development today will provide high-infiltration soils in 20-30 years.
  - Neely: good points to raise about considering soils as a factor for the
- Mike discussed some results of the Baltimore Ecosystem Study (BES). Trees very likely help, but how much does one tree do for nitrogen? Always have to weigh the value of resources for verification versus restoration. Need a balance.
- Keith verbally discussed Pataki et al (year?). He noted Tom was a co-author. It was very helpful as a theoretical and conceptual paper, with a focus on understanding biogeochemical processes in urban areas and how to quantify green infrastructure benefits. Discusses possible costs and disservices for green infrastructure to better understand the net benefits.
  - There has been more discussion of disservices in recent years. It will help when we discuss leaf litter in more detail.
  - Mike: by planting trees we are adding more areas where natural processes like denitrification can occur.
  - Neely: the modeling team has asked previous panels to look at other forms of nitrogen, but to express the net benefit in terms of TN. There are many ways to look at the overall effect.
- Peter discussed results from a study of over 1,000 parking lot trees on Walt Disney World property. Found 81% were in good condition.Soil volume and canopy coverage. 21.5 inches biggest dbh. 1000 cubic feet seemed to be threshold, with 95% rate of "good" trees. 100% at 1500 cubic feet. The trees will resize themselves based on the soil volume they are planted in. There is a lot of resistance to increase the soil volume due to cost, so there is a question of what the optimal soil volume would be to achieve most "good" or healthy trees with least cost or soil volume. The study does not cover soil conditions or soil chemistry in detail.
  - How feasible is it to assess or evaluate tree health without on-site assessment? Nowak and others do imagery assessments using non-leafed images to get better estimates of impervious cover, but then it may not capture tree health.
    - Peter agreed that an on-site assessment of tree health may be a reasonable condition for credit.
  - Peter: for MN stormwater manual if you want a tree with expected canopy of 800 square feet, then you would need 1600 cubic feet of soil volume (1:2 ratio). It's like with rain gardens, where the soils and media are
- Sally: we need to be able to measure and track these tree plantings and tree canopy. A lot of the potential is in people's back yard. We may not know all the specifics about species, soil volume, etc. The practice is not a big-hitter in terms of what is currently tracked or

reported by the jurisdictions. Want to bring practical side of how to track, report and credit these trees over time.

- o How it might look is a locality would report the trees they plant and they would get credit for a time. Every 5 years we will update the land use based on 1-m data and some BMPs like tree planting would be wiped clean in favor of the accurate and updated land use. So from a verification perspective this is a useful way to credit, but verify. The panel can weigh in on what it recommends in terms of the methods for when or what to wipe clean based on updated imagery and land use.
- o This would give a more complete picture of what is going on and would account for other impacts, such as emerald ash borer.
- o Keith: we are looking at overall canopy for the county, not going to the parcel level. Using the imagery, in a sense we are losing canopy at the county scale.
- o Part of the charge of the panel is how to quantify or credit the tree canopy, or perhaps individual trees.
- o Loading target for Forest land use will be going down for Phase 6 of the Model.
- o There was discussion of the current Phase 5.3.2 Watershed Model and the Phase 6 Watershed Model. Currently the intent is to have Tree Canopy as a separate land use in the P6 Model. Areas of canopy >1 acre (with unmanaged pervious understory) are classified as forest, but tree cover <1 acre in area are treated as tree canopy. Tree canopy can be over pervious or impervious land uses, so canopy would modify the load from that understory.
- o There was a subgroup of people that developed the report, but it can be referenced as a Forestry Workgroup product.

Discussion of BMP definition and crediting approach
- Neely led further discussion about how to define/credit the BMP
  - o The proposed 25% reduction/modifier is set relative to urban pervious. That relative benefit would hold and translate to a higher % reduction relative to urban impervious.
  - o The 25% is based on primarily on evapotranspiration (ET) information.
  - o There was discussion about longer term trends and the effect of management actions and wastewater treatment. Neely mentioned a recent USGS study and will share the reference with the group.
  - o Tree planting may not be able to keep up or cancel the effects of other changes or disturbances, but maintaining existing tree canopy is critical for the overall water quality and trends.
  - o We can recommend the conditions that would be ideal to have, but would need to discuss whether those should be qualifying conditions or not. Can rely on 5 year updates of imagery and the land use.

Wrap-up and review action items and next steps
- **ACTION**: Jeremy will add all slides to the Scholar site; Keith will provide some summary bullets points for uploading.

Panel session adjourned; convened for Open Session following lunch:
http://www.chesapeakebay.net/calendar/event/22656/

SUMMARY OF ACTIONS AND DECISIONS
Open Session: Urban Tree Canopy Expert Panel Stakeholder Forum
Wednesday, June 3, 2015, 1:00PM-4:00PM
http://www.chesapeakebay.net/calendar/event/22656/

Welcome and Introduction
- Jeremy Hanson (Virginia Tech, Chesapeake Bay Program; Panel Coordinator) welcomed participants and reviewed the agenda. He and Neely Law (Center for Watershed Protection; Panel Chair) summarized the Chesapeake Bay Program's BMP review process that the Urban Tree Canopy (UTC) expert panel will be following. View the slides, the BMP Protocol, and the panel's statement of work for more information.

Panel Introductions
- Each panel member present briefly introduced themselves.

Stakeholder Presentations
Dave Nowak, US Forest Service (remotely)
- Dave discussed urban hydrology and how iTree tools (including iTree-Canopy and iTree-Hydro) can be used to estimate the stormwater volume reduction or other benefits associated with green infrastructure and tree cover.
- View the presentation for more details.
- Frank Rodgers (Cacapon Institute): How does iTree-Canopy or iTree-Hydro differentiate between tree canopy (TC) over impervious or TC over pervious?
    o Nowak: based on averages for land uses from field information we have.
- Mike Galvin (SavATree): how do impervious vs. pervious compare?
    o Nowak: Best recollection, roughly 10:1. For every 1% of impervious cover you add, you have to plant about 10-12% of tree cover to offset the increase. Depends on other factors, especially rainfall intensities and depths (large vs. small storms).
- Anne Hairston-Strang (MD DNR Forest Service): Role of infiltration. Does the iTree model account for soil types?
    o Nowak: iTree-Hydro does include infiltration and we are working to add or improve routines for infiltration and evapotranspiration. The best place to plant trees over pervious is over the least infiltrating soils. Andretti at SUNY-ESF is working on the different soil types for iTree.
- Barbara Brumbaugh (City of Chesapeake): Why do you believe there was such a difference in the Durham data? Do you have any coastal plain data for the amount of runoff reduced?
    o Nowak: Probably precipitation, but would have to revisit data. Drivers are…We are working to expand and include Coastal Plain. We are trying to build up the database and include other cities or areas to see if the curves and trends hold.
        ▪ Barbara White: Would like to have a similar study in the tidewater area and coastal plain of VA
- Mark Symborski: How much N, P, and sediments, if eventually washed off trees over impervious cover, will end up in the stream system anyway? And how does that affect the pollutant reduction rates for canopy over impervious cover?

- - Nowak: Don't know the answer for certain. That would depend on a number of factors; couple deposition and the canopy models. N will dissolve and wash off, but this all depends on event mean concentration (EMC).
- Keith Cline (Fairfax County): determining canopy over impervious, have an idea for how easy it is to estimate that using the imagery and iTree-Canopy?
  - Nowak: Sometimes it is easy if you know where the roads are and you can make pretty good guesses. It becomes tougher in heavily canopied areas, but it is possible with aerial imagery.
- Sally Claggett (USFS): when you look at the Durham curve the reduced runoff curve starts fairly high, which may be an indication of evapotranspiration. At high impervious cover percentages, they are doing poorly due to soil capacity. Do you concur?
  - Nowak: Need to explore the data more. Could also depend on the amount of precipitation. Could be that Durham receives less rainfall.
- Neely Law (CWP): work we've done in older areas of Baltimore suggests that the texture of the soil allows for greater infiltration than would be expected based on hydrologic grouping.
  - Nowak: Could be partly that, but also several other reasons. Also depends on precipitation intensity.
- Mark Symborski (Montgomery County, MD): Are tree leaves that end up in the storm drain system taken into account by the models?
  - Nowak: No. We are estimating the leave drop and nutrients/carbon that would be associated with those leaves, but we do not know where they end up in the overall system so we do not model where they go.
- Justin Hynicka (MD DNR Forest Service): Does the range of calibration data cover the full range of 1-100% or how much of that is extrapolated
  - Nowak: We calibrate to the actual conditions of the watershed based on actual data. Once calibrated the range of 1-100% impervious or 1-100% tree canopy is simulated with all modeling.
- Dave encouraged anyone to share suggestions or thoughts on new needs or applications for the iTree tools. Always welcome thoughts on how to improve or expand the tools.
  - Claggett: As we've been talking, we'd like to know more about the type of urban forest in terms of physical site conditions – what type of understory, age, associated physical characteristics of surrounding area and the associated benefits/modeling outputs.
    - Nowak: difficult to break up by biological data. All they have is cover, not age, etc., which is difficult.
    - Claggett: we are starting to have hi-res imagery for whole watershed to differentiate whatever is possible at that scale.
    - Nowak: if we could break them out by height classes that would help (age distribution).
  - Hairston-Strang: It won't be available for Baltimore for a while, but generally is there a role for the plots?
    - Nowak: probably want to go to LIDAR map, which will help tease out the structural differences. Baltimore is data-rich, but outside is weaker. In the interim, we can use existing iTree plots.
- Law thanked Nowak for taking time to present and respond to questions remotely.

Neely Law, Center for Watershed Protection
- Law reviewed some studies that investigated the potential contribution that fallen leaves may have for nutrients in urban catchments. She emphasized that trees are good and more trees are even better. She noted that there have been questions about how important leaf litter may be in the urban nutrient context and how to perhaps consider or address it while evaluating the overall benefits of urban tree cover. There are major data gaps, but a rough estimate comparing upland number from Nowak (2014) in Baltimore City to an outfall number from a recent CWP (2013) study in Easton, there may be an 85% reduction from upland to outfall. Very rough estimate, but it does demonstrate very large losses and transformations along and within the urban drainage network.
  - View [the presentation](#) for more information.
- Law: Comparing phosphorus loads to percent tree cover in catchment area, and tying that to frequency of street sweeping – more trees, more P; more sweeping, more P captured; also seasonal pulse in P conc. of leachate – Spring pulse is probably pollen and seeds, Fall pulse is leaf fall
  - Peter MacDonagh (Kestrel Design Group): Another Minnesota study looked at cost per pound of phosphorus removal $50-70/lb-P and found that street sweeping was actually extremely cost effective for collecting phosphorus (usually $350-$400/lb-P).
- Hairston-Strang: research question relates to benefit of leaf litter organic matter versus detriment – don't want to starve the streams.
- Steve Saari (DDOE): many jurisdictions have leaf litter pickup, and associated compost production – anyone quantify this?
  - Law: trying to quantify, but it is difficult.
- Ted Brown (Biohabitats): can we look at the load differential between runoff reduction benefits of planting trees over impervious cover vs. potential for leaf litter loading with and without street sweeping. In other words could the expert panel show higher removal credit when planting is coupled with street sweeping or would that be double counting?
  - Hanson: Both this UTC and the street cleaning panels have to ensure their definitions do not lead to double counting any part of the credit, leaf litter or otherwise.
  - Law: this accounting question is fundamental to the debate. Leaf litter could be a reduction in the benefit of tree planting, or there are other ways to account for it.
- Eric Sprague (Alliance for the Chesapeake Bay): Forest is not a zero load – urban tree planting may already account for leaf litter since forest cover is the calibration point.
  - Hanson: The info is there, it's a great point, but it's very difficult to parse. It is a known factor, but not a known quantity.
- Saari: Steve Saari: the ultimate question regarding a factor or datum is "what would we do with this?" At programmatic level, the nutrients can't really drive a BMP like street sweeping.
- Claggett: we're basically saying that trees can't keep up with our developed landscape, and how do we manage trees to account for this?
- Rodgers: hard to account, because due to deposition, a tree in Maryland may be collecting and depositing nutrients from Ohio, for example.

Craig Carson, Montgomery County (MD) Department of Environmental Protection

- Craig described the county's MS4 program and related aspects of their role in managing stormwater, which includes planting trees and maintaining canopy. The county has adopted UTC goals and has its own tree canopy law. He reviewed MDE's criteria for MS4 credit for reforestation or for individual trees. He noted that the county collects planting date, species, size of tree at installation, location and minimum survival rate for its own records.
    - View [the presentation](#) for more information.
- Claggett: are any of those county credits related to the CBP BMP credit for 100 trees/acre?
    - Carson: WE've only been using the programs we handle in house, so cannot say how they relate to the CBP BMP credits. The canopy law is fairly new and we are still developing the details.
- Saari: are 2 inch DBH (diameter at breast height) trees for stream restoration as well?
    - We usually plant 1.5 inch caliper and continue to measure them while they become fully established. When they reach 2" we count them for credit.
- Law: with the new tree canopy law will there be a mechanism for reporting and tracking the data?
    - Carson: Laura Miller is working on tracking trees planted and developing the new program. Still in early stages. Right now anything we currently have is largely based on what we have established in the restoration credit.
- Galvin described a recent experience with a client and the roadside tree law. Would have been easiest to cut down the trees in a situation, but because of the law they remained as a result of the importance the law places on existing trees. Are you seeing any effort really incentivizing preserving trees versus planting?
    - Carson: recognizing resources is important, and all other benefits of trees.
- Saari talked about tracking mortality in projects they're planting. Are there other mortality tracking efforts in other areas? DC is not tracking mortality in existing and untouched tree stands. There are other activities going on so what we ultimately track and report is not a net increase. Unable to track or report the net change because we don't have mechanisms to capture all the various activities that remove or add trees.
    - Carson: we do monitor trees and track health, but there's a data-intensive threshold that is difficult to overcome.
- Claggett noted the CBP will be compiling high resolution (1m) data for land use and land cover which would include tree canopy across the entire Bay Watershed.

