**Minimum Design Criteria (MDC) Team  
10/27/2014  
Triangle J COG, Durham**

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| **Attendees** | | | | | |  |
| ***Team Members*** | |  | | |  | ***Others*** |  |
| Eban Bean  Bradley Bennett  Jonathan Bivens Tim Clinkscales Tracy Davis Boyd Devane Hunter Freeman Mike Gallant Joe Hinton  Marc Houle Ron Horvath Bill Hunt  Linda Lewis |  | | Brian Lipscomb Annette Lucas  Mike MacIntyre Todd Miller  Cameron Moore Tom Murray Robert Patterson Derek Pielech Peter Raabe Larry Ragland  JD Solomon Virginia Spillman Toby Vinson Rob Weintraub |  | | Julie Ventaloro, NC DEMLR  Ben Brown, City of Raleigh |

**Bioretention***Annette had handout of potential MDCs which were pulled from the BMP Manual.* **Item 1 – Excess Flows**Bill H- Instead of having overflow device inside the device, put it outside the device. Water comes in on curbline, cell fills up, water keep going down curbline, I think that’s a reasonable device. Don’t need overflow device inside the cell or even immediately adjacent to it.  
Marc – Would that be okay for larger storms, larger than the design storm?  
Hunter – Are we talking about #1 and #7 here?  
Bill H -One is water quality depth, then additional volume ponds over that cell for a limited number of hours for peak flow mitigation. We should allow that, in my opinion. They’ve been successful with 6 inches in addition to 12 in Philadelphia. If we do that, we have to make sure we maintain these things.  
Annette – What’s the deepest ponding depth for temporary flood control?  
Bill H – 24 inches.  
Ben b- Is there a time limit?  
Bill H – Size it to capture 12 inches for water quality, then another 6 inches with no orifice. So 18 inches, sole mechanism would be infiltration, which means you’re capturing 1.5 inch event here; then another 6 inches above what would be your orifice for peak flow mitigation.   
Robert – He’s saying you can have your overflow up to 6 inches higher which is different than what #1 is saying.  
Brian L – What about cells with grass? We’ve put 3 feet in there and grass is fine.  
Bill H - Trick is to maintain the right infiltration rate. Some here in Raleigh, vegetation struggles for a while, but has come through it. Let grass grow up a bit too, which helps performance of the system.  
Mike G – Is bioretention required that it be offline where bypass flow can’t go through?  
Annette – No. It’s typically designed with riser in cell with 12 inch ponding depth but with large orifice so storms go through system; had no value for peak flow mitigation in the past.  
Mike G – Can’t do a riprap spillway?  
Robert – Yes, you can.  
Annette – Do we still want to say 9 inches is preferred?  
Linda – No point in having it in there if we’re not going to enforce it.  
Virginia- There is always settling, so if start with big planting depth, you end up with a lot more.  
Joe – We are having problem with settling.  
Annette – So start with less than 12 inches ponding depth?  
Virginia – That’s my preference, but I understand concerns with that.  
Jonathan – I understand settling, but are you also getting siltation back?  
Joe – If you’re filling back in with sedimentation, you’re getting a different percentage; you’re getting up to 20, 25% fines. You need to keep fines out.  
Jonathan – If people operate them long term and almost any stormwater, there is some kind of particle in it.  
Joe – Filter medium -- when we get to that --we may address that then.  
Jonathan – Is there a curve, a median where elevation ends up?  
Bill H – Looked at 43 randomly-selected cells across the state. 2/3 of them had less storage volume than they were supposed to. 1/3 had more storage volume. Most of the time it was depth related. Most of time, depth was not as deep as specified on plans. We had problems teasing out exactly why – overmulching is one example.  
Annette – Should we keep ponding depth as 12 inches or less or change that?  
Hunter – For water quality storm, 12 inches is fine. But I agree with temporary flood control.  
Robert – We need a better construction spec to account for settling.  
Jonathan – But settling may not be problem. After functioning for years, if 2/3 are shallow, settling not the problem. We have bigger problem later on that is causing device to flip.   
Bill H – We do need a soils spec.  
Annette – That’s on our list. Here’s what I have now: Ponding depth shall be 12 inches or less for the water quality volume. For peak flow mitigation, water may be ponded up to an additional 12 inches. The peak flow outlet elevation shall be a maximum of 18 inches above the planting surface.  
Robert- In #1 we call it an overflow device there -- should we keep terminology consistent?  
Brian L – Wouldn’t overflow be additional to peak flow volume you’re capturing?   
Annette – So storms in excess of design flow -- your design flow could also be for some peak flow mitigation as well.  
Ben B – Can we caveat that? We have people arguing about what the design storm means. Could we say it could be both?  
Jonathan – I think we need to go back. The bypass device may not be in this bioretention cell. It could be prior to entering cell, so do we need to restructure this to incorporate that? This language almost prohibits having the overflow outside the device. Need to rewrite this.  
Robert – To clarify that you could say outlet device may be inline or offline.  
Hunter – Or flows in excess of design storm may be bypassed. These can still be inline devices.  
Rob W – If it’s offline, it means before it gets there. You wouldn’t have same peak flow depths calculated, so Rule 7 has to be “A” or “B” to go with Rule 1 being “A” or “B.”  
Jonathan – Might allow you to have a device to control elevation but not be an entire bypass. That gets into peak vs greater than peak vs water quality. Designing for 25- or 50-year storm, then you have water quality below that.  
Rob W – My question is going back to concept of MDC. Should we be concerned with water quality and storm, or do we need to get down to the minimum which is storm?  
Hunter – Minimum is defined as TSS level and function in perpetuity.  
Annette – You have to have design storm figured out to meet TSS. Water quality storm is focus of MDC, right? Then peak flow and flood control should be in design.   
Hunter – If the standard is the same as a wetland but has a cap of 12 inches, we can look at language from wetland and just say maximum ponded depth. I’m not sure if it’s an easy addendum to wetland language or not. Probably no maximum on top of wetland, but there is a maximum on top of bioretention.  
Peter – Why is there a max on top of bio retention cell? If have good infiltration rate, will be able to infiltrate huge surge of water.   
Brian L – Certain plants don’t like to be inundated, so wouldn’t want to cover them with water.  
Peter – But for sandy basin with fast infiltration, they’ll be covered for short period of time.  
Bill H – If we were sure the systems would infiltrate like they’re supposed to, 24 inches would be too restrictive.  
Hunter – Can we say depth exceeding 12 inches but no greater than 24 inches? Might be confusing, but at least we’d have consistency.  
Robert – Some of recent designs for bioretention, the 100 year stage isn’t staging up that high.  
Hunter- In Raleigh, with 10 year peak flow, they look at routed depth. They don’t look at where orifice sits. I want to make sure here if the group thinks it needs to be addressed, are we talking about routed depth or elevation of overflow – extended detention vs flow through? If orifice is at 18 inches, the 100 year may still pond 40 inches deep but it’s all going through catch basin, so it’s leaving quickly. We have 3 stages, so to the extent we can clarify that -- ponding depth shall be 12 inches or less for the water quality volume. For peak flow mitigation, water may be ponded up to an additional 12 inches. The peak flow outlet elevation shall be a maximum of 18 inches above the planting surface.  
Annette – Change EXCESS FLOW item to: PEAK FLOW MITIGATION. The bioretention cell may be designed to temporary pond storms exceeding the design storm at a depth exceeding 12 inches but no greater than 24 inches for peak flow mitigation. The peak flow outlet shall be a maximum of 18 inches above the planting surface.  
Jonathan – We still need language about bypass.  
Linda – Maybe it should be two separate criteria.  
Annette – Change Item 1 to 3 different items: 1. MAXIMUM PONDING DEPTH FOR WATER QUALITY STORM. The maximum ponding depth for the water quality storm shall be 12 inches. Item 2 would be PEAK FLOW MITIGATION. The bioretention cell may be designed to temporarily pond storms exceeding the design storm at a total depth exceeding 12 inches but no greater than 24 inches for peak flow mitigation. The peak flow outlet shall be a maximum of 18 inches above the planting surface. EXCESS FLOWS. Bioretention cells shall include an overflow device or a bypass for storm flows in excess of the design flow.  
*Group agreed to all three of the above items.*

**Item 2 (now Item 4) SETBACKS FROM WATER SUPPLY WELLS**  
Annette – Should this be moved to general MDC?  
*Group agreed it should be moved to general MDC.*  
Joe H – Need 15 foot separation from septic system (groundwater absorption).  
Brian L – We need to doublecheck our infiltration: 50 feet from private wells; 100 feet from public. But does that disagree with water supply rules --   
Tim – Can local health department still give variances? Shouldn’t health departments deal with this, not stormwater people?  
Joe H – Folks are designing them without knowing setbacks, so we need to put something in there to prompt designers to check.  
Tim – But that’s their job to know all this stuff.  
Jonathan – There are hundreds of rules and regs that could apply to this for various things. If we rewrite all of those, this will no longer be a short form. I think we have a general statement somewhere else that states all other rules and regs apply.  
Joe H – Doesn’t need to be here, but if going to address water supplies, also need to address septic systems.  
Annette – If public water supply updates their regs, then ours will be out of date.  
Joe H – Need to prompt designers to check with the appropriate authority. I’d take that whole thing out and put it in general recommendation to check with appropriate regulatory agency.  
Jonathan – Designer is supposed to know all these things. We can’t put all those in this rule.  
Ron – You can work it down to local level – there’s all kind of stuff that puts restrictions on it.  
Joe H – Take that whole thing about the water supplies out. Opens up can of worms. Let them fight the local people.  
Jonathan – Don’t want to write rules that change when other people change them.  
Annette – So this will be a recommendation in general MDC: Stormwater facilities are not allowed in a number of setbacks, buffers, etc?   
Todd – You don’t want to say we’re just recommending you check for all these other rules.   
Annette – What do you want Item 4 to say? How should it be worded?  
Robert – Permits say must be in compliance with other state and federal regulations.  
Annette – So move this to general MDC: COMPLIANCE WITH OTHER APPLICABLE REGULATORY PROGRAMS. Siting and design of all stormwater control measures must comply with all applicable federal, state and local requirements.  
Julie – If this is an MDC, will someone have to demonstrate compliance with all local regs before we issue a permit?  
Linda – If I see something that is an obvious error with another regulation, I will point it out. But I don’t say you must do this before we issue a permit.  
Robert – We don’t have legal authority to enforce somebody else’s rules. Can we put it in as a general statement in narrative of BMP Manual?  
Annette – To me it seems like a mismatch if we’re putting it in permit, but not in rule.  
Jonathan – How do you require it if it’s not in a rule? Most of projects we bid, in general conditions it’s written in contract that you have to adhere to all state, local and federal regulations. Period. It’s in all contracts to do that.   
Tim – So if it’s a checkbox in MDC, can they hold the permit up?  
Rob W – The only way you can issue the stormwater permit would be that everything else is in line? It’s a timing issue, so we need to have as much flexibility as possible in the wording.   
Peter – From permitting process standpoint, is it better to find out about this stuff on the front, even though it’s outside the jurisdiction of the stormwater reviewer? It’s on the person getting the permit, but seems as though having that check in place would help efficiency.  
Tim – I agree it could help efficiency. When there’s ambiguity and you hold up a permit, that’s where the problem is.   
Mike G – If we’re talking about a fast track process, then you’re reviewing the plans on the back end, the as builts. If I send you as-built plans with septic system under wet pond, then I deserve what’s coming to me. That’s where you run into problems. If you see a site plan, they dug the well closer than it should be, at that point, that’s a civil liability case. I think it’s right for the reviewer to point it out. I would personally like to get a comment that I missed something.   
Peter – How do you encourage that comment to happen?   
Mike G – Designer should be aware of the setbacks --  
Robert – Something general in Manual, not necessarily a checkbox.  
Virginia – We handle it as a note on the plan -- All necessary approvals have been obtained from 404/401. If they don’t have it, we ask for copies to be submitted to us. If you don’t have it, you can go back to environmental consultant. Then you’re liable because you put it on the plan.  
Mike G – For sewer, you check a box for meeting the minimum design criteria. So if you’re not 100 feet from water supply well, you explain why you’re requesting a variance to that on the application.  
Jonathan – To Linda’s point – she catches something, puts it on there. If designer disagrees, what basis can she reject that permit?  
Linda – I can’t. I’ve done my job, pointing out discrepancy.  
Annetete – If everything in permit is ready to go except well setback not adequate, would you issue the permit?  
Linda – Because of the way it’s written today -- 50-foot setback -- that wouldn’t be an issue.  
Annette – No one’s arguing that if the reviewer’s aware of discrepancies with other rules, nice to have designer point it out. But we seem to disagree whether should be recommendation or MDC?   
Brian L – Can it be in rule, but not as MDC? If it’s not in this rule, but it’s in another rule, like the water supply wells rule, you notify the people that do have the authority (water supply, septic). Then let them handle that.  
Annette – So are you saying you want DEMLR to have this as a requirement?   
Brian L – I’m saying you notify the person with the authority over the rule.   
Annette – I don’t think anyone disagrees with that, but should DEMLR be able to put project on hold until they address the issue?  
Jonathan – Right now she has no basis for holding the permit.  
Tim – When you put that statement in there, you’re opening it up to every other rule on the books.  
Mike G – Probably most issues are with separations of utility crossings. DEMLR doesn’t have to see profiles for stormwater reviews.   
Annette – If we put this in MDC, that could be part of compliance later on. If we put it as recommendation, then we don’t have teeth to hold it up or enforce against it, but we can notify the authorities.  
Mike G – Stormwater rules don’t say anything about utility crossings. You rely on sewer and water to set those and keep track. Same situation here.  
Linda – That 50 feet is not for protection of infiltration; it’s for protection of well.  
Rob – Has nothing to do with stormwater or MDC’s we’re discussing now.  
Peter – Will MDC form for permit have checkbox that Mike G was talking about?  
Mike G – If we don’t put that in MDC, wouldn’t be included. But other programs already have these in their rules.   
Todd – You’re certifying on application that project complies with all federal state and local programs.  
Hunter – I don’t think it’s the stormwater program’s problem.  
Marc – I think it should be a recommendation, but it would be hard to enforce.   
Todd – Isn’t it the designer’s responsibility?  
Ron – Exactly. I’m responsible for covering all the bases.   
Hunter – So I get hired to design a bioretention cell. Some other firm is handling lot layout, roads, etc. How do I certify it will meet all those other rules?  
Linda – But it does say siting and design of stormwater control measures. You’re not signing off that whole project meets rules – just the design of stormwater control measures.  
Jonathan – The Corps of Engineers is overarching on DOT work. Until you have all your other permits, they won’t sign off. That’s how they are. All of these laws apply to every project. If you’re just doing it piecemeal, part of the function of this law is to protect owner as well. Someone has to make sure consultants are talking. If this one is designing low pressure sewer, this one stormwater, someone else reviewing buffers, there is some interconnectivity.   
Tim – But that’s not a state law problem.  
Jonathan – If every permit just has to meet its silo, Linda can’t reject the permit; other person can’t reject permit, then owner stuck with it.  
Rob – Stormwater is where we begin with a lot of our subdivision design these days. Problem I see is what Jonathan was talking about. Last guy to sign off makes sure everything is in place. So to have this in rule doesn’t make sense in stormwater.  
Mike G – Will always be issues you don’t know about.  
Joe H – Right now, if I leave it as it is, it’s a rule. If it goes into recommendation, is it a rule?  
Annette – No.  
Joe H – You’ve got things in there that are going to change the 100 feet – we need to take it out of here and decide where we’ll put it.  
Annette – How about this as a compromise? Now DEMLR is divorced from DWR – we don’t even have buffers. What if we said you have to comply with all DENR programs as a general MDC; then complying with other regulations would be a recommendation. Doesn’t open up every single thing this way. How about this in general MDC: Siting and design of all stormwater control measures shall comply with all applicable DENR requirements. The project should also comply with other applicable federal, state and local requirements.  
Tim – We’re always talking about consultants not doing a good job, how do we protect the public from agendas regulators might have? How do we check the regulators? What does limiting it to DENR limit it to?  
Todd – If you go back to the enabling legislation, it says MDC shall comply with water quality standards. That’s very broad – the water quality standards.   
Mike G – So water quality standards will cover wells and wetlands --  
Annette – What do you all think of the above compromise? Can hold up permits based on compliance with DENR regs only? Would you all feel more comfortable?  
Hunter – I think we should repeat the legislation in this rule.  
Todd – I think you’re sort of capturing it with limiting it to DENR.  
Peter – Just pull language from the law and make it a general MDC. All general MDCS shall comply with statutes. That goes back to root of law and is protective of water quality.  
Annette - I’ll go back and look at the statute and put those in. So now we have this as general MDC:  
 COMPLIANCE WITH OTHER APPLICABLE REGULATORY PROGRAMS. Siting and design of all stormwater control measures shall comply with all applicable DENR requirements under General Statutes. . . .(move language on WQ statutes from H480). . The project should also comply with other applicable federal, state and local requirements.  
*Group agreed to above language.*  
  
**Item 3 (now Item 5) SITING 1**  
Robert – Why don’t we just copy infiltration language?  
*Group agreed to*: SEPARATION FROM THE SHWT. The bottom of bioretention cell shall typically be a minimum of two feet above the SHWT. However, the separation can be relaxed to one foot when the applicant can prove that the water table will subside to its pre-storm elevation in five days or less.  
  
**Item 4 (now Item 6) SITING 2**  
Bioretention cells shall not be used in drainage areas that are not permanently stable.  
Linda – There’s always issue of when something stops being sediment device and starts being stormwater device.  
Mike G – When do you stabilize the vacant lot?  
Robert – More important when lot using crush and run which is “stable,” but there will be a lot of fines.  
Ron – Not a matter of construction; matter of permanent placement. Don’t design bioretention when you know upstream area is going to be disturbed. For example, don’t use bioretention downstream of mining operation.   
Annette – It might be both.   
Mike G – Now you account for all of what you’re going to disturb, or you have to do separate plan for each lot. You end up doing erosion control for all lots in subdivision, build traps, when you stabilize everything, they go away. But when build house, still have erosion plan that covers that lot. Otherwise, erosion control inspector would say have to do erosion plan for individual lot.  
Todd – What do words “permanently stable” mean?  
Robert – Shouldn’t use in areas with high sediment flow.  
Hunter – Should be recommendation to stabilize upstream area but not an MDC. Always going to be   
questions related to phasing.  
Jonathan – We already have a general MDC #8 that addresses this: cleaning out sediment practices --  
Hunter – My vote is to strike this one.  
Todd - What about flood prone or high erosion areas?  
Jonathan – We go back to don’t put it anywhere stupid. That’s the other reading of this. Is it stable due to offsite, not due to your project.  
Annette – Siting recommendation: Bioretention cells should not be sited in areas that are prone to long-term erosion or high sediment loads. Does this sound good?  
*Group agreed to this as recommendation.*

**SITING 3**  
*Group agreed to strike this.*  
  
**SIZING**  
The bioretention cell shall be designed to hold the design storm volume assuming no infiltration will occur during the storm event.  
Bill H – I can tell you why it’s there. There’s a factor of safety associated with design. Extent to which systems were underdesigned, we could limit number of cells that underperformed to almost 35% from 2/3. 35% is not particularly good, but better because of conservative sizing.   
Mike G – Is that because of variability in infiltration testing – the uncertainty in that?  
Bill H – Reason they were underperforming were bowl size too small. Construction -- not calcs -- were incorrect.  
Ron – Would you say that majority of those didn’t have an adequate as-built survey performed?  
Bill H – Absolutely. If we required as builts of the ponded area, then I think we can be less conservative.  
Ron – Anyone have strong objection to providing as builts by registered land surveyor?   
Annette – That’s something we can address.  
Ron – Went back on systems built in late 90’s in which contractor provided as built. Found out 20 years later they weren’t even close.   
Mike G – In fast track scenario, when I certify sewer design, I have to provide a set of as builts.  
Tim – That’s something you shouldn’t certify. Seal it that it meets the requirements.  
Mike G – I require a surveyor because if I tell someone it’s correct, I can’t practice surveying.  
Annette – Challenging that we need to do MDC before we do fast track – but we’re getting off topic a bit.  
Bill H – For a long time, we’ve operated on premise that being off a couple inches in device is okay. But in bioretention, inches do matter.   
Annette – This is easier and folks are used to it.  
Bill H – I’d like to have practices be smaller, save money.  
Tim – Even if we had best sand on earth, we can’t use one inch of our infiltration rate --  
Hunter – I think this should stay in here. DENR’s enforcement of as builts is very different from enforcement by local communities. They have power to hold CO back – DENR doesn’t have that.   
Annette – DENR staff is busy. We may or may not have time to compare as builts to what we approved.  
Robert – Since we always get as builts, can we offer an alternative design at the local level based on routing?  
Annette – Point of BMP is that the stormwater go through media in short period of time. And if you can develop standards that differ but meet that objective, that would make sense.   
Annette - I’m hearing people supporting #8 as it’s written.  
Ron – When a muni sees #8, they’ll see you have to do this. It’s a requirement. No language that says alternative design is acceptable.  
Annette – There will be some overarching alternative language that we’ll work on.  
Bill H – Can we highlight it in yellow to make sure we go back to it?  
Derek – I think some sort of allowance for variances – we allow variances to this in Wilmington for site restrictions if show compliance with routing.  
Mike G – If make this easier to do compared to wet pond, you’re ahead of the game.  
Annette – Because of the ponding issue, it’s inherently a larger practice --  
Bill H – Goal for our state is to put practices in at right size so we achieve water quality needs, mitigate hydrologic impacts, and keep costs down. The way the curb practice is right now, we can get a 1.4 inch event totally captured with a cell sized to capture one inch. We need a way to ensure systems go in like they’re supposed to. There’s no practice that competes with water quality benefit of bioretention as far as pathogens, temperature, phosphorus – if it’s designed right. So let’s try to make it more user friendly, make footprint smaller by adding variance or other criteria.  
Annette – With Stormwater E-Z, that’s already in there.  
Linda – I don’t think there’s any problem with being able to allow the ponded depth to take into account the infiltration that occurs during a storm event. It is today because of the way the rule is written. But I think they need to apply factor of safety to the infiltration rate, like 50%.   
Peter – That approach seems good in my mind. I agree with Bill. As far as stream health, the more bioretention we use, the better off we’ll be. If sizing is disincentive, we should figure out way to set up rules to not create that disincentive.  
Hunter – Do other BMPs have sizing requirement?  
Annette – They don’t.  
Hunter – They say how to determine volume, but not how to size it specifically. If it’s not addressed in other BMPs, why address it in bioretention cells?  
Annette – Address it in guidance? Let people route if they want to?  
Mike G – We should encourage people to do routing calculations. You can now design wet ponds without doing routing.  
Hunter – If someone came in and asked for something smaller than minimum, should that be the minimum? Now I’m talking myself out of keeping this and not address sizing at all. We talked about ponding depth. What about treatment trains?  
Bill H – This is being sized so you take all the water – this is your one shot, nothing going on downstream.  
Annette – So Hunter, you’re proposing --   
Hunter – Keep maximum ponding depths, but strike this item.  
Ron – Detention element can be larger than treatment element – using cisterns, sending out to bioretention. Don’t need a lot of ponding depth in this scenario. Controlling input size.  
Hunter – To say that one bio cell has to have a certain footprint seems overly prescriptive.  
Annette – So do we just delete the sizing item? Let the ponding depth handle that?  
Peter – Back to the beginning of the conversation -- structures not built as designed are not working.  
Jonathan – Contractors built the devices, turn them over to business development, homes. Landscaper comes in and regrades everything.   
*Group agreed to strike this item, but we need to review as builts, compliance on back end.*

**CELL GEOMETRY**  
Bill H – I don’t know why we have this here. I think we inherited this from Maryland. It’s about developing “microclimates.”  
*Group agreed to strike this.*  
  
**PRETREATMENT**  
Annette – Chapter is more specific. Took out a lot of this language for purposes of MDC.  
Bill H – Pretreatment is about achieving certain inflow velocities.  
Ron – From BMP Manual, “Pretreatment Options,” paragraphs one and two don’t seem to go together. Most bioretention is heavily impervious areas. If you’re doing a road strip, you might have sod as pretreatment, but the way second paragraph reads, you must be designed for pretreatment. I don’t think I’ve ever put a pretreatment on a parking lot. Sheet flow from parking lot into cell without going through grass strip or sod. Might go through mulch before reaching bioretention media. Problem with sod – tires destroy grass strip around edge so it doesn’t function. I don’t think requiring pretreatment in urban areas will work.   
Peter – I’ve been trying to figure out how this works with curb and gutter extension retrofit. This says you can’t do bioretention there because you’d need pretreatment.   
Bill H – Riprap could be the pretreatment. It’s an energy dissipator. If you slow your velocity down, that’s essentially the purpose of pretreatment. That and trash, sediment, which will accumulate in zone where velocity has been slowed. One thing about bioretention is it tends to be accessible from all angles, so trash pickup is easy.   
Peter – Remove 9, keep 10.  
Annette – So completely focus on inflow velocity for pretreatment purposes?  
Brian L - For inflow, can we say inflow must be non-erosive velocities?  
Jonathan – If go to grass swale, it’s no longer sheet flow. But if that’s what works, that’s what you use.   
Annette – So make Item 9 (PRETREATMENT) a recommendation and keep 10? INFLOW. Inflow shall be at non-erosive velocities (for example, one foot/second for mulch and three feet/second for grass).  
*Group agreed.*

**MEDIA MIX**  
Joe H – The soil mixture we’re finding is having issue with compaction. We have 8-12% fines; but some sands also have fine sands. When fine sands are there, you get considerable compaction. That reduces amount of medium and greatly reduces infiltration rate. This drop in infiltration rate occurs after only a couple rain events. Crusting is only half the problem. When you dig down, you bring up clods. That shouldn’t happen with sand. In septic systems, when you do a sand filter, it is a prescription washed sand that’s not good for anything else. It is a coarse sand. You have to look at percent of fine sands. This is a work in progress. We’re going through process of separating mixture, getting rid of fines, and taking just that sand and seeing what’s left in there. Some sand has mica in it. Mica goes down and we get a shiny filter paper.  
Mike G – Have you tried manufactured sand?  
Joe H – It doesn’t say that. We’ve used 92% sand, and it was the worse infiltration rates that we had. We’ve done them at surface and subsurface. Some of subsurface was better, but right above the woven fabric, they put another yellow sand there vs organic looking material above it. Water poured over sand was standing. Should be using coarse sand. Also, in infiltration devices, they should be using coarse sand.  
Mike G – Are we requiring filter fabric in infiltration devices?  
Joe H – Not required.  
Bill H – I agree with Joe. We should know more about sand vs fine sand. When we did that survey of bio cells, we timed drawdown, and it wasn’t as good a relationship based on sand vs silt/clay because of amount of fine sand in pure sand mixtures.  
Jonathan – There are some naturally-occurring pockets down east that have clean, coarse sand. You need a requirement for it. Most manufacturing done under ASTM.  
Joe H – We’re trying to determine what amount is excessive.   
Bill H –We’re trying to hash this out also.  
Annette – So it sounds like Bill and Joe are working on this issue.  
Bill H – Communicating with Bill Lord as well. I’ll make sure Joe is part of this correspondence. Let’s say for the next meeting.  
Jonathan – These percentage ranges here are very tight to be practical to produce economically. When you look at a 3% range for sand – how are you going to check that? Let’s make sure it’s commercially available and we can practically produce it.  
Annette – Are we okay with letting Joe and Bill get back to us on this next month?  
*Group agreed.*  
Robert – Can we throw in for consideration other types of manufactured media, like Stalite?

**MEDIA PERMEABILITY**  
Joe H – Internal permeability can meet criteria, but surface permeability may not.  
Annette – In my reviews, I never really checked the permeability specifically.   
Joe H – What depths are we talking about? There are a lot of people that don’t certify that.  
Annette – My question is can we assume get performance we want if media is correct?  
Bill H – If we get media and compaction right, permeability should be okay. Permeability is a moving target – different now vs a couple years from now. We didn’t know that very well 5-10 years ago. Maybe permeability can be a target, not a requirement.  
Annette – This is difficult to implement as a design criteria. It’s more of a verification of a design criteria.  
Ron – Maybe this is more of a maintenance spec?  
Joe H – Who maintains them?  
Ron – That’s a whole other issue.  
Joe H – Surface and subsurface systems are required to be checked and certified to local health department so we know they’re working. But right now with these, what is being checked, maintained?  
Robert – Phase 2 permit requires annual O&M report. We prefer a PE or landscape architect or somebody that’s taken the class do the inspection.  
Mike G – When you find it’s not infiltrating, what do you do -- replace media?  
Ron – First need to find out the problem.  
Joe H – Say it’s the filter fabric – replacing the media won’t solve it. Lots of things might be creating the problem in a given system.  
Todd – What percentage of these systems have problems?  
Bill H – In our survey, it was 6%.  
Rob W- Will people move away from using bioretention if we make O&M things too stringent?  
Bill H – Pretty simple. If you see water ponding after a rain event, it means it’s not working; if you don’t see water ponding, it’s working. We try to make it really easy.  
Joe H – I’ve run into dead plants because of too much water and because they’re too dry.   
Rob W – If someone does see dead plants, too much water, what is the requirement for them?  
Bill H – Most of time we’ve had to fix them where top 6 inches had to come out. A couple of times had to be completely redone.  
Ron – Most I’ve had to do is rake the surface.   
Joe H – Run double rings on the surface. What if subsurface is the problem rather than the surface?  
Ron – Key is having annual inspections to make sure it’s working.  
Joe H – That and making sure you have the right medium. Right now we have a product out there that is not helping the situation.  
Annette – What about this: MAINTENANCE OF MEDIUM. The bioretention cell shall be maintained in a manner that results in a drawdown of at least one inch per hour at the cell surface.  
*Group agreed.*  
  
**MEDIA DEPTH**  
Bill H – Why do we have a maximum here? Some people might want deeper to meet hydrological goals?  
*Group agreed to strike “The maximum depth of the media shall be four feet.”*  
Bill H – Not convinced 18” is good enough for pathogens, but good for TSS. Need 2 feet for pathogens.  
Annette – Reducing it to 18” would make us have more bioretention cells.  
Rob W – Media is expensive, so extra 6” is a lot.  
Linda – If our goal is TSS removal --   
Todd – Unless you’re in SA waters.  
Bill H – 18” is not good enough for nitrogen. Might be barely okay for phosphorus, but not really.  
Brian L – It’s still better than dry detention.  
Todd – If make it 18” with no underdrains and sized for design storm, where is water going?  
Annette – IWS and underdrains are not necessarily mutually exclusive.  
Todd – Are you getting better treatment if you’re infiltrating?  
Peter – Put a minimum depth if you have an underdrain.  
Annette – If no underdrain, may just build infiltration device rather than spending money on media.  
Peter – Put a bullet in that says for TSS, 18” is minimum depth.  
Joe H – Isn’t this supposed to be minimum?  
Derek – If they’re designing this just for TSS, would they even put media in? Wouldn’t it just be an infiltration basin?  
Bill H – I don’t think they would use the 18” here in Piedmont because it won’t get nutrient removal.  
Joe H – This is for minimum designs for fast track.  
Tim – This is minimum for straight TSS. Minimum is based on non buffers, not this, not that --  
Annette – We came up with water quality standards, TSS, and maintenance as goals of MDC. If we had to explain why we have 2 feet, and DOT only requires 18”, we can say loading rates from what’s coming off DOT is different than from typical commercial and residential development.  
Tim – If it’s good for DOT, then why isn’t it good enough for everyone else?  
Bradley – It’s also good for them to do retrofits.  
Brian L – I think DENR’s manual used to say 18” for grassed cells.  
Bill H – We added grassed cells in 2007.  
Virginia – Would we prefer to have a sand filter or biocell with 18”? That’s what we’d be saying. We’d prefer you to have a sand filter over a biocell by not allowing the 18.”  
Mike G – If you want people to do bioretention, the more leeway you want to have. Vast majority of storms will be much less than design storm. So for, say, 75% of cases, you get fine treatment. You’ll be marginal for the rest. Still better than a wet pond.  
Virginia – But the reason should be you don’t have elevation on site for 18” and not because you want to save money on media.  
Annette – You’re right. We’re creating two similar practices. Sand filters have a big sedimentation filter you have to use. Makes you think about logic of using one vs the other.  
Bill H – If it’s really only for TSS, 18” is fine.  
Annette – Maybe we have a more complicated credit table with media depths, IWS vs no IWS?   
Bill H – In end, media selection will vary based on what nutrients you’re trying to remove.  
Rob W – I don’t think we have much choice other than saying 18.” Bill said that 18” doesn’t remove nitrogen, but 24” would.  
Bill H – 24” gets you close, but could be between 24-30.” Nitrogen number probably should be 2.5 feet. That has been from testing.  
Bradley – It’s also the media changes too.  
Peter – If we’re going to make this 18,” let’s be clear that’s just for TSS. This doesn’t meet our goal of making these MDCs address water quality standard.  
Bill H – I am concerned too on the coast about pathogens. Studies have shown that 18” not enough for pathogens. We need 2 feet. But if it’s only for TSS, and we make that clear, 18” is right way to go.  
Todd – Concerned this will lead people to think this is an easy way to comply with standards such as nondischarge requirement for FC in SA waters.  
Bill H - Every inch of rainfall is roughly 12-18” of media. So a 1.5” storm could in theory be captured in 24” media.  
Annette – What if we say 18” in noncoastal counties and 24” in coastal counties? We don’t have a numerical standard in the rules directed at pathogens, so makes it hard to hang our hat on you’re supposed to be doing something more than TSS. But we can base this on water quality standards.  
Mike G – If we don’t have separation from SHWT, we end up at wet pond.  
Todd – In coastal counties, it’s the SA watersheds that have more restrictive standard (1.5” storm). Maybe it should say SA watershed instead of coastal.  
Tim – I’m not sure how we can separate this here. Statute says what devices can do different on SA vs non SA. I don’t know that we can put different restrictions on SA waters for bioretention. Infiltration is only device that talks about greater design storm. Might be right, but statute doesn’t say we can do it.  
Annette – Pathogens is water quality standard for SA waters.  
Bradley – In Phase 2 areas, for SA waters, supposed to use devices for fecal coliform dieoff to the maximum extent practicable.  
Annette – So if 6” really makes difference between using wet pond and bioretention, designer could argue for using only 18” as a variance to us.  
Tim – Designer won’t design with a variance in mind. They would just use the wet pond. My biggest concern is if DOT can do it in SA waters, then everyone else should be able to do it.  
Annette – DOT has additional requirements for things like retrofits. They have an overall program.  
Todd – DOT and Phase 2 communities have discharge permits. Coastal stormwater rules are nondischarge rules.  
Annette – Maybe say for Grassed with no IWS: 18” in non-SA and non-NSW waters; 24” in SA and NSW waters?  
Bill H – What about thermal pollution? How prescriptive can we get in this?  
Brian L – In rules, put minimum for whatever you have authority to regulate. Then in Manual, put recommendations for other pollutants of concern.  
Bradley – Getting complicated. I go back to what Brian said.   
Annette – How about Grassed with no IWS: 24 inches – may be allowed to reduce to 18” if can show TSS is the only pollutant of concern?  
Rob W – I think this is contrary to how we’ve been doing other devices. I think it needs to be 18” unless TSS is not only pollutant of concern.  
Peter – Back to what Mike was saying about creating options. If you’re saying 18,” and there are few areas where you’re only looking at TSS, that would dissuade people from using bioretention. If we say if you need something greater than 18,” you can’t do fast track, we shouldn’t say that.  
Todd – Narrative antidegradation standard -- we’re hearing that 18” is not protective of water quality.  
Brian L – If your influent was already below nutrient standard and only concern is TSS, then 18” would get you to meet water quality standard, so 24” wouldn’t allow you to gain anything.  
Annette – There are a lot of non-DOT cases where influent isn’t below nutrient standard.  
Tim – How much of land area in NC that doesn’t have nutrients, SA, trout waters, etc?  
Bradley – There’s 35% of the state that doesn’t have stormwater controls.  
Annette – Lot of areas classified NSW waters but don’t actually have NSW program.  
Peter – I like 24 but reduce to 18 if only doing TSS. If want to go through fast track and anything more than TSS, do 24.  
Annette – If we tie this to classification, people will know in advance what’s going to be expected of them going into the process. Grassed with no IWS: 24” except you can reduce to 18” in B, C, SB and SC waters?  
Bradley – So many things not included in that like WS-III. Maybe we should simplify in rule, put details in Manual.  
Linda – Couldn’t you say depends on type of cell and purpose of cell, what you’re trying to achieve --  
Robert – Target pollutant  
Tim – Receiving watershed  
Annette – We have a finite number of classifications.  
Bradley – But those are supplemental. There are also primary classifications. Remember these rules were written a long time ago. 85% TSS was a surrogate for all these other things, getting overall pollutant removal.  
Annette – Proposing being a little more loose with when you can use 18”? Some people will want more certainty.  
Todd – With all other measures, how much difference in treatment are we getting based on these design differences? Is this common with infiltration? If reduce how far SHWT, it will affect everyting equally depending on type of treatment?  
Bradley – For infiltration, no underdrain system, much larger area infiltrating, non discharging system, pollutant removal with that. Bioretention is a hybrid from that standpoint with infiltration with media and some carried through underdrain systems. You’re right with other devices, we didn’t get so specific.  
Annette - Grassed with no IWS: 24” except you can reduce to 18” in B, C, SB and SC waters with no supplementary classification?  
Mike G – How about “or” reduce to 18”?  
Linda – What happened to if TSS is your only pollutant of concern?  
Annette - Then problem of interpreting when TSS the only pollutant of concern.  
  
**MEDIA P-INDEX**  
Bill H – This is important where we have P and N issues. I think range could be broader in places where you’re not trying to reduce P and not trying to add it. I think you could go up to 50. But we should debate that.  
Annette – Should we? How about: The phosphorus index (P-index) for the media shall be between 10 and 30 or may increase to 50 if the receiving water is class B, C, SB and SC waters with no supplementary classification (Move to guidance: This is enough phosphorus to support plant growth without exporting phosphorus from the cell.)   
*Group agreed.*  
Annette – How much of a burden to go from 30 to 50?  
Bill H – Gives you less flexibility as to type of compost you add, where media comes from. That’s an advantage of going up to 50. But people can provide media of P-indexes less than 30.

**DRAWDOWN RATE**  
*Group agreed to strike this.*

**UNDERDRAIN**  
Bill H – This is a relatively cheap insurance policy. Without underdrains, they turn into big wetlands, basically, with cattails etc. Underdrain has internal water storage zone. My opinion is this is a cheap conservative design feature, with upturned elbow. Two inches per hour is conservative, but that’s also knowing underlying soils are damaged during construction, decreasing the infiltration rate by a factor of 10.  
Peter – So if we require underdrain, should we also require internal water storage?  
Bill H – They are almost synonymous.  
Annette – In my reviews, I’ve noticed few IWS’s.  
Peter – IWS good for nutrients, pollution, hydrology, cheap.  
Bill H – I feel like I’ve failed. I’ve been teaching this for years.  
Peter – Shouldn’t this be an MDC?  
Annette – Outside of NWS, there’s no additional removal credit for using IWS. We’re not quantifying the benefit via runoff reduction.  
Joe H – How do I measure *in situ* runoff reduction?  
Linda – So if you can’t achieve one inch per hour, you have to have underdrain?  
Annette – When you excavate, if *in situ* infiltration rate has less than 2 inches per hour, then you need an underdrain.  
Joe H – You just said soil infiltration and not drainage.  
Annette – It should say infiltration rate.  
Joe H – I would put infiltration/permeability rate.   
Joe H – Problem with testing is testing gets done before planting, before final product.  
Mike G – In permeable pavement, you must scarify or rake before put down stone. Doesn’t Manual require this be put on the plan?  
Joe H – But when we come out there, we don’t have those plans.  
Rob W – This is backwards than what I was saying on last issue. We should require underdrain unless you get permeability (via scarifying, soils, etc). In this area, using heavy equipment on poor soils, you’ve got to plan on an underdrain. In coastal areas, do you usually not need an underdrain?  
Mike G – On coast, you can hit a clay layer.  
Joe H – Some marine sediment clay can be nasty.  
Annette – How about: UNDERDRAIN. An underdrain shall be installed unless it can be demonstrated that the in-situ soil infiltration/permeability rate is 2 inches/hour or greater immediately prior to the placement of the bioretention media. (Advice in BMP Manual: This is usually the case for soil tighter than sandy loam or if there has been significant soil compaction from construction.) STRIKE: Trees should not be planted within 5 feet of slotted drains.)  
Mike G - People are going to want to do underdrain and not want to do soil test.   
Annette - Miss out on opportunity for infiltration by having underdrain.  
Linda – Underdrain is still a discharge.  
Mike G – Would put a level spreader/filter strip on it.  
Annette – You could put an upturned elbow on an underdrain. That reduces amount of discharge from underdrain.  
Mike G – Then what is underdrain doing?  
Annette – It’s kind of like insurance. It can pop over elbow.  
Robert – So can we make elbow an MDC?  
Bill H – In Ohio, you have to prove why it won’t work, then you don’t have to use IWS.  
Annette – How about: UNDERDRAIN. An underdrain with internal water storage shall be installed unless it can be demonstrated that the in-situ soil infiltration/permeability rate is 2 inches/hour or greater immediately prior to the placement of the bioretention media.   
Todd – What does this do to your sizing for the design storm? If you’re holding water there --  
Annette – It doesn’t change that I believe.  
Todd – Does internal water storage count toward your volume?  
Bill H – It could. It hasn’t yet. That’s why 18” – safest thing is 18” from planting surface. IWS will extend to within 18” of planting surface or surface of media. You can adjust it some, but if you want to pick a number, that’s a good number to use. You’d require 3 feet of media for that system, so 18” of that 3 feet has been allocated for IWS which is between an inch and inch and a half of water storage, but gravel area associated with underdrainage.  
Annette - How about: UNDERDRAIN. An underdrain with internal water storage shall be installed unless it can be demonstrated that the in-situ soil infiltration/permeability rate is 2 inches/hour or greater immediately prior to the initial placement of the bioretention media. STRIKE: Trees should not be planted within 5 feet of slotted drains.)  
*Group agreed.*

**Add Recommendation as #16:** Scarify or disc the bottom of the bioretention cell before initial placement of the bioretention media.  
*Group agreed.*

**CLEAN-OUT PIPES**Brian L – We’ve never had to clean out an underdrain.  
Bill H – In Maryland, they were checking these. He said one time he had to go in and clean it out. That was because roots had gotten in.  
Brian L – Only thing I’ve heard is that tree roots cause problem with underdrain. That can’t be flushed anyway.  
Rob W – The more cleanouts you have, the more opportunity for problems with stuff getting in them.  
Bill H – We’ve used cleanouts as observation wells, diagnostic tools.  
Brian L – We put one at end of every line.  
Mike G – Is there a minimum spacing?  
Brian L – We use 10 foot so we can get dump truck in.  
Marc – We use 10 foot too.  
Bill H – We’ve seen problem with clean outs being hit with mowers.  
Brian L – We put them flush with ground now.  
Annette – How about: At least one clean-out pipe shall be provided on each underdrain line. Clean out pipes shall be capped. It is recommended that the clean-out pipes be located to prevent damage by maintenance equipment.  
*Group agreed.*

**PLANTING PLAN 1**  
Annette – How about: A minimum of one tree, three shrubs and three herbaceous species shall be incorporated in the bioretention planting plan unless it is a grassed cell. A recommended planting density is 400 stems per acre.  
Brian L – This should be a recommendation.  
Robert – Not worded well – trees, shrubs vs species, any combination of these?  
Brian L – For water quality purposes, does it really matter?  
Annette – What if we wanted it to be more outcome oriented?  
Bill H – Plants are important. Roots are particularly important.   
Peter – Should it be plants of certain root depths? Not the top of plants that matter – should be root parts.  
Bill H – Mm hmm. Let’s come back to the Team on this later.  
Todd – Keep in mind maintenance requirements. It’s hard to image a system working in perpetuity if you have to take a big tree out to do maintenance.  
Annette – Trees love water and will go for that underdrain, clog it up. Bill and I will work on this.  
  
**PLANTING PLAN 2**  
Annette: How about: Plant size shall be no less than 2.5” dbh for trees, 3 gallons for shrubs, and 1 quart for herbaceous plants.   
Annette – Bill and I will tackle 18-22 and bring back to Team.

**MULCH 1**  
*Group agreed to strike this.*

**MULCH 2**  
Brian L – Will be a headache if mulch washes away.  
Robert – I think we should require this.  
Rob W – Do you always buy your own mulch, not make it yourself? Why does it have to be commercially available?  
Brian L – Let’s lose “commercially available.”  
Robert – Do we want to specify that this does not apply to grass cells?  
Annette – How about: For tree/shrub bioretention cells, double or triple shredded hardwood mulch shall be used for the portion of the cell that will be inundated. (Explain in manual – because it is less likely to be washed away.)  
*Group agreed.*

**MULCH 3**  
For tree/shrub bioretention cells, mulch shall be uniformly placed 2-4 inches deep. (In chapter, mulch should be renewed as needed to maintain a 2-4 inch depth until the plants create their own mulch layer.)  
*Group agreed*  
  
**MULCH 4**  
Bill H – Once established, mulch may not be needed.  
*Group agreed to move this item to manual* (see Mulch 3).

**INTERNAL WATER STORAGE** – *Move to manual, already addressed above*.

**NUTRIENT DC** – *Incorporated into credit table*.

**RECOMMENDATIONS 1 and 2**  
Rob W – Recommendations 1 and 2 need to be studied by Annette and Bill

**RECOMMENDATION 3**  
Washed Number 57 stone should be installed around the underdrain.  
*Group agreed.*

**RECOMMENDATION 4**  
*Group agreed to keep as is.*

**RECOMMENDATION 5**  
Todd – Are there any unique maintenance issues if you perch it like this?  
Bill H – Making sure that berm is maintained.  
Mike G – You’re going to impound 4 or 5 feet of water --  
Annette – With water plus media, it could be pretty deep.  
Bill H – This was for bioretention cells up against a building.  
Robert – We have one at a fire station where there wasn’t room for a slope, so they built a wall on the side of the cell.  
Annette – It’s just another option.

**Action Items**Annette –Annette –Send Team additional homework in 2 weeks.  
Annette and Bill – Study Recommendations 1 and 2 and work on Items 18-22 (see above)  
Team – Review chapters and additional homework as assigned.

**Next Meeting – November 17, 2014 – 9:30 to 3:00.  
 Disconnected Impervious and Sand Filters**