GREENVILLE COUNTY, SC COMMENTS ON EPA PROPOSED CONSTRUCTION EFFLUENT GUIDELINES PUBLISHED NOVEMBER 28, 2008

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I. General Comments:

A. Turbidity Limits. GREENVILLE COUNTY does not agree with EPA's assessments related to the requirement for turbidity effluent limits of 13 NTU for construction sites 30 acres in size and greater for several reasons (specific comments and justifications are given in Supporting Information, Items 1 - 4).

1. Environmental conditions, particularly rainfall, for the locations cited in 40 CFR Part 450, Effluent Limitations Guidelines and Standards for the Construction and Development Point Source Category; Proposed Rule, hereafter called 40CFR450, are from locations in Auckland NZ, California, Oregon, and Washington, and Vermont and not characteristic of locations in the central and eastern portions of the US. Rainfall intensities tend to be light and annual R factors as well as return period single storm up to the 10 year storm tend to be very low (less than 50) in these areas indicating minimal erosion potential as compared to the southeast. Volumes of runoff and sediment in a 2 year storm will be much lower than in South Carolina, thus the attainment of 13 NTU's in a 2 year storm is much more attainable for these conditions than for South Carolina. We believe it is unreasonable to apply the same standards to the rest of the country based on using data for this area. The Auckland, NZ system developed by Earl Shaver is a good system. However, the soil is much different from most US soils, their climate is very different, and their approach to construction timing as a result of the difference in these factors may not be applicable to most of the United States. Monitoring conducted by Greenville County, South Carolina in 15 minute intervals for the last 7 months on the Reedy River indicates that turbidity rarely reaches levels of 13 unless a week or more passes without rainfall and there are no other disruption to the system. In rainfall events it is typical to see readings that exceed the limits of the monitoring device (1400 NTU).

2. The specific application of NTU standards to areas with clay content greater than 10% ignores basic principles of erosion and sedimentation. Soil erodes not

just as primary particles, but as primary particles plus aggregates. These aggregates are bound together by clay as well as organic matter to form much larger particles. Settling velocities for these larger particles are orders of magnitude greater than the original clay and silt, which greatly increases trapping. Although not all primary particles are aggregated, it is important to consider this aggregation in calculating trapping. It is not clear that this was done in developing the proposed regulations.

3. The specification of an effluent limit as a standard should occur without a model that can predict the effluent values. These effluent values depend first on the particle size distribution and density and second on the ratio of discharge to surface area of the pond (Haan et al, 1994). Other factors are much less important. Procedures are not currently available for predicting the size of the flocs, if flocculants are to be the standard treatment, thus the modeler would need to rely on laboratory tests of all soils in the construction site, including various combinations of surface and subsurface soils. The lack of predictive tools and burdensome data requirements are a serious limitation to implementation of this standard. Discharge to surface area can easily be predicted with a number of models (Wilson et al, 1986), however, studies by Tapp and Barfield (1986) showed that it is very difficult to make predictions of floc sizes for all these different type soils from construction and grading activities. No model is currently available make these predictions, thus the designers will be in a quandary in trying to develop designs and permit reviewers would not be assured that designs submitted would meet the NTU standard. This situation is similar to the situation the surface mining industry faced when the Surface Mining Reclamation and Control Act was passed in the late 70’s (seventies). Rules were promulgated for a performance standard max TSS of 35 ppm average and 75 (seventy-five) peak in runoff from a 10-year storm. There was no technology to ensure compliance with the standard could be achieved. Like the proposed rules in Option 1, EPA and the Office of Surface Mining (OSM) published rules with a design standard along with the performance standard. The mining industry was faced with using the design standard, knowing that they could not meet the performance standard. This resulted in a disruption in the industry and took EPA over 5 years to finally develop a settable solids standard that could be met. Surely we can do better this time.

