MWQPA

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These comments were copied verbatim from an email submitted to the Association from Kelly Williamson of AquaShield ™, Inc.

Quoting:

Below are comments from one of our research guys, Mark Miller, who has been heavily involved in the NJCAT/NJDEP process with me. Mark also serves on the ASCE committee for maintenance issues of stormwater BMP's (I may not have the committed name correct, but that is what they have been working on for several months now). These are our intercompany thoughts of what you sent on GTAP. First of all we are really glad to see Georgia taking a real positive move on this. It seems they have looked around some to what other states have/are doing. An easier way to do this may be to accept another State's program as do the 11 (or so) TARP states. Notice GA referenced TARP documents often in this draft. Is that their intention?

> I've taken a look, and I see that he Draft GTAP is focused essentially on field testing. I have a number of comments, and can probably add more in conversation. But this can get things started.
>
> - They have borrowed much from TARP (7/03). I see that they have not incorporated the NJDEP 1/06 revisions to TARP (they may not be aware, since it is rather obscure).
> - 80% TSS removal on net annual basis.
> - The flow chart is modified somewhat from TARP, but is essentially the same.
> - I'd like to know who the "other stormwater and water resources professionals" for the TRC are selected. No exclusion of vendors is cited.
> - PUD is of question, and concern, as it seems rather arbitrary, which is not the intent of the whole document. The number and locations seem arbitrary, so how is that a level playing field?
> - They do mention that TARP and other states are suitable for field performance data. They make no reference to TAPE, and no mention of the 100:20 rule. They cite NJDEP, EPA, Caltrans, ASTM, ASCE's BMP database (nothing with the current BMP committee, may not know it exists?).
> - They call for independent field testing of 15 storms, multiple sites is recommended.
> - There is no window of conditions for TSS, and PSD maximum is 500 microns.
> - The TER report allows for lab data, but there is no protocol to establish how lab performance was obtained (Indy, NJDEP, their own?).
> - I'm not thrilled with page 12 and 13. The way I'm reading it is that sampling is to include bypass flows. Bypass flows must be measured and bypass loadings calculated using the influent concentrations. This can cause major confusion and misinterpretations and misrepresentations as well.
> - Section 7.2 is the old TARP. Dr. Magee and I discussed this for our QAPPs, what we have in the QAPPs were approved and follow the 1/06 revisions. Namely, 0.1 inch (not 0.15), No minimum duration (not 1 hour), 60% of storm, not 70%, and no composites.
> - There is no re-suspension testing requirement (good).

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- They cite PSD for 4 regions of GA, and cite lab surrogates for the soil types. We don't have SCS-250 test data (page 16). Does this mean you can't sell in areas where you don't have lab data with that standard?
- The accumulated sediment sampling calls for 3 constituents, they make sense, but they could be over kill.
- The QAPP is OK, but they could have easily cited EPA or ASTM documents as standards, Now they will have to dig through various formats, and that may not provide for the level playing field.
- The statistics is straight from TARP.
- Appendix B is straight from TARP.
- Finally, the 3rd paragraph on page 3 in the Intro caused me confusion since it points out flaws in the manual, and is not a new thought. I first read the first page as contradictory.

In my humble opinion, it appears as though there is limited practical experience from those that prepared this. It's a good start, but if approaches like those in 7.2, for example, are followed, we'll never get there. We can discuss other observations and response preparation. Thanks.

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End of Quote

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BAYSAVER TECHNOLOGIES, INC.
Engineering Stormwater Solutions

April 11, 2008

Steve Haubner
Water Resources Engineer
Metropolitan North Georgia
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Dear Mr. Haubner,

Thank you for providing us the draft of your pending technology evaluation program. I have had a chance to review this and would like to offer my thoughts.

First, I applaud your efforts and agree that the Stormwater Technology Industry has done a less than stellar job of supplying meaningful evaluations and data. Recently I attended a meeting with NJCAT regarding a host of concerns and the multitude of issues related to its program.

Realistic Time Frames
My greatest concern is that the results GTAP is trying to acquire will not be met given the allotted time frame. The time frame from receiving a PUD to obtaining Georgia Field data can easily be 3 to 5 years. The basic sequence is simple:

1. PUD approval (could be quick)
2. Find test sites where technology testing is practical (0-6 months)
3. Project design must be completed (2-6 additional months)
4. Construction must be completed and site stabilized (6-24 months)
5. Testing can begin
6. Need to collect 15 qualified storms (what if Georgia enters a drought) (6 to 24 months)

Using these parameters, each site would take a minimum of 2 years, with no complications, and could easily take as long as 5 years.

This problem has plagued the NJCAT program resulting in a discussion of possible changes to the TARP program, currently being made at this time.

Field Testing Goals
Field testing to determine the removal efficiency of a stormwater treatment system provides no equal basis for comparison. This is one of the fundamental problems that has plagued the industry. Each site has different pollutants, different storm events (intensity/duration), different temperatures, different topography, etc. Because of the vested interest in acceptable data, great efforts are taken to find the "ideal" site. When one considers this, it becomes clear that this cannot be an equal comparison of a technology.

The concept for which I would personally advocate is for a standard lab protocol to be developed, which uses standard surrogate sediments so that tests can be repeated by anyone wishing to validate a product. This test should be run through an entire load cycle (maintenance interval) and could be done with mass balance verification at different intensities. The lab testing could establish a standard which can then be verified with field testing where the operation under field conditions can be affirmed. The cost of the lab testing is a fraction of the field testing and provides immediate data as a basis for an approval. Under the current draft protocol, there will be no verifications beyond a PUD for most likely 3 to 5 years from now. What will be installed in the interim?

Separator vs. Treatment Train

Using the GTAP PSD to achieve 80% TSS at any economical level would require a filtration system, with the exception of coastal areas. The d_{50} of the PSD of the other 3 areas is in the 20-30 micron range and cannot be economically achieved with current separator sizing guidelines (It would require significantly oversized settling chambers than currently applied). Based on the above statement, filtration becomes the most practical BMP technology in achieving an 80% TSS removal rate. The application of the Treatment Train concept will reduce maintenance costs. The easier and less costly a system is to maintain, the more likely it will be maintained.

Therefore, the addition of a maintenance interval/load requirement is very important to this evaluation.

Maintenance During Testing

Each technology should be evaluated through an entire maintenance cycle. This assessment is critical to a true evaluation of the life cycle cost of any system. For example a system might meet the TSS efficiency but have to be maintained every 3 or 4 storms. Currently this data is not required as part of an evaluation.

Unfortunately the only system that has completed the NJCAT TARP testing was maintained every 6 months during 18 months of testing. This is not openly stated in the report, however the clear inference is that in order for it to achieve the required removal efficiencies, this level of maintenance is necessary for that particular product. Therefore, the life cycle cost of this system should include this level of maintenance.

Field Testing Costs

Each field test will cost between $100K and $300K to complete. I assume to meet the GTAP requirements this would be 4 tests minimum (1 for each area). This is a very high price to pay for any manufacturer and certainly will discourage some, perhaps very viable technologies, from being able to enter the market.

A standardized lab test with field follow up would most likely produce a far quicker return for both.

Separator Lab Testing

Currently there are several labs that can test separators. A separator requires the ability to handle very high flows and a scour/resuspension test should be run as well. There are various sizing protocols that can be applied to these such as Stormwater Management Model (SWMM). All of these will produce a sizing protocol to achieve the required efficiency. The system can be tested to include a mass balance and a base load to a full maintenance cycle. Lab testing can be adjusted over various storm intensities and can be adjusted to local hydrographs.

Filter Testing

A filter is a more practical unit to test because it is limited on flow per unit area. This is fully scalable and can then be protracted over larger areas and larger flows with simple math because all of the particle behavior within the fluid stream becomes irrelevant in a filter. Mass Balance methodology is achieved by load in vs. load out through filtration of the test filter effluent. Load to maintenance can also be quickly evaluated because the incoming load is known and the efficiency is known. This results in a very quick and accurate estimation of load to maintenance.

Suggestions

1. Develop a GTAP lab test protocol.
2. If technology passes the GTAP lab protocol, it receives an interim certification.
3. Within 2 years of the interim certification, the technology must undergo testing on at least 2 sites.
4. If GTAP field test data indicating likely compliance (not necessarily complete) is not provided within 3 years of interim certification; the certification is suspended until met or compliant data is provided.

I would like to thank you for allowing BaySaver Technologies, Inc. to comment on the new GTAP protocol. I would gladly propose some suggestions for laboratory testing if you would consider this as a viable option. We look forward to working with you on these issues.

Sincerely,

Thomas E. Pank
President

April 11, 2008

Mr. Steve Haubner
Water Resources Engineer
Metropolitan North Georgia Water Planning District
40 Courtland Street NE
Atlanta, GA 30303

Re: Georgia Technology Assessment Protocol (GTAP) Public Comment

Dear Mr. Haubner:

Thank you for the opportunity to provide comments on the GTAP. Drafting stormwater regulations that are fair and effective is crucial to protecting and preserving the health of waters impacted by development. This task is made difficult by variability between watersheds, pollutant sources, and competing priorities among developers, regulators, and engineers. In keeping with the goals of the Clean Water Act and the economic realities of development, regulations should protect the beneficial uses of waters at the lowest practicable cost. CONTECH applauds the efforts made by the ARC and the MNGWPD to ensure this objective is accomplished. Because of rising land values, proprietary treatment devices are often less expensive than traditional land-based treatment systems, placing pressure on local regulators from the development community to approve these devices.

In the ‘70s and ‘80s when stormwater was beginning to be recognized as a threat to water quality, engineers turned to land based best management practices (BMPs) like ponds, swales, and vegetated buffers. Performance data from these traditional stormwater treatment systems in large part dictates the performance levels currently required by many states and municipalities. With new treatment technologies continually emerging and our knowledge of stormwater science improving, it is crucial that stormwater regulations reflect these changes. In the last fifteen years a variety of proprietary stormwater BMPs have been introduced, including hydrodynamic separators, catch basin inserts, filter devices, and others. Sorting through a long list of competing products, and deciding which of these technologies are viable stormwater solutions can admittedly be a daunting task. This is especially true considering that not all manufacturers are able to provide quality data to document performance claims, so there is some skepticism regarding their use. However, that does not justify the dismissal or devaluation of these products as a whole, many of which have been properly tested and have the data (both 1st and 3rd party) to substantiate their claims. We are very pleased that the ARC and the MNGWPD have drafted the GTAP with the goal of addressing this issue. Based on our review of the document and our experiences with regulations and approval protocols throughout the county, and specifically with the Washington (TAPE) & New Jersey (TARP/Tier II) stormwater evaluation programs, we would like to offer the following comments.

