Appendix D Summary of Expert Panel Meeting Minutes

December 5, 2011
Meeting Minutes
Urban Stream Restoration Expert Panel

EXPERT BMP REVIEW PANEL Stream Restoration		
Panelist	**Affiliation**	**Present ?**
Deb Cappuccitti	MDE	Yes
Michael Bumbaco	Virginia Beach	Yes
Matt Myers	Fairfax County	Yes
Dan Medina	Atkins	Yes
Joe Berg	Biohabitats	Yes
Lisa Fraley McNeal	CWP	Yes
Steve Stewart	Baltimore County	No, Briefed on 11/23.
Dave Goerman	PA DEP	Yes
Natalie Hartman	WV DEP	Yes
Jeff Sweeney	EPA CBP	Yes
Josh Burch	DDOE	Yes
Robert Walter	Franklin and Marshall	Yes
Tom Schueler	CSN (FACILITATOR)	Yes

Summary of Action Items

The Panel directed Tom to (a) provide the sediment load/impervious cover model inherent in the Watershed Model and (b) Get Gary Shenk (EPA CBPO) to provide more detail on sediment and nutrient dynamics at its next meeting

Bob Walter agreed to provide Sujay with papers on sediment and phosphorus dynamics to add to the database. Tom requested that all panelists review the spreadsheet to determine if any important black and grey literature needs to be added to the spreadsheet, and if so, to provide the citation or pdf to Tom no later than December 20, 2011. Tom will forward these studies to Sujay and the panel as a whole. Sujay agreed to provide the entire non-Bay spreadsheet, and the panel agreed that each member would take on reviewing 10+ papers on the non-Bay list prior to our next meeting. Tom will work with the panel on doling out papers to the panel as a whole

The panel agreed to meet for a face to face meeting in Annapolis, tentatively scheduled for January 25th. The ¾ day meeting would have telephone connections for folks who cannot travel. The meeting would devote several hours on research presentations by Solange, McNeal (or Bill Stack), Kaushal, Walter, Stewart and others. Panelists who want to present their own data or nominate a colleague are asked to let Tom know by December 20.

1. **Call to Order and Panelist Introductions.** Tom Schueler called the meeting to order at 11 AM. Each of the panelists introduced themselves and explained their background in retrofit analysis and implementation in their jurisdiction. Tom briefly outlined the BMP review panel protocol by which the panel would conduct its business, and asked the panel whether they understood their role and had any questions about the protocol. Tom then outlined his role was to facilitate the panel, organize the research and methods, and document its progress, but not be involved in the decision-making process.

The Panel then discussed and approved the draft charge for the stream restoration panel. **The Panel** agreed that Regenerative Conveyance Systems (RCS) should be within the purview of the panels deliberation, with a majority of the panel concurring and no dissent. **Dave G** inquired whether it was within the charge to look at effect of stream restoration in less developed areas, and Tom indicated that the panel could make such recommendations if it felt they were justified. **Dan** inquired as to the nature of the panel's final product. Tom indicated that the under the BMP review protocol, it would be a technical memorandum that describes the definition, rates, qualifying conditions and reporting mechanisms with an appendix that summarizes the scientific data evaluated.

1. Background on the Original CBP Approved Nutrient Removal Rates

Tom presented some background on how the original stream restoration rates were derived eight years ago from Steve Stewart's single study. Tom noted that Steve's subsequent research on Spring Branch revealed higher rates, and that other studies in the Baltimore metro area reached similar conclusions.The key point being that the existing CBP-approved rate for urban stream restoration was no longer adequate and deserves updating. Tom also noted the many local governments in the Bay watershed were keenly interested in the panels' recommendations.

2. **How Urban Sediment Delivery is Currently Modeled in the Chesapeake Bay Model**

Jeff Sweeney (EPA CBPO) briefly described how urban stream sediment and nutrient dynamics are currently simulated in the current version of the Chesapeake Bay Watershed Model. **Joe** and **Bob** both noted the importance of stream channel erosion relative to upland sources of sediment and nutrient loads from urban lands. **Mark** noted that sediment loadings were scale dependent, with higher loadings discovered for zero and first order streams. The Panel directed Tom to (a) provide the sediment load/impervious cover model inherent in the Watershed Model and (b) Get Gary Shenk (EPA CBPO) to provide more detail on sediment and nutrient dynamics at its next meeting

3. University of Maryland Research Synthesis Project

Dr Kaushal concisely described their ongoing work to develop a research synthesis on nutrient and sediment dynamics associated with urban stream restoration projects. He provided an Excel spreadsheet (Attachment A) which contained a meta-data analysis on about 30 recent urban stream restoration research projects. **Dave** noted that the spreadsheet was dominated by nitrogen research, and **Bob Walter** agreed to provide **Sujay** with papers on sediment and phosphorus dynamics to add to the database. Tom requested that all panelists review the spreadsheet to determine if any important black and grey literature needs to be added to the spreadsheet, and if so, to provide the citation or pdf to Tom no later than December 20, 2011. Several panelists indicated they would like to see the non-Chesapeake Bay citations (which may number around 200 or so). **Sujay** agreed to provide the entire non-Bay spreadsheet, and the panel agreed that each member would take on reviewing 10+ papers on the non-Bay list prior to our next meeting. Tom will work with the panel on doling out papers to the panel as a whole.

4. **Scoping of Technical Issues to Address**

Several panel members indicated the importance of defining uncertainty in relation to the panel recommendation, and the need for practical definitions of various types of urban stream restoration practices, that reflect stream order, landscape position and restoration objectives. The panel agreed to take on these issues at its next meeting

January 25 2012
Urban Stream Restoration Expert Panel
RAPID STREAM RESTORATION DATA REVIEW WORKSHOP

Objective: Provide a forum for the panel to rapidly review urban stream restoration research in the Bay watershed as it relates to nutrient and sediment delivery

10:30 to 11:30 **Sediment/Nutrient Delivery in the Watershed Model** G. Shenk, EPA

11:30 to 11:40: **The Rapid Research Review Process** Schueler/CSN

11:40 to 12:00: **Spring Branch Data, Baltimore County** S. Stewart/DEPRM

12:00 to 12:20: **Baltimore City Stream Data** B. Stack/ CWP

1:00 to 1:20 **Nitrogen Dynamics** S. Kaushal/UMD

1:20 to 1:50 **Anne Arundel County Projects** S. Filoso

1:50 to 2:20 **PA stream research** Walter

2:20 to 2:40 **Virginia Sediment Work** Medina/Atkins

NOTE: RESEARCH REVIEW POWERPOINT PRESENTATIONS AVAILABLE FROM CSN

Areas of Possible Concurrence

Stream restoration and the Bay Model

- The scale at which the CBWM simulates sediment dynamics are river segments that average about 60 to 100 square miles in size, and therefore do not explicitly simulate the contribution of channel erosion to enhanced sediment/nutrient loadings for most 1st, 2nd and 3rd order streams.

- The CBWM indirectly gets to this by assuming edge of stream sediment loads are a function of the impervious cover in the contributing watershed, using empirical relationships from Cronin and Langland (2004).

- The CBWM simulates only partial sediment delivery from the edge of stream to the main stem of the Bay (15 to 30%). This means there will be a strong scale effect in any estimate of urban stream restoration removal rates (i.e., a higher rate that occurs at the local project reach versus a lower rate for the sediment that actually reaches the Bay.

- Stream restoration as a BMP can be modeled in many different ways within the context of the current version of CBWM, a unit load reduction (BMP factor), a variable removal rate for edge of stream loads or a change in delivery factor. The rate can also be variable with respect to watershed space and flow (i.e., triggered over and above a flow threshold, differential rate between physiographic regions etc). The panel can utilize this versatility to best represent the suite of stream restoration practice(s).

- The CBWM does not currently account for differences in sediment grain size, and this could be an important refinement for the 2017 model revisions. The panel indicated a strong interest in working with the CBWM modeling team on recommendations for improving the simulation of urban stream and sediment, with an understanding that the model cannot necessarily incorporate a range of values

The Current EPA-Approved rate for urban stream restoration

- Several studies seemed to indicate that current estimate for stream restoration is extremely conservative (Stack/Stewart), and may need to be increased, at least for some classes of stream retrofit practices.

The prime objective of stream restoration is not pollutant reduction

- Stream restoration is a carefully designed intervention to improve the hydrologic, geomorphic, water quality and biological condition of degraded urban streams, and cannot and should not be implemented for the sole purpose of nutrient or sediment reduction. Urban stream restoration is generally only warranted in urban stream reaches that have been or are currently being degraded by upstream watershed development, or require protection of critical public infrastructure.

- A qualifying project must meet certain presumptive criteria to ensure that high-functioning portions of the urban stream corridor are not used for in-stream stormwater treatment (e.g., geomorphic evidence of active stream degradation, an IBI of fair or worse, hydrologic evidence of floodplain disconnection, etc.)

- In general, the effect of stream restoration on stream quality is amplified when BMPs are implemented upstream in the catchment to reduce runoff and stormwater pollutants and improve low flow hydrology. Projects that combine restoration with upland retrofits may merit an additional nutrient and/or sediment reduction.

Defining stream restoration practices

- The panel concluded that no single, universal removal rate could be applied to the wide range of stream restoration techniques that are being applied across the Bay, although it may be possible to develop rates or methods for certain categories of stream restoration.

- Several different classifications were proposed, including projects designed to provide:
    - natural channel design
    - floodplain reconnection
    - stream wetland complexes,
    - removal of legacy sediments (i.e., Big Spring)
    - woody debris
    - regenerative conveyance systems
    - stream bank stabilization

- The panel is encouraged to think through different possible classification schemes prior to the next meeting, depending on whether they are splitters or lumpers. Recommendations of the panel should have both a local and Bay-wide consideration.

- In doing so, they may need to identify a unique project design approach to define each stream restoration class (e.g., Rosgen analysis for Natural Channel Design) and determine if there are sufficient performance studies available for the class to estimate unique rates.

- Within each class, it may be important to define secondary characteristics that help define rates, such as landscape position, stream order and reach length.

A" Simple" Conceptual Model for an Improved Rate

The rate may be calculated as the combined effect of "prevented" channel enlargement and increased in-stream nutrient processing associated with the stream restoration project.

The Prevented Sediment Approach

- The primary effect of stream restoration is to prevent channel enlargement within the project reach, and retain bank and floodplain sediments (and attached nutrients) that would otherwise be lost from the reach.

- The mass of "prevented" sediment and nutrients by a stream restoration project depends on the monitoring design approach. Studies that rely on bank pins and soil nutrient content tend to provide robust estimates, over the long term for streams that are actively incising or enlarging. The effect can be masked in studies that measure changes in nutrient sediment concentration above/below the project reach (or in comparison to a reference reach) unless they capture enough of the storms that cause bank erosion.

- Several panelists provided predictive data on the effect of bank retreat and the nutrient content of bank and floodplain soils. The panel indicated a strong interest in comparing this and other data to see if it is possible to develop regionally specific rates.

- Bill Stack proposed a method using project specific design data to develop rates, based on bank height, bank erodibility hazard, and near bank stress. These parameters are currently measured/estimated in virtually every project that would qualify as stream restoration, and can be input into predictive equations by developed by Dave Rosgen, the U.S. Fish and Wildlife Service and others to derive expected bank retreat. Bill provided several other equations to convert into management units such as tons of sediments, and suggested that the Spring Branch efficiency method might be applied to the erosion rates. Several panel members were interested in looking at more detail for this option in further detail at the next meeting.

The In-stream Processing Approach:

- A great deal of recent science has looked at the impact of stream restoration on nutrient processing, with a strong emphasis on nitrogen. Based on a handful of studies in the piedmont and coastal plain, uptake and de-nitrification can reduce daily nitrate-N loads on the order of 0 to 40%. (Kaushal/Filoso). Other changes to other forms of nitrogen may occur, but probably do not change the mass exported through the reach. Several project factors may be associated with greater nitrogen reduction:

    - *Slow down stream flow (increased low flow retention time)*

- *Add dissolved organic carbon(riparian reforestation and/or instream woody debris)*
- *Reconnect stream to floodplain and/or wetlands*
- *Upstream or lateral treatment by stormwater BMPs*

- It may be possible to identify specific design factors, individual practices, and riparian management factors associated with projects that might be expected to generally promote (or diminish) increased in-stream nutrient processing.

- There appears to be a connection between the length of a stream restoration project and the cumulative length of the upstream drainage network and/or the contributing drainage area to the project reach. Short restoration projects in large catchments do not have enough retention time or bank protection to allow nutrient and sediment removal mechanisms to operate, especially during storm events.

Impact of stream restoration is influenced by the dominant flow regime.

- Although it can be masked by the study design, there are clear differences in sediment removal rates during storm flow and base flow conditions, and the relative proportion of both flows determines annual reductions.

- During base flow conditions, the nutrient reductions appear related to the retention time within the project reach.

- During storm flow conditions, the impact depends on the size of the storm and/or discharge event. Just a few large storms each year account for most of the reductions in sediment (and sometimes for nutrients).

- The value of groundwater is mostly unknown and potentially underestimated. Hydro-modification is an important aspect of stream restoration.

Legacy sediments.

- Most stream restoration projects ultimately need to be interpreted in the context of the extent and depth of legacy sediments that exist within the study reach.

- The removal of legacy sediments and the subsequent recreation of wet meadow floodplain system shows significant promise to produce significant sediment and nutrient reduction benefits (although monitoring has just commenced on the first major demonstration project in Big Spring, and space constraints in some urban stream corridors may preclude full implementation this approach).

March 5, 2012
Meeting Minutes
Urban Stream Restoration Expert Panel

EXPERT BMP REVIEW PANEL Stream Restoration		
Panelist	**Affiliation**	**Present ?**
Deb Cappuccitti	MDE	Yes
Michael Bumbaco	Virginia Beach	Yes
Matt Myers	Fairfax County	Yes
Dan Medina	Atkins	Yes
Joe Berg	Biohabitats	No
Bill Stack	CWP	Yes
Lisa Fraley McNeal	CWP	Yes
Steve Stewart	Baltimore County	Yes
Dave Goerman	PA DEP	No
Natalie Hartman	WV DEP	Yes
Jeff Sweeney	EPA CBP	No
Josh Burch	DDOE	Yes
Robert Walter	Franklin and Marshall	Yes
Sujay Kaushal	University of Maryland	Yes
Solange Filoso	University of Maryland	Yes
Julie Winters	EPA CBP	Yes
Gary Shenk	EPA CBP	No
Bettina Sullivan	VA DEQ	No
Norm Goulet	NVRC	Yes
Russ Dudley	Tetra Tech (FACILITATOR)	Yes
Tom Schueler	CSN (FACILITATOR)	Yes

Summary of Action Items

The Panel met via conference call for a 2-hour discussion that covered possible areas of concurrence, summaries of the compiled research, and approaches to determining nutrient and sediment reduction rates.

The panel initially reviewed the Possible Areas of Concurrence document. Tom Schueler will be revising the document based on comments made by the panelists.

Research review by the panelists resulted in some action items. Lisa Fraley-McNeal will look into monitoring requirements and distribute to the rest of the panel for discussion as an agenda item at a future meeting. Bill Stack will work with Steve Stewart and Solange Filoso dig deeper into any possible gap between erosion rates and load reductions observed in the field.

Bill Stack presented on the BANCS method and agreed to write it up and distribute to the rest of the panel.

The next meeting (via conference call) of the Urban Stream Restoration panel is tentatively scheduled for April 10, 2012.

1. **Review of Possible Areas of Concurrence.** The meeting began by reviewing the Possible Areas of Concurrence document developed from the previous meeting. Specific

language in the document will be modified based on panelist's comments. Below are comments raised for specific sections of the document.

Stream Restoration and the Bay Model
The goal is to reduce sediment but sediment from upstream sources is still needed to replenish downstream tidal wetlands.

The Current EPA-Approved rate for urban stream restoration
It is unclear whether we have enough information to claim that the current estimate for stream restoration is extremely conservative, although studies have shown that the sediment export is higher. Consideration should be given to the effect of stream restoration over time. Stream restoration should be separated from upland restoration practices.

The In-Stream Processing Approach
A great deal of discussion was had regarding this approach, including a discussion on dealing with phosphorus versus nitrogen. Hydromodification should not be considered an important aspect of stream restoration.

A "Simple" Conceptual Model for an Improved Rate
In-stream nutrient processing should be expanded to include the riparian area, groundwater exchange, and other factors that influence the nutrient cycle. The mass of "prevented" sediment is dependent on the location within the watershed.

2. **Other Panel Presentations on their Research Reviews.** Four panelists prepared slides discussing their review of urban stream restoration research papers. These are summarized below.

Josh Burch
Josh noticed a range of restoration effectiveness and suggested there should be a tiered approach to stream restoration values. Perhaps restorations could receive a low/medium/high ranking depending on the effectiveness of the technique for nutrient and sediment removal. Steve Stewart suggested we should work with Chesapeake Bay modelers to incorporate temporal changes to the restoration projects.

Lisa Fraley-McNeal
During Lisa's review she discovered that there are no real seasonal differences and that a common theme to pollutant load reduction was slowing down the flow. She highlighted the importance of effective monitoring and Bob Walters asked what we can recommend to practitioners to get the monitoring data we need. Lisa is going to check on monitoring recommendations and report back.

Deb Cappuccitti
Deb questioned whether the studies really represented the condition of all stream restorations and pointed out one project that seemed to be deteriorating. She noted a potential gap between measured load reductions and the load reductions observed in the field. Bill Stack is going to work with Steve and Solange to delve deeper into this.

Solange Filoso
Solange determined that estimates for sediment load reductions shouldn't be the same for all stream orders. She also summarized that nitrogen concentration and riparian buffer connection is important to nutrient reductions. She commented that restoration effects can

be negative and that the age of the restoration should be considered, siting some restoration projects in NC as an example.

3. **Concepts for Classifying Stream Restoration Projects.** This discussion centered around the question, "Are project factors more important than restoration classes?" Dan Medina suggested that the focus should be on the specific project and should consider the condition of the stream. Bob Walters noted that it's important to diagnose the problem correctly before restoration to determine the success or failure of the project. Bill Stack suggested that monitoring is required to ensure restoration is functioning over time.

   Steve Stewart noted that research studies are largely based on design classifications and that most studies do not partition out individual functionality, making the assessment of project factors difficult. There was general discussion on the use of design technique terms such as Regenerative Stormwater Conveyance and Natural Channel Design and whether those terms are proprietary and should be avoided.

4. **The Prevented Sediment Approach.** Bill Stack presented on the BANCS approach using methods developed by Dave Rosgen. He mentioned using data from Steve Stewart to determine an actual reduction rate. Bob Walter commented that there are more factors that can create bank erosion than just shear stress (i.e. freeze/thaw). Bill will write up the method and share with the panel. The goal is to see if an approach like this can be developed that would attempt to account for location differences within the watershed. It is also important to see how this compares to monitored data in order to improve the degree of certainty.

April 24th, 2012
Meeting Minutes
Urban Stream Restoration Expert Panel

EXPERT BMP REVIEW PANEL Stream Restoration		
Panelist	***Affiliation***	***Present ?***
Deb Cappuccitti	MDE	Yes
Michael Bumbaco	Virginia Beach	No
Matt Meyers	Fairfax County	Yes
Dan Medina	Atkins	No
Joe Berg	Biohabitats	Yes
Bill Stack	CWP	Yes
Lisa Fraley McNeal	CWP	Yes
Steve Stewart	Baltimore County	Yes
Dave Goerman	PA DEP	Yes
Natalie Hartman	WV DEP	No
Jeff Sweeney	EPA CBP	Yes
Josh Burch	DDOE	Yes
Robert Walter	Franklin and Marshall	No
Sujay Kaushal	University of Maryland	Yes
Solange Filoso	University of Maryland	**No**
Julie Winters	EPA CBP	Yes
Gary Shenk	EPA CBP	N0
Bettina Sullivan	VA DEQ	Yes
Norm Goulet	NVRC	Yes
Tom Schueler, Cecilia Lane	CSN (facilitator)	Yes
Molly Harrington	CBPO	Yes
Non - Panelists: Russ Dudley - Tetra Tech,		

ACTION ITEMS

ALL Members to provide constructive comments in the next 2 weeks to create an improved draft of the framework document reviewed during the meeting.
ALL to work on Section 7 Future Research Needs
ALL to read through Lisa Fraley-McNeal's monitoring document and comment
Joe Berg to write up section describing RCS and the dry channel and wet channel options.
Joe Berg to write "Prevented channel erosion component (stormflow)" (Section 3, Protocol #1)
Josh Burch to write-up applicability to rural projects (Section 4)
Deb Cappuccitti to write-up "Dry Channel RCS effect" based on MDE guidance document (Section 3, Protocol #4)
Russ Dudley to write introduction to Section 3 on the Review of Available Science and can help with associated bullets.
Solange Filoso and **Sujay Kaushal** to write-up "Instream nutrient processing (denitrification) during baseflow" (Section 3, Protocol #2)
Bill Stack to consider Deb Cappuccitti's suggestion regarding estimating prevented sediment loss/ Protocol 1 and take the lead on writing up Accountability (Section 6)

Steve Stewart to write summary of uncertainties (Section 3)
Tom Schueler to work with Norm Goulet to check with Gary Shenk on how BMP degradation curves apply and draft "Definitions and Qualifying Conditions (Section 4)

MEETING MINUTES

Introduction/Announcements: Tom Schueler

- Objective of meeting to move from background review to recommendation determination.
- Seeking comments to the draft as a whole and pragmatic answers to questions/concerns raised

Review "Proposed Protocols for Defining Pollutant Reductions Achieved by Individual Stream Restoration Projects": The Panel spent time going through the draft document in the following structured manner:

- Overall reactions to document:
  - Josh Burch: Concern that protocol will add significantly to workload of stream restoration.
  - Deb Cappuccitti: Concerned that in the guidance for stream restoration credits, the process shows that local governments want specific numbers to plan for (eg budget figures prior to analysis).
  - Joe Berg: Protocol document shows great effort. Believes that Protocol 2, Option 2 has limited feasibility.
  - Matt Meyers: Intermediary between applied rate and monitoring data
    - Qualifying conditions to allow streams for mitigation to receive credit.
- Discussion of Protocol 1, Recommended Crediting Procedure for Prevented Sediment Loss during Storm Flow:
  - Method of converting bank erosion to pollutant loading: disadvantage of method is that it only accounts for nutrients associated with sediment.
  - Frost heaving may be contribute
  - Only takes into account sediment supplied, not delivered
  - A pictorial guide to support BEHI measurement procedures would be helpful
  - Spring Branch Study method: noted as the only study completed therefore justification for estimating the effect of BMPs, but not for using loading rate as constant across watershed.
    - **Deb Cappuccitti**: These numbers may be best because they reflect middle.
    - **Steve Stewart**: However, the numbers must work within the CBP model.
  - **Cappuccitti**: BANCs method results in numbers too high; Projects fail and lead to continued or increased loading; Spring Branch #'s in the middle and may be best to use
  - **Cappuccitti**: estimate erosion rate from a stable stream and subtract from nutrient loading estimates (Step 2) → **Bill Stack to consider this suggestion**

- Discussion of Protocol 2, In-stream Nutrient Processing:
  - Option 2 "Design Features" maybe superfluous: difficult to construct, hard to accomplish design required for reductions
  - **Julie Winters**: recommends keeping description to restoration, stay away from the term "credits".

DECISION: Option 1 in need of further work; however option 2 can be disregarded.

- Discussion of Protocol 3: Stream bank stabilization with flood plain reconnection and hydromodification
- This protocol is fairly rare
- Discussion of Protocol 4: Regenerative Stormwater Conveyance (RSC) Design
    - Protocol not developed
    - Joe Berg points to MDE 2011 guidance document for rates, notes there is a lack of monitoring data, use Bill Hunt data when panel reconvenes
    - Matt Meyers: Concern with outfalls/regenerative storm water conveyance systems

ACTION: Joe Berg to explore different types of channel designs to receive credits.

ACTION: Norm Goulet and **Tom Schueler** to check with Gary Shenk on how BMP degradation curves apply.

ACTION: Members to provide constructive comments in the next 2 weeks to create an improved draft.

- **Writing Assignments for Recommendations Memo:** The Panel was asked to take on specific sections for the final recommendations memo.
    - Section 3. **Russ Dudley** to write introduction and can help with associated bullets.
    - Section 3, Protocol #1. **Joe Berg** to write "Prevented channel erosion component (stormflow)"
    - Section 3, Protocol #2. **Solange Filoso** and **Sujay Kaushal** to write-up "Instream nutrient processing (denitrification) during baseflow"
    - Section 3, Protocol #4. **Deb Cappuccitti** to write-up "Dry Channel RCS effect" based on MDE guidance document
    - **Steve Stewart** to write summary of uncertainties (Section 3)
    - Section 4. **CSN** to draft "Definitions and Qualifying Conditions"
    - Section 4. **Josh Burch** to write-up applicability to rural projects
    - Section 6, Accountability. **Bill Stack** and **Lisa Fraley McNeal** to take the lead on
    - Section 7, Future Research Needs. **All** panelists to work on

- **Monitoring Research Summary:** Lisa Fraley McNeal discussed her review of existing stream restoration monitoring research.

ACTION: Come to a decision regarding a Monitoring Consortium.
    - MD Stream Restoration Association, recommend Bay-wide monitoring consortium to increase monitoring efforts in concentration and rigor

June 11th, 2012
Meeting Minutes
Urban Stream Restoration Expert Panel

EXPERT BMP REVIEW PANEL Stream Restoration		
Panelist	***Affiliation***	***Present ?***
Deb Cappuccitti	MDE	Yes
Bob Kerr	Kerr Environmental Services Corp.	Yes
Matt Meyers	Fairfax County	Yes
Dan Medina	Atkins	Yes
Joe Berg	Biohabitats	Yes
Lisa Fraley McNeal	CWP	No
Steve Stewart	Baltimore County	Yes
Dave Goerman	PA DEP	No
Natalie Hartman	WV DEP	No
Josh Burch	DDOE	Yes
Robert Walter	Franklin and Marshall	No
Sujay Kaushal	University of Maryland	Yes
Solange Filoso	University of Maryland	Yes
Julie Winters	EPA CBP	Yes
Bettina Sullivan	VA DEQ	No
Tom Schueler	CSN (facilitator)	Yes
Panel Support and Observers: Russ Dudley – Tetra Tech, Debra Hopkins – Fish and Wildlife Service, Patrick Shearer. Kerr, Bill Stack, CWP, Norm Goulet, Chair USWG, Molly Harrington, CRC, Cecilia Lane, CSN, Emma Gutzler, Fairfax		

ACTION ITEMS

Bill, Lisa, Sujay, Solange and Tom: Meet in July to discuss modifications to protocol 2 on instream nitrogen processing

Sullivan, Burch, Goerman, Hartman, Cappuccitti: Send Tom basic info on state stream restoration permitting process and key contacts to include in a Table in final report. Also, please check to see whether the writeup on Pre and Post Construction Monitoring Requirements is consistent with what is required for permits in your state

Matt Meyers to produce a table comparing sediment loading from degraded vs. natural urban streams, provide a summary of the USGS research on urban stream restoration, and develop a design example for a real Fairfax County project would be credited under protocols 1 and 4

Steve Stewart to write summary of uncertainties and develop a real world design example (e.g., Upper Mine Bank Run project) on how credits would work

CSN to draft a version of recommendations memo by July 15 and send out to panel for review

ALL: put together your key stream research and modeling recommendations and send to Tom by end of July

MEETING MINUTES

Introduction/Announcements: Tom Schueler

- Tom Schueler thanks everyone for attending this pivotal meeting
- Deb and Joe put together a write-up for RSC
- Goal of this meeting is to get pretty close to recommendations and identify any remaining issues that need to be dealt with
- RTV will need to be dealt with: if too stringent, will be disincentive; too loose, people will game the system; should mitigation projects qualify?
- Fish and Wildlife and EPA informal group meeting in mid-July to meet on RSC permitting issues – would help to have qualifying conditions prior to that meeting
- Debra Hopkins from FWS reps Habitat WQGIT observing the meeting today
- Russ Dudley put together a bibliography for an appendix – thank you
- **Action**: The Panel approved the meeting minutes from April

Proposed Outline Discussion: Tom Schueler went through the proposed outline for the technical memo (Appendix C) and asked for the Panel's feedback. The following comments were made:

- Section 7 should include panel recommendations on how to improve the CBWM which can be included in the planned 2017 model refinements
- Section 7: research recommendations. It was agreed the panel should emphasize priority research that improve the quality of the protocols that are recommended?
- Section 7 **Deb** suggested that the title for Section 7 should be changed to "future research and implementation needs" to ensure permitting consistency by regulatory agencies, local outreach and training and other efforts to implement the recommendations. The panel concurred.
- **Steve Stewart** mentioned developing a spreadsheet tool to assist people with calculations for each of the protocols. Tom Schueler agreed that it should be listed as a recommendation but noted that we do not have the budget to develop such a tool.
- **Meyers**: would help to have a table to compare degraded vs. natural urban stream compared to a natural stream would produce **Meyers will produce,** Include curve of imperviousness to sediment concentration
- **Action:** The Panel accepted the draft outline with aforementioned changes

Discussion on Prevented Sediment Protocol: Bill Stack and Steve Stewart led the Panel in a discussion on the prevented sediment protocol, with an initial focus on the difference in edge of field vs edge of stream sediment loads, as simulated by the CBWM and calculated by protocol 1 (see stewart memo and stack response. After a lengthy discussion, the panel recommended that we address this issue in our modeling recommendations and get some additional feedback from CBP modeling team to ensure the load reductions under the protocol are consistent with CBWM. Tom and Bill to work Gary Shenk of CBP to resolve this issue.

There was some discussion about whether the BANCS method is applied to legacy sediment removal projects, and whether these rural projects had a higher streambank nutrient content (as suggested by the sediment nutrient table prepared by CSN). The Panel consensus was that the BANCS method as well as Protocol 3 would both probably apply to legacy sediment projects, and that Tom should consult with Walters to get his take on a 2-tier approach for urban and rural(ag) stream bank nutrient content approach. The panel agreed that the urban numbers appear reasonable and are fine as a default, but it would always be preferable to obtain nutrient content numbers directly from the project data.

Action: The Panel directed CSN to do a more detailed writeup on Protocol 2 reflecting their consensus

Dry and Wet Channel RSC Definitions and Proposed Rates: Joe Berg and Deb Cappuccitti led the Panel in this discussion. They noted that the report should reference Anne Arundel County's approved practice specification (Reg. Step Pool Conveyance System) and the 2011 MDE's NPDES MS4 permit document. They proposed a dry and wet definition, based on where the practice is implemented in the stream network, the appropriate environmental conditions, and the size of the drainage area. The dry channel RSC would be treated as a stormwater BMP with a fixed removal rate , whereas the wet channel would be calculated using the appropriate protocol(s) for which it qualifies.

Action: The panel concurred with this approach, but wanted to see more detail in the definition and writeups in the next draft

Refinement of Protocols for In-stream N processing Effect: Sujay Kaushal, Solange Filoso and Bill Stack led the Panel in a discussion of in-stream Nitrogen processing. There was considerable panel discussion on the proposed protocols, and although progress was made, no firm consensus was reached.

Action: Sujay, Solange, Lisa, Bill and Tom agreed to meet in July to further refine the protocol, and present a recommendation to the panel.

Some key themes of the discussion on instream processing (no reconnection):

- Need to come up with an operable definition of the floodplain, and the hydrologic volume that occurs during re-connection (for both baseflow and stormflow)
- If there is little or no floodplain reconnection, than the amount of instream nitrogen processing will be limited?
- There was some support for Protocol 2, Option 1 (Forestry workgroup method that looks at the effect of riparian forests and wetlands in the stream corridor), with some modifications.
- Need an operable definition of the stream baseflow component of N load (i.e, the only effective treatment would be during baseflow conditions
- What % of annual load is in baseflow? Stack estimates 20%. Steve Stewart, Bob Shedlock (USGS) say there's even more variability than that
- Tom proposed an alternative which was to use the actual CBWM pervious land loading rate (discounted by 40% to eliminate surface runoff from pervious lands). Some support for this approach
- Sujay: denitrification can happen in stream: algae, microbes – dependent on amount of light., C/N ratio, O2 levels in stream
    - Combining the options may be a good approach: b/c accounts for variability, allows for flexibility based on specific project
    - Quantitative assessment for contribution of groundwater and stormwater in the crediting process, understanding the site in advance, during baseflow to do a simple water balance preconstruction = b/c groundwater contribution is key to the crediting process

- Some key themes of the discussion on instream processing (w/ reconnection):

- in-stream nutrient processing cuts off during high in-channel flows
- Stewart: most of denitrification taking place in wetland/forest corridors;
- More quantitative assessment of floodplain connectivity (Method 3) = can be done by bank height
- **Stack**: bank height is included in Method 3, but may need to be spelled out a bit more
- Not sure that Method 3 should be predicated on the 1" storm as the event to define the storm runoff volume that is captured in the floodplain. Perhaps a set of curves could be developed to express the new connection storm volume as a function of rainfall depth or runoff depth volume?
- **Kaushal:** May want take a similar approach to baseflow reconnection but base on field measurement of baseflow in the study reach.
- **Berg/Stewart**: challenge with monitoring small streams, accuracy is reduced. Also, daily cycle with baseflow, seasonal variation in baseflow, long-term variation, antecedent rainfall events will affect basefloew conditions
- **Sujay:** could average longitudinal, and daily variation; even if underestimate the baseflow at the time, N is also variable conservative, general approach
- **Solange**: important to determine what the dominant form of export of nutrients in urban streams prior to choosing protocol (possibly via LULC and topography) i.e. is stormflow the dominant form of export → Protocol 3 etc. The large storms define the Nutrient export of streams
- Stewart: need 2 methods: local gov'ts need multiple options: an easy one for less credit, more advanced restoration technique that would allow for more credit keep local governments' resources (and knowledge base) under consideration.
- **Stewart/Meyers:** to write up example projects on Upper Mine Bank Run and unspecified Fairfax County project: describe the project, how it would be credited

Discussion on Other Key Elements of Recommendations: The Panel discussed the proposed write-up on the key non-nutrient recommendations that was supplied in advance of the meeting

Action: The Panel directed CSN to proceed with a more detailed version to be included in the draft recommendations memo, and contributed the following insights

- Section 1: Environmental Considerations and Permitting
  - Medina: IBI only refers to biological health...not necessarily water quality
  - Solange: Meyers: reconnecting/maintaining the riparian corridor necessary, Need to add the following:
    - *A qualifying project maintains or enhances the riparian corridor, compensating for any project related losses*
- Section 2: Qualifying Conditions for Stream Restoration Projects
  - Should the minimum be 100'? Seems reasonable
    - Berg: Spot Treatments: Typical projects are several miles long but only stabilize sections of the stream: Need to differentiate between
    - "study reach" and "work areas" with prevented sediment credit for eroded areas defined by BANCS method and should be clearly articulated in a design example
  - Berg doesn't like qualifying conditions "state-approved design methods" b/c state has not pioneered these designs, Tom suggested adding **a table that indicates the state and federal permitting authorities that need to be consulted regarding restoration projects**
  - Existing Stream Restoration Projects

        - Old projects without BEHI curves will default to interim rate
- Section 4: Stream Mitigation and Nutrient Trading Issues
    - When a 404 permit it is issued there will be an impact
    - Nutrient trading: stream restoration is an option but more stringent requirements
    - Specific bullet for offset (different from trading)
- Section 5: Applicability of Protocols to Non-Urban Stream Projects
    - Berg: define rural vs. urban
    - Not prepared to make recommendations for ag streams for various reasons but the urban rate may apply however will be conservative
- Section 6: Provisions for Local Tracking, Reporting and Verification
    - Duration
        - Stewart: proposed 5 year verification timeframe should be linked to probability of failure i.e. stream restoration projects more likely to fail within the first 2 years; after that should go to 10 years
        - Bob Kerr: do we need a specific timeframe or just tie to TMDL updates?
- Section 7: Pre and Post Construction Monitoring Requirements
    - **Each of the state reps look at the general description and decide if it's good enough**

September 25th, 2012
Meeting Minutes
Urban Stream Restoration Expert Panel

EXPERT BMP REVIEW PANEL Stream Restoration		
Panelist	***Affiliation***	***Present ?***
Deb Cappuccitti	MDE	Yes
Bob Kerr	Kerr Environmental Services Corp.	No
Matt Meyers	Fairfax County	Yes
Dan Medina	Atkins	Yes
Joe Berg	Biohabitats	Yes
Lisa Fraley McNeal	CWP	Yes
Steve Stewart	Baltimore County	Yes
Dave Goerman	PA DEP	No
Natalie Hartman	WV DEP	Yes
Josh Burch	DDOE	Yes
Robert Walter	Franklin and Marshall	No
Sujay Kaushal	University of Maryland	No
Solange Filoso	University of Maryland	Yes
Julie Winters	EPA CBP	No
Bettina Sullivan	VA DEQ	Yes
Tom Schueler	CSN (facilitator)	Yes
Panel Support and Observers: Russ Dudley – Tetra Tech, Rich Starr – Fish and Wildlife Service, Lucinda Power, EPA CBPO, Jeff Sweeney, EPA CBPO, Matt Johnston, EPA CBPO, Bill Stack, CWP, Norm Goulet, Chair USWG, Jeremy Hanson, CRC, Cecilia Lane, CSN		

MEETING MINUTES

Review/Approval of June Panel Meeting Minutes and July Subgroup Minutes: Tom Schueler (CSN) began the meeting by thanking all of the panelists for their hard work and their feedback on the technical report.

ACTION: The Panel approved the meeting minutes from June Panel meeting and the July subgroup meeting. The Panel decided to accept comments on the technical report until October 12, 2012.

Tom noted that a number of panelists have contacted him regarding the framework of the permitting recommendations. **Tom** noted that Nick DiPasquale (Director, CBP) has formed a permitting workgroup for a regional permitting approach to address many of techniques being discussed in panel. The workgroup is entitled: *Stormwater Management, Stream Restoration and Wetland Restoration Workgroup*. **Joe Berg** (Biohabitats) noted that he doesn't think that the Panel is the appropriate place for recommending regulatory guidance rather it is the charge of the panel to focus on water quality TMDL issues. **Deb Cappuccitti** (MDE) noted that as an employee of a regulatory agency it would not be possible to divorce herself completely from any potential conflicts within her administration. **Tom** pointed out that this is not an uncommon situation for panelists, so panel members are encouraged to propose language that allows

flexibility for state programs. **Solange Filoso** (UMD) noted that it might be appropriate to recommend an independent review of the final technical document.

Presentation on Stream Functional Assessment, *Rich Starr, US FWS*
Rich Starr discussed how the stream functions pyramid framework may be a useful tool to ensure that stream restoration projects provide more functional uplift than just increased nutrient removal. His main conclusions can be found in his presentation. The following are some of the discussion highlights:

- Difficult to make changes in level 1; practitioners have most influence in level 2 variables; Site selection is very critical if you want to achieve a healthy stream
- Goal to think about all parameters occur in stream corridor, how they are interrelated and if they are/not functioning
- Where you enter in the pyramid depends on one's goals and objectives
- Can change the performance standard to apply to a specific set of goals
- **Joe Berg** noted that floodplain connectivity and access to organic rich sediments and a good storage volume in the stream channel are all necessary for good stream restoration projects. **Rich** noted that while his examples were focused on NCD projects, other kinds of stream restoration projects could be assessed, as long as the appropriate performance indicators were selected.

Updates on the Floodplain Reconnection Protocol, *Bill Stack, CWP*
Bill briefly reviewed the changes to the floodplain reconnection protocols that were discussed at the July subgroup meeting, indicated how the curves were created for Protocol 3, and laid out the remaining technical decisions that the Panel needs to make on this topic. His main conclusions can be found in his presentation. The following are some of the discussion highlights:

- Basic premise is that denitrification occurs in stream channels and floodplain reconnection. The methods make the assumption that denitrification occurs b/c stream channel/floodplain behaves much like a wetland. Can use wetland studies to apply denitrification credit by estimating how stream channel behaves like a wetland.
- Baseflow (Protocol 2):
    - Surface area is critical to estimate denitrification credit
    - If we meet 1% threshold of the wetland to drainage area surface ratio can meet N removal rates in Table 6 (Step 2)
    - Unit loading rates for pervious areas only and adjusted for interflow
- Floodplain reconnection (Protocol 3):
    - Estimate how much storage volume available in floodplain area
    - Berg: if have floodplain that is connected at 1" return interval, no storage with the 1 year storm? Only get storage for volumes larger than that
        - Larger more infrequent storms have less floodplain reconnection
- Panel Comments:
    - **Solange**: Was skeptical of using wetlands data to project instream N Processing in Protocol 2, noting that wetland removal is greatest during growing season, but may export during fall/winter, no net removal and can lead to overestimation of nitrogen removal Also, wetlands that hold a lot of water can become anoxic, no conversion of ammonia to nitrate, volume of water is not sufficient, need to consider maximum depth
    - **Solange** thought that it might be appropriate to recommend an independent review of Protocol 1.

- Panel: was somewhat skeptical of the "stream as a wetland" approach and that we should review the quality of research studies for both protocol 2 and 3 (issue of riparian buffer vs. palustrine wetland).
- CSN/CWP to come back to the panel with some additional options
- **Bill** to pass along wetland forestry document to panel (via Russ Dudley)
- **Cappuccitti –**asked **Bill** if the Protocol 3 considers floodplain connection at various depths along the stream restoration project, **Bill** felt this was a good point, and suggested it was possible to develop estimates based on each reach
- **Berg** thought it may be too difficult to develop such estimates even with many data points, further discounting not good
- **Deb** suggested adding verbiage to explain how to possibly deal with situations with variable connection depths, e.g. break reach into segments or take an average.
- **Panel**: Both Protocol 2 and 3 may need additional qualifying conditions regarding floodplain reconnection design (min residence time, max ponding depth, defined bank height ratio, etc.
- **Solange**: On Protocol 3, new study from NC show frequency of inundation along floodplain, high frequency of flooding is more important than volume

ACTION: Tom and Bill to put together a draft of supplemental site design criteria to support Protocol 2; other panelists are encouraged to provide their input as Tom and Bill draft the list

ACTION: Tom and Bill to revisit wetland issue for Protocol 2 and check the scientific justification for wetland restoration efficiencies provided in Protocol 3

Rapid Feedback on First Draft of the Final Technical Memo Each panelist was asked to take 3 or 4 minutes to provide specific feedback on what they liked (and didn't like) about the first draft. Their main points are listed below. Due to the number of panelists who were unable to attend the meeting, the Panel decided to extend the comment period until **October 12, 2012**.

- **Dan Medina**:
  - One concern with the use of the word "meaningful" on page 25 in the following statement: "*...applicants should demonstrate that meaningful upland restoration practices and /or stormwater controls are being coincidentally installed*" - how to define meaningful?
- **Josh Burch**
  - Sections 4.1 and 4.2 need to be re-worded
  - Dry channel RSC referred to as Protocol 4 but if RSC is BMP then is it really a separate Protocol?
  - Concerned with Pre/post construction monitoring requirements – should the recommendations give people a choice of what to monitor.May not want to be prescriptive, what to monitor is dependent on objectives

ACTION: Panel decided to omit the monitoring protocol from the document

- **Natalie Hartman**
  - Need better definition of an urban stream
  - Non-urban stream restoration definition needs to be added
  - She was unsure how urban stream restoration ties into MS4 entities

- **Tom** felt it would not be necessary to distinguish stream restoration for MS4 and non-MS4 areas since they are visible enough projects that require so many permits regardless of MS4 classification

- **Steve Stewart** decided to hold his comments until later

- **Lisa Fraley-McNeal**
  - Was curious about how the recommendations will tie into the Bay Watershed Model. **Tom** indicated he would follow up with Matt Johnston from CBPO modeling team about the issue

- **Solange Filoso**
  - Requested that she be allowed to submit her comments to **Tom** and the rest of the panel by email
  - Noted that there are a few studies in Anne Arundel county that the panel could use to validate the approaches (with observed data)

- **Joe Berg**
  - Reiterated his perspective that a meaningful floodplain connection should be considered under Protocols 1, 2, and 3 together.
  - Will work with Bill Stack and Tom on the floodplain reconnection section (Protocol 3) and to forward those edits to **Tom** and the rest of the panel

- **Matt Meyers**
  - Suggested that the a note be made at the end of each protocol regarding meeting local TMDLs
  - Commented that he would send a link to the USGS presentations on the Difficult Run study that was mentioned during the June panel meeting – data will help support the work that the panel is doing
  - **Note:** the Difficult Run presentations have been added to the sharepoint site

November 7th, 2012
Meeting Minutes
Urban Stream Restoration Expert Panel

EXPERT BMP REVIEW PANEL Stream Restoration		
Panelist	***Affiliation***	***Present ?***
Deb Cappuccitti	MDE	Yes
Bob Kerr	Kerr Environmental Services Corp.	No
Matt Meyers	Fairfax County	Yes
Dan Medina	Atkins	Yes
Joe Berg	Biohabitats	Yes
Lisa Fraley McNeal	CWP	Yes
Steve Stewart	Baltimore County	Yes
Dave Goerman	PA DEP	No
Natalie Hartman	WV DEP	Yes
Josh Burch	DDOE	Yes
Robert Walter	Franklin and Marshall	No
Sujay Kaushal	University of Maryland	Yes
Solange Filoso	University of Maryland	No
Julie Winters	EPA CBP	Yes
Bettina Sullivan	VA DEQ	No
Tom Schueler	CSN (facilitator)	Yes
Panel Support and Observers: Jeff Sweeney, EPA CBPO, Matt Johnston, EPA CBPO, Bill Stack, CWP, Jeremy Hanson, CRC, Cecilia Lane, CSN		

MEETING MINUTES

Review/Approval of September Panel Meeting Minutes: Tom Schueler (CSN) began the meeting by thanking all of the panelists for their hard work and their feedback on the technical report.

ACTION: The Panel approved the meeting minutes from September Panel meeting.

Update on Panel Next Steps: Tom briefed the panel on the next steps to get the recommendations approved through the CBP BMP review protocol process, including coordination with Bay modelers, informal review by other experts, and the agricultural work group, and the proposed approach to get input and approval from Urban Stormwater Workgroup, Watershed Technical Work group, the Habitat GIT and the Water Quality GIT. Tom also described how the various technical appendices will be developed.

- 11/20/12 Bay Program Modelers and Scenario Builder Team to make
- Coordinate with Ag Workgroup on non-Urban Stream Restoration recs
- Face-face in December at Fish Shack with USWG and WTWG and members of Ag workgroup
- 30 Day comment period for the states
- After which will be submitted to 3 GITs
- Will be working with CWP to develop the appendices, meeting minutes and technical documentation

- Lisa has volunteered to present recommendations at the workgroup meeting but all panelists would be welcome to attend and participate in the meeting.

Key Changes in Second Draft of Expert Report: Tom went over the key changes in the second draft of the panel report as follows:

- The Hyporheic Box Method: **Bill Stack** (CWP) presented an empirical method for determining N reduction via denitrification during baseflow that was recently developed by Sujay, Bill, Tom and Paul Mayer. This conservative approach defines the geometry of a hyporheic box associated with a stream restoration to which a unit denitrification rate is then applied. The Panel was asked to decide whether this approach is better than the existing Protocol 2 method.
    - **Dan Medina** noted the following:
        - Bank height ratio needs to be clarified
        - Asking for a degree of precision that will be difficult to meet by practitioners
    - **Deb Cappuccitti** asked about the average bulk density conversion rate
        - Tom clarified that an implementer must measure bulk density at each individual site
    - **Joe Berg** asked about the carbon content
    - The Panel generally likes the method, **allow for a 3-day period to establish better qualifying conditions and let Tom know of any questions or concerns**
- Use of Jordan (2007) CBP-approved nutrient removal rates for floodplain wetland restoration projects
- More general approach to stream functional assessment methods
- Reorganized and slightly modified Protocol 1
- Updated curves for floodplain reconnection
- Revised design examples
- Less prescriptive text on pre and post construction monitoring requirements
- *Floodplain Reconnection Criteria for Protocol 3*
    - **Dan Medina** commented
        - Tied to the 1-year event,
        - Floodplain surface area to drainage area
        - Bill to make a recommendation to define extent to floodplain
        - Frequency a component
        - Add a visual representation
    - **Joe Berg** said should remove the residence time condition
        - Surface area wetted and the frequency of wetting
    - **Tom** clarified that trying to prevent a 10-minute inundation of the floodplain qualifying for the credit
    - **Dan** suggested changing the x-axis
- Future research and management priorities
- A six month window to "test drive" the protocols to make sure they can be properly applied by users
    - **Deb** questioned why the extent should be limited to 6 mo
    - **Josh** supports the idea of a timeline approach

DECISION: The Panel decided the Hyporheic Box Method is a suitable replacement for Protocol 2 but will have until Monday, November 12, 2012 to establish any additional qualifying conditions.

Panel Feedback on the Key Changes: Tom asked the panel for their feedback on the second draft of the expert panel report. The following are a few major points that were made:

- Tom noted that sediment reduction had been left out of Protocol 3 due to the lack of existing data.
- Tom asked the Panel if it would be okay to add a sediment credit to Protocol 3
- The Panel noted that at a minimum Protocol 3 should receive credit for sediment removal equal to Protocol 1 but probably should be greater.
- **Matt Johnston** noted that streams should be consistent with the way BMPs are put into the model and recommended a comparison to the interim rate
- **The Panel** decided to create a comparison table that demonstrates the lbs/ft reductions associated with the different Protocols as (either individually or collectively) they compare to the interim rate.

ACTION: Any additional comments/edits on 2nd draft get to Tom/Bill by November 21st. Tom and Bill to put together the Appendices by the December meeting**.**

Panel Feedback on the Final Recommendations: Each panelist was asked to provide final comments on the report by **November 21st** and indicate whether they would be comfortable with endorsing the final recommendations as written, or identify specific changes that are needed to get their support. Based on the feedback, the Panel, as a whole, decided to approve the final report, contingent upon the completion of specific changes requested.

Tom thanked the panel for all of their hard work and commended them on a great set of recommendations and specifically thanked Bill Stack and Lisa for their help on the final recommendations. **Dan** thanked Tom for his leadership on the Panel.