4. In the PowerPoint that was used in a meeting to discuss the proposed regulations, the statement was made that Texas already requires sediment basins designed for 2-year, 24-hour storms, so additional storage volume for ATS (advanced treatment systems) is not required. Other states have developed programs that are stricter than the proposed rule under option 1. Since 1991 South Carolina developers and contractors have been subject to state regulations (48-14 code of laws 1976 as amended), 72-400, 72-300 storm water regulations) called the Storm water Management and Sediment Reduction Act that requires construction sites to design sediment controls to be 80% efficient at capturing sediment in a 10 year, 24 hour storm. These requirements not only apply to sediment basins and traps but to all sediment control devices. Design aids

developed for SCDHEC (Barfield et al, 2001, Hayes et. al, 1998) provide procedures based on soil conditions in South Carolina and are based on the 10-year 24-hour design storm. These conservative tools are required use by engineers in the design and evaluation of sediment control devices (including silt fence) to ensure that the SWPPP provides an 80% trapping efficiency. Alternately, the designers can use a more sophisticated approach or model that is less conservative. To this end there are very few waters of the State of South Carolina are impaired for turbidity.

B. Design Procedures for Preferred Option Number 1. We find serious concerns about the specifications for the controls EPA proposes in this option. They fly in the face of validated theory and demonstrated practice. We do not disagree with the requirement for a sediment basin for disturbed areas 10 acres and greater draining to a single point nor do we disagree with having a required sediment storage volume, however we extremely concerned with using the proposed design parameters/ procedures for the following reasons:

1. Long established and validated theory based on studies at the MIT, University of Kentucky and Pennsylvania State University (Camp, 1946; Wilson and Barfield, 1984; Ward et al., 1977, Jarrett et. al and Driscoll, et al., 1986) have shown that particle size distribution is the most important design parameter, followed by surface area and outflow rates. This is fundamental for small to large sedimentation basins. Nowhere are these parameters mentioned in option 1.

2. The first requirement specified in the proposed procedures is a volume requirement of 360 cubic foot per acre. Studies by the Maryland (McBurnie et al., 1990) showed that accounting for surface area to peak discharge was a critical parameter in pond trapping. McBurnie's work shows that by keeping volume constant and increasing the surface area or changing the peak discharge the calculated trapping efficiency increases by an order of magnitude. Studies done by McBurnie et al were done with the SEDIMOT II model using the CSTRS pond algorithms and the same conclusion was reached. The CSTRS model is well documented and validated. These data clearly do not support the use of a volume requirement as a design standard.

3. The detention time requirement of 72 hours is excessive and unnecessary if a performance standard is used. McBurnie et al (1990) showed that detention time was not a good design requirement. In fact the McBurnie et al predictions made using the well validated CSTRS model (Wilson et al., 1984) showed that ponds with the same volume and detention time could have dramatically different trapping efficiencies if the surface areas were varied. For a given loading of runoff and sediment, a variety of pond shapes and sizes, each having a different detention time, can be used to meet a given effluent standard. Thus, if the pond is designed to meet a given effluent standard or trapping efficiency, and the design model is appropriate, detention time will not matter and should not be used as a design parameter. Additionally, detention time is highly variable in a storm. Using the plug flow analogy, the first plugs will have a short detention time and the last plugs the longest detention time (Haan et al., 1994). When a

detention time is calculated for a given storm, it is based on a weighted average for all the plugs.

4. Size distribution of eroded sediment is the most important parameter. It is not mentioned in the document as something to take into account, except to specify chemical treatment for soil clay content greater than 10%. It is critical that ponds be designed to account for varying size distribution, otherwise many will be overdesigned and others under designed. Usually, when "rules of thumb" are employed, the best performing structures are designed on a surface area to peak discharge (using NRCS 10 year 24 hour design storm event) ratio using a representative particle size diameter from the eroded particle size distribution and the SC design aid mentioned earlier (D_{15} for most SC soils, See SCDHEC Storm water Design Manual).

5. Use of a skimmer can be desirable and we do not object to it, but is not a major factor in trapping efficiency. Most sediment basins used by GREENVILLE COUNTY are dry basins skimmers work best with a permanent pool. The skimmer approach is based on the assumption that an outlet located at the surface will withdraw from the surface instead of the classical assumption of uniform withdrawal. That is not true, according to discussions by this author with Penn State University personnel involved in their excellent study. As a result of the development of density gradients late in the storm, after inflow stops, withdrawal can become slanted toward surface withdrawal. However, this is after the highest concentrations have been discharged and the impact on outflow concentrations and trapping is not as great as would have been expected. Quoting from 40CFR450:

   "*McLaughlin found that addition of PAM to sediment traps resulted in average effluent turbidities of 152 NTUs using a rock outlet and 162 NTUs using a skimmer outlet. For one set of tests, use of a standard stone outlet along with PAM was able to attain an average effluent turbidity of 51 NTUs, while tests with jute/coconut mesh baffles with PAM were only slightly higher, at 71 NTUs."*

   These words can hardly be used as a resounding support for requiring the use of a skimmer outlet or porous baffles.