1) **Section 3.0**

It is unclear whether or not all submitted manufactures data will be presented on the website and/or made available to the public. It appears that some information/results may be excluded at

BMP Performance Expectation Functions – A Simple Method for Evaluating Stormwater Treatment BMP Performance Data

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ABSTRACT

Many regulatory agencies throughout the United States are faced with the issue of having to review BMP performance data for the purpose of acceptance and design. This paper outlines a simple method of analyzing qualified performance data relative to the defined performance expectations established by the agency.

Current issues surrounding BMP performance evaluation are whether to use percent removal or effluent based guidelines. For percent removal guidelines the question is whether to use concentration or load based reduction.

This method addresses all of these concerns, allows the reviewer to set criteria to meet effluent limits, concentration and load reduction goals.

This method includes the establishment of a Performance Expectation Function (PEF) which is based on both target effluent concentrations, percent removals, and load reductions. Performance data from BMP monitoring which have been collected to an established monitoring protocol are then compared to the PEF on both a percent removal and load basis. Analysis of residuals allows for the establishment of confidence limits in the BMP meeting the designated performance expectations.

This method can be used for pollutants such as TSS, TP, Ortho-P, TN and metals.

INTRODUCTION

Many regulatory agencies are struggling with how to set simple yet realistic goals for Best Management Practice (BMP) performance. Many regulations provide for simple removal rates of pollutants such as an 80% TSS removal or a total annual TSS load reduction of 80%. Some agencies use other parameters such a 65% Total Phosphorus removal requirement. What is problematic is that these simple requirements do not reflect the reality of how BMP's actually perform in the field.

In efforts to get away from percent removal requirements, other attempts at setting flat effluent standards for BMP's (e.g. 20 mg/l TSS effluent) are also problematic in that the level of treatment required to constantly meet these standards is very high. To some degree, by definition, the performance of a BMP is probabilistic and presumptive and therefore it has not been deemed practicable to constantly expect performance levels that meet effluent standards. There are also concerns that the cost of this level of treatment and associated maintenance are too high and that setting a fixed effluent standard may introduce complexities in terms of monitoring and compliance.

Clearly both of the approaches are problematic yet have beneficial aspects that perhaps could be combined to form a simple, realistic, and achievable performance standard for BMP's that can add a level of confidence the BMP is going to meet the standards though analysis of field data. BMP performance claims should be based and verified with the confidence that a percent removal or effluent concentration or load reduction will occur given a range of influent concentrations and/or particle size distributions.

THE TROUBLE WITH PERCENT REMOVAL

From a purely analytical perspective the simplistic 80% removal requirement has some serious flaws. First, lets assume that influent concentrations are extremely low, say 20 mg/l. For an 80% reduction the effluent would need to be 4 mg/l, which is often below the probable quantitative limits (PQL) set by commercial laboratories. In other words, with a PQL of 5 mg/l the best any technology could ever achieve is 75% removal.

Another issue, which is even more significant, is the notion that there are irreducible concentrations (Schueler, 1996). This is predicated on the notion that given the operation of BMPs that there is no expectation that the effluent will be below some amount. Many stormwater professionals accept that the irreducible concentration is at 20 mg/l (or greater) for TSS. In fact, advanced wastewater treatment regulations typically set effluent guidelines at 20 mg/l of TSS. Why, would we expect a relatively simple stormwater BMPs to outperform a plant with primary treatment, secondary treatment, automation, intensive maintenance and operators?

The irreducible concentration could also be viewed as a baseline effluent concentration. As an extreme example, say that water with zero mg/l of TSS enters a wetland. More than likely the effluent will not be zero and could easily be 20 mg/l. Though there is a net export of mass, at these concentrations this type of BMP behavior should not be a surprise.

So, using the example above, given an influent concentration of 20 mg/l and a 20 mg/l irreducible concentration, the expectation for percent removal is zero. Clearly this is far from the 80% rule, yet given the practical reality of BMP performance, is acceptable.

Data analysis using percent removal is typically not an accepted practice. The arithmetic averaging of percent removal, though sometimes used, is generally not accepted because it can be deceptive. For example, a series of small storms with small runoff volumes may yield higher removals due to long term settling of displaced water. Less frequent, higher magnitude storms yield low removal rates but have much greater volumes of water being discharged. Simple arithmetic averaging could yield a result that the BMP worked well when in fact in terms of mass load the BMP did not work well at all.

On the other hand if influent concentrations are continuously low, the average percent removal is low, and the BMP judged not to work, when in fact, given irreducible concentrations, all that could really be concluded is that the site has a low pollutant load and the function of the BMP is indeterminate.

Another issue, which has been discussed, is the plotting of percent removal vs. influent concentration. Typically, when plotted a characteristic curve is the result. The nature of the curve shows removal efficiency increasing with increasing influent concentrations. It has been shown that error plays a part in the characteristic (de Ridder et.al., 2002). The error is most pronounced at low concentrations due to analytical resolution. However, are there are other influences on the curve characteristic that may have a direct bearing on BMP performance?

One major influence can be particle size distribution. Lehman and de Ridder (2005) showed a direct correlation between intensity and TSS concentration. In general, as storm intensity increased, influent TSS concentration increased as well. This finding is consistent with physically based models in which increased intensity results in more detachment energy, higher peak flows and transport energy. Though not applicable in all cases, it leads to the hypothesis that higher removal efficiencies at higher concentrations is the product of transporting larger particles, which are easy to remove.

So it appears that there are both advantages and disadvantages in using concentration alone to evaluate BMP performance. But clearly, given these issues, simple percent removal as a standalone measure of performance should not be done.

LOAD VS. CONCENTRATION

Many will argue that the sum of loads or mass load calculations are the only way to evaluate BMP performance. Others will argue that concentration is most important.

Mass load reduction is also a simple concept. Basically mass load reduction is done by calculating the event mean concentration (EMC) of a storm times the runoff volume to yield the total mass of the influent and effluent. The percent reduction of the mass load is calculated from there.

While this method seems straight forward, there are issues with this method as well (Strecker et. al., 2004). Say, for example, a BMP gets a series of small storms with EMCs of about 100 mg/l. The EMCs of the effluent are at about 70 mg/l which yields a 30% removal of TSS. However a large storm transports a huge amount of mass (possibly consisting of large volumes of sand) at a concentration of 1000 mg/l with an effluent of 100 mg/l for a percent removal of 90%. When the sum of loads is conducted, the amount of mass and high removal of the one storm outweighs the others and leads to the conclusion that the BMP achieved an 80% reduction of mass load, therefore is was working.

What is problematic is that even though an 80% mass load reduction was achieved, the effluent concentrations were high and still exhibit significant water quality impacts. So in this case one might accept a BMP that really does not meet water quality needs.

On the other hand, lets say that a BMP has influent EMCs of 50 mg/l and Effluent EMCs of 20 mg/l for 5 storms and one storm at 120 mg/l in and 24 mg/l out. The sums of loads removal is calculated to be about a 66% removal. This result may lead to the conclusion that it does not meet the 80% goal and is rejected even though, given the concentrations, the BMP actually performed very well. Clearly, more data with higher concentrations may be needed to be conclusive, but these data are not sufficient to reject the BMP for low performance.

These situations lead to the conclusion that, to understand the operation of the BMP, <u>one must look at both load and concentration for making decisions on performance.</u>

PERFORMANCE EXPECTATION FUNCTIONS

From the discussions above it should be evident that simplistic percent removals on either a concentration or mass load basis do not allow for proper evaluation of BMP performance and effluent guidelines are not practicable. However one may consider combining the two into a method which is simple, flexible, measurable, considers both concentration and mass load, and most importantly is achievable by many BMPs.

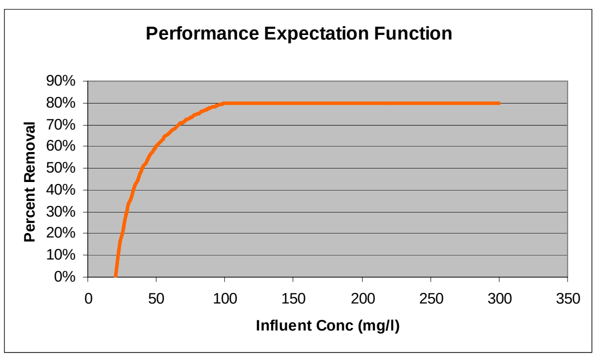
A Performance Expectation Function (PEF) can achieve these goals. The basis of the PEF is that the regulatory agency defines the PEF based on their specific water quality goals. The agency defines the irreducible or baseline concentration (typically 20 mg/l for TSS) that constitutes an effluent guideline for concentration below a threshold amount. Then, for influent concentrations above the threshold, percent removal (typically 80%) is used.

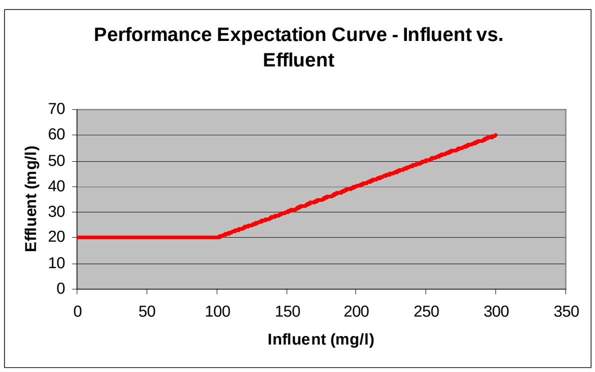
For example with a baseline concentration of 20 mg/l an agency would set an effluent guideline of 20mg/l for influent concentration of 100 mg/l or less. For concentrations greater than 100 mg/l the performance expectation is 80%. Put simply, the PEF would be "for concentrations less than or equal to100 mg/l the expected effluent is 20 mg/l and for influent concentrations greater than 100 mg/l the expected effluent is 80% of the influent.

Figures 1 and 2 show how the PEF can be illustrated in two ways. The first is a plot of influent vs. percent removal and the second is of influent vs. effluent.

This curve now defines the performance expectation of the BMP. Since the BMP performance is probabilistic one would expect that some of the data points will be above the line and some will be below the line.

It is important to realize that the PEF can be used for other pollutants such a phosphorus and metals or can be more complex. For example, the city of Portland wants the concentration percent removal to rise to 90% at concentrations exceeding 280 mg/l





Figures 1 and 2. Sample PEF Functions expressed as influent vs. Percent removal and influent vs. effluent

USING THE PEF TO EVALUATE BMP PERFORMANCE

Once a PEF is defined by the regulatory agency, observed performance data from a qualified BMP monitoring project can be used to compare how the observed performance meet the expected performance as defined by the PEF.