Discussion

- Law noted there is a dichotomy for tree canopy and tree planting. On one hand it is considered a very cost-effective practice, but on the other hand it is considered as very difficult from a tracking perspective. She asked for participants for their thoughts about how they would like to see tree planting or tree canopy as a BMP for nutrient and sediment credit, knowing that it has to be tracked, reported and verified.
    - Lou Etgen (Alliance for the Chesapeake Bay): in the agriculture sector there is a credit for nutrient management plans, and maybe a similar approach could apply

- here where incentives or credit is given for management or maintenance when we know that certain actions are beneficial.
- Hairston-Strang: the tree canopy assessment is the periodic gut-check since it's impossible to account for and track all the trees dying or being removed.
- MacDonagh: the trajectory for basically every urban area is a continuous loss of trees or green space.
- Galvin: part of this is a learning exercise. It helps to know how many trees are being planted compared to the overall trends or losses.
- Cline: a lot of this is state specific. Maryland has its Forest Conservation Act, but Virginia doesn't have anything like that. Think we should be careful because the specific requirements or implementation issues can vary widely across the jurisdictions.
- Saari: DC planting trees to outrun the mortality, knowing not all new trees will survive. Perhaps we should report a more conservative number to have that buffer in place.
- Etgen: if we had the money to gather the high resolution data every year then we wouldn't have these concerns about tracking these trees annually, but we do not have the money and have to rely on less frequent updates, like every 5 years.
  - Rodgers: what about just using iTree Canopy, take 1-2 days, and any municipality or jurisdiction could handle this level of reporting.
  - Having the land imagery data available in combination with the BMP reporting is useful.
- Law: the BMPs are reported annually. Would it be amenable to only update the tree canopy only every 5 years when the land use is updated with high resolution data?
- Hanson: land use data are updated as often as data are available. The years in between, there must be extrapolations to model/account for the year-to-year changes. Therefore, it's still important to report the BMPs in order to fill in the gaps. Both pieces of info are important so that 5 years from now, we can calibrate the reported data with the actual data, and identify the differences based on location, etc.
- Julie Mawhorter (USFS): The tracking is important for short-term crediting, and also to manage the trees planted.
- Carson: different entities might be competing for the same space – a rain garden in the right of way might be battling the same root space for a tree.
- Hairston-Strang: how can we best improve the Bay? i-Tree Hydro doesn't have the geospatial differentiation. It may be beneficial to somehow allow inclusion of soil type or infiltration rates.
- MacDonagh: Increased soil volume for trees helps increase the success of those trees. We have used up some of the best trees (e.g. elms) and have to increasingly rely on species that may require more specific conditions or may not be as successful in their survival.
- Law: if you look at crediting for runoff reduction practices vs stormwater treatment, the credits are developed based on infiltration and the associated processes even if the reductions are not quantified in terms of the specific mechanisms.
- MacDonagh: first 30 inches of soil depth is where ~80% of nutrient processing occurs.
- Law: We have a lot of people here involved with tree planting projects in some way. Does every tree count?
  - It was noted that UTC assessments sometimes include non-native species.

- o Galvin: Every tree counts, but you can't count every tree. It is a tracking and reporting issue.
- o MacDonagh: question to me is not should every tree count, but should every tree count equally? If someone is planting trees properly with plenty of soil volume and at a high survival rate, then that is better than improperly planting more trees that won't succeed or live.
- o Rodgers: Cacapon collects the same data as Montgomery County: location, date planted, species, stock size. A lot of data is from volunteers. We are going to these plantings and finding that the volunteers are infilling dead trees with new trees, eliminating the direct data-reality connection. Trying to count every planted tree can become a very difficult process.
- o Chris Brosch (Virginia Tech, VA DCR): the agriculture nutrient management panel has relied on values from literature to estimate an effectiveness value that we can discount according to other factors that we cannot measure. Could give tree planting a base condition credit, and based on certain program components, apply discounts. If those programs do certain things, the discount can be removed later on, making the credit modular, or "plug and play".
  - ▪ Hairston-Strang agreed. Suggest having some simple rate or estimate and build from there.

Wrap up and next steps
- Hanson asked each Panel member to share their biggest take-away messages or lessons learned from the day.
- Galvin: The big eye opener is to think about how much of the overall land cover and land use is really at issue here, i.e. only a percent of urban areas. Take away all agriculture, forest, and parse out everything, and everything else, this BMP is very small.
- Tom Whitlow (Cornell): Seconded Galvin's point – largely supported by the panel's literature synthesis. Makes putting specific credit values on this BMP very difficult.
- Claggett: runoff reduction is something we can sort of measure, but it is just a piece of the nutrient/sediment benefits attributable to canopy. There may be uncertainty in the range, focus should be on additional pieces.
- Cline: Building on what Mike said, we are looking at a small overall piece of the watershed. The amount of planting is a very small component of the larger picture for tree canopy and water quality. It's more about preserving our larger trees and existing canopy. The management of our existing canopy is the truly important piece.
- Susan Day (Virginia Tech): Agree with Keith, but noted that tree planting may not occur or be reported if there isn't a nutrient and sediment credit associated with it.
- MacDonagh: Preserving the canopy and incentivizing the maintenance of that canopy is a more important piece overall. See this as a two-pronged thing, with the focus on preserving existing canopy, with tree planting being a smaller supporting measure.
- Karen Cappiella (CWP): We all seem to be on the same page, and personally like the simplicity of the top-down approach that would be based on periodic updates to hi-res tree canopy and land imagery.
- Day: concern that relying too much on imagery may miss some on-the-ground issues such as the forest health. A future discussion point would be that aerial imagery may not pick up dying forest until it's too late.

- Some of the panelists felt that Urban Forest Management Plan could be a good idea and there are examples of that. Cline noted that for Fairfax County they have many different plans that cover different pieces of their overall tree and forestry management.
    o MacDonagh suggested that penalties for loss of existing canopy may be more effective overall approach.
    o Whitlow: management of forest may include removing largest trees on rotational basis, as part of best management.
    o Galvin: take a logic model format – what are inputs and outputs – canopy in, ecosystem services out.
- Law and Hanson thanked everyone for their time and participation.

Adjourned

Participants

Name	Affiliation
Panel members and support	
Neely Law	CWP
Karen Cappiella	CWP
Peter MacDonagh	Kestrel Design Group
Susan Day	Virginia Tech
Tom Whitlow	Cornell University
Keith Cline	Fairfax County (VA)
Sally Claggett	USFS
Mike Galvin	SavATree
Jeremy Hanson	Virginia Tech, CBPO
Ari Daniels	CWP
Other in-person participants	
Anne Hairston-Strang	MD DNR Forest Service
Chris Brosch	Virginia Tech, DCR
Eric Sprague	Alliance for the Chesapeake Bay
Frank Rodgers	Cacapon Institute
Jenny McGarvey	Alliance for the Chesapeake Bay
Julie Mawhorter	US Forest Service
Justin Hynicka	MD DNR Forest Service
Lou Etgen	Alliance for the Chesapeake Bay
Rick Fisher	Anne Arundel County DPW
Steve Saari	District of Columbia Department of the Environment
Tuana Phillips	CRC
Kate Baker	Chesapeake Conservancy
Jeff Sweeney	EPA, CBPO
Craig Carson	Montgomery County DEP

Webinar participants	
Dave Nowak	USFS
Barbara White	VA Dept. of Forestry
Barbara Brumbaugh	City of Chesapeake
Barbara Duke	City of Virginia Beach
Bob Goumas	City of Suffolk
Casey Kellner	City of Springfield, MO
Claire Jones	City of Suffolk
Mark Hockley	PA DEP
Chuck Mills	California ReLeaf
Colin Jones	MDA
David gasper	NYS DEC
Dana Coelho	USFS
Dona M Foster	USFS
David	City of Suffolk
Earl Bradley	
Ed Heide	City of Suffolk
Ellen Mussman	Baltimore County, MD
George Onyullo	DDOE
Robert Goo	EPA
Jacob Dorman	City of Suffolk
Jeff White	MDE
Jill Sunderland	HRPDC
Jenny Tribo	HRPDC
Julia Bartens	Davey Resource Group
Justin Shafer	City of Norfolk
Karen Coffman	MD SHA
Kelsey Brooks	VA DEQ
Kate Gordon	MD SHA
Lara Kling	VA DEQ
Marcia Fox	DE DNREC
Mark Symborski	Montgomery County, MD
Markku McGlynn	DDOE
Mary Gattis	Alliance for the Chesapeake Bay, LGAC
Michael Knapp	Montgomery County, MD
Michael Nentwich	City of Norfolk
Nicholai Francis-Lau	MDE
Liz Ottinger	EPA
Ginger Ellis	Anne Arundel County, MD
Robbie Coville	Davey Resource Group
Robin Pellicano	MDE
Sarah Davis	Springfield, MO
Shoshana Risman	George Washington University
Ted Brown	Biohabitats
Tomas Jordan	City of Suffolk
Rob MacPherson	City of Virginia Beach
Chris Kennedy	City of Virginia Beach

SUMMARY OF ACTIONS AND DECISIONS
Urban Tree Canopy Expert Panel
Wednesday, June 24, 2015, 12:00PM-2:00PM EST
Conference Call

Name	Affiliation	Present? Y/N
Karen Cappiella	Center for Watershed Protection	Y
Sally Claggett	US Forest Service, CBPO	Y
Keith Cline	Fairfax County (VA)	Y
Susan Day	Virginia Tech	Y
Michael Galvin	SavATree	Y
Neely Law (Chair)	Center for Watershed Protection	N
Jeremy Hanson (Coord.)	Virginia Tech, CBPO	Y
Peter MacDonagh	Kestrel Design Group	Y
Jessica Sanders	Casey Trees	N
Thomas Whitlow	Cornell University	Y
Qingfu Xiao	University of California-Davis	N
Non-panelists/Support		
Brian Benham	Virginia Tech (Project Director)	N
Marcia Fox	DE DNREC (WTWG rep)	N
Ken Hendrickson	EPA Region 3 (Regulatory Support)	N
Jeff Sweeney	EPA, CBPO (CBP modeling team rep)	Y
David Wood	CRC, CBPO (CBP modeling team rep)	N
Ari Daniels	CWP	Y

Welcome and Introduction
- Jeremy convened the meeting and reviewed the day's agenda.
- **DECISION**: June face-to-face meeting minutes were accepted as written.

BMP definition discussion
- Karen recalled the current definition for tree planting and reviewed the preliminary proposed definition for panel discussion. She explained the rationale for the preliminary definition, which is based on the panel's conversations at its June 3rd meeting. Tree canopy is more than tree planting and involves protecting/maintaining existing canopy. Forest canopy as a whole is important. WQ benefits for individual trees is likely minimal.
  - She asked if the panel members agree with the definition to include maintenance of, and increase in tree canopy.
    - Tom asked what kind of units would be measured or reported for something like maintenance.
      - Susan asked for clarification about the radius mentioned in the draft definition. The 120-ft minimum radius is the threshold for an area of trees to count as forest (1 acre) in the model. Karen noted that might not be needed in the final definition, but wanted to include that detail for discussion.

- Sally suggested the group better define what we are calling the practice. Right now it is "urban tree planting/urban tree canopy" or just "tree planting in urban areas." The verification guidance from the FWG moves away from that term and refers to it as "expanded tree canopy."
- There was discussion and general agreement to keep "urban" in the name. May need to clarify what is meant by "urban," but for our purposes, urban means areas that are developed or not included in other land uses by the Bay Program (agriculture, forest, etc.).
- Susan and Mike suggested simply calling it Urban Tree Canopy.
- Keith did not see a problem including "protection" or "maintenance" in the BMP name because it implies an action by the jurisdiction.
- Ari noted the "M" in BMP would encompass protection, maintenance, etc.
  - There was some general discussion of BMP crediting as a part of the definition discussion.
    - Jeff: for the TMDL there isn't awarding of "credits" in the sense of a water quality trading program. We track the progress that the jurisdictions make towards their numeric targets using estimated reductions from the various BMPs included in Model scenarios. In addition EPA also looks at programmatic goals stated in the jurisdictions' WIPs. For the purposes of this group, suggest being careful with the term "credit."
      - Tom asked about the units being considered and there was discussion. There are lots of different units, depending on the specific element under discussion. Locals/states will report the number of trees planted or acres, while the Model estimates the water quality benefits of the practice in terms of lbs of TN, TP, TSS.
        - **Post-meeting note:** Panels are encouraged to use English units in their reports (Fahrenheit, acres, feet, lbs, etc.)
  - There was additional discussion about the definition, verification, and the use of the hi-res land cover data.
    - Sally: Protecting and maintaining canopy is a part of verification, but do not see it as a part of the definition.
    - Susan: I thought that we were leaning towards programmatic elements as a part of the BMP.
    - Karen: We can include programmatic elements in a number of ways, e.g. qualifying conditions.
    - Jeff: There are about 175 BMPs available for reporting. They all require some form of appropriate maintenance. If it is not maintained then the BMP will no longer receive credit once its "credit duration" expires. What we're really reporting is the planting or actions that produce an expected increase in acres of canopy.
    - Susan: Protecting your existing canopy can be considered a management action because it reduces the baseline of continual canopy loss.
    - Sally: all the programmatic elements are important, but this panel needs to focus on the science and the effects that changes in canopy coverage have

on water quality. I.e., what is the benefit for TN, TP and TSS associated with one additional acre of tree canopy?

- ▪ Susan: do not see the programmatic aspects as something that would require units (e.g. urban forester on staff). The acres or trees planted would be the only units for reporting practices.
- ▪ Keith and Susan commented that while there may continue to be losses of tree canopy, there is still a management action involved. There could have been more loss without certain programs or other efforts.
- ▪ Sally: some of the jurisdictions will gain tree canopy. Expect tree planting to continue to be reported.
- ▪ It was reiterated that BMPs should be focused on actions on-the-ground that produce water quality benefits.
- o Karen recalled the proposed definition. The UTC BMP includes actions and/or program elements that result in the maintenance of and/or increase in tree canopy in the urban landscape.
  - ▪ Keith noted there are a number of different ordinances in place that can increase the amount of protected areas under those easement mechanisms. Think that would be important and should be reported on. There may be a decrease in overall canopy but they increased the acres of protected areas.
  - ▪ If the panel develops a credit based on preserved acres then jurisdictions would then need to report the number of preserved area.
- o Keith: there are sometimes state legislative limits to what we can require in terms of tree preservation for development. The Dillon Rule. Some tools in Maryland, for example, are not available in other states like Virginia.

Minnesota crediting method

- Peter discussed the way trees are addressed as a BMP in Minnesota's stormwater BMP manual. He pointed out the Wiki website is continuously updated. The tree credits are used for new development or areas along linear corridor. He encouraged the panel to visit the website: http://stormwater.pca.state.mn.us/index.php/Trees
  - o Peter noted there has been some push back on the requirement for 2 cu ft of soil volume per 1 sq ft of projected mature canopy. Susan commented that science doesn't support necessarily projected mature canopy rather than something better correlated with tree biomass, like DBH.

Crediting methods – Chesapeake Bay jurisdictions

- Ari noted the time and summarized how the various Bay jurisdictions address trees as a stormwater BMP for their purposes. The CWP wanted to know if the states have existing requirements or programs that could be affected by the panel's recommendations.
  - o NY, PA and DC give credit at the site level in the context of new or redevelopment requirements.
    - ▪ There are approved BMP panel reports for retrofits and new state performance standards, so Jeremy mentioned that trees in the context of these requirements may already be addressed.
  - o Ari described Maryland's impervious acre reduction equivalence used for their MS4 retrofit requirements.

- BMP reduction efficiency (%) OR difference in land use loading rates, divided by difference between forest and impervious loading rate.
- At the municipal level, they track the amount of impervious acres treated by retrofits. MDE uses that information to track the MS4 areas' progress towards the state's 20% retrofit goal.

Discussion of crediting methods
- **ACTION:** Jeremy, Karen and Neely will chat offline and make revisions to the proposed definition and crediting approach based on today's discussion. The panel will revisit the issue and discuss the revised proposed definition at its next call on Wednesday, July 22, 12:00PM-2:00PM EST.
- Jeremy noted the panel may select a new standing monthly time for August and beyond, and he asked panelists to be ready to discuss their Fall teaching schedule on the next call.

Wrap-up, review action items and next steps
- Karen and Jeremy noted the time. They thanked everyone for their time and engaged discussion.

Adjourned

SUMMARY OF ACTIONS AND DECISIONS
Urban Tree Canopy Expert Panel
Wednesday, July 22, 2015, 12:00PM-2:00PM EST
Conference Call

Name	Affiliation	Present? Y/N
Karen Cappiella	Center for Watershed Protection	Y
Sally Claggett	US Forest Service, CBPO	N
Keith Cline	Fairfax County (VA)	Y
Susan Day	Virginia Tech	Y
Michael Galvin	SavATree	N
Neely Law (Chair)	Center for Watershed Protection	Y
Jeremy Hanson (Coord.)	Virginia Tech, CBPO	Y
Peter MacDonagh	Kestrel Design Group	Y
Jessica Sanders	Casey Trees	N
Thomas Whitlow	Cornell University	Y
Qingfu Xiao	University of California-Davis	Y
Non-panelists/Support		
Brian Benham	Virginia Tech (Project Director)	N
Marcia Fox	DE DNREC (WTWG rep)	N
Ken Hendrickson	EPA Region 3 (Regulatory Support)	Y
Jeff Sweeney	EPA, CBPO (CBP modeling team rep)	Y
David Wood	CRC, CBPO (CBP modeling team rep)	N
Ari Daniels	CWP	Y
Peter Claggett	USGS, CBPO	Y

Welcome and Introduction
- Neely convened the meeting and reviewed the day's agenda.
- **DECISION**: June 24th call minutes were accepted with one edit from Susan.

Updates to BMP Protocol
- Jeremy summarized changes to the BMP Protocol, which was approved by the WQGIT on July 13th. He described that the review/approval process for panel reports was revised, and that panel members will need to complete the new conflict of interest (COI) disclosure form. He agreed to split it into a separate document and share it with the panel for their review and completion. Since it is a new form, he asked panel members to contact him with any questions as they complete the form.
- **ACTION**: Jeremy will provide the COI form for the panel members. Panel members will review and complete the form and submit to Jeremy. They should contact Jeremy with any questions or comments about the form.

General Points of agreement
- Neely recapped the write-up, survey and conversations shared with panelists since the June conference call. Neely noted that she, Karen and Jeremy also spoke with CBPO staff on issues related to an annual tree canopy BMP. Jeremy and Neely explained CBPO staff's concerns about the panel's direction that relies on updated land cover imagery that would only be updated periodically (e.g., every 5 years). For TMDL tracking and reporting purposes, that approach would pose a number of problems. The high-resolution data is not guaranteed to continue in the future for unknowable budgetary reasons. Also, periodic updates may not coincide with major checkpoints such as 2017 and 2025, when EPA and the jurisdictions need an understanding of the estimated water quality effect of all implemented management actions like tree planting.
- Neely and Peter explained how the land uses are updated every year. Peter noted that tree canopy is a new land use for the next version of the model. Data of county level housing trends is main way to help estimate and forecast changes in development (and thus tree canopy coverage) on a short-term or annual basis. For now we are only forecasting tree canopy in developed (urban/suburban) areas. With only 30-meter NLCD data it is more difficult to forecast or predict changes in tree canopy. Need high resolution imagery to better understand changes or trends in tree canopy.
- High resolution imagery will give us a detailed baseline of tree canopy in the watershed. If high resolution imagery is not available, then we need to consider other options for how to track estimated changes in tree canopy over time.
- Jeremy recalled Peter's explanation of how annual projections/updates are made. He explained how assumptions and best available data determine the annual changes in the land uses (the delta). Every so often there is a new NLCD, Ag Census, or other major data source that becomes available and there is a substantive update.
- Jeff and Neely explained that an annual tree canopy BMP would ultimately be the net change (gain or loss) of tree canopy over time in a given area. Boils down to tree coverage over time, so moving more towards how to estimate or track canopy from year-to-year, while every 5 years there will ideally be high resolution data to confirm/verify the canopy coverage. So we are

- Peter clarified that tree canopy in the Phase 6 model will be any patches of trees (urban or non-urban) that don't meet the criteria for forest (patches of trees >1 acre).
- Neely directed panelists' attention to decision point 1, statement 1 on her slides.
  - Susan felt TC should include all tree coverage, not just the smaller patches. It was clarified that forest is tracked as a separate land use with extremely low loading rates. The existence of that forest is essentially a BMP given the low loading rates compared to other land uses. Tree canopy is areas of tree coverage that are too small to be considered "forest" by the CBPO. Susan suggested calling it "tree canopy" and not "urban tree canopy."
  - Peter mentioned that based on recent analysis he did, 18% of all roads in the watershed appear to be covered by trees, so the load from the road land use would be significantly reduced
  - After discussion and clarification there was agreement on the following statement: measuring the WQ benefits of tree canopy should be tracked as a land use and not as an annually reported BMP. Can refine the language and phrasing in the final report.
    - **DECISION**: Measuring the WQ benefits of tree canopy should be tracked as a land use and not as an annually reported BMP.
- Decision point 1, question/statement 2:
  - There was discussion about a possible disconnect between the preceding statement and the 2nd one. Jeremy explained that the issue seems to be how a county or state could use data or information of planting or conservation to modify the estimated annual change in the land use. Tom noted in that case there would still be a need for some element of local/state reporting for actions like tree planting.
    - Neely summarized that based on feedback from the jurisdictions and stakeholders, and following the literature, an annual credit based on overall canopy is the best method.
    - Keith agreed and added that just because tree planting can be tracked, it should not necessarily be tracked. Tree planting is a very small overall piece of canopy. Planting trees is very important, but we should move away from that old approach and focus on the overall tree coverage. The total inventory of canopy, not just inventory of individual trees.
    - Peter M asked if trees or tree canopy under an easement is credited or accounted for differently
      - Jeff noted that this issue has been discussed with engaged foresters in the region before. The trees under an easement are counted because they remain in the land imagery and land use every year.
      - The panel could mention various tools available for maintaining existing canopy, which is a critical part
  - Neely noted the time and reserved the discussion for continued discussion on the next call.
- There was agreement from the panel on decision point 2: Do the water quality benefits for tree canopy land uses vary by pervious and impervious land uses [under the canopy].
  - **DECISION**: The panel agrees that the water quality benefits for tree canopy land uses vary by pervious and impervious land uses under the canopy.

Wrap-up, review action items and next steps
- Jeremy noted the next call is scheduled for August 26th and asked if anyone's fall semester schedule requires a change in the meeting time; none were raised though the August call will need to be moved up one hour to avoid a conflict with Neely and Jeremy. Jeremy will note this change in an email to the group along with the dates for September and October calls. If anyone has conflicts given a new semester schedule the panel can work to find a new regular time. Neely thanked everyone for their time and engaged discussion.

Adjourned

SUMMARY OF ACTIONS AND DECISIONS
Urban Tree Canopy Expert Panel
Wednesday, August 26, 2015, 11:00AM-1:00PM EST
Conference Call

Name	Affiliation	Present? Y/N
Karen Cappiella	Center for Watershed Protection	Y
Sally Claggett	US Forest Service, CBPO	Y
Keith Cline	Fairfax County (VA)	Y
Susan Day	Virginia Tech	Y
Michael Galvin	SavATree	Y
Neely Law (Chair)	Center for Watershed Protection	Y
Jeremy Hanson (Coord.)	Virginia Tech, CBPO	Y
Peter MacDonagh	Kestrel Design Group	Y
Jessica Sanders	Casey Trees	N
Thomas Whitlow	Cornell University	Y
Qingfu Xiao	University of California-Davis	Y
Non-panelists/Support		
Brian Benham	Virginia Tech (Project Director)	
Marcia Fox	DE DNREC (WTWG rep)	Y
Ken Hendrickson	EPA Region 3 (Regulatory Support)	N
Jeff Sweeney	EPA, CBPO (CBP modeling team rep)	Y
David Wood	CRC, CBPO (CBP modeling team rep)	N
Ari Daniels	CWP	Y
Peter Claggett	USGS, CBPO	Y

Welcome and Introduction
- Neely convened the meeting and reviewed the day's agenda.
- **DECISION**: July 22nd call minutes were accepted.

Methods to estimate water quality benefits of tree canopy

- Neely explained that the panel is being asked to provide its recommendations for relative loading rates, or water quality benefits associated with tree canopy over impervious and tree canopy over pervious. The WQGIT needs to approve any new Phase 6 land uses (including tree canopy) at its 9/14 conference call, so they've asked for additional information from the panel to explain why more than one tree canopy land use is needed, and what the relative loading rates would be.
- Karen reviewed methods and assumptions to derive the proposed relative loading rate reductions of 8% reduction for TC over pervious and 21% for TC over impervious. She asked for questions.
  - Sally: Transpiration value of 5% seems low. A study in Hubbard Brook had much higher transpiration rate, but that was not an urban area. Range of 23-32%.
  - Susan asked for clarification about turf and open space in the Phase 6 Watershed Model. Would expect tree canopy to be over open space or meadow or something other than turf grass.
    - Neely: That's a good point and it reinforces our approach to define set a relative loading rate.
  - Neely discussed sources for the numbers used. For interception, initially had a 13% figure that was an average based on a handful of studies that were scattered around and were not necessarily urban areas. After further consideration, went with the 18% interception value which reported in a study in the Chesapeake Bay.
  - For transpiration, may be able to get a refined value from iTree analysis, but want to know if the panel is comfortable with the conservative 5% value.
  - Jeremy asked for clarification about the factors that can affect transpiration. He encouraged the panel to use a conservative value since the tree canopy may be quite variable and a conservative value would be the safest approach.
  - Susan mentioned that transpiration may not be directly relatable to throughfall, so may need to adjust that in the methods. Tom agreed linking it to throughfall may also be confusing; rainfall is a better parameter.
  - Qingfu and Susan noted that transpiration is very dependent on location, climate, etc. The 5% appears to be based on California data, so is probably too low.
  - Karen: The majority of studies reported results as rates for an individual tree or a volume of what was transpired. So it was hard to find a value that could be applied as a % of rainfall or throughfall. Transpiration in particular is extremely variable for a number of reasons. Do not recall any studies that provided a transpiration value for an urban tree as a % of annual rainfall.
  - The panel can proceed with 5% or some other value and recommend that the transpiration value may need to be adjusted in the future, and that adjustment could be made in the next calibration of the Model in 2016.
    - Peter: if the panel takes that approach it would help if they provide information about the potential range or variability so the modeling team has a sense of how much or how little the transpiration or runoff reduction might change.
  - Mike: we're basing this runoff reduction on what is on the ground at the end, but if the tree wasn't there then the transpiration and those other processes would not have occurred. Want to be sure we are properly crediting those activities to the tree.

- o Karen: we are calculating runoff reduction by taking difference between the runoff reduction from a site with and without a tree.
- o Sally commented that the calculations are still very conservative.
- o Neely summarized that there was agreement on the modified calculations/methods
  - ▪ Would need to bring something back to panel with a quick turnaround and perhaps have another brief call before the 9/14 WQGIT to get the panel's sign off.
- o Neely recapped that there was no agreement on calculation results or numbers at this time. She asked the panel to provide any information about any of the parameter values (transpiration, etc.) soon. At this point, continue to focus on the current values and revised calculation steps.
- o **ACTION**: Panel members with any relevant studies or information about parameter values (transpiration, etc.) should provide those sources to Karen and Neely by COB Friday, 8/28.
- o **ACTION**: Updated calculations and results will be shared with the panel early next week (week of 8/31) and the panel will have a 30-minute call on Thursday, 9/2, at 1:00PM EST.
- o Tom asked Karen and Neely to provide the primary references for the current assumption values.
- o **ACTION**: Karen/Neely will post the referenced studies on the Scholar site and message the group when they are available.
  - ▪ Post-meeting note: the files are posted in the Scholar folder for the 8/26 call.

Panel schedule for remainder of 2015
- Jeremy noted the proposed schedule described in the agenda. Will push back the regular September conference call one week to Wednesday, September 30th. A face-to-face on 10/21 is problematic for Tom.
- **ACTION**: Jeremy will distribute a Doodle for the October Face-to-Face to see if there's a better option available.
  - o Will schedule a short (1-hour) conference call one week after the face-to-face to resolve any lingering items.
- Jeremy and Neely noted the time, recapped the next steps, and thanked everyone for their participation and engaged discussion.

Adjourned

SUMMARY OF ACTIONS AND DECISIONS
Urban Tree Canopy Expert Panel
Thursday, September 3, 2015, 1:00PM-2:00PM EST
Conference Call

Name	Affiliation	Present? Y/N
Karen Cappiella	Center for Watershed Protection	Y
Sally Claggett	US Forest Service, CBPO	Y
Keith Cline	Fairfax County (VA)	Y
Susan Day	Virginia Tech	N
Michael Galvin	SavATree	Y
Neely Law (Chair)	Center for Watershed Protection	Y
Jeremy Hanson (Coord.)	Virginia Tech, CBPO	Y
Peter MacDonagh	Kestrel Design Group	N
Jessica Sanders	Casey Trees	Y
Thomas Whitlow	Cornell University	Y
Qingfu Xiao	University of California-Davis	Y
Non-panelists/Support		
Brian Benham	Virginia Tech (Project Director)	N
Marcia Fox	DE DNREC (WTWG rep)	Y
Ken Hendrickson	EPA Region 3 (Regulatory Support)	Y
Jeff Sweeney	EPA, CBPO (CBP modeling team rep)	N
David Wood	CRC, CBPO (CBP modeling team rep)	N
Ari Daniels	CWP	N
Peter Claggett	USGS, CBPO	N
Bill Stack	CWP	Y

Welcome and Introduction
- Neely convened the meeting and verified participants.

Finalizing methods and estimates of water quality benefits of tree canopy
- Neely summarized some changes in the past week to the method following comments from panel members. She described three options the panel has in terms of confirming its methods and estimates for the WQGIT. #1 includes transpiration and is the same method that was discussed the previous week; #2 excludes transpiration; #3 excludes transpiration but includes an adjustment for interflow. Sally wanted clarification about the interflow assumptions and preferred option 3. Keith also preferred 3. Qingfu noted interception amount is mostly evaporated. He also supported option 3. Neely clarified that the interflow benefit in option 3 does not treat TP or TSS, but does provide additional TN reduction, so for option 3 it's 18.5% TN reduction, and 17% reduction for TP and TSS. For option 2 it's 17% for TN, TP and TSS. This assumes that a 5% transpiration rate translates to a 5% reduction of interflow. Sally expressed concern that 5% is too low or conservative. Tree canopy as a land use is primarily capturing existing canopy, and newly planted trees are only a very small piece.

- Neely and Jeremy noted the time and asked each panel member: yay or nay? Option 3, as described during the call with 5% transpiration.
  - Karen, Keith and Jess: yay
  - Tom: Yay, as first iteration.
  - Sally, Peter: yay, with reservations that 5% is too low
  - Qingfu: yay, but there could be other estimate(s) to make improvements
  - Mike had left call, but responded yay to option 3 via email
  - Susan was on travel.
  - **DECISION**: The panel approved recommending Option 3 in its technical memo to the WQGIT.

Adjourned

SUMMARY OF ACTIONS AND DECISIONS
Urban Tree Canopy Expert Panel
Wednesday, September 30, 2015, 12:00PM-2:00PM EST
Conference Call

Name	Affiliation	Present? Y/N
Karen Cappiella	Center for Watershed Protection	Y
Sally Claggett	US Forest Service, CBPO	Y
Keith Cline	Fairfax County (VA)	Y
Susan Day	Virginia Tech	N
Michael Galvin	SavATree	Y
Neely Law (Chair)	Center for Watershed Protection	Y
Jeremy Hanson (Coord.)	Virginia Tech, CBPO	Y
Peter MacDonagh	Kestrel Design Group	Y
Jessica Sanders	Casey Trees	Y
Thomas Whitlow	Cornell University	N
Qingfu Xiao	University of California-Davis	Y
Non-panelists/Support		
Brian Benham	Virginia Tech (Project Director)	N
Marcia Fox	DE DNREC (WTWG rep)	N
Ken Hendrickson	EPA Region 3 (Regulatory Support)	Y
Jeff Sweeney	EPA, CBPO (CBP modeling team rep)	Y
David Wood	CRC, CBPO (CBP modeling team rep)	N
Ari Daniels	CWP	Y
Peter Claggett	USGS, CBPO	N
Bill Stack	CWP	Y
Invited guests--Dave Nowak, USFS; Alexis Ellis, Davey		

Welcome and Introduction
- Neely convened the meeting and verified participants. She noted the primary focus of the call would be to learn about a potential tool to help the panel formulate its annual BMP reduction estimates.

- She updated the panel on the status of the tree canopy land use recommendations for the Phase 6 watershed model. The land uses were approved by the WQGIT on 9/28, but the loading rates are currently set equal to the underlying land use instead of the panel's recommended (reduced) loading rates. The rates can be adjusted in subsequent versions of the beta model based on input from the panel or workgroups.
  - There was discussion about the panel's role in refining the loading rates for CBP approval in the future. It was noted that the modelers and various workgroups will also have a role in adjusting or refining the methods or loading rates. The panel does not have the entire burden from a loading rate perspective. The panel can focus on its work to estimate the annual BMP reductions and the loading rate issue will be clarified moving forward. Will know more in coming weeks.

Discuss UTC BMP annual credit
- Keith felt excited about the tool. Suggested perhaps we could not just limit the analysis to trees planted, but simulate other management actions too. Curious if we could use Landscape for that.
- Neely introduced Alexis and Dave. They presented about i-Tree Forecast and how it operates. Built off iTree Eco. Loads into forecast to run the simulation. Can start with a base population of at least one tree and add information for a project or additional trees. Dave discussed how to operate the tool, its parameters, options and assumptions.
  - They noted that hydrological effects won't be in first version of Forecast. Working to figure out how to incorporate that large database into the tool without breaking it. (Sitoshi?) Have hydrologic benefits by county (lower 48 states) and could calculate/provide those manually. Hydrologic benefits were developed with grant from EPA. Have a table with all that information, including evaporation, evapotranspiration, avoided runoff, vegetation uptake, etc.
    - Neely asked how the area gets defined/set up in the model.
      - Would be done in the Eco portion. Would enter that area and information. Default is the area in the database, but can be overridden with personal data.
    - Neely noted the phase 6 land uses include tree canopy over turf and tree canopy over impervious. Is there a way to distinguish the understory in the tools?
      - Dave: Not in forecast. Could do that in Hydro to look at impacts. That would allow you to change the level of impervious cover.
    - Karen: what format are the hydrologic benefits provided?
      - Cubic meters per year. Separate numbers for each of the variables.
        - Neely: If we had area of county could we convert it to a depth of runoff?
          - Dave: Yes, but have to consider if extrapolation is done properly to that given area.
    - Sally: who is the intended user for Forecast?
      - Dave: County planners, managers, consultants, or anyone who uses Eco and wants to understand the population of their trees going forward. This is just the first piece. It is a dynamic tool. Want to add climate change or other factors in the future.

- Sally: how might we determine a watershed-wide average?
  - Dave: Could do it for all the counties using the Hydro outputs.
- Jeremy asked about how the tool(s) may account for development now or in the future. Dave mentioned they are waiting for new data coming out next year and will build that into Landscape. Would be tough to account for anthropogenic effects in Forecast.
- Bill: What's the basic hydrologic model component? Curious about the typical size of storms it would be based on.
  - Dave: TOPMODEL and green-ampt
  - Alexis: Based on the weather data, so whatever has occurred in the timeframe.
- Ari discussed some possible variables and trial scenarios that could help inform the panel's annual BMP estimates.
  - Variables (see Ari's slides for more info):
    - Number and species distribution
    - Size
    - Mortality rate
      - Pest events
      - Extreme weather events
    - Planting area distribution
    - Location
  - Jeremy asked how the species composition may affect the end results in terms of hydrologic benefits
    - Dave explained the tool won't respond directly to the species per se, but the size of the tree over time, leaf area index for that county/region, etc. Depends on characteristics.
    - Jeremy: So looking at the first 5-10 years of a tree's life, the estimated hydrologic differences would not vary widely based on the assumed species composition.
  - Neely asked what is most important in terms of model sensitivity. Want to narrow down the scenarios to a manageable number and knowing the most important variables would help.
  - Dave responded to a question from Mike: if you have an inventory or plot-based information that would be your base population. Think what Ari is interested in is planting scenarios that aren't currently available. I.e., what is the estimated effect of planting trees, based on the average effect from those scenarios.
    - Alexis noted she can pinpoint the effect of newly added trees.
  - Keith: Forecast will take your existing population and estimate what happens to it over time. Will need to look at the planting scenarios and compare. Have to think in certain terms from a BMP perspective.
    - Alexis clarified she can separate out the starting population from new trees, but the current forthcoming version of Forecast itself does not include those new cohorts in the calculation.
  - Keith felt that Landscape may be the tool of interest for purposes of understanding the effects of planted trees or other management actions.
    - Landscape has those hydrologic tables built in.

- o Mike asked for clarification of what the intended use of the Forecast is for the panel.
    - Neely: Alexis will run scenarios for us in Forecast to provide a baseline or estimated trends over time. So we would have an idea of what happens to a population of trees annually over time.
    - Keith: preservation or other actions reduce the die off or mortality rates. Trees planted is just one practice or action.
        - Neely: we'll include discussion of this on 10/21 agenda.
    - Peter agreed the tool would be really helpful. He asked if jurisdictions could track and report trees that are cut like they do for trees planted.
        - Jeremy felt the data may be available in some jurisdictions and areas, but would not be available or reported in many other areas.
        - Keith: depends on the jurisdictions and their role in planting, maintaining and removing trees. Many other entities (nonprofits, etc.) are involved in both planting and cutting.
        - Peter: Suggested that question because it may be an important part of the picture and could potentially overwhelm planting effort in some cases.
        - Sally: Agree it is a very important issue, but it also something that is already credited in a sense. If they lose forest as a land use it affects their overall progress towards their target reductions. Our initial charge includes suggestions on how the practice will be tracked, reported and verified.
- o Ari asked for any immediate reactions to the table and scenario construction. Noting the time, Jeremy asked panelists to provide their feedback. Alexis noted that the scenarios described on Ari's slide would be a relatively quick turnaround, but she noted she starts maternity leave on October 26.

Wrap-up, review action items and next steps
- **ACTION**: Comments and feedback on the proposed scenario construction to Ari by COB October 7th so he can provide updated scenarios to Alexis shortly after that.
- Jeremy to provide minutes from the call and previous calls to panelists.
- **ACTION**: Panel members that would need overnight travel funds or reimbursement for the 10/21 meeting in Ellicott City should contact Neely immediately to confirm funds are available before they make reservations or travel plans (Tom/Peter/Qingfu). A conference line and webinar will be provided for anyone that cannot attend in person.
- Jeremy thanked everyone for their time and engaged discussion.

Adjourned

SUMMARY OF ACTIONS AND DECISIONS
Urban Tree Canopy Expert Panel
Wednesday, October 21, 2015, 9:00AM-4:00PM EST
Meeting

Name	Affiliation	Present? Y/N
Karen Cappiella	Center for Watershed Protection	Y
Sally Claggett	US Forest Service, CBPO	N
Keith Cline	Fairfax County (VA)	Y
Susan Day	Virginia Tech (sabbatical)	N
Michael Galvin	SavATree	N
Neely Law (Chair)	Center for Watershed Protection	Y
Jeremy Hanson (Coord.)	Virginia Tech, CBPO	Y
Peter MacDonagh	Kestrel Design Group	Y
Jessica Sanders	Casey Trees	N
Thomas Whitlow	Cornell University	N
Qingfu Xiao	University of California-Davis	Y
Non-panelists/Support		
Brian Benham	Virginia Tech (Project Director)	N
Marcia Fox	DE DNREC (WTWG rep)	N
Ken Hendrickson	EPA Region 3 (Regulatory Support)	N
Jeff Sweeney	EPA, CBPO (CBP modeling team rep)	Y
David Wood	CRC, CBPO (CBP modeling team rep)	N
Ari Daniels	CWP	Y
Peter Claggett	USGS, CBPO	N
Bill Stack	CWP	N
Invited guests-- Alexis Ellis, Davey; Rebecca Hanmer, Forestry Workgroup		

Welcome and Introduction
- Neely welcomed everyone and verified participants.
  - **DECISION**: The 9/30 conference call minutes were accepted as written.

Discussion of CBP partnership comments on proposed land uses and loading rates
- Jeremy explained that the WQ Science document was provided by Sally Claggett and Julie Mawhorter. It summarizes technical and scientific questions from the USWG and WQGIT regarding the panel's recommended land use loading rates and methods. Jeremy pointed out that he and Neely provided draft responses for the panel's feedback. The goal is to get a sense of the panel's response and thoughts on the comments so Neely and Jeremy can accurately communicate the panel's consensus back to the commenters.
- Rebecca thanked the panel for all their hard work so far and in the coming months.
- Neely mentioned the panel's timeline is being extended into February-March 2016 due to the additional task of the loading rate recommendations and the time it took to deal with that.
- Neely reviewed the comments, primarily from MD SHA and VA DEQ, and the draft responses.

- o Neely recalled previous discussion of transpiration and interflow, which led the panel to provide the "bump up" to account for the transpiration of the tree. There were concerns about applying that transpiration for trees over impervious cover. Impervious surfaces in the model do not have interflow or subflow, but in reality there is some or else the trees would not live. The panel would need to discuss this in more detail moving forward with the modeling team.
- o Neely also pointed to the comments regarding the one-to-one reduction and leaf litter issues.
  - ▪ Neely explained the street sweeping panel also looked at the leaf litter issue. She had looked into all of that same literature for this tree canopy panel. The street sweeping panel determined that it didn't have the information necessary to make any recommendations to address leaf litter at this time. There isn't any new science from what has been reviewed.
    - • Jeremy described that the load from leaf fall of trees is one of many "sources" that is implicitly captured in the calibration. For new trees planted over impervious perhaps the panel can figure out if the leaf fall should have an effect on the overall effectiveness, but for trees planted in pervious settings there probably is no water quality concern. Leaves falling into a gutter are a potential concern, not necessarily leaves that fall in a field. Trees have always lost their leaves.
    - • Jeff encouraged the panel to continue to consider and address the issue as best they can with the available information. Helps to document all of that in the report.
  - ▪ The panel will continue to discuss the one-to-one assumption that was part of its initial recommendations.
- o Neely noted questions raised about the Herrera citation. She clarified that the Herrera approach and methods were used, but values from studies in the Chesapeake Bay were substituted. This was documented in the memo.
- o Neely pointed to infiltration comments. She recalled previous comments Susan Day had made regarding potential impacts of trees on soils' infiltration ability and need for additional research to document this effect of tree canopy on the surround soil environment and effect on runoff and pollutants
  - ▪ Peter noted a study in Canada looking at shelter belts and the infiltration on both sides. However those trees were planted back in the 1930s so we can't know when those effects were realized.
- o Neely reiterated that the panel will be able to more fully explain its reasoning in the full report.
  - ▪ Rebecca: if interception is such a large part of the equation, but perhaps a recommendation could be made for additional information gathering or research to measure runoff factors for areas with tree canopy. Neely mentioned that research recommendations are a standard component of panel reports, so the panel will certainly define the data gaps and research needs. She also noted that differences in definitions also matters. Given the CBP definition of tree canopy, it can be more difficult to get the kind

of information a future panel would need. Most studies and tools look at tree coverage in an urban forest or forest perspective.
- o **ACTION**: Panel members should email Jeremy and Neely any thoughts or comments on the proposed responses (red text) by COB Thursday October 29.

Review and discuss crediting methods for BMP
- Neely recapped where the panel had left off in its BMP discussions back in July, before the panel's time was monopolized with the land use recommendations.
  - o She asked if the panel members still agreed with the approach that an annual BMP reduction credit would be replaced by the tree canopy land use every five years. I.e. the annual reduction would be available until the land use is re-mapped to avoid double counting. Continued discussions needed with CBP to better understand expected methods to update/adjust tree canopy land uses on an annual basis.
    - ▪ Peter noted the 50 sq ft threshold is a good one. Gives them more information and incentive to improve the way they plant trees.
    - ▪ There was discussion about potential crediting or double counting issues and options for addressing them.
      - Peter asked if the ash borer has already done the bulk of its damage or if more damage is expected. Keith noted that the ash borer is just getting started in Northern Virginia, but ash is roughly only 5% of the canopy, but there are major concerns about the loss of that canopy. Ash is a common landscaping tree though, so entire plantings are at risk in some contexts. Expect that signal would be strong enough to show up in the land use updates.
  - o Neely recalled the panel's discussion about actions that protect and maintain existing canopy. The issue is how to define and quantify those effects on an annual basis. It involves actions different than tree planting. Protecting and maintaining existing canopy would be the most effective action to offset loss rates There was discussion of potential options for how to define or quantify
    - ▪ Primary purpose of the model is to help develop WIPs …EPA is considering developing the Phase III WIPs on a future 2025 condition. The Phase I and Phase II WIPs were developed based on existing conditions. Basing them on future conditions would place much more importance on conservation programs. That will be a partnership decision so EPA is just one of parties involved. The decision would be made after the panel has completed its work, however.
      - Issues to consider:
        - o Time lag between planting and mapped land use
          - ▪ May not be depending on how credit is developed (i.e. project TC vs. annual change)
        - o Model: track and report credit as BMP and replaced with land use approx. every 5 years
        - o 3 approaches to address conservation
          - ▪ Inform model annual TC projection
          - ▪ BMP

- - - - Local conservation programs
    - o Note: 2017 WIP address future 2025 conditions to include jurisdictional conservation programs
  - ▪ Keith asked for clarification of how forest/timber harvest is factored into the current model.
    - • Jeff explained the Phase 6 model: true forest, disturbed, and harvested. There is a "forest harvesting practices" BMP that includes the various best practices involved with minimizing the potential water quality impacts.
  - o Neely reviewed the panel's previous proposed definitions for the BMP and land use. She noted the land use definition had been approved by the WQGIT. The panel still needs to discuss and refine its definition for the BMP(s).
    - ▪ Neely suggested:
      - • Planting, converting
      - • Maintaining, would apply to existing TC land use.
    - ▪ She reviewed some additional elements for a revised definition for the panel to consider:
      - • Represents "net" acreage of tree canopy (net = existing - loss + replacement)
      - • Every tree counts
      - • Less than 1 acre
      - • Trees over pervious and over impervious
      - • Trees planted as part of BMPs excluded
      - • Trees must be planted in good condition and maintained to ensure survival
      - • Need to address how trees in BMPs are not counted as this (tree canopy) BMP
    - ▪ Keith asked for clarification about how to account for trees that are planted in another BMP like a rain garden. There was discussion and the group agreed that it is an inconsequential issue, though it is something that will need to be mentioned and addressed in the report. If the tree(s) is large enough it will be captured in the land use through the high res imagery, but do not expect that to be an issue. It is highly unlikely that anyone would undergo effort to report the planted trees as a BMP in addition to the primary BMP associated with those trees.
  - o There was discussion of possible crediting approach and things to consider. Want to make it as easy as possible to report given information available to jurisdictions. There are a number of factors to consider for credit development (e.g., size and species of tree, growth/loss rate, understory land cover, planting conditions, etc.). Need to document and mention the various factors and demonstrate that the panel considered the factors when developing its recommendations.
    - ▪ Peter noted there were pretty clear thresholds in that Disney study between tree survival and soil volume. Over 1500 ft3 was 100%, a little over 80% for 500 ft3, and only around 50% for 100 ft3.

- ▪ Neely noted that the panels and the CBP cannot set explicit design criteria, but the panel can provide its suggestions about what factors and criteria can help ensure the survival and performance of the BMP.
- ▪ Factors to consider:
  - • Tree species: small, medium, large (later revised to just large and small)
  - • Tree species general category
    - ○ Broadleaf/deciduous
    - ○ Evergreen
  - • Also "default" average tree to account for jurisdictions not reporting other information
  - • Growth and loss rate
  - • Understory land cover
  - • Planting conditions
- • Neely recapped that iForecast can help the panel understand how canopy changes/expands annually. Initial scenario focused on tree planting. Ari and Neely summarized results from the initial iForecast scenarios that were run by Alexis. Ari and Neely thanked Alexis for running the scenarios.
  - ○ Initial scenarios designed to give a general sense of results for various locations in the watershed. Selected mortality rate of 5%. A lit review provided where N>81,500 indicated overall average mortality was 4.2% (post meeting note: Lit review conducted by Jenny McGarvey and shared with CWP via pers. communication). Conversations with panel and landscape architects indicates that mortality rate ranges from 4-6%. So 5% is reasonable starting point.
    - ▪ The average starts at 5% and varies by DBH after first year. First year all mortality is 5%, but can go up or down in subsequent years based on DBH and it may not average out to 5% overall in the long run.
    - ▪ Ari explained that a cohort is any single group of trees that have all common variables assigned to them. He clarified that a single scenario was run though it included about 40 cohorts that each describe different paths/outcomes based on the programmed variables.
  - ○ They reviewed outputs. Canopy area per tree planted vs. time. This answers "how much canopy did you get for every tree planted?" As opposed to per tree remaining. If you look only at remaining trees then the canopy is much higher. Looked at overall averages for the simulated areas over 30 years. Also reviewed breakdowns by species. 40 cohorts over the 4 locations and 5 species. So 25,000 of each tree in each location for each light exposure, etc. Geographic location in Forecast only determines the number of frost free days per year, so Baltimore and Norfolk have overlapping curves by location and increased from 50 sq ft to over 200; Cooperstown only increases from 50 sq ft to a little over 100. Jeremy asked if Forecast is entirely annualized or if planting date/month can be differentiated in the model. Alexis explained that it is annualized so there are no assumptions or differences based on planting date.
    - ▪ Jeremy asked if the total available area for the trees is specified. Curious if we can get a sense of density in Forecast. Alexis explained that the total area was not specified for these general simulations, but it could be. She

noted that the model can account for changes in CLE as the trees grow, but did not build that in for these particular simulations.

- iForecast can accept general categories such as "broadleaf, large," but some calculations (e.g. crown width or height) need to know the species. Could perhaps look for representative species within the groups.
- Neely asked for a better idea of the average longevity for urban trees
  - Peter noted that Chicago did a survey and found 7 years was average life for street trees. Other studies have found around 13 years, or as high as 23 years for street trees. Street trees have highest mortality rates.
    - Keith clarified that many urban trees are on private property or planted away from the street. Not all urban trees are street trees that have those low lifespans.
- Keith noted that the geographic location and the light exposure were two factors that seemed to have a significant effect on the canopy coverage within a five year period.
- Neely asked how the panel could best explore the effect of land us within iForecast. Alexis noted that the land use tends to affect the mortality most directly. The CLE could also be affected or tweaked in that context. With some research could maybe adjust the growth rates as well. By default iForecast only currently presents results broken out by land use.
  - Ari: could define a "transit" land use for our purposes and specify different mortality rates or other variables. Could make a comparison to the standard/average cohorts. Would need data to support those different assumptions though.
  - Could maybe use the number of frost free days as a starting point.
  - The assumption is that you are getting credit for trees that are planted properly under the right conditions to ensure greater chance of survival.
  - Peter noted a study by Tom Smiley for Charlotte, NC. In the downtown area. After 30 years of tree growth there was an exceptionally high survival rate. The soil volume was 700 cu ft for each tree.
    - It was pointed out that 2" caliper is most likely 1" DBH for trees being planted.
  - Jeremy suggested some comparison cohorts could be simulated with different density assumptions. There was discussion about how to approach the BMP credit, what to report, how to factor in density, the existing BMP definition, etc. The iForecast results seem to imply that the current definition of 100 trees planted per acre falls far short of the intended one acre of canopy coverage at both 10 and 30 year marks.
  - Change in tree canopy equals (net) growth in existing tree canopy plus new trees planted
    - Existing TC is known and it is mapped (at distinct points in time)

- - CBWM projected change in land use on annual basis in between imagery updates
  - o If we know an average age of urban trees we could use iForecast results for estimated canopy area per tree at that age.
  - o Jeremy suggested the panel look for representative surveys or data that the panel can use to better understand representative species/groups of trees in the CB watershed, particularly in developed areas. Same for any other assumptions we may use about the typical age of existing within developed tree canopy areas.
  - There was extensive discussion of how the annual BMP would be simulated in the watershed model as either a land use change BMP or an "efficiency" (i.e. a percent reduction). The reductions could be simulated in an equivalent way, but the accounting within the model is different.
- Groups of trees that represent small, medium and large. It was suggested to use a weighted-average for frost free days for the entire watershed, instead of various locations. Alternatively, could proportion the trees based on relative area of climactic zones within the watershed.
  - Soil volume is a major factor, so it was suggested that spacing could be a useful mechanism to ensure adequate spacing. Peter mentioned that spacing of at least 25 feet is good, but 35 feet is recommended.
- The light exposure did not have as great an impact in the first 5 years, but over the 30 years it has a significant effect. Again, spacing and soil volume helps ensure that the tree has the necessary light exposure to grow well and live longer.
  - Keith mentioned that in reality most of these trees will be planted in open space, not in shade of existing forests or trees.
  - Peter mentioned that 180 sq ft of canopy coverage (at 30 years from the averaged iForecast results) would have diameter of 15 feet. So that would be the closest you could plant trees.
  - Peter also noted that in urban areas trees are often planted in the shade of buildings so it may make sense to keep the 50/50 split after all
  - Will keep half-half split for CLE assumptions.
  - Keeping 1 million trees constant for these additional cohorts. Divide them based on distribution of climatic zones.
  - There was discussion of the distribution of species. It was suggested that the different between small trees and the mid/large trees is of more interest.
    - o **ACTION**: Keith will provide some suggestions for potentially representative species to select for cohorts.
  - Will also add conifer and deciduous.

- Neely: to recap discussion the differences in tree growth are more a function of the planting conditions (soil volume, spacing, etc.) than a function of the underlying land use. This will need to be conveyed in the final report, depending on recommendations Expert Panel provides
  - o Participants went through Ari's modified version of the spreadsheet results from iForecast. They looked at different breakdowns and graphs of the results, focusing on the first five years of the simulations, the runoff avoided, and other results of interest.
  - o Neely asked Alexis for additional documentation from Satoshi that explains how the runoff avoided was calculated. Alexis will put Satoshi in touch with Neely/CWP and Jeremy so the group can discuss some of the estimated WQ benefits in more detail in November.

Wrap-up, review action items and next steps
- **ACTION**: Panel members should email Jeremy and Neely any thoughts or comments on the proposed responses (red text) by COB Thursday October 29.
- **ACTION**: Keith to provide suggested species for modified cohorts.
- **ACTION**: Panelists will be asked to weigh in on modified iForecast cohorts. Neely and Ari will send out summary of modifications following Keith's suggested species.
- **ACTION**: Neely and Jeremy will work with Sitoshi and plan a discussion
- Neely and Ari recapped some additional discussion items and analysis that
  - o Projected land use changes…work with CBPO modelers
  - o Newly planted tree vs preserved or existing tree of an older age tree (~20" DBH or 30 yrs old)
  - o Newly planted tree vs standard BMP like bioretention
  - o Number of trees that actually make an acre based on Forecast results
- **ACTION**:
- Neely and Jeremy thanked everyone for their time and engaged discussion.

Adjourned

SUMMARY OF ACTIONS AND DECISIONS
Urban Tree Canopy Expert Panel
Wednesday, December 9, 2015, 1:00PM-4:00PM EST
Conference Call

Name	Affiliation	Present? Y/N
Karen Cappiella	Center for Watershed Protection	Y
Sally Claggett	US Forest Service, CBPO	Y
Keith Cline	Fairfax County (VA)	Y
Susan Day	Virginia Tech (sabbatical)	N
Michael Galvin	SavATree	N
Neely Law (Chair)	Center for Watershed Protection	Y
Jeremy Hanson (Coord.)	Virginia Tech, CBPO	Y
Peter MacDonagh	Kestrel Design Group	N
Jessica Sanders	Casey Trees	Y
Thomas Whitlow	Cornell University	Y
Qingfu Xiao	University of California-Davis	Y
Non-panelists/Support		
Brian Benham	Virginia Tech (Project Director)	N
Marcia Fox	DE DNREC (WTWG rep)	N
Ken Hendrickson	EPA Region 3 (Regulatory Support)	Y
Jeff Sweeney	EPA, CBPO (CBP modeling team rep)	Y
David Wood	CRC, CBPO (CBP modeling team rep)	N
Ari Daniels	CWP	Y
Peter Claggett	USGS, CBPO	N
Bill Stack	CWP	Y
Invited guests-- Alexis Ellis, Davey;		

Welcome and Introduction
- Neely welcomed everyone and verified participants.
  - **DECISION**: The October minutes were accepted as written.

Discussion of options
- Neely explained two options for how the panel can recommend the BMP reduction is simulated in the annual progress runs, as a land use change or as an effectiveness value (aka a % efficiency). She recalled the panel's working definition for the urban tree canopy BMP. The focus of today's discussion is on tree planting, with other actions to be later discussed in January. She and Jeremy clarified how the two approaches are different even if the reduction is the same. Either way the reported acres would be taken out whenever the land use imagery is updated, so the differences only apply for the years in between the imagery and land use updates. They asked for panelists' input or thoughts on their preference.
  - Sally: initially liked the land use change approach but the effectiveness value does seem easier programmatically and for reporting. Prefer the effectiveness value for that reason.

- o Keith agreed with Sally. The reporting elements would be the same, but the accounting seems easier.
- o Tom was curious how the effectiveness value may change over time in the real world and what empirical data would be used to support or explain that change. Prefer something quantifiable and verifiable.
  - ▪ Neely responded the data is currently not available in a format or scale that would enable this analysis and panel can discuss this further as part of 3rd agenda item for discussion (Supplementary analysis). Expert Panels are convened to review existing credits to refine assumptions and values. Panel will be asked to provide research-based recommendations that would improve the load reduction credit (effectiveness of relative loading rate) as part of the Expert Panel report.
- o Jess agreed with Tom
- o Neely noted the balance in favor of simulating it as an effectiveness value over as a land use change.
  - ▪ Qingfu was okay with that approach and pointed out that "land use" is usually used in a different context.
- o Sally suggested that the panel proceed with treating tree planting as an effectiveness BMP instead of as a land use change. Jeremy and Neely asked if there were any objections to that, noting it wouldn't be a fully final recommendation until the panel's report is completed. No objections were raised.
- o **DECISION**: The panel will proceed with treating the annual BMP (the tree planting component) as an effectiveness value rather than a land use change BMP.

Discussion of panel's use of iTree Forecast
- Neely recalled the CBP's current definition for the tree planting BMP, which is simulated as a land use change where 100 trees equals one acre that is converted from urban pervious to the forest land use. She explained the discussion at hand is limited to how we can translate the trees planted into an area of tree canopy to help quantify the BMP for Phase 6. The water quality benefit associated with that canopy is the next step, but first the panel needs methods to determine how much canopy area is gained by planting a tree(s).
  - o Neely mentioned that one point that was made repeatedly back in June and in other discussions is that the current BMP reporting needs to be as simple as possible.
    - ▪ Sally added that the BMP represents a very small amount of reduction in the overall WIPs so that is another reason to keep it simple for the annual progress submissions.
- Neely recapped that the goal of using iTree Forecast is to estimate the canopy gained associated with tree planting. She summarized the cohorts that were used in Forecast, thanks to the assistance and work from Alexis.
  - o Ari explained that Alexis averaged the frost-free days (FFD) associated with all the municipalities within the Chesapeake Bay watershed and arrived with 172 FFD. Most fall between 150 and 210 FFD in the watershed. 105 and 255 are outliers.

- Neely and Ari described one hypothetical approach to use the panel's Forecast outputs and information and provide a simple way for a jurisdiction to determine the amount of canopy based on the number of trees planted. Ari reviewed options for the panel to consider for determining how much canopy to credit for each planted tree. He summarized some potential pros/cons for each option.
  - Option 1, the canopy would be based on the current canopy coverage, i.e. it would change annually for the duration of the BMP.
  - Option 2, the canopy would be based on projected canopy area at the time of the next land use update (i.e., 5 years).
    - Sally mentioned that it might be better to talk about the canopy in terms of the tree's age rather than the caliper at time of planting. Keith commented that the imagery tends to pick up a tree once it is 9 feet tall. Ari explained that CBP staff indicate that the tree is expected to be detected in the imagery once its canopy is ~50 square feet.
    - Neely noted the canopy area will vary by tree type. The outputs are based on the assumption that on average the tree is 1" caliper at the time of planting.
  - Option 3 would be based on projected canopy in 2025.
  - Jeremy noted that the panel is not limited to only those 3 options. He suggested a fourth option where the canopy is averaged based on a certain (TBD) number of years (e.g., 2.5, 5, or 10) and the canopy would then be equal each of the years. While a tree's canopy does change year to year in the real world, it is important for the modeling tools and the BMPs to be consistent.
- Neely asked for the panelists' input on the options and described the decisions.
  - Sally pointed out that the land uses based on imagery will not distinguish the canopy based on tree size or type, etc. The tree canopy land use will be updated every five years. She preferred option 2 or some version of it.
  - Qingfu preferred option 1.
  - Keith: the Forecast tool has much more science and information behind it, so the information from the tool is much better than the existing BMP. Seems that the canopy would have to be consistent each year though. Much more difficult if we try to deal with variable canopy credits. Suggest that the credit is given at time of planting based on project canopy that accounts for mortality, etc. So then it is just a matter of what year you choose.
  - Karen: leaning toward option 2 since it seems like more of a middle ground looking at the 5 year, or maybe the fourth option. Since we agreed to simulate it as an efficiency that may affect the panel's choice.
  - Keith asked if the periodic land use update affects how the panel should approach this. Unclear if the 5 year distinction is arbitrary or if they should coincide. Perhaps the fourth option could have longer timeframe like option 3.
    - Ari felt that looking at an average would be a reasonable way to consolidate and address some of the pros/cons from the other three options.
  - Tom suggested using smaller numbers of trees in the example scenario to illustrate how the credit would work; may be more realistic. The land cover is the most solid approach and most verifiable. Mildly in favor of the second option.

- Bill: in the real world as the canopy grows beyond 2025 it becomes a very large benefit in terms of those longer term loads. The benefit continues to grow beyond the life of the practice. Need to emphasize that. Sally agreed.
- Jeremy explained that the Watershed Model is used for simulating and tracking the cumulative effect of management actions and changes on the ground.
- Jeremy noted the time and that there seemed to be a preference for Option 2, but more discussion was needed at the next call. Neely and Jeremy will prepare some refined options for January with side by side comparisons of what the canopy would be based on a set of different ages/average (e.g., 2.5, 5 years, 10 years). Will need a panel recommendation at that time.

Discussion of potential supplementary analysis
- Neely summarized a request from Tom to investigate available datasets that could be used to estimate a change in water quality or runoff response from a watershed based on a change in canopy cover. After discussing the analysis with leaders of the CBPO modeling team, we determined that it is not possible to conduct this analysis for the panel's benefit with available data. The data required is not currently available and cannot be derived or developed at this time. While there are available land use and land cover data over the timeframes of interest, the water quality monitoring stations with the necessary nutrient and sediment data are associated with drainage areas that are too large to effectively isolate the effects of tree canopy over those timeframes, whether it's 10, 15 or 30 years.
- Tom suggested someone might be able to do something better in the next cycle of BMP review. Could suggest a certain number or size of catchments that could be combined with high resolution imagery and other available data to help isolate the effect of tree canopy changes from factors that usually confound that analysis.
- Jeremy mentioned that every panel includes a section that outlines future research recommendations identified by the panel. Every panel stumbles upon research gaps or issues that would ideally be addressed in the future to improve the science the next time the BMP is revisited by the CBP or others.
- Sally mentioned the tree canopy land use is brand new so the Forestry Workgroup and the partnership will continue to explore what insights that new information and high resolution imagery may offer.

Wrap-up, review action items and next steps
- Neely and Jeremy thanked everyone for their time and engaged discussion. They will circulate a Doodle for mid to late January and will also work to put out a little survey about some options/numbers to consider in the meantime.

Adjourned

SUMMARY OF ACTIONS AND DECISIONS
Urban Tree Canopy Expert Panel
Friday, January 29, 2016, 1:00PM-4:00PM EST
Conference Call

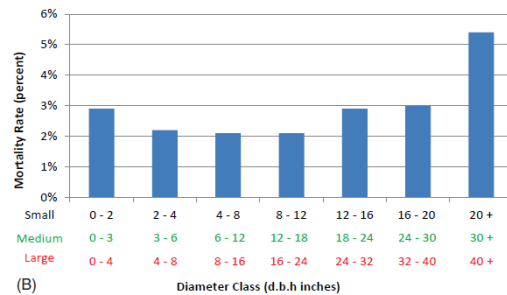| Name	Affiliation	Present? Y/N
Karen Cappiella	Center for Watershed Protection	Y
Sally Claggett	US Forest Service, CBPO	Y
Keith Cline	Fairfax County (VA)	Y
Susan Day	Virginia Tech (sabbatical)	N
Michael Galvin	SavATree	Y
Neely Law (Chair)	Center for Watershed Protection	Y
Jeremy Hanson (Coord.)	Virginia Tech, CBPO	Y
Peter MacDonagh	Kestrel Design Group	Y
Jessica Sanders	Casey Trees	N
Thomas Whitlow	Cornell University	Y
Qingfu Xiao	University of California-Davis	Y
Non-panelists/Support		
Brian Benham	Virginia Tech (Project Director)	N
Marcia Fox	DE DNREC (WTWG rep)	N
Ken Hendrickson	EPA Region 3 (Regulatory Support)	N
Jeff Sweeney	EPA, CBPO (CBP modeling team rep)	Y
David Wood	CRC, CBPO (CBP modeling team rep)	N
Ari Daniels	CWP	Y
Peter Claggett	USGS, CBPO	Y
Bill Stack	CWP	Y
Invited guests—Justin Hynicka, MD DNR; Marion Divers		

Welcome and Introduction
- Neely and Jeremy welcomed participants to the call. Neely reviewed the day's objectives.
- Jeremy noted the busy agenda and asked for any comments or edits to the December minutes should be sent to him.

Discussion of revised options for expanding tree canopy as a BMP
- Neely recapped that the panel agreed to credit the BMP annually as an effectiveness value rather than as a land use change. Neely noted that some representatives of the Forestry Workgroup (FWG) asked the panel to consider Forecast output for projected canopy growth at 0% mortality in comparison to the 5% assumption the panel has currently input into Forecast.
  - Sally understood the 5% is applied in Forecast each year, and that was one reason for concern from the FWG since it may overestimate the mortality. Ari noted that the mortality calculation could be overridden in Forecast to simulate it that one-time instead of annually, but that the panel had previously discussed and decided to apply it annually. Neely further clarified that the 5% is the overall mortality but

the actual % mortality applied each year varies based on trees species and DBH relative to height at maturity. *For panel's reference added after the meeting:*

Mortality Rate (percent)

Small	0 - 2	2 - 4	4 - 8	8 - 12	12 - 16	16 - 20	20 +
Medium	0 - 3	3 - 6	6 - 12	12 - 18	18 - 24	24 - 30	30 +
Large	0 - 4	4 - 8	8 - 16	16 - 24	24 - 32	32 - 40	40 +

(B)   Diameter Class (d.b.h inches)

- Neely offered one potential option for the panel to consider, i.e. to offer two credit options: one based on a 0% mortality and one based on the 5% mortality. For the former, there would be stricter qualifying conditions that would provide assurance that trees planted have the greatest survival and growth rates to include replacing trees that are lost.
  - o Keith: the assumption or condition that every tree lost will be replaced is false and does not exist. The fact that mortality was built in was a strength of using Forecast to help construct the credit because it would account for that realistic loss of trees. No jurisdiction can achieve that 0%. Since it's not a single entity or structure like a stormwater pond it is impossible to check and replace every tree that is lost. The verification of health/survival would be prohibitive for almost any jurisdiction, and would not be done. There's a big difference between a living tree and other types of BMPs.
  - o Mike concurred with Keith that the 0% scenario would be unreasonable and that the 5% makes more sense.
  - o Sally noted the partnership had already endorsed BMP verification guidance that instructs jurisdictions to replant lost trees.
    - ▪ Ari mentioned that this tree planting BMP is different than some of the other tree-based BMPs. Whereas BMPs like riparian forest buffers are larger contiguous areas of trees, the tree planting BMP could be individual trees reported at an aggregate scale.
    - ▪ Bill pointed out that the verification documents and protocols from the workgroups are guidance that sets a bar for the jurisdictions. Jurisdictions will not always be able to adhere to every aspect of the guidance, depending how high the bar is. Past expert panels have provided recommendations for BMP verification that must be followed to obtain and keep the credit.
- Neely explained the mapping threshold based on the high-resolution imagery is 9m^2, or 97 sq ft. She pointed out that the various cohorts (except for coniferous) tend to hit or pass that threshold approx. 10 years after planting.
    - ▪ Neely: there is such a wide level of variability with site conditions that the 5% mortality is effectively a way to build conservatism into the credit. We aren't distinguishing red buds from oaks, or soil volume, soil types, etc. Those factors can have a dramatic effect on the growth of a tree and its ability to meet its growth potential.
    - ▪ Sally was concerned that the annual application of mortality in Forecast perhaps lowered the expected canopy per tree too much.

- Mike: these credits and incentives are low per tree, and water quality credit should not be a driver for tree planting, Incentives come from jurisdiction for all of the other benefits provided by trees. The benefits of trees really add up when they are planted in large numbers and when they exist in larger continuous areas.
- Keith: The accumulation of all your trees is what matters and provides the benefits, so not hung up on looking at the individual tree.
- Sally: even with the current Phase 5 reduction it is a relatively small BMP. Want the panel to be aware of that.
- Neely asked the panel: Does the 100 trees/acre need to be revised: Consensus: Yes, it needs to be revised.
  - **DECISION**: The Phase 5.3.2 conversion of 100 trees/acre needs to be revised for Phase 6.
- Given the minimum mapping unit for tree canopy (97 sq ft) and review of Forecast output, does the panel agree:
  - A tree will, on average, meet the 97 sq ft threshold after 10 years. Therefore, the tree will receive credit as a BMP for 10 years, but will be credited as a land use after that (when the imagery will be able to detect it).
    - Sally: At least 10 years.
    - Keith and others agreed with 10 years.
  - **DECISION**: A tree will, on average, meet the 97 sq ft threshold after 10 years. Therefore, the tree will receive credit as a BMP for 10 years, but will be credited as a land use after that (when the imagery will be able to detect it).
- Provide a default tree?
  - Sally and Mike: Yes.
  - Mike noted that coniferous is only planted in reforestation contexts, and the vast majority of planting is broadleaf.
  - Neely noted that over the first 10 years there is not much difference between the large and medium broadleaf growth projection.
  - Exclude coniferous from default?
    - Keith and Mike: yes.
    - Sally noted that coniferous will still be tracked and counted under the land uses. Jeremy pointed out coniferous would still be tracked and reported through the BMP and the land uses, but the decision is to exclude it from the calculated default tree.
  - **DECISION**: The panel will recommend a default tree, which will be calculated based on broadleaf only.
- Default should be based on broadleaf medium, large, or both ("default broadleaf")?
  - Keith: Medium broadleaf
  - Mike: default broadleaf (med and large)
  - Tom: default broadleaf. In final report, include a disclaimer that we recognize it is a simplification but it will balance out in the end.

- Jeff: the modeling tools can have as many BMPs as the panel wants. Other BMPs have various categories like that, and if the jurisdiction doesn't specify one, then it gets credited at the lowest effectiveness value from those categories.
- Peter: Broadleaf medium
- Sally: broadleaf default (Large and Medium)
- Karen: broad default of Medium and large (post meeting input)

o Geographic: have different canopy credits based on FFD or not?
- Mike: agree with having two. No additional work from the jurisdictions in terms of reporting and there is a wide discrepancy between New York and southern parts of Virginia.
- Peter: average (166).
- Sally: use the average.
- Keith: use two.
- Jeremy noted that the map for FFD is not a north-south division.
- Neely determined the panel can revisit this decision later. She noted the difference is rather small until after year 10 of growth. Once we determine our chosen year of projected growth then we can make a more informed choice about how to account for FFD.

o Mortality
- Peter: 5% is more realistic and accounts for real world conditions.
- Keith: the 5% is a safety estimate and would account for mortality and in a sense build verification into the BMP reduction. The science brought us to the 5%
- Sally: it is a very little amount of credit for 10 years anyway. Tree planting itself is a very small piece of the pie, which is far outweighed by other factors such as development.
- Sally: 0% mortality or apply mortality one-time instead of annually.
  - Jeremy suggested the panel could present the 0% mortality canopy projections in the report to demonstrate the potential yield a jurisdiction could see in its imagery after 10 or more yearsif they provide the right soil conditions, etc. That way the panel can communicate the potential longer term gains if the jurisdictions take the right steps, but still provide a more realistic BMP credit.
- Tom: 5% sounds reasonable acknowledging what the conditions are
- Mike: prefer the 5% approach. Our role should be based on what we can justify with the science and 0% just does not seem reasonable based on our role as a panel.
- Karen: we can justify the 5% whereas 0% isn't realistic, but maybe some other value in between would make sense. We don't have time to run more Forecast scenarios but maybe there's some other way to provide a bump-up. Agreed with Jeremy's suggestion to use the 0% to illustrate potential growth given proper maintenance, planting techniques etc

o Neely will send email laying out issue for panel's growth period of choice (2.5, 5, 10, etc.)

Land use loading rates for tree canopy
- Justin reviewed his and Marion's work to assess the runoff benefits of tree canopy. He walked through their conceptual models and asked for input from the panel.
- Justin noted there is not a lot of direct data to support a loading rate, but there is a wealth of information about the underlying processes that we can put together in a modeling approach. He reviewed analysis about the reduction in water volume by tree canopy relative to impervious and pervious land covers. Initial results using 2015 precipitation and soil type characterized by HSG D properties. Looking at the water balance you have 18% reduction for canopy over impervious and a 26.3% reduction for TC over turf.
- Tom mentioned hydraulic lift. Trees with deeper roots redistribute water across different strata. Probably more detail than is needed for the task at hand, but there will be different ETs. Mentioned some recent studies from Stu Schwartz that may be useful.
- Justin: still looking at how to adjust the nutrient values based on the water balance reductions.
- Justin: For tree canopy over impervious, can vary the throughflow term. Right now it is the max amount of ET you can get; it is a very important term in the model overall. The analysis done for HSG D. For tree canopy over turfgrass, if you improve infiltration you might not improve the reduction from canopy because the soils are already doing the work at that point.
- Panel to review material provided by Justin and provided comments to Neely or Jeremy; in general panel found modeling approach reasonable.
- Jeremy noted there is a webinar scheduled on 2/11 when Justin and Marion will present their recommended loading rates to the partnership. Panel can review/discuss Justin and Marion's nutrient findings during our next call in February.
    - Information for the 2/11 webinar is available on the CBP calendar: http://www.chesapeakebay.net/calendar/event/23466/
- Neely noted the time and thanked everyone for their time and participation.

Adjourned

SUMMARY OF ACTIONS AND DECISIONS
Urban Tree Canopy Expert Panel
Wednesday, March 2, 2016, 2:00PM-4:00PM EST
Conference Call

Name	Affiliation	Present? Y/N
Karen Cappiella	Center for Watershed Protection	Y
Sally Claggett	US Forest Service, CBPO	Y
Keith Cline	Fairfax County (VA)	Y
Susan Day	Virginia Tech (sabbatical)	N
Michael Galvin	SavATree	Y
Neely Law (Chair)	Center for Watershed Protection	Y
Jeremy Hanson (Coord.)	Virginia Tech, CBPO	Y
Peter MacDonagh	Kestrel Design Group	N
Jessica Sanders	Casey Trees	N
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Non-panelists/Support		
Brian Benham	Virginia Tech (Project Director)	N
Marcia Fox	DE DNREC (WTWG rep)	Y
Ken Hendrickson	EPA Region 3 (Regulatory Support)	Y
Jeff Sweeney	EPA, CBPO (CBP modeling team rep)	Y
Ari Daniels	CWP	Y
Peter Claggett	USGS, CBPO	N
Bill Stack	CWP	Y
Invited guests—N/A		

Welcome and Introduction
- Neely and Jeremy welcomed participants to the call. Neely reviewed the day's objectives.
- Neely pointed that Qingfu did participate on 1/29. No other comments raised for the 1/29 minutes; they were accepted as amended.

General overview of draft report
- Neely noted the distributed draft is the first full draft. Some sections still need to be updated (Sections 3 and 4, based on land use loading rate recommendations).. Focus today will be on recommendations highlighted in section 5.4 of draft.
- Neely noted that she and Jeremy had discussion with Matt Johnston from CBPO modeling team, who recommended the panel credit the annual BMP as a land use change. This does not affect methods used to develop panel recommendations. There would be no difference in the credited reductions, but accounting for it as a land use change would be consistent with other BMPs that are also land uses. She noted this will require some edits in the draft report to reflect this.
- Neely recapped points of agreement from the January conference call. Agreed to default tree on broadleaf only. Panel agreed the 100 trees per acre needs to be updated, support for different values arise from Expert Panel discussions and Forecast output, along with

FWG analysis recommending 200-300 trees/acre. Forecast analyses range from 182-420 trees/acre as presented in the draft report.

- Neely explained the consensus-based approach for the panel and subsequent CBP workgroups approval process. Currently plan for panel approval in April. Report would then be released for a comment period by CBP partnership
- **ACTION**: Panelists to provide any final comments, edits or input by COB Friday March 11th. Use track changes and comments feature in the Word file. Send feedback to Neely and Jeremy.
- Neely reviewed the outline of the report and highlighted some of the areas that will be updated and expanded in next version. She asked panelists to review and provide comments on all definitions (Section 2) and asked if there are additional terms that should be defined.
- Keith commented that the report should clearly explain that the panel's recommendations will only address tree planting, not conservation
  - Need additional text to explain that "every tree planted counts." Previous Phase 5 BMP may have also counted every tree, but it wasn't explicit in the definition.

Discussion: BMP recommendations and options
- Neely summarized the five recommendations identified in Section 5.4 of the draft report. She noted that recommendations 1 and 2 may be incorporated together in the next draft, given the land use change approach suggested by Matt Johnston. Panel agreed trees planted after 10-yrs of projected growth would be captured by high resolution imagery. Once classified as a land use using high resolution imagery, the BMP credit would no longer exist.
- DECISION: Panel agreed with Recommendations #2 with clarifications requested. Will review revised recommendation in next draft. Panel had previously agreed to 10 year lifespan for Recommendation #1; the combination of these recommendations will be clarified based on panel's discussion and input.
- Sally requested clarification in the recommendation describing the lifespan of the credit vs the transition from BMP to land use acreages.
- Neely and Jeremy will work with the CBP modeling staff to develop the technical appendix that will explain how the BMP will be implemented and report and tracked. There are technical issues beyond the expert panel that need to be resolved by the Bay Program as the model transitions from version 5.3.2 and version 6 (e.g. acreages of tree planted based on existing credit and recommendations of the expert panel). Neely recalled that for recommendation 3, there were differences of opinions on whether to have two climate areas (150 FFD and 210 FFD) or one climate area (166 FFD). She explained that many counties will have areas with both climate areas.
  - Keith: looking at the map and information now, 166 FFD does seem like the most reasonable approach.
  - Marcia: Agree with that as a reporting agency, that would greatly simplify the tracking and reporting.
  - Mike: does seem like one climate area is preferable, would otherwise have to specify which counties are associated with one or the other climate zone.
  - Sally: agreed. id note that most of the larger urban areas in the watershed, that would most likely claim this type of BMP credit, would fall in the 210 FFD zone,

so may want to consider that or explain that in the report. Using a 166 FFD average, would therefore be considered conservative for this area.

- o Karen: agreed that one climate is preferable to avoid confusion of having one number for planning purposes that is different from the actual credit
- o **DECISION**: The panel agreed to set its recommendations based on one representative Baywide climate zone (166 FFD).

- For recommendation #4, tree type eligible for credit. Neely recalled the panel previously agreed on broadleaf default as a necessary simplification for reporting and tracking given available information typically available for this practice. A combined broadleaf large and medium species is used in the example that uses 10 tree species. Panel agreed.
- Neely described some possible options for setting the BMP credit. Option 1 is a basic credit. Option 2 is one example of an enhanced credit based on 2.5% reduced mortality. Option 3 is a second example of an enhanced credit based on 25-yr expected growth.
- Bill commented that the panel may not want to base the enhanced credit on 25-yr expected growth given the timeline of the Bay TMDL and reconciling this potential additional canopy growth that is credited vs 10 yrs
    - o Sally: trees per acre decision should be separated from the BMP credit duration issue.
    - o Mike agreed with having one basic credit.
    - o Marcia agreed with sticking with one basic credit.
    - o Keith: agree with one basic credit.
    - o Karen liked the enhanced credit idea, but understood the reasoning for having one credit.
    - o Marcia noted that a number of the qualifying conditions criteria are already built into the Forestry Workgroup's verification guidance and the jurisdictions' verification plans. Jeremy and Sally agreed that keeping it simple is preferable. The partnership's verification framework acknowledges that verification rigor should be based on the relative priority or reduction associated with a BMP.
    - o Keith: want to be conservative, but not too conservative. Keep it simple to minimize the hoops that the jurisdiction would need to jump through for tracking and reporting.
    - o Mike: Share Keith's concern that we never addressed protection and conservation of trees from a BMP perspective. Would like to keep the expected growth in a reasonable timeframe, did not agree with a credit based on 25 years of projected growth
    - o It was noted that 144 sq ft per tree planted, or 300 trees/acre.
    - o Looking at all these scenarios and range of variables, we can agree that a certain value is best representative of a reasonable "average tree."
    - o Sally: the value selected should be guided, not taken explicitly, from Forecast results. The results show quite an increase from the current credit.
    - o Neely: The value recommended by the panel needs to have documentation and rationale along with best professional judgement the recommendation
    - o Mike: when we agreed to use this tool as basis to inform our recommendations, feel we should choose from among the values presented from the outputs. The science and modeling tool got us here. 200 trees/acre seems to be at fringe of the results.

- o Neely: Based on the panel discussions, the following recommendations was put forward: One credit with basic qualifying conditions, number of trees planted and some other basic guidance, using 144 sq ft as per tree value.
  - ▪ Sally: do not suggest including planting guidance.
  - ▪ No objections were raised by those present. 144 sq ft.
  - ▪ **DECISION**: Panelists agreed with 144 sq ft average canopy per tree planted.

Update: tree canopy land use loading rates

- Jeremy recalled that Justin Hynicka presented his methods to the panel at their 1/29 call. Justin presented on a webinar on February 11th, and there were some adjustments to the methods and assumptions based on feedback from the partnership during and following the webinar. Jeremy noted the updated documentation will be ready soon. The Urban Stormwater Workgroup, Modeling Workgroup, and Water Quality Goal Implementation Team will consider the updated relative loading rates in the next couple weeks.
- Sally added that she felt Justin did a really good job of teasing out differences between nitrogen, phosphorus and sediment in the latest proposed rates.

Wrap-up and review of next steps

- Neely: verification discussion in section 6 is written in context of panel's own perspective and input in light of verification guidance and Phase 6 watershed model. Marcia noted that DE received a conditional approval of its verification plan and will be submitting updated plan soon. Lots of moving parts.
- Next call: TBD. Jeremy will distribute a Doodle for early April.

Adjourned

SUMMARY OF ACTIONS AND DECISIONS
Urban Tree Canopy Expert Panel
Friday, April 8, 2016, 12:00PM-2:00PM EST
Conference Call

Name	Affiliation	Present? Y/N
Karen Cappiella	Center for Watershed Protection	Y
Sally Claggett	US Forest Service, CBPO	Y
Keith Cline	Fairfax County (VA)	Y
Susan Day	Virginia Tech (sabbatical)	N
Michael Galvin	SavATree	N
Neely Law (Chair)	Center for Watershed Protection	Y
Jeremy Hanson (Coord.)	Virginia Tech, CBPO	Y
Peter MacDonagh	Kestrel Design Group	Y
Jessica Sanders	Casey Trees	Y
Thomas Whitlow	Cornell University	Y
Qingfu Xiao	University of California-Davis	Y
Non-panelists/Support		
Brian Benham	Virginia Tech (Project Director)	N
Marcia Fox	DE DNREC (WTWG rep)	N
Ken Hendrickson	EPA Region 3 (Regulatory Support)	N
Jeff Sweeney	EPA, CBPO (CBP modeling team rep)	Y
Ari Daniels	CWP	Y
Bill Stack	CWP	Y
Invited guests—N/A		

Welcome and Introduction
- Neely welcomed participants to the call. Neely explained that the primary objective for the call is to ask the panel for approval on the decision draft of their report.
- Jeremy asked for comments or edits on minutes from the March 2nd conference call; none were raised. **DECISION**: The March 2nd minutes were approved as written.

Land use loading rate approval
- Neely explained the relative land use loading rates developed by Justin Hynicka and Marion Divers were approved by the WQGIT on March 14th. The panel previously discussed and reviewed Justin and Marion's work. No additional comments from participants were raised.

Approval of decision draft
- Neely described the CBP review/comment process. Once the panel approves its report for release, it will be released to the various workgroups and the WQGIT. There is an initial 30 day comment period before seeking approval from the sector workgroup, followed by the WTWG, and finally the WQGIT. Once the WQGIT has accepted the report the panel is officially disbanded and thanked for all its work. Until then Neely and Jeremy will be

primary contacts for handling and responding to comments, and they will contact specific panelists or the full panel as needed based on the comment or issue.

- Neely reviewed the major recommendations and revisions in the decision draft. She mentioned that a clarification was added to explain the recommended BMP only covers urban tree planting at this time, while conservation practices may be considered by a future panel. Sally noted that conservation practices do not necessarily "expand" canopy. Jeremy suggested "protect" as a better term.
- Neely walked through additions and clarifications to sections 3 and 4; no comments were raised. She reviewed section 5 in more detail with participants.
    - o Neely explained that some text was added to section 5.2 to address how the panel's methods and iTree Forecast were applied in more detail.
    - o Sally asked for clarification about the edits for recommendation 2 in section 5.4. Keith noted that the focus is on total acres of canopy credited, not just acres planted like it used to be.
    - o Qingfu noted that tree species can vary significantly in their water quality performance. Neely agreed but explained that the panel, like others, did not want to be too prescriptive in terms of what species should be planted or credited. Those types of decisions are jurisdiction specific and panels need to build their recommendations accordingly.
    - o Neely noted that section 5.4 will likely draw most of the attention when the report is released.
- Sally: Should explain or mention somewhere in the report that while tree planting is a good thing, it's recognized that those gains are likely to be overwhelmed by other factors. Tree planting is just one small piece of a small piece. Neely pointed to a paragraph toward the beginning of section 5 that makes some of these points. She asked Sally or others to provide suggested language for that place, or for insertion or emphasis in other parts of the report. Peter agreed that it could be helpful to emphasize those points in the recommendations part of the report. Keith recalled the panel had discussed the importance of conservation and perhaps the language for future research could be expanded to emphasize the vital role of conservation.
- Neely described the text in the verification section. She noted that the language was crafted carefully since the FWG has developed its sector guidance that was accepted as a part of the CBP's BMP verification framework. There was discussion about the relation of the panel's verification recommendations to the existing guidance and the state's current verification plans. Jeff and Jeremy explained that when a new BMP is approved/added, then the states update their QAPP accordingly. The state and EPA would consider the panel's recommendations in addition to, not in place of, the guidance from the FWG and their current verification plans. The state and EPA would work together to set procedures that are rigorous enough and satisfy the protocols for the given BMPs.
- Prior to leaving the call, Keith suggested to add to management needs that jurisdictions use tools to evaluate net loss/gain of tree canopy beyond Chesapeake Bay land use updates. It is expected to see a continued net loss of tree despite extensive efforts to replace tree canopy by tree planting given continued development patterns in the Bay watershed

- Neely noted that Tom and Keith needed to leave the call soon and she asked for approval of the report through the verification section, pending final review and editorial comments/changes.
    - Sally noted that the 380 trees/acre conversion may be an issue with the FWG. Jeremy agreed it's likely to be a focal point in the forthcoming months when the report is being reviewed.
        - **POST-MEETING CORRECTION:** There was a typo in the slides that incorrectly stated 114 sq. ft of canopy per tree planted (or ~380 trees per acre). After the meeting this error was pointed out and corrected to the panel, since they previously agreed to 144 sq. ft (or ~300 trees/acre).
    - Keith agreed with releasing the report as-is. Agree with making the verification a suggested recommendation for the jurisdictions to consider, not a requirement or condition for the jurisdictions (e.g. 2 years after planting visit subsample of planting sites). Want to see that sort of decision left up to the locality to use the method or approach they prefer.
    - Tom explained the importance for being able to modify the model going forward as data to characterize the impact of tree canopy on water quality is provided. Need to continue to make a case for on-ground empirical data collection for improvements to the model in the future. Neely noted that the future research needs section hopefully captures that point, which has also been made by MDE and others.
    - Peter: No objections. It is important to make the points about conservation throughout the report, including the executive summary. The credit may be minimal for the tree planting, and they'll see the most benefits by protecting their existing canopy. Important to make that point up front because the planting credit will draw some scrutiny but it's such a small part of the canopy.
- Neely walked through recommendations from the future research and management needs section.
    - Jeremy explained two new bullets based on comments from MDE when the loading rates were discussed and approved by the WQGIT on 3/14. There were some follow-up emails to get to the suggested bullets; he asked panel members for thoughts about the language and if there were any objections to including them in the section 7 list.
        - Qingfu: okay with adding this in, since there's always a need for more data collection like that.
        - No objections were raised to adding the bullets.
        - Peter commented that a general struggle is incentivizing "doing more good" rather than looking at it in terms of "doing less harm." Jeremy pointed out that there is a part of the report that explains some of the panel's rationale that if a locality is prudent and has good conservation statutes, sites trees carefully with good soil volume and other conditions, etc., then in the long run they will see more gains in their canopy than the suggested 380 trees/acre.
            - **POST-MEETING CORRECTION:** There was a typo in the slides that incorrectly stated 114 sq. ft of canopy per tree planted (or ~380 trees per acre). After the meeting this error was pointed

out and corrected to the panel, since they previously agreed to 144 sq. ft (or ~300 trees/acre).

- Neely noted that final clarifications from today will be made. She asked if anyone else had objections or final input on approving the report.
  - o All members approved the report as discussed with final amendments.
- Neely and Jeremy described the next steps after the call.
  - o **ACTION**: Panel members should send Neely any further comments by COB 4/15.
  - o **ACTION**: Neely will distribute updated final version by Friday 4/22. Panelists will be given one week to provide any final thoughts (by COB Friday 4/29), and if nothing is received that is the version that will be sent out to the partnership for comment.
- Jeremy did note that the report is not strictly locked down when it is sent to the partnership, so if panel members do overlook something or have additional thoughts after the 29th they can be addressed along with the rest of the partnership's comments.

Wrap-up and review of next steps
- Neely and Jeremy thanked all of the panel participants for their contributions and engagement over the past year. They noted this will likely be the panel's last conference call, but it was a tremendous pleasure working with everyone.

Adjourned