6. The length to width ratio criteria of 4:1 in the proposed regulations is overkill. EPA's early recommendations were that the L: W ratio should be greater than 2.0 to prevent short circuiting and decrease dead storage. Although a misconception about the way flow occurs in ponds, these terms of short circuiting and dead storage do serve a useful purpose in communication with persons unfamiliar with pond hydraulics. They in fact are parameters that allow pond sedimentation models to properly predict sediment discharge and are typically developed from model studies. Griffin et al. (1985) show that a sharp change occurred in dead storage at an L: W ratio of 2.0. At that point, the dead storage transitioned from 25% to 15%, using either plug flow or CSTRS models. We recommend that the value of 2:1 continue to be used since it is well accepted and ponds designed with this value seem to work well.

7. Baffles are mentioned in the proposed regulations as an important factor. Unpublished studies at the University of Kentucky indicate that one baffle placed half way between the inlet to the pond and the drop inlet spillway was effective in controlling short circuiting in ponds with an L: W value less than 2.0. The desired width of the baffle should be about ½ the width of the pond at the location of the baffle.

8. Design procedures are available using simple design aids or sophisticated computer models to properly take these factors into account. These include SEDIMOT II, SEDCAD, SEDIMOT III, and SEDPRO. We recommend that these models be used in designing ponds and other BMPs with a performance standard rather than use a collection of design standards as proposed in option one.

C. **<u>Use of Turbidity as a Standard Because It is Easy to Measure.</u>** GREENVILLE COUNTY is very concerned with the use of turbidity as a performance standard for the following reasons:

1. In South Carolina areas where clay content is 10% or, more streams draining undisturbed areas frequently have background turbidity of more than 13 NTU during 2 year or smaller storms. Therefore, it is unreasonable to restrict the discharge to below background levels.

2. Citing the ability to quickly measure a turbidity level and adjust treatment is an indication that EPA expects the treatment system to be similar to a water treatment plant where an operator is on site at all times and can rapidly adjust the dosage and mixing rate. That may be necessary to meet drinking water standards, but certainly is not an appropriate expectation for stormwater discharge for either during construction or post construction, particularly in the central and southeastern US states. The very few non-portable effective sediment control systems, such as the Auckland, NZ site cited by the EPA, do not have operators on site 24-7 to adjust rates, nor do they use filtration tanks. Rather, the designs are currently based on experience and laboratory studies and feed rates are approximated by passive systems. That would certainly be the case for those cited studies where floc logs have been used. Given the massive number of sites that would occur from the proposed Options 1 and 2, regulation of appropriateness of designs to meet the effluent standard under these options can only be realistically reached if there are one or more process based computer models to predict runoff and sediment yield from construction sites as impacted by BMPs that use combinations of flocculation, detention, and possibly filtration. Thus, the permit applicant would have to demonstrate apriori that the proposed design would be expected, based on a validated computer model, to meet the effluent standard in the design storm.

3. Other options exist for measuring sediment in the discharge. It is probably more important for us to be concerned with settable solids rather than turbidity. We can measure settable solids relativity easy in an Imhoff cone and it can be done in the field. One only empties a 1.0 liter sample into the cone, shakes it up, and lets it sit for an hour. At the end of the hour, the volume on the bottom of the

cone is measured by reading the graduated markings on the Imhoff cone. The good news about settable solids is that they can be predicted in the state of the art computer models mentioned previously. Thus, we can design devices to meet a performance based a settable solids limit in the discharge. Also settable solids are the portion of the sediment that can impact stream health by settling in the conveyance and covering the micro benthonic organisms in the stream. A companion option would be to develop a linkage between settable solids and turbidity for a region or state.

4. EPA's stated goal is to remove the fine particles from the discharge. Yet nowhere has a case been made that these fine particles that may move through the conveyance system have an adverse impact on stream health as long as they flush through the system.

D. Establishing Chitosan-Enhanced Sand Filtration as the standard of comparison for treatment for Options 2 and 3. In 40 CFR 450, Chitosan-Enhanced Filtration is mentioned numerous times as the standard used for cost analysis and for other treatments. A total of 19 treatment sites were evaluated where this is used. The treatment systems were portable systems, illustrated in the slide sets used in the January 23, 2008 SBA Roundtable. GREENVILLE COUNTY disagrees with the use of this standard for treatment based on the following reasons:

1. As stated above, the location of the treatment sites did not include a location in Midwest or Eastern US where R factors are large generating very high sediment loads. Thus, results from the studies cited cannot reasonably be assumed to be applicable to Midwest and Eastern US conditions. The small number of erosive rainfall events combined with the relatively small R factors for these events leads to the conclusion that the results from these studies are not transferable to the Midwest and Eastern US conditions. The required size of the systems is likely to be much larger than those shown in the photographs in the January 23, 2008 SBA Roundtable slides and thus much less portable than those systems are claimed to be.

2. The rapid filtration systems used are likely to clog quickly from the heavy sediment load in the Midwest and Eastern US construction sites, requiring frequent back flushing of the filters or disposal of the media and replacement. The locations cited have sediment loads that are typically much lower than in South Carolina. Thus, operating costs for the sites in the Northwest can not be reasonably used to estimate costs in the Central and Southeast regions of the country. Additionally, these systems as well as the proposed option 1 will require additional right of way. It is not clear that right of way costs are included in the cost estimates.

3. Because of our valuable coastal wetlands, concern is expressed in South Carolina about the possibility of mining the coastal wetlands for oyster shells to help generate the 2.3 million pounds of Chitin from crab shells that 40 CFR 450 indicated would be needed if this technology is adopted. Such mining for shells to be used on rural roads was halted many years ago because of the destruction of the coastal wetlands. 40 CFR 450 asks for comments about other flocculants

that might be biodegradable for the Chitosan-Enhanced Filtration system, but EPA has not proposed an alternative or cited any studies where an alternative has been successfully used. This does not give a sense of comfort to contractors and developers who might be facing required use of this product in conflict with the requirement to protect coastal wetlands. This technology should not be forced upon the construction industry until alternatives are found and demonstrated to be successful and economically feasible at a significant number of sites in Central, Eastern, and Southeastern US.

4. Making this change will likely create issues, similar to that experienced with Surface Mining Sediment Control Rules in the 1970's. In mid to late 1970's, Congress debated and passed the Surface Mining Reclamation and Control Act (SMRCA), requiring that sediment control be a major component of all surface mining activities. President Carter signed the bill and it became the law. Then, the newly created Office of Surface Mining (OSM) was charged with making regulations that would meet the requirements of the law and effluent criteria established by the US EPA. At that time, EPA had a sediment effluent TSS requirement of 35 ppm average and 75 ppm maximum in a 10 year 24 hour storm event. There were no computer models available at the time that would predict whether or not this standard could reasonably be met and permit applications were being signed by professionals certifying that the proposed sediment criteria would be met by the very small BMPs being proposed. A group of experts met at OSM headquarters in Washington, discussed the rules, explored options, and proposed a design standard which required sediment ponds with a 24 hour detention time when subjected to a 10 year 24 hour storm. At the time, the use of detention time on a real storm with a variable hydrograph was a new procedure requiring a lengthy set of calculations and was primarily a trial and error process (See Haan and Barfield, 1978; Barfield et al, 1981 for example calculations) involving many hours of number crunching. There were no watershed models that included procedures for calculation of effluent concentrations from sediment detention ponds, but a new model of sediment pond performance called DEPOSITS (Ward et al, 1977, 1979a, 1979b, 1979c) had been released that could be matched with an input hydrograph and sediment yield from other sources to give a first prediction of sediment yield from a given site. Procedures were not in place at that time to generate eroded size distributions for sediment. Thus the prediction results for what might be expected in a surface mine yet to be developed were speculative at best. Thus states, OSM, and EPA regulators scurried about for several years trying to find a reasonable approach to design and regulation and tensions were high between states and the federal government and lengthy lawsuits resulted. After a number of years of chaos in which the mining industry was under the double bind of having to build ponds to meet the design standard, certify that they would meet the requirements of the effluent standards, and not having any reasonable certainty that they would. Finally, the EPA conducted a study using the DEPOSITS model and concluded that performance criteria of peak settable solids concentration of 0.5 ml/liter in a 10 year 24 hour storm was a realistic standard issued a new regulation specifying that standard. SEDIMOT II, a

public domain model and the predecessor of SEDCAD, was available for use and after suffering through years of unnecessary conflict, the mining industry, the states, and OSM finally had a model that could be used to assure that properly designed ponds would meet the effluent standard.

5. All of this discussion leads to the plea that EPA and the construction industry try to do better this time. It seems to GREENVILLE COUNTY that a reasonable approach to this would include the following:

   - Since Options 2 and 3 require technologies that have not been adequately evaluated and validated for Midwest and Eastern US, allow the use of a settable solids standard of 0.5 ml/liter or an 80% trapping efficiency requirement such as South Carolina presently enforces for a initial period of time to allow evaluation of these technologies in these regions. The design aids and procedures from South Carolina have been shown to be effective and can be extended to the other states.
   - EPA should support evaluation of the proposed technologies at a significant number of locations throughout the Midwest and Eastern US during this period to assure that they are successful and economically feasible. A significant number of these sites should be DOT construction.
   - During this period, EPA should support the development of models that can be used to predict apriori the effectiveness of using a given ATS system at construction sites, including DOT sites.
   - The feasibility of predicting apriori the expected turbidity from a construction site and from the effluent from the ATS BMPs should be evaluated. This will require some creative thinking since the turbidity meters typically do not work above a few thousand mg/liter sediment concentrations, a low outflow concentration from storms in the Midwestern and Eastern US. If turbidity cannot be accurately predicted, a TSS or settable solids standard should be adopted. South Carolina DOT would be pleased to participate in the study.

II. Specific Comments

A. **Part 450 Subpart B 450.21 (a) (2) and (4)** -These items mention controlling storm water volume. Item (4) requires control of volume and peak rate leaving the site. In theory this sounds good but, in practice this requirement is not attainable during construction. To control the stormwater runoff volume will require structures much larger than to control the sediment. GREENVILLE COUNTY opposes this requirement due to the increased land cost for to build oversized structures. If the intent is to control erosion of outlets as stated then GREENVILLE COUNTY believes all that is required is to control the velocity of the discharge and provide some outlet protection. It should also be pointed out that the problems created by volume increases or changes in stream channel morphology, something that happens over a long period of time. Construction, on the other hand, is a short term source of increased runoff volume at a given location. Once construction is completed, it would be more feasible to control volume in a post construction situation.

B. **<u>Part 450 Subpart B 450.21 (a) (7)</u>** - A definition is needed for the width of the natural buffer to be maintained around surface waters. What is the minimum width?

C. **<u>Part 450 Subpart B 450.21 (a) (10)</u>** – A definition is needed for the range of slopes that EPA considers to be steep slopes.

D. **<u>Part 450 Subpart B 450.21 (b) (2)</u>** - This requirement will add a tremendous burden to GREENVILLE COUNTY and its developers to acquire an additional six feet to establish this buffer on site and is particularly a problem in construction in urbanized areas. It will be very expensive. Would it not be better to define the specific objective for the buffer strip and allow the engineer to decide how to meet that objective and how to show apriori that it would be met?

E. **<u>Part 450 Subpart B 450.21 (b) (4)</u>** – The requirement for a wheel wash will be extremely burdensome for GREENVILLE COUNTY. The County does many small projects and to be forced to install a wheel wash is unreasonable for most of these projects. This is overkill and expensive to install and maintain. Has any data been collected showing the impact of a wheel wash project on sediment production, showing what is expected with current technology and with wheel wash technology? GREENVILLE COUNTY believes this requirement be justified by the use of this information prior to being mandated in a regulation.

F. **<u>Part 450 Subpart B 450.21 (b) (5)</u>** – This requirement is overly burdensome and expensive requiring each project to maintain and provide for at least one or more street sweeping devices and operators. EPA does not require this level of management for post construction activities. This is a daily street sweeping requirement. Many tons of sediments wash off of paved areas normally during a rain event. Construction activity properly done using stabilized entrances (no wheel washes) will not add significantly to this normal loading. Again, has any data been collected showing the impact of a street sweeping on sediment production from construction sites, showing what is expected with current technology and with street sweeping? GREENVILLE COUNTY believes this requirement be justified by the use of this information prior to being mandated in a regulation.

G. **<u>Part 450 Subpart B 450.21 (b) (8) (i), (ii), (iii), (iv), (v)</u>** – The design parameters EPA provides are inappropriate for designing a sediment basin for performance, as discussed previously in this responses . GREENVILLE COUNTY proposes a procedure based on a ratio of basin surface area to peak discharge. With a set design performance guideline such as 80% trapping efficiency, the size of the basin can be determined by routing all flows from the drainage area through the structure for a pre-selected design storm event (GREENVILLE COUNTY suggests the 10 year 24 hour event).

In most all cases GREENVILLE COUNTY finds that a length to width ratio (L: W) of 2:1 adequate to prevent short circuiting and dead space. As previously discussed, model studies have shown a sharp break point at a 2:1 L: W, with lower ratios giving high dead storage volumes and higher ratios giving a lower dead storage.

EPA proposes a higher 4:1 ratio which GREENVILLE COUNTY believes is overkill and will not significantly affect the performance of a properly designed basin. This requirement will increase the cost of the structure as configurations will require additional right of way to meet this requirement.

EPA proposes to require a skimmer outlet device that will give surface withdrawal as part of the sediment basin design. GREENVILLE COUNTY does not object to the use of skimmers, but objects to stating that they give surface withdrawal. As long as there is a significant inflow into the typical sediment pond, withdrawal patterns appear to be fairly uniform and surface withdrawal is not typically occurring. After significant inflow stops and settling results in a significant density gradient, withdrawal begins to be more weighted toward surface withdrawal, but significant flow would still be expected to come from the lower levels until a very significant density gradient occurs. Thus, GREENVILLE COUNTY believes the skimmer is not a major factor in sediment trapping. The skimmer outlet is usually applied to a basin designed as a wet structure. Many basins GREENVILLE COUNTY uses are normally dry. GREENVILLE COUNTY finds this requirement overly prescriptive and should be left up to the judgment of the engineer to apply the appropriate outlet configuration for the conditions.

EPA proposes to require a 72 hour detention time. However, studies conducted for the Maryland Department of the Environment (McBurnie et al, 1990) have shown that ponds with the same loading of runoff and sediment and identical detention times can have widely varying effluent sediment concentrations. Conversely, by designing the basin for a performance standard such as trapping efficiency using an eroded particle size distribution from the site, the residence time has already been accounted for and the basin is right sized. In the case of the dry basin a controlled dewatering outlet size to discharge the volume of the design storm event or 72 hours can be installed. In most cases, this will be a very small tube subject to constant plugging and obstruction requiring constant maintenance. GREENVILLE COUNTY opposes the 72 hour requirement for the permanent pool and suggests that the dewatering requirement be a minimum of 24 hours. Therefore, GREENVILLE COUNTY does not allow dewatering before 24 hours, but there should not be a requirement to hold longer than 24 hours.

H. **Part 450 Subpart B 450.22 (a) (2)** – GREENVILLE COUNTY opposes this regulation for to require an effluent limitation of 13 NTU for construction sites of 30 acres in size for reasons discussed above. Specifically these reasons are:

1. In South Carolina only 2% of the 2500 monitoring stations are listed as impaired for turbidity. Therefore, turbidity does not appear to be an issue in the state.
2. The 13 (thirteen) NTU standard has not been shown to be reasonable and economically feasible under SC rainfall and soil conditions. Data from STORET database from monitoring conducted by SCDHEC for the past 10 years on the Reedy River indicate an average turbidity of approximately 20 NTU’s.

3. Design to meet such a standard will require validated computational models to predict apriori the trapping of flocculated sediment in the proposed ATS systems. Such models are not currently available.
4. Background values in most water courses during a rain event exceed this value many times in South Carolina
5. Computational procedures are not available to predict apriori the turbidity in sediment laden flow. In order to design to meet a standard, such computational procedures are needed.
6. Much of the erosion in established urban areas such as those in South Carolina occurs in channels called ephemeral gullies. These include swales and road ditches. Studies by Clemson University in streams in Anderson County, SC indicated that most all of the sediment carried by the stream was eroded from these channel banks by the power of the stream and was not a result of sediment wash off.
7. Further, turbidity is not the appropriate standard to use simply because it is easily measured in real time. This measurement does not provide an indication of how much sediment is in the discharge. One could trap 99.9% of the sediment and still not meet the 13 NTU requirements.
8. The 30 acres size limitation regardless of disturbed area does not appear to be a reasonable threshold. GREENVILLE COUNTY believes there should be a threshold for implementation based on disturbed area draining to a single point. This should be adjusted and applied to disturbed area rather than size of the site. The disturbed area will be the contributing factor to the sediment yields and most critical to apply these regulations. GREENVILLE COUNTY does not believe the threshold limitation of 30 acres in size is appropriate for implementation.
9. As we continue to create impervious area and refuse to control runoff rates and volume in post construction urban systems, stream channel degradation will continue. Even in areas such as South Carolina where peak rate and velocity controls are in the regulation discharging increased volumes over longer time periods continue to degrade our streams. This is not an issue for the construction period requirement. This is a post construction issue and cannot be prevented by implementing addition controls such as numeric effluent standards on the construction industry.
10. South Carolina is a rural state with a significant amount of agricultural and forestry land disturbing activity. To exempt this industry from this strict standard will mask any future benefit of improvement from implementation of this standard on the construction industry.

III. Supporting Information

A. <u>Rainfall Characteristics for States Cited as Justification for 13 NTU’s</u>

The return periods for areas cited as having demonstrated the effectiveness of the Chitosan-Enhanced Filtration System are in areas with small return period rainfall R factors for 10 yr or smaller return period storms. Thus they would be expected to be highly effective in trapping sediment. The higher value of 10-year or smaller return period are much larger, as shown in Table 1.

Table 1. Return Period Rainfall R Factors for Historic Storms in South Carolina as Compared to Sites Cited in 40 CFR 450 ATS Treatment Tests

State City	1 Year	2 Year	5 Year	10 Year
South Carolina				
Charleston	74	106	154	196
Clemson	51	73	106	133
Columbia	41	59	85	106
Greenville	44	65	96	124
California				
Red Bluff	13	21	36	49
San Luis Obispo	11	15	22	28
Oregon				
Portland	6	9	13	15
Vermont				
Burlington	15	22	35	47
Washington				
Spokane	3	4	7	8

B. Diameters and Settling Velocities of Primary Particles and Aggregates

Table 2. Diameters and Settling Velocities for Primary Particles and Aggregates

Particle Class	Clay	Silt	Small Aggrgts	Sand	Large Aggrgts
Diameter (mm)	0.002	0.01	0.03	0.2	0.3
Settling Velocity (ft/hr)	0.00067	0.0167	0.0937	3.814	4.075

C. Impact of L:W Ratios on Dead Storage in Ponds

Studies were conducted by Griffin et al (1985) in a pond model to evaluate dead storage in triangular ponds with varying length to width ratios. The results showed that the momentum factor was not very important, but that a sharp break occurred at an L: W ratio of 2.0.

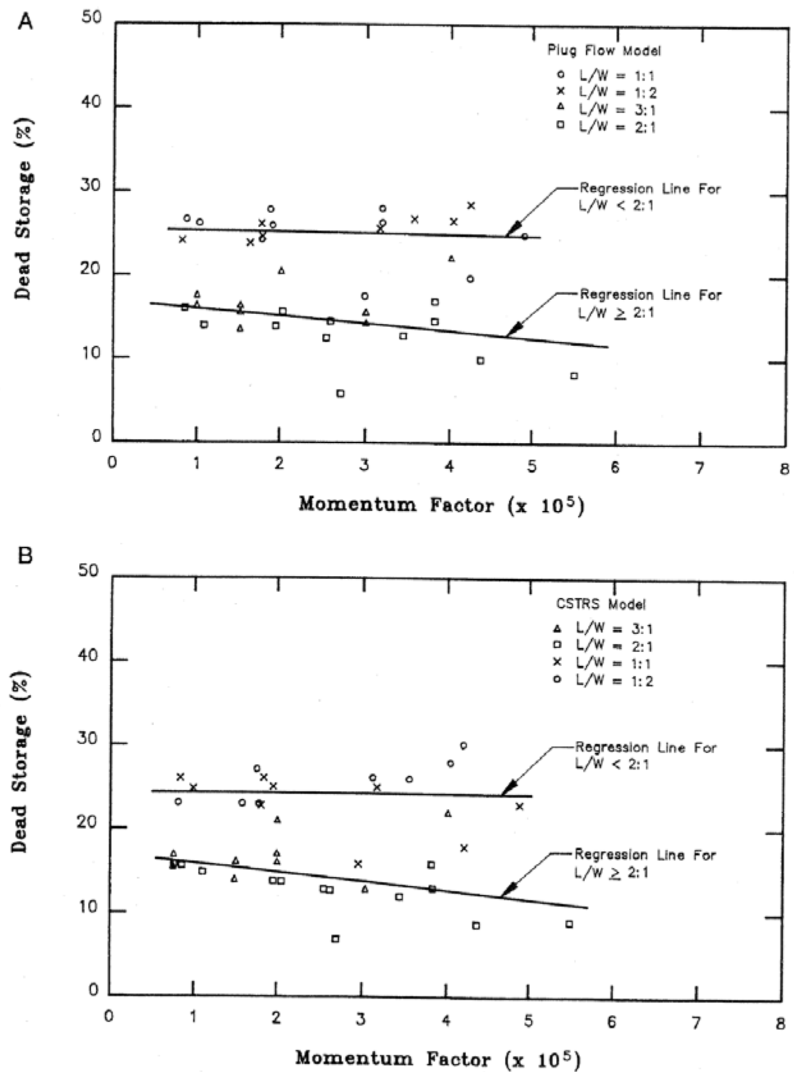

Figure 1: Relationship between dead storage and momentum factor for ponds of varying L: W ratios. Computations were made with the plug flow and CSTRS models (after Griffin et al., 1985). The momentum factor is the inflow momentum divided by the weight of fluid in the pond. (A) Optimum dead storage value for plug flow model. (B) Optimum dead storage value for CSTRS model with two reactors.

D. Use of a Volume Standard or Detention Time Standard for Ponds

A study was conducted for the State of Maryland of the appropriateness of a volume standard or a detention time standard for designing ponds. Figure 1 shows how trapping efficiency for a given detention time can change as a result of changing surface areas. Figure 2 shows how trapping efficiency changes for a given volume as surface area changes. These results do not support the use of volume standards or detention time standards as a design procedure.

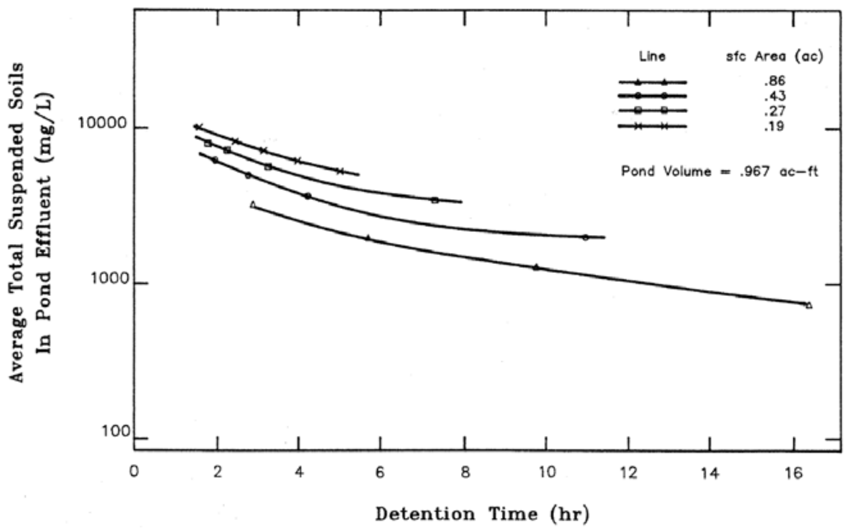

Figure 2: Effects of detention on effluent TSS for a hypothetical reservior in Maryland's Coastal Plains. Predicted values are from simulations using SEDIMOT II with ponds of varying surface area but with the same volume (after McBurnie et al., 1990)

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