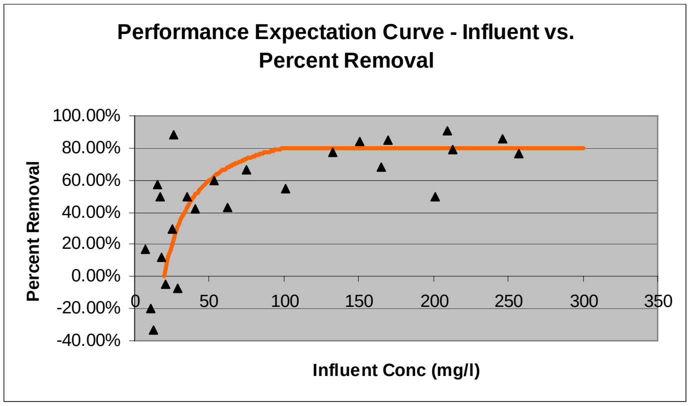
For the sake of illustration a hypothetical data set was constructed and is shown in Table 1. The sample population is 25, which for a field monitoring population would be considered substantial.

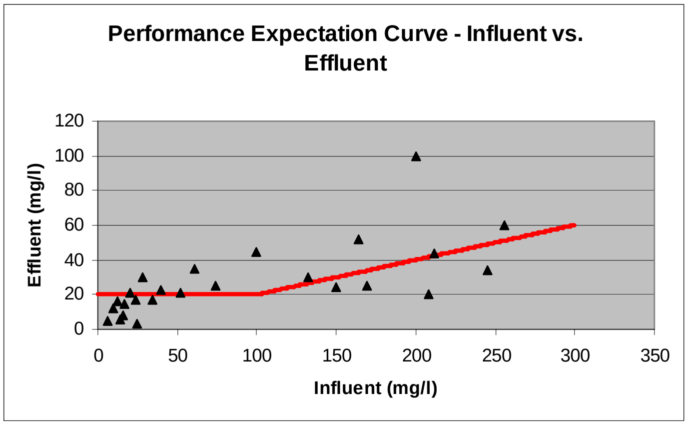
These data can then be plotted against the PEF to gain a visual perspective on performance. Figures 3 and 4 present the data in a graphical format with the PEF.

Table 1: Hypothetical Data Set for Example Analysis

Influent	Expected Effluent	Expected Percent removal	Observed Effluent	Observed Percent Removal
6	20	0.00%	5	16.67%
10	20	0.00%	12	-20.00%
12	20	0.00%	16	-33.33%
14	20	0.00%	6	57.14%
16	20	0.00%	8	50.00%
17	20	0.00%	15	11.76%
20	20	0.00%	21	-5.00%
24	20	16.67%	17	29.17%
25	20	20.00%	3	88.00%
28	20	28.57%	30	-7.14%
34	20	41.18%	17	50.00%
40	20	50.00%	23	42.50%
52	20	61.54%	21	59.62%
61	20	67.21%	35	42.62%
74	20	72.97%	25	66.22%
100	20	80.00%	45	55.00%
132	26.4	80.00%	30	77.27%
150	30	80.00%	24	84.00%
164	32.8	80.00%	52	68.29%
169	33.8	80.00%	25	85.21%
200	40	80.00%	100	50.00%
208	41.6	80.00%	20	90.38%
212	42.4	80.00%	44	79.25%
245	49	80.00%	34	86.12%
256	51.2	80.00%	60	76.56%

Once the data are plotted against the PEF, one can begin with a numerical and visual analysis of the data. Though both graphs are presenting the same data, the influent vs. % removal seems to convey more information. Looking at the influent vs. the effluent it seems, that in viewing the points that the question of what fraction (percent) is removed is always asked. Some additional visual aspects are:





Figures 3 and 4. Performance Expectation Functions vs. Observed Data

1. **Spread of the data points**. Do the data points have a tendency to group or scatter? Data points that form tighter groups should represent a more robust and predictable technology. Scattered points indicate a lot of variance in the performance characteristics.
2. **Position of the points about the line.** For percent removal, points above the line are exceeding expectations whereas points below the line are not meeting expectations. If the majority of the points are tightly clustered and above the line this is a good indicator that the technology is meeting or exceeding expectations. Clusters below the line indicate the technology is not meeting expectations. Finally, clusters about the line may be visually indeterminate.
3. **Outliers.** Note that in the example there are two points which may represent outliers. For the analysis one may decide to include or exclude the points.

DATA ANALYSIS – OBSERVED VS. EXPECTED

It is important to understand that the PEF is defined by the "user" and the observed data points are plotted about the line. Therefore the PEF is not the outcome from a regression analysis of the points but are a defined performance standard from which one can compare observed vs. expected.

One method of comparison is the sign test. This is a simple nonparametric statistical test to estimate if the scatter of the points about the line, represent the same population or a population which rests above or below the line. For example, if the BMP performance characteristic did follow the PEF, it would be reasonable to expect that 50% of the points would rest above the line and 50% below. If higher frequencies of occurrence lied either above or below the line then this may indicate that the BMP is either outperforming or underperforming expectations.

SIGN TEST

The Sign Test is a nonparametric test that may be of use when it is only necessary to know if observed differences between two conditions are significant. That is to say, with appropriate use of the sign test, it would be possible to determine if X is really "more" than Y, or however the conditions are arranged. The sign test is structured so that plus (+) and minus (-) "signs" are used to denote change in magnitude, as opposed to a quantitative measurement.

In a sign test the concentration differences are calculated by subtracting the observed from the expected. Positive number are then assigned a plus sign and negative numbers are assigned a negative sign. Differences of zero (i.e. Observed = Expected) are omitted. The outcome of the number of points above and below the line are compared to a population when it is expected that half the points are above the line and half are below. Using a binomial distribution the probability that the number of occurrences above (or below) the line, as explained by chance, is calculated. The probability is then evaluated to decide if the samples do or do not represent the PEF. There are three outcomes from this test.

1. The probability is high that the observed data match the expected
2. The probability is high that the observed do not match the expected and are greater (+)
3. The probability is high that the observed do not match the expected and are lesser (-)

With outcomes 1 and 2, the hypothesis that the BMP meets or exceeds expectations would be accepted, at least on a concentration basis. Outcome 3 indicates the BMP is below expectations and should be rejected.

$$P(X) = \frac{n!}{(n-X)!X!} \cdot p^X \cdot q^{n-X}$$

Where:

P(S) The symbol for the probability of success (+)
P(F) The symbol for the probability of failure (-)
p The numerical probability of a success (use 0.5)
q The numerical probability of a failure (use 0.5) (P(S) = p and P(F) = 1- p = q)
n The number of trials
X The number of successes (positives)

So in the example there are a total of 25 samples. Of the 25 samples, 13 are above the line(+) and 12 are below (-). This indicates a 50% probability of occurrence which clearly indicates this BMP is meeting expectations. As an example however, lets assume that of the 25 pairs, there were 17 below the line and 8 above then there is about a 5% chance of this occurring which would lead to the conclusion that the BMP was not meeting performance expectations. (http://home.clara.net/sisa/pairwise.htm)

MASS LOAD BALANCE CALCULATIONS

As mentioned above simply looking at the influent vs. percent removal or influent vs. effluent does not tell the whole story. These graphs convey no information on load reduction.

Load reduction evaluation is a quantitative method based on calculating both the expected load removal (expected concentration times the actual runoff volume) and the observed load removal. The difference between these two values represents a residual that can then be further analyzed. Table 2 shows these calculations.

Table 2 – Mass Load Balance Calculations

Influent mg/l	Expected Effluent Mg/l	Expected Percent removal	Observed Effluent Mg/l	Observed Percent Removal	Volume (liters)	Mass IN (mg)	Effluent Mass Observed	Effluent Mass Expected	Mass Remove Observed - Expected
6	20	0.0%	5	17%	2000	1.20E+04	1.00E+04	4.00E+04	-3.00E+04
10	20	0.0%	12	-20%	500	5.00E+03	6.00E+03	1.00E+04	-4.00E+03
12	20	0.0%	16	-33%	300	3.60E+03	4.80E+03	6.00E+03	-1.20E+03
14	20	0.0%	6	57%	500	7.00E+03	3.00E+03	1.00E+04	-7.00E+03
16	20	0.0%	8	50%	1500	2.40E+04	1.20E+04	3.00E+04	-1.80E+04
17	20	0.0%	15	12%	150	2.55E+03	2.25E+03	3.00E+03	-7.50E+02
20	20	0.0%	21	-5%	2000	4.00E+04	4.20E+04	4.00E+04	2.00E+03
24	20	16.7%	17	29%	800	1.92E+04	1.36E+04	1.60E+04	-2.40E+03
25	20	20.0%	3	88%	1900	4.75E+04	5.70E+03	3.80E+04	-3.23E+04
28	20	28.6%	30	-7%	350	9.80E+03	1.05E+04	7.00E+03	3.50E+03
34	20	41.2%	17	50%	800	2.72E+04	1.36E+04	1.60E+04	-2.40E+03
40	20	50.0%	23	43%	1100	4.40E+04	2.53E+04	2.20E+04	3.30E+03
52	20	61.5%	21	60%	5000	2.60E+05	1.05E+05	1.00E+05	5.00E+03
61	20	67.2%	35	43%	2000	1.22E+05	7.00E+04	4.00E+04	3.00E+04
74	20	73.0%	25	66%	5000	3.70E+05	1.25E+05	1.00E+05	2.50E+04
100	20	80.0%	45	55%	2000	2.00E+05	9.00E+04	4.00E+04	5.00E+04
132	26.4	80.0%	30	77%	1600	2.11E+05	4.80E+04	4.22E+04	5.76E+03
150	30	80.0%	24	84%	9000	1.35E+06	2.16E+05	2.70E+05	-5.40E+04
164	32.8	80.0%	52	68%	3000	4.92E+05	1.56E+05	9.84E+04	5.76E+04
169	33.8	80.0%	25	85%	1800	3.04E+05	4.50E+04	6.08E+04	-1.58E+04
200	40	80.0%	100	50%	800	1.60E+05	8.00E+04	3.20E+04	4.80E+04
208	41.6	80.0%	20	90%	5000	1.04E+06	1.00E+05	2.08E+05	-1.08E+05
212	42.4	80.0%	44	79%	30000	6.36E+06	1.32E+06	1.27E+06	4.80E+04
245	49	80.0%	34	86%	9000	2.21E+06	3.06E+05	4.41E+05	-1.35E+05
256	51.2	80.0%	60	77%	2000	5.12E+05	1.20E+05	1.02E+05	1.76E+04

Table 3 summarizes the outcome from Table 2.

Table 3 – Summary of Table 2

Total Mass In (KG)	Total Mass Out (KG)	Total Mass Out Expected (KG)	Observed – Expected (KG)
13.83	2.93	3.04	-.011

Note in this case that a negative number reflects a positive result. In other words, less mass left the BMP than expected. So one could conclude from a mass basis that the BMP met expectations as well.

Note that on a mass basis, the expected percent removal calculates to be 78% and not 80%. Clearly if the water was much cleaner with lower EMC's the mass removal could be say 50% and still meet performance expectations, however, one may ask the question how well the BMP would operate at higher concentrations which would warrant additional samples at higher concentrations.

The load reduction assessment can be further refined if there is an infiltration component. If a fraction of the entire runoff volume is reduced through infiltration or evaporative processes then the expected mass load would be a product of the (influent volume)x(Expected infiltration component)x(expected percent removal) the actual mass load would be the (Effluent volume)x(effluent concentration)

This allows an assessment of how well the infiltration component is working rather than assigning a simple percent which perpetuates the issue. One should use caution however because the infiltration capacity is most likely not constant and reduces over time with progressive loading.

COMPARISON TO THE EXPECTED RAINFALL DISTRIBUTIONS

Another issue about the use of storms is how they are distributed. Another way to misinterpret data is to not evaluate how the unit was sized as compared to the magnitude of the storms or storm flows that occurred. In most areas one can use local rainfall data to construct a cumulative rainfall depth frequency curve or a cumulative flow duration curve. These curves can be used to adjust flow data (or runoff volume data) to normalize what actually happen during the monitoring period vs. what would be expected to happen over a much longer period of time.

In most (if not all) cases one would find that BMP's tend to work better during small storms (especially BMP's that rely on volume storage and settling) and one would also find that the highest frequency of occurrence of storms is smaller storms. So it stands to reason that an additional weight should be added to the data set to provide an adjustment which weights the data to be more representative of what will statistically occur over a period of time vs. what just happened during the sampling period.

ANALYSIS OF OUTLIERS

Analysis of the outliers can be done for both the concentration and load. One method is to analyze the residuals (observed minus expected) to determine if they are normally distributed about the mean, which in this case would be zero. Box and whisker plots can then be used to identify the points outside the second or third standard deviations.

PERFORMANCE EXPECTATION FUNCTIONS FOR OTHER POLLUTANTS

A PEF can be constructed for other pollutants as well. In some cases the PEF may be more complex due to the more complex nature of the pollutant. Total Phosphorus for example has a soluble component to it. Most BMPs do not address Ortho-P and in many cases can generate Ortho-P from the decomposition of organic matter. Typically the reduction of Total-P is associated with the organic and mineral phase of Total-P associated with the TSS. (Wigginton et al, 2000) The soluble component adds a layer of complexity in that; the higher the fraction of Ortho-P to the Total P, the BMP relative performance will significantly drop.

So, in the case of a PEF for Total-P there could be two base lines. The first is the Ortho-P baseline and the second is the fraction of the particulate Total-P associated with the baseline TSS concentration. The PEF for the ortho fraction could be set to zero, and the particulate fraction could be then tied to the TSS removal or some function of the TSS removal.

For example, if an influent sample had 0.3 mg/l of Total P of which 0.10 mg/l was Ortho-P then the remainder could be associated with the TSS. If the influent TSS is at 50 and the expected percent removal of is 60% so (conservatively assuming a linear relation between TSS and TP) the removal expectation for the TSS fraction of the TP is 60% of 0.2 mg/l which is 0.12 mg/l. This gives an expected effluent of (0.10 mg/l + 0.12 mg/l) = 0.22 mg/l. Thus the expected percent removal is only 27%. In this case the observation was 0.21 mg/l, therefore, the BMP was exceeding expectations for TP even though the Ortho-P fraction was elevated on the effluent side.

Table 4 – Summary of Example Total-P Performance Expectation Function

Parameter	Influent (mg/l)	Effluent (mg/l)	% removal	Expected Effluent mg/l
TSS	50	20	60	20
Total P	0.3	0.21	30	0.22
Ortho P	0.10	0.12	-20%	0.10

CONCLUSION

This method of analysis is relatively simple and does not use “heavy statistics”. However it does provide a reasonable balance between the need to simply define expected BMP performance while taking into consideration much of the practical reality of how BMP’s actually perform. This method takes into account both concentration and load and allows for a realistic comparison to expected performance that is characteristic of most accepted BMPs.

The use of the PEF also allows the regulatory agency to stipulate the expected BMP performance. This allows for a connection between the BMP performance and water quality needed to meet the water quality requirements for the receiving waters.

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the discretion of the TRC. Under what circumstances would submitted information be limited for public use? To ensure all manufactures and vendors are treated equally this should be clearly defined. Both municipal regulators and developers should have access to data for both approved and failed technologies (page 4).

Similarly, this section references the TRC's ability to apply use restrictions. Circumstances for such limitations should be clearly defined to prevent potential product bias (page 4).

On the Evaluation Process flow chart, should there be a separate box for "approval by the TRC" between the "scope a test plan" and "perform performance testing" boxes? Based on the roles and responsibilities for the TRC it would appear that their approval will be required on any test plans (page 5).

2) **Section 3.2**

The term of the pilot use designation (PUD) should be more clearly defined and specify an appropriate allowable number of installations. This number should be large enough to ensure monitoring goals are achievable (approximately 5) but not so large that it is cost prohibitive to remove installations of an inferior product should testing reveal performance claims and water quality goals are unachievable by the product (page 6).

This section also references the use of information gathered under the ETV and TAPE protocols. Both programs allow for the evaluation of SSC rather than (or in addition to) TSS. Where SSC may be an acceptable measure for pretreatment devices or products exclusively targeting large particle distributions, it is not an appropriate measure for standalone treatment devises. We therefore recommend that SSC data only be used as a supplement to TSS removal data (page 6).

3) **Section 3.3.2**

Sizing and flow rates at which testing was performed should be included in both the performance reporting and the Specific Reporting Claims. The absence of this information opens the door for field installations of approved products under sizing designs (with resulting performance reductions) significantly different than the designs and flow rates for which they were tested and approved (page 7).

The typical maintenance interval and costs should be included in the maintenance documentation (page 7).

4) **Section 4.1**

We recommend clearly specify the sizing process and BMP expectations for manufactured structures. If manufacturers do this the agency can loose control over facility sizing (page 8). Please see attached documents for further discussion.

For on-line systems scour of previously captured material should be evaluated for bypass conditions. Quantities of resuspended and/or scour sediment should be reported and included in the evaluation process (page 8).

5) **Section 4.2**

The term and application for pretreatment should be clearly defined.

How are the following two items evaluated and what weight is put on these factors in deciding where 80% TSS removal may not be required? Who has the authority to make this determination? Each of these items should be clearly defined and transparent in the regulation.

- Improves the effectiveness, extends the useful life, or extends the maintenance cycle of a downstream treatment device or infiltration facility.
- Results in a more cost-effective treatment system (page 8).

Using multiple “pretreatment” systems, or systems with removal efficiencies of less than 80% TSS, in a series to “add up to” 80% removal should be prohibited. In other words 3 products in a series that each remove 30% TSS likely do not achieve 90% removal simply by being placed in a series. In general, pretreatment systems do not achieve 80% TSS removal due to the inability to remove the finer gradation particles. Simply stringing these systems together does not provided an enhanced ability to remove finer sediments. Therefore the sediments that pass through the first system in a series of identical products are likely to pass through subsequent systems. Similarly, when multiple proprietary structures of varying type and design are used in series or a treatment train application the product that targets the largest particle size should be placed first in the series with trailing BMPs following the same order, but with an appropriate performance reduction to account for the previous BMP (page 8).

6) Section 5.1 (item 3)

Standard categorical EMCs for TSS should be defined for various land types (for example 75 mg/L for commercial sites). When systems are being sized on a net annual load basis the concentration of TSS being designed for can significantly impact product sizing, resulting performance, and/or maintenance intervals (page 9).

7) Section 5.2

Again, sizing and the flow rates at which testing was performed should be included in both the performance reporting and the Specific Reporting Claims. The absence of this information opens the door for field installations of approved products under sizing designs (with resulting performance reductions) significantly different than the designs and flow rates for which they were tested (page 10).

8) Section 6.0

Flow rate data, inflow and outflow hydrographs with reference to design should be included with the performance testing reporting documentation (page 11).

9) Section 7.1 and 7.2

Performance data should exhibit the ability of a product perform under conditions similar to those found in GA. However, field testing within the state may not be necessary for this demonstration. If testing performed in other geographic regions under reasonably similar conditions meets the GTAP criteria and provides sufficient evidence to demonstrate the ability to meet the desired water quality goals and pollutant removal claims then this testing should be sufficient for consideration. This is especially true for sites that have already been verified and certified under similar protocols such as NJCAT/NJDEP program. There are huge costs associated with field-testing BMPs, making it impossible for specific BMPs to be tested in every locale throughout the country. Current drought conditions in GA may make it difficult to collect quality data for 15 storms in the region as outlined in section 7.2. Poor data collected in GA should not be preferred to quality data collected elsewhere (page13 & 14).

10) **Section 7.2**

If storms smaller than .15 inches of total rainfall are appropriately weighted relative to frequency of occurrence then they should be eligible as a qualifying storm event (page 14).

In addition, the 6 hour inter-event period seems unnecessary as antecedent conditions have been shown to have little to do with BMP performance and TSS transport (page 14).

11) **Section 9.0**

According to Section 9.0 it appears that the inclusion of statistical testing on performance claim data is encouraged (should be performed) vs. required (shall be performed). Parametric statistics (Regression of EMC), Non-parametric statistics (Summation of Load, one-tailed sign test), and observed performance vs. expected performance (similar to line of comparative performance) should be included as a requirement for reporting.

12) **General Comments - Clearly Defined Objectives**

Field monitoring is challenging and expensive. In order to minimize cost and assure that a project can be completed in a timely manner it is imperative to have clearly defined objectives.

a) Define suspended solids – WA defines suspended solids as Suspended Solids Concentration (SSC) less than 500 microns. NJ uses Total Suspended Solids (TSS). We recommend that the GTAP include analysis of SSC, SSC < 500 microns, and TSS. In addition, to assist with determining the amount of organic matter present in the stormwater, we recommend sampling for Total Volatile Suspended Solids (TVSS), for clarity regarding mineral and organic content.

b) Define Performance Objective – WA defines the performance objective for basic treatment (TSS) where 80% TSS is removed for influent concentrations greater than 100 mg/L. Influent concentrations less than 100 mg/L, WA has an effluent benchmark of approximately 20 mg/L. We recommend including a similar performance objective.

c) Data Quality Objectives – It would be beneficial to include emphasis on which storm event criteria are the most important for the technical review committee to consider. Emphasis should be on rain depth, intensity, and storm event coverage. Aliquots, antecedent times, duration, and volume are important characteristics that should be reported, but may not be the most important criteria. In addition, for flow-based technologies, peak operating rate is an important characteristic to include, and for volume-based technologies, percent of the volume captured. The TARP/Tier II protocol requires at least two storm events greater than 75% of the system's design.

d) Completion Objectives – Recommend including a section entitled Completion Objectives that contains an example of a summary table that includes all of the data quality objectives. This should simplify the review process.

e) Storm Event Summaries – Recommend to include an example of an individual storm report (ISR) that includes all of the relevant storm event information, including hydrographs, aliquot (time stamp), and precipitation depth/intensity. Applicants are likely to provide multiple tables for each characteristic, which will impair the ability for the technical review committee to review the data on an individual storm basis. A summary ISR reduces the time to review (from hours/days to minutes). This should be recommended as a requirement and included in an appendix.

In addition to these comments we would also like to submit the attached paper for your review and consideration. This document reflect CONTECH's positions regarding BMP performance measures. We appreciate the opportunity to provide comment on the GTAP and look forward to working with the ARC and the MNGWPD in establishing clear, equitable regulations regarding manufactured products. Please let us know if you have any questions or need any additional information. Call me at (404) 273-2991.

Sincerely,
Dionne Driscoll

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Comments on March 2008 GTAP Draft Proposal

Overview

Every stakeholder involved in the testing and verification process for BMPs appreciates an effort to standardize the process. There are several shortcomings in the concept, however, that need to be considered. These include the cost of implementing any new standards or testing which are ultimately borne by the general public. If new standards or testing can bring improvements in performance which enhance the general welfare and improve the environment, they can be justified. If they simply add another level of cost with no advancement in the application of water quality standards there is no justification for an additional layer of assessment in the approval process. The following comments should be taken in the light of constructive criticism given in the interest of better serving the citizens of Georgia, and improving the quality of the waters of the State of Georgia. The existing designation of proprietary devices as “Limited Application Controls” by the GSMM is the proper and ultimate control provided to jurisdictions in the State. Any jurisdiction with oversight of water quality should have the right to restrict the use of any device on a site-by-site basis. That ability to control the approval process should remain in place. In that light, any GTAP evaluation should be viewed as an advisory or informational process, not as a process that would render a technology “Approved” or “Disapproved” under the protocol. The correct designation should be that a technology was “Approvable” for a specific use or removal rate under the GTAP protocol. The rationale for this type of approach is presented below.

Existing Testing Protocols and Procedures

The usefulness of testing, in general, is highly limited. Field and laboratory testing each have severe shortcomings that make them unreliable for judging the actual performance of any BMP. We feel qualified to comment on these procedures based on the fact that our devices have been both field tested and laboratory tested. In addition, we have records on thousands of cleaning and maintenance operations that show a variability of performance that cannot be quantifed with any standardized test. While testing, especially laboratory testing, has given us insights into improving our products, the real improvements have come from closely tracking and examining the actual devices in the field.

Existing Field Testing

Several “standard” field testing protocols are familiar to stakeholders in this industry, including TARP, TAPE, ETV and other more localized protocols, including the outline in Section 3.3.10 of the GSMM. Every one of these protocols suffers from systematic shortcomings which are impossible to overcome with today’s technologies. Field testing is expensive and unreliable at this time. This comment should be taken as coming from

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a technology that achieved the highest removal rate for any gravity based system tested under the EPA's ETV protocol.

Field testing suffers from several types of sampling problems. The inability of automated samplers to acquire timely and accurate samples is well documented. One serious drawback is the positioning of the uptake device in the pipe. No credible laboratory believes it can use a single sample point in a water column and obtain a representative at any given flow rate, much less use the same single sample point at highly variable flow rates. The practice of placing a single strainer in a pipe or other conveyance to provide a representative sample is simply wrong, but alternative methods are expensive and have shortcomings of their own. The timing of the sampling is another problem that plagues automated samplers, especially in long storms with several peaks. If the samples were actually taken accurately, can it be said that they are representative of all the flow between sampling intervals? Flow weighted samples depend on flow meters that are notoriously inaccurate, and often upstream and downstream meters vary by a large margin. Some samplers cannot lift particles over 100 microns or so, and all of the larger fraction of sediment and grit is left uncollected. In short, samplers get samples that do not reflect conditions in the pipe, that may or may not represent that section of the storm at times that are based on very primitive logic for determining sampling points, and averaged over flow rates that are often inaccurate. All of these shortcomings are well documented, but no good alternative exists today, so we still conduct field studies.

A big positive for field studies is that the material is natural and includes organics, bacteria, hydrocarbons, trash, debris, some heavy metallic grit, and a wide variety of other substances. Of course, many of these materials never make it into a sample. If an accurate method of collecting all of the materials becomes available, and better sampling logic and flow measurements can be developed, field testing will be much more valuable. Even as it exists today, field testing is a good element to consider when evaluating technologies. It should count as a positive in an assessment program, but it should be viewed realistically for what it is, and not be used to disqualify any technology. The GTAP committee should recommend that public domain practices (General Application Controls) be tested in Georgia to the exact same standards as proprietary technologies to establish a baseline for performance.

Existing Laboratory Testing

Laboratory testing can establish performance curves for a device based on carefully measured removal rates for a graded sample of material are various flow rates. If the "indirect sampling" of aliquots taken before and after treatment are verified by mass balance, laboratory performance curves are very reliable. By indirect sampling, we mean that a concentration of material such as 200 mg/L is measured going into the device, and a concentration of 50 mg/L is measured coming out of the device, the

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removal rate would be calculated to be 75%. Because the concentration being fed to the device can be known, the sampling apparatus in the infeed pipe can be calibrated (in its placement) so that the samples taken from it analyze at the known concentration. The outlet pipe sampling is not as easily calibrated, as the concentration is not known. If mass balance is performed after the test, where the weight of the material fed into the device is compared to the amount captured, the actual removal percentage can be determined. In this way, the calibration (placement of sampling apparatus) of the outlet pipe can be checked, and adjusted if necessary. If this is done, the laboratory testing can be relied upon to be accurate for the conditions under which it was performed.

The shortcomings of laboratory testing, while different than field testing, are just as serious. The first shortcoming is that a steady state flow does not mimic the conditions in an actual storm. Some protocols call for a device to perform to some specific percentage of removal standard at the peak flow of a water quality storm, and ask that the device be certified in the laboratory at that flow rate. Of course, that approach is incorrect. From the outset, using some storm peak derived from a hydrograph is not reflective of actual storm conditions. Even if it were, all of the rest of the storm would have flows less than the peak, and the real performance of a device would have to be measured by the flow rates distributed across a hydrograph (or model) with the target peak. Once this is done, the device would perform properly for the largest water quality storm anticipated, but it would perform much better over the entire subset of storms up to and including the water quality peak storm. The guidance of the EPA, when it suggests that removal of 80% of solids may be a good surrogate for pollution control, says that such removal performance should be measured over all of the storms up to and including the water quality peak storm. GTAP would be well served to establish a method of distributing the Georgia water quality peak flow storm over an event, possibly the modified SCS method suggested in the GSMM to model a peak flow from the 1.2 inch “first flush” rainfall depth. Further distribution of the subset of storms up to and including that peak flow storm should be developed from the 50 plus years of daily rainfall records available in the state to establish a reasonable distribution of storms by depth. In this way, new technologies could be laboratory tested for a particular particle size definition, and empirically evaluated for performance on a fair and equitable basis.

If removal percentage is to dominate the evaluation of proprietary devices, this approach may be adequate, but the material used in laboratory testing should be recognized as bearing no resemblance to the actual material carried by stormwater runoff. The average density of silica, at 2.65 is higher than the average density of materials removed from BMPs. While pure silica will weigh about 165.5 pounds per cubic foot, we have found that the average weight of material removed from our vaults is about 105 pounds per cubic foot, or an average density of about 1.68. This is because the material contains organics and some trash which have very low densities. The low density material is also offset by some very heavy materials which are completely metallic or which contain high amounts of metal. A disadvantage of

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laboratory testing is that the material does not mimic the actual material to be collected in the field.

A further problem with laboratory testing is that even with gradations of particle sizes, the material is generally introduced at one concentration, and the particle size distribution does not change with the size of the flow, or over time. In the field, low flows mobilize small particles, and higher flows mobilize larger particles. Over time, the available quantities of small particles tend to be depleted at the source area, and small particles are less frequently encountered, even at low flows. In summary, a laboratory test cannot reflect conditions in the field.

Testing Summary

We have found that there is insufficient evidence in the overall GTAP proposal to warrant any new field testing for any device that has been tested to a reasonable protocol by another agency. Our view is that any field testing that meets the general criteria in the GWMM and a reasonable QA/QC standard should be acceptable to the TRC. Any test administered under this protocol would simply be one more test of a single device on a single site with little to add to the existing knowledge of the field performance of a particular device. The cost of a study that essentially duplicates what has already been done would be excessive, unless it could shed new light on some aspect of performance. An example of such a study would be a study of a device that had not been previously tested in a climate similar to that of Georgia. A study from a semi-arid climate, or from a wet climate with very low intensities, such as the Pacific Northwest, might not be applicable to Georgia. A study that did not consider bypassed flows might also be judged insufficient. Even in these cases, the evaluation of individual events within the study might be sufficient to avoid recommending a new study for a proven technology. In our opinion, GTAP should be widely inclusive of existing protocols, and the TRC should only recommend a new field study after due deliberation and with full justification of the cost to be incurred by the manufacturer. Doing otherwise could be viewed as trade restrictive, and an undue burden on the manufacturers as well as the general public.

For laboratory testing, reasonable protocols have been established and, if verified by mass balance calibration, should be adequate for the GTAP assessment without modification. Once again the GTAP should be widely inclusive of all laboratory testing that is verified by mass balance. Manufacturers that have good laboratory data should not be subjected to new testing simply based on minor variations from the proposed GTAP standards.

To better understand the position of manufacturers, the GTAP effort should recognize that there are many states and hundreds of other jurisdictions that have fostered various protocols and testing procedures. When there is some justification for new testing, this

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may be fine, but in most cases, this is simply unwarranted expense that is passed on to the citizens of the jurisdiction involved. An effort to give Georgia jurisdictions a consistent approach to approvals is good, but needs to be carefully evaluated in the light of the state of current testing procedures, and existing test data. In our view, the reliance of a test in Georgia of questionable accuracy that shows how one device worked in a few storms (intentionally omitting small storms), on one site during one season is a very poor method upon which to base approval.

As a group, the established proprietary manufacturers have the largest body of data available for BMP performance. This data goes far beyond any testing on public domain BMPs, which are all (or almost all) manufactured systems as well. The difference is that most public domain systems are made of concrete and soil, as opposed to concrete and other materials. Any system of evaluation must use the existing data, unless it can foster better methods and more accurate information. Of course, new devices without field or laboratory testing should be subjected to testing on a timely basis. Even so, there is no need to establish a new protocol that may or may not be accepted in other areas, when several already exist.

Section-Specific Comments

Section 3.2 Pilot Use Designation.

This section will effectively kill any new device proposal under GTAP. No vendor or developer will suffer the economics of trying a new technology when the testing required will almost certainly cost 10 times the cost of the technology and, without being able to control the TRC committee's evaluation of the data produced, be prepared to further suffer the cost of removal and replacement of that technology if it does not meet performance goals. A pilot use designation cannot bear consequences to the actual site owner beyond the vendor not being granted approval for the use and performance he was seeking. The cost of the testing can be borne by the vendor, if there is no existing testing of the technology. To say that established protocols like "ETV and TARP may be suitable" is simply wrong, unless specific flaws in the existing testing, such as a major climate difference, or non-qualifying storms are present. This is exactly the type of mistake that needs to be avoided, unless something in the GTAP protocol indicates that it is superior to existing protocols.

Section 3.3.2 Vendor/Manufacturer of the Technology

This section is very well worded, and gives room for explanation for additional aspects of a technology's performance. All too often, only a single number, "removal percentage" is considered, and there are pollutant-specific technologies that need to be considered. The GTAP effort should seriously consider a much wider scope of performance for pollutants other than sediments. All too often, regulators and manufacturers alike tend to focus simply on sediments, particle size distribution etc. Phosphorus is a perfect example of a serious pollutant that escapes scrutiny in many cases.

In addition to laboratory and field testing, CrystalStream and other manufacturers have field data concerning the mass and characteristics of pollutants removed from their technologies. Testing only indicates potential performance, whereas manifests of materials removed indicates actual performance. Recent research by many organizations indicates that protocols based on percentage of removal rates based in indirect sampling may miss up to 80% of pollutants.

Section 4.0 Treatment Performance Goals

This section uses the acronym TSS, which is assumed to mean Total Suspended Solids throughout. This designation can be confused with the EPA analysis procedure, EPA TSS 160.2, which is a method of measuring the concentration of sediments in a water sample in mg/L. The writers of GTAP are referred to the Federal Interagency Sediment Project, where the EPA, Army COA, USGS and four other agencies have agreed that the proper analysis method for evaluating the sediment concentration in surface waters is ASTM D3977-97 (SSC). The guidance of the FISP documents is too extensive to recount here, but when writing treatment goals and protocols, it would be better to state, "Total Suspended Solids" or "Total Sediment Load" to avoid confusion between TSS the pollutant, and TSS the analysis method. This leads to people wanting to evaluate sediment concentrations by the TSS method rather than the SSC (or other more appropriate) method, which FISP points out as being clearly wrong.

Section 4.2 Treatment Train, Retrofits, and Pretreatment Applications

This section refers to coarse solids over 500 microns, and notes that there is no model ordinance or explicit performance standards for these applications, etc. The lack of pretreatment for land based systems, especially infiltration, bioretention, constructed wetlands, or sand filters has led to many failures of these systems that are unnecessary. This is an area where GTAP should concentrate a lot of work, and move toward establishing standards to enhance land based BMPs. The ASCE has done excellent work on gross pollutants and establishing standards which can be utilized by GTAP to move this important aspect of water quality performance forward.

Section 5.2 Specific Performance Claims

This section is flexible enough to allow applicants to establish reasonable removal goals for testing. It should be remembered that in the field, variability of performance is a reality that is influenced by many factors, not the least of which is the influent concentrations. We have devices designed to the exact same standards that exhibit

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performance variability up to a factor of four. Most of the time this variability comes from the fact that one site is simply very clean and low usage. A test on a "dirty" site can enhance the apparent performance of a technology, and a test on a very clean site may show very poor performance. Our point here is that performance should be a range for most technologies. The field data clearly indicate that this is the case. This also indicates that a test site should be chosen carefully, and the performance on a test site may not be duplicated on all sites in the field. Once again, the poor reliability of field test data and procedures could kill a proposed technology that might be of great benefit to the waters of the State.

Section 6.0 Performance Testing Reporting

This is well written and conforms to most of the existing testing protocols. This is the type of consistency that should allow GTAP to accept the testing from most well managed field testing programs.

The commitment to testing bypassed flows show good insight on the part of the GTAP writers, and avoids a major mistake made by most testing protocols.

7.0 Sampling Design Considerations

Overall, most of this is well stated, however, while proper design of the test site is easy to write into a proposal, it is very difficult to achieve. For example, the statement, "Samples should be collected at a location where the stormwater flow is well-mixed." Collection points are highly variable with the flow, and GTAP writers are encouraged to include specific guidance on this issue, and all others concerning test site design. There is a large body of recent work that targets improved test site design, and sampling.

7.4.2 Particle Size Distribution (PSD)

In our opinion, this section incorporates the major error in this draft proposal.

With the understanding that most manufactured devices are installed on highly impervious sites, usually high-traffic and high human impact sites, the proposed incorporation of background soil information is completely inappropriate. For a low density subdivision or a similar site where there is a low amount of impervious surface, there may be some justification for considering background soils. Even in these cases, the landscaped surfaces are well managed, and not likely to erode native soils except in the construction phase, and the initial stabilization phase.

For most commercial, office, institutional, and high density residential sites (the vast majority of manufactured BMP sites) native soils are never encountered. The site is

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usually graded and compacted to a minimum of 95% proctor, and then covered with building, roof, pavement and carefully managed landscape elements. Almost without fail, manufactured amended soils will be used on the site and the landscaping will be professionally installed, managed, and maintained. To force someone like a gas/convenience operation in the Highlands or the Piedmont to use a manufactured technology four times larger than the same operation in the costal area would be poor science, and would impose an undue burden on the site operator. Note that reducing the average particle size by one-half changes the capture rate by (approximately) the square of the particle diameter. In nine years of cleaning BMPs, including land based BMPs, we have found that native soils are almost never encountered post-construction on a stable site. What we do find in these devices consists of pavement course wear, (especially in sites over 4 years old), very large sediment (such as builders sand) added to landscape areas, trash, and vegetative material. Those proposing to impose native soil protocols on these types of devices or any other BMP are invited to the field to see the types of material encountered in manufactured devices, and should examine ponds and bio-retention areas to convince themselves that this part of the proposed protocol needs to be changed.

Consider that this would be a windfall for our industry, and that we are advocating something that is not self-serving. To force the community to adhere to these standards would mean excessive costs that cannot be justified. In addition, if anything like this is to be considered, a similar sizing burden would need to be placed on every “General Application Control” in the GSMM, which, after all, have to deal with the same particle size distribution as manufactured products.

Good work is being done by many, including Dr. John Sansalone (University of Florids) and Dr. Bill Barfield (Clemson University working on the IDEAL model), concerning the typical PSD for various types of sites. Something like these works should be used in lieu of this approach, which is fundamentally flawed.

On page 19, reference is again made to gross particles, and we believe that the work of the ASCE and others should be referenced and incorporated here.

8.0 Date Quality Assurance and Quality Control

-and-

9.0 Statistical Testing of Data and Date Reduction

This is another good example of GTAP use of established practices. No need to establish new procedures here and you did not.

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Summary

GTAP is a good effort which will benefit manufacturers, jurisdictions and the citizens of Georgia when implemented. It is our sincere hope that the comments contained herein will be taken in the spirit which they are given, which is a desire for constructive changes to improve your efforts. We have experience in being field tested by more than one agency, and in having laboratory testing completed to meet a Tennessee jurisdiction's request. While we complied, others complained, and the test requirement was dropped after we spent almost $100K. Standards are important, and the GTAP effort is very important to all stakeholders. We offer our constructive criticisms and observations, in the hope that the mistakes and misconceptions carried forward by others will not be repeated in Georgia. While many other jurisdictions "talk the talk", Georgia has quietly led the way in the approval, installation and maintenance of BMPs of all types. If properly implemented, GTAP will push Georgia to the forefront nationally. In our opinion, if is essential that you get this right.

Still today, over half of our installations go without cleaning and maintenance, due to lack of enforcement, and most of the public domain structures we are asked to inspect have never been cleaned or maintained. Nevertheless, we have removed over 4.2 million pounds of material from our devices in Georgia alone, and properly disposed of it. The potential for properly specified, installed and maintained manufactured devices in Georgia is vast, and we encourage your efforts to bring consistency and fairness to the evaluation of these important part sof the BMP toolkit. In that light, we will be glad to meet with the committee to discuss these specific comments from CrystalStream, or as a part of the manufacturers association (MWQPA) to assist the committee as a stakeholder group.

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Technology That Separates

April 10th, 2008

Re: Georgia Technology Assessment Protocol (GTAP) for Evaluating Emerging Technologies

To: Metropolitan North Georgia Water Planning District

Environment 21, LLC is a developer and manufacturer of proprietary stormwater treatment products and would like to submit the following comments on the proposed GTAP for consideration. As a stake holder in the stormwater market we feel we should have a value added input in the development of a protocol of this magnitude.

Section 1.0 Paragraph 4 & 5
Field testing although done with a consistent method, will not yield a result that is meaningful and applicable. We agree that there needs to be a scale to compare various vendor products to, however the protocol should be more consistent with evaluating the pollutants retained in the system.

Section 3.0 Paragraph 4
Field testing is good, but why re-invent something that has already been done in other areas of the country. In addition data has revealed flaws with the current testing methodology being used for field verification in other parts of the country. ASTM C27 has recognized this and established a committee (C27.7) to develop a standard for verification that everyone can use and would be standardized across the country.
In addition it is stated "*Other protocols, including modifications of any specific procedures (judged to be more applicable for the technology) may be submitted to the TRC for consideration and possible approval.*" This leaves things very open and allows for personal opinions to be used for determination of acceptance. If other field testing has been completed it should be acceptable for approval.

Page 5 Flow Chart
You state is on Page 4 Section 3.1 that other test data can be submitted for consideration. Where is this in the flow chart?

Section 3.2 Paragraph 1
This designation although warranted could limit emerging technologies from entering into the Georgia Market due to the cost of completing field testing. Someone could have the perfect system but not be able to afford the testing, thereby depriving the Georgia tax payers and watershed from the benefits of the system. Once again if laboratory and field testing has been completed elsewhere it should be acceptable and rated based on the performance results and material retained.

Section 3.3.2 Performance Testing and Reporting
By stating third party testing you are restricting new products from entering the market since there are agencies offering funding for testing. It will need to be paid for by the vendor. Third Party is independent and non-influenced or biased.

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Section 4.1
What is the particle gradation? Please define TSS- Should be defined sooner not in section 7.4.2

Section 4.2
This is more applicable to hydrodynamic separators. Hydrodynamic separators provide a level of treatment and each product on the market has a level of performance based on particle size capture and floatable capture.

Section 5.2
Beside vendor claims, it should incorporate a product classification system. Every site does not need to capture 1 micron particles. If this was the case then this protocol should be directed to filters only and give hydrodynamic separators no credit. Hydrodynamic separators are meant to be part of a treatment train to meet the overall goal of 80% retained pollutants.

Section 6.0 Item 9
Studies have been completed by the University of Minnesota showing a large inconsistency in the accuracy of grab samplers (as great as 300%). By using a mass balance approach and estimating the site loading vs the retained pollutants in the systems you can obtain an estimated performance. In addition this would include an analysis of the retained pollutants for particle size distribution (PSD) and pollutants captured (ie. Phosphorus, Zinc, hydrocarbons, etc).

Section 7.1.1 First Sentence
Please see last comments- too much inconsistency in accuracy of samplers.

Section 7.1.1 First Paragraph Last Sentence
Who and how is it decided where to place the sampler? What about the particles that are at a lower or higher point in the flow stormwater is not evenly mixed.

Section 7.1.1 Page 13 Last Paragraph Last 2 sentences
Since when is stormwater and sediment evenly mixed. Mass balance testing would eliminate this variable and potentially false sample.

Section 7.2 & 7.3
Who determines whether alternate methods are superior? This should be defined to eliminate personal opinions.

Section 7.4.2
What is the bottom end of the Particle Size Distribution (PSD). This protocol should have different classifications for different products (ie. filters vs hydrodynamic separators.).

Section 8.0
When is the QA/QC program reviewed? Nothing indicated that it is reviewed prior to testing.

Section 8.4
Should be traceable standards

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In closing we would like to say that we understand the need for a standard for evaluating proprietary products and support the need, however more vendors who have a vested interest and some of the greatest stormwater minds on staff should have been included in the committee as stake holders in the upfront- this is our business. If every agency in the country requires field studies in their area it will only create additional cost to the manufacturer and thereby cause the cost of the systems to increase in value.

In addition more and more data is becoming available showing that automated grab samplers do not have the accuracy in stormwater they have in wastewater. Stormwater is not evenly mixed. The testing method should be reconsidered.

We also feel that in addition to an evaluation standard agencies should have a parallel plan established for the maintenance of installed systems and a capability to enforce the maintenance of these products. All of us vendors can develop some of the best stormwater treatment products in the world, but if they are not serviced they will cease operate and to continue to clean up our watersheds.

Please feel free to contact us with questions or concerns.

Sincerely,

Jeffrey Benty
Environment 21, LLC
Manufactured Water Quality Products Association (MWQPA) Member

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208 Jefferson Street
Newnan, GA 30263

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FPC Adairsville, GA
FPC Clanton, AL

Toll Free: 800-282-6958
Local: 770-251-0296
Fax: 770-254-2223

Date: April 11, 2008

Re: Georgia Technology Assessment Protocol (GTAP) for Evaluating Emerging Stormwater Treatment Technologies

To: Steve Haubner / Water Resources Engineer
Metropolitan North Georgia Water Planning District (MNGWPD)

Foley Products Company is a major manufacturer and supplier of stormwater infrastructure in the Southeast. We would like offer our comment and review of the GTAP protocols dated March 12, 2008.

First, we want to compliment the MNGWPD on its leadership in this important sector of our state's future infrastructure and thank you for allowing us to offer our input and dialogue about the best path for our state.

In general, these devices offer great potential to substantially improve water quality in a way that is much easier to maintain, more consistent in design and more sustainable than many more traditional site development practices commonly used. They definitely enhance the site engineers' ability to provide treatment on commercial and industrial applications where space is often limited and there are many competing spatial goals.

We offer the following general commentary on the proposed protocols:

1. The document is heavily weighted toward field testing. Field verification of performance is an important aspect in the application of these technologies; however, considering the amount of field testing that has already been carried out on these devices, what is to be gained by a repeat performance in Georgia. The high variability of such factors as site geometry, soils, hydrology, site washoff, land use to name a few, make results taken from site testing very hard to quantify in any truly meaningful way. That is why most of the industry is moving toward laboratory testing as the preferred method to evaluate performance. Lab testing is much more repeatable and would allow the performance of each device to be

more easily compared to other devices in their class. This would also move us farther down the road toward a more standardized design methodology that could be applied by site engineers in a consistent manner. This approach would take these devices out of the black box, lead to performance classification of competing technology and allow the market to sort out what product is most applicable to achieve the 80% TSS goal when applied in the context of an overall stormwater treatment train.

2. There is very little in the document regarding classification of treatment devices and applicability. For instance, a hydrodynamic separator is very different from a targeted filtration system. Obviously, test methods and reporting would be different as well. Categorization of technologies and industry agreed upon test methods and reporting standards would, again, lead to more comparable results.
3. A lab test driven model as described above could be further verified through field sampling and limited analysis of retained pollutants. This could be easily accomplished, with guidelines, in the normal maintenance cycle of the devices. These samples would give a much broader set of data points and be much more practical than a intricate field test procedure on a limited data set with very little follow up on actual performance.

Again, thank for you consideration.

Respectfully,

Tim Williams, P.E.
Foley Products Company
Technical Services Manager

Hydro International Comments on
The Draft GTAP for
Evaluating Emerging Stormwater Treatment Technologies
April 10, 2008

1. The Draft GTAP appears to have been developed from a review of other widely-accepted field test protocols such as TAPE and TARP. No mention is made in the Draft GTAP of the acceptability or the transferability of test data obtained under TAPE or TARP protocol for technology evaluation. It would seem that proprietary BMP manufacturers should receive some type of “credit” if their product has been approved by agencies that require testing in accordance with TAPE or TARP protocol. Perhaps MNGWPD could apply a much simpler approval process to devices that have been accepted under TAPE or TARP protocol, such as laboratory testing of products using the suitable laboratory surrogates listed in Table 1 under simulated storm conditions typical of Georgia.
2. The Draft GTAP requires testing consistent with intended applications and geographical locations in Georgia. It is not entirely clear if the Draft GTAP intends manufacturers to test in each of the four physiographic regions in Georgia in order to obtain approval to sell their product in those regions. Furthermore, do products have to be tested in each category of land use before it is approved for that land use. If so, the large number of physiographic region and land use combinations could make it prohibitively expensive to obtain “blanket” approval in the State of Georgia.
3. The Draft GTAP requires an analysis of inflow PSD during testing. For each physiographic region, what is the allowable variance from the general soil types for the storm data to be acceptable for product evaluation? Considering the variability in soil type from site to site within each region, and the effect that seasonal differences in storm types will have on PSD, it could be very difficult to obtain a PSD that is typical for a region.

April 11, 2008

Mr. Steve Haubner
Water Resources Engineer
Stormwater Treatment Technology Review Committee
Metropolitan North Georgia Water Planning District
40 Courtland Street NE
Atlanta, Georgia 30303

Subject: Georgia Technology Assessment Protocols (GTAP) for Evaluating Emerging Stormwater Treatment Technologies

Dear Mr. Haubner,

Imbrium Systems appreciates the opportunity to review and comment on the drafted Georgia Technology Assessment Protocols (GTAP) for evaluating emerging stormwater treatment technologies. Below we have outlined our thoughts, suggested adjustments and comments for consideration in an effort to enhance the proposed draft GTAP. We trust our extensive track record, experience and input will help strengthen the proposed GTAP.

General Comments:

Imbrium recognizes and agrees limitations have existed with stormwater quality test protocols and processes to date, however a lot has certainly been learned and experienced since the original inception and implementation of stormwater protocols. One of the most significant limitations is the dynamics and costs associated with conducting stormwater field monitoring/testing and analyses. In order to allow innovative technologies to emerge with field test validation of claims, we strongly believe it is imperative for all stakeholders throughout the United States to provide and maintain some level of reciprocity between similar stormwater field testing protocols. It is equally important that these protocols abide by and adhere to sound science as it relates to hydrology, pollutant capture and data analyses/reporting. The two primary protocols which appear very similar in test protocol nature to GTAP are; TARP and TAPE. Each time an entity pursues a single field test there is a tremendous financial and resource investment made (>$250,000). Most technologies and supporting vendor organizational infrastructure can not support that type of investment in multiple locations, thus the requirement to conduct field tests in various states and various sites to level of GTAP, TARP or TAPE protocols can often stifle the availability of emerging innovative treatment technologies.

GTAP page 3 - "Furthermore, the lack of consistent review and evaluation of monitoring and performance data has been a source of frustration for local government, vendors and the development community."

Another significant limitation has been the lack of program reciprocity across the nation. When reciprocity exists, the field test data generated from alternative states falling within the GTAP guidelines for example should be acceptable by the Stormwater Treatment Technology Review Committee, assuming the GTAP process is followed by the vendor and sound science has been applied.

A general comment is to have the members of the TRC aware and even participate in active national stormwater quality committees that include out-of-state influences, academics and regulators driving increased information exchange to broaden the committee's overall scope and input. A few suggested national committees are;

- ASTM C27.70 Stormwater Subcommittee
    - Contact; Mike R. Miller,
        - mmiller@press-seal.com
        - (260) 348-9889

- ASCE/EWRI Proprietary BMP Committee
    - Contact; Dr. George Guo
        - qguo@rci.rutgers.edu
        - (732) 445-4444

The objective would be to collectively drive towards a protocol and process, where reciprocity exists for evaluating proprietary stormwater treatment systems nation-wide. The expected outcome would be for local governments to have a solid protocol/process for making decisions relative to stormwater quality devices. In addition experience/resources/knowledge could be leveraged to hold manufactures to the same high standards with the end goal of protecting down stream water quality. A positive environment would be created for introducing emerging innovative stormwater technologies and obtaining verifiable claims.

Page 2; Objectives of the Protocol

The objectives of this protocol are to characterize a technology's effectiveness in removing pollutants from stormwater runoff for an intended application and to compare test results with vendor's claims.

Page 3; 2.0 – Purpose of this Document

This document's primary purpose is to establish a testing protocol and process for Georgia for evaluating and reporting on the performance and appropriate uses of proprietary stormwater treatment technologies and systems for address postconstruction stormwater runoff. It is not intended for use in evaluation of erosion and sedimentation control technologies or products.

Based on the stated Objective and Purpose, the field testing and the resulting data/verifiable technology claims which will occur outside of the state of Georgia should be accepted for field performance claim verification by the TRC with the following conditions;

1 – Adherence to the GTAP test protocol and process

2 - Hydrology differences between the actual field tested location versus the representative location within Georgia is accounted for with proper engineering design using rainfall data analyse and appropriate WQ_V treatment criteria. The hydrology methods within the Georgia Stormwater Management Manual can account for differences. If further concern exists, a generic restriction would be to only accept field test data from other regions within North America which also have Type II rainfall patterns, or more aggressive rainfall patterns (Type III).

3- Urban runoff and associated pollutants vary with every site. Proprietary stormwater treatment technologies are primarily used in urban settings, for the purpose of treating runoff from stable sites, which typically have high amounts of impervious cover. Hence the interest of solids removal is not soils; it is the urban wear which exists from anthropogenic activities. The types of particles (pollutants) which should be targeted are the finer materials (clay-sized, silt-sized, and fine sand-sized particles, not necessarily clay, silt and sand). Previous research conducted across North America (US EPA NURP studies) and globally (International Stormwater BMP Database) provides enough data supporting the ideals that pollutant loadings should be addressed based on site type and not soil type.

Page – 6; 3.2 Pilot Use Designation

The TRC will evaluate applications for new technologies or products not currently in widespread use. A pilot use designation (PUD) allows limited use of a technology or product (upon TRC review of a technology engineering report) for the sole purpose of collecting additional field performance data. <u>Local governments may allow PUD technologies to be installed in new development or redevelopment situations provided that the vendor and/or developer agree(s) to conduct additional field testing based on the GTAP and agree to remove/retrofit installations that fail to meet performance claims.</u>

Reasonable retrofits to a device should be enforced or requested, however based on the purpose and intent of the GTAP evaluation protocol and process; it is excessive to put forth a stipulation to remove an installation which was used for validation purposes. Suggest rewording the last statement as; <u>Local governments may allow PUD technologies to be installed in new development or redevelopment situations provided that the vendor and/or developer agree(s) to conduct additional field testing based on the GTAP and agree to ~~remove/~~retrofit installations that fail to meet performance claims.</u>

Page – 6; 3.2 Pilot Use Designation

Note: This designation is not intended to be used for conducting research on experimental devices. The TRC will not consider an application for pilot use designation unless the application includes sufficient performance data that clearly demonstrates acceptable feasibility and the likelihood that it will achieve desired performance levels at actual full-scale field conditions. <u>Laboratory and/or field performance data obtained in other states and using other protocols such as the ETV and TARP may be suitable for this purpose.</u>

Presentation of Full-scale lab testing or less than 15-rain event field studies should be necessary in order to obtain PUD status.

Based on the stated objective and purpose of GTAP, the field testing and the resulting data/verifiable technology claims which will or have occurred outside of the state of Georgia (ETV, TAPE, or TARP) should be accepted for field performance claim verification by the TRC with the following conditions;

(Same comments as Section 2.0 – Purpose of the Document)

1 – Adherence to the GTAP test protocol and process

2 - Hydrology differences between the actual field tested location versus the representative location within Georgia is accounted for with proper engineering design using rainfall data analyse and appropriate WQ_V treatment criteria. The hydrology methods within the Georgia Stormwater Management Manual can account for differences. If further concern exists, a generic restriction would be to only accept field test data from other regions within North America which also have Type II rainfall patterns, or more aggressive rainfall patterns (Type III).

3- Urban runoff and associated pollutants vary with every site. Proprietary stormwater treatment technologies are primarily used in urban settings, for the purpose of treating runoff from stable sites, which typically have high amounts of impervious cover. Hence the interest of solids removal is not soils; it is the urban wear which exists from anthropogenic activities. The types of particles (pollutants) which should be targeted are the finer materials (clay-sized, silt-sized, and fine sand-sized particles, not necessarily clay, silt and sand). Previous research conducted across North America (US EPA NURP studies) and globally (International Stormwater BMP Database) provides enough data supporting the ideals that pollutant loadings should be addressed based on site type and not soil type.

To ignore sound science obtained from field testing conducted in other states limits the innovation, limits the GTAP Program potential and limits the proper protection of water bodies within the State of Georgia while reducing competition (lower overall costs due to more options available). This situation follows along more closely to a "closed-door-policy" as opposed to the much needed reciprocity for stormwater treatment technology evaluation. It is great that the Metropolitan North Georgia Water Planning District has chosen to take a lead to address the lack of consistent review and evaluation of monitoring and performance data. Science is science, so the energy put forth by the TRC and vendors which adhere to the GTAP protocol should have their data accepted and reviewed by the TRC for full evaluation status to assist many more local governments, vendors and the development community

Page – 6; 3.3.1 MNGWPD Stormwater Technical Review Committee (TRC)

- Meeting, as needed (two to four times per year) to review new submittals and revise/update the GTAP and website;

As result of the significant investment all vendors have made or will make, it would be requested that the TRC have systems in place to be available to review new submittals at least 4 times per year, or as needed.

Page – 7; 3.3.2 Vendor/Manufacturer of the Technology

Performance Testing and Reporting

The vendor/manufacturer completes independent third-party performance field testing of the technology following the GTAP.

If the TRC is requiring independent third-party field testing, but the vendor is paying for those services, it is no longer an independent third-party. If the TRC provides or pays for those services, then a true qualified and objective, independent third-party can exist to the benefit of all. It is suggest the term independent "third-party" be reconsidered as second-party.

Page – 8; 4.1 Stormwater Performance Requirements

The performance goal applies to the water quality design storm volume or flow rate, whichever is applicable.

Based on the goal of addressing pollutant reduction on an average annual basis the following language change is recommended: The performance goal applies to the average annual (or annualized) water quality volume. This approach is supported by WEF and ASCE and focuses on treating the 80^{th} – 90^{th} percentile of WQ_v.

Page – 8; 4.2 Treatment Train, Retrofits, and Pre-treatment Applications

• Provides mostly coarse solids removal (> 500 microns) including all litter and debris.

It is suggested that these two potential considerations, removal of mostly coarse particles > 500 microns and removal of all litter and debris, be separated, as they should involve differing unit processes which can potentially impact downstream water quality. The most common unit process is gravity settling, which even the re-suspension/scouring of a 500-micron diameter particle is very possible during intense, large storm events. To prevent re-suspension/scouring of settled particles, there should be a by-pass or the unit is installed off-line. This by-pass or external diversion structure does not allow for the capture of all floatables during high flow events. Floatables for example can be captured during the higher flow events via screens and inverted-Tees.

In addition there are a number of technologies classified as hydrodynamic devices with a range of removal capabilities. For example some technologies are able to capture finer particles (such as the NJDEP PSD) while most if not all can remove upwards of a 100% of 500-micron sized particles. These technologies and their performance capabilities fit very well in the section 4.2 category, however their capabilities fall within the two suggested particle gradations (i.e. sil-co-sil 106 and 500 micron particles). We would suggest that something like an NJDEP or OK-110 particle size distribution be used for the retrofit target gradation.

Page – 13; 7.1 Test Site Selection Considerations

Select field test sites that are consistent with the technology's intended applications (land uses) and geographical location in Georgia (e.g. Piedmont region, coastal areas, etc) that will provide influent concentrations typical of stormwater for those land use types.

As previously commented, tests conducted outside of the state of Georgia should be recognized as long as they follow the protocol requirements for all the reasons outlined in the Section 2.0 and 3.2 comments.

Page – 14; 7.2 Storm Event Criteria for Sampling

• At least 0.15 inch of total rainfall.

To be congruent with alternate field test protocols, and extend inter-state reciprocity, it is suggested that this event criteria be adjusted from 0.15 inch of total rainfall, down to 0.10 inch of total rainfall.

Page – 15; 7.4.2 Particle Size Distribution (PSD)

To meet the 80% TSS removal goal, treatment technologies must be capable of removing TSS across the size fraction range typically found in Georgia urban runoff.

As commented on in Sections 2.0 and 3.2: Urban runoff and associated pollutants vary with every site. Proprietary stormwater treatment technologies are primarily used in urban settings, for the purpose of treating runoff from stable sites, which typically have high amounts of impervious cover. Hence the interest of solids removal is not soils; it is the urban wear which exists from anthropogenic activities. The types of particles (pollutants) which should be targeted are the finer materials (clay-sized, silt-sized, and fine sand-sized particles, not necessarily clay, silt and sand). Previous research conducted across North America (US EPA NURP studies) and globally (International Stormwater BMP Database) provides enough data supporting the ideals that pollutant loadings should be addressed based on site type and not soil type.

The discussion about particle size and PSD is relevant; however focusing in on regional soils is much less relevant to these technologies which are applied primarily in the urban environment, not as erosion sediment control (ESC) practices. It is suggested that section 7.4.2 be re-reviewed/re-written with much less emphasis on Georgia's soil types, and more focus on typical urban runoff particle size distributions, based on site type, not surrounding soil types.

Imbrium appreciates the opportunity to put forth these comments and suggestions to the GTAP TRC. We trust our long history of experience and the input presented will be helpful in strengthening the GTAP. We believe it is important that the TRC and GTAP consider our comments as interstate science should exist to allow for cost mitigation created by reciprocity and maximizing the number of choices; as well as avoiding time delays to deliver emerging innovative technologies due to required resources in multiple locations within the U.S. By extending inter-state reciprocity with this program and not specifying that testing must be conducted solely within the state of Georgia, the GTAP program will stimulate innovation for all stakeholders if sound science and engineering is allowed to prevail, while providing verified tools to protect our watersheds.

In addition there is a manufactures association (MWQPA) which is currently being assembled and is in the early stages of discussing and addressing issues such as inter-state reciprocity, amongst many others. Imbrium Systems is currently evaluating this initiate and have participated in the initial meeting. We believe this association is a potential tool for manufacturers to speak with a unified voice relative to some of the issues raised here.

If there are any questions or needed clarification, please do not hesitate to contact me at sperry@imbriumsystems.com and/or (301) 279-8827.

Sincerely,

Scott Perry; CPSWQ
Sorbtive Product Manager
Imbrium Systems Corporation

CC: Maita Pang – Imbrium Systems
Rob Crossman – Imbrium Systems
Ernie Carrasco – Rinker Materials

Steve Haubner

From: Jon McDonald [jmcdonald@kristar.com]
Sent: Friday, April 11, 2008 5:20 PM
To: Steve Haubner
Cc: Skip Short; Craig Beatty
Subject: GTAP comments
Attachments: GA Draft Regs 2007-Kristar markup 041108.pdf

Steve,

Please find the attached copy of the draft GTAP with a few brief comments. This is submitted both as part of the MWQPA and as individual feedback.

As noted on the document, this protocol clearly borrows heavily from the TAPE and TARP, established and in use in the NW and NE respectively. One must question the need for another similar protocol rather than just adoption of one or the other. Many states that have adopted the TARP have added special requirements for adaptation to local needs. The Washington State Department of Ecology's TAPE and Emerging Technologies program is the longest running and most refined process of its kind and many permitting jurisdictions simply defer to products listed with them. Overall, we would discourage reinventing the wheel or duplicating a process that already exists elsewhere. There is a great amount of effort underway, reflected in committees in ASTM and ASCE/EWRI to bring together disparate protocols and to provide verification and certification programs with consistent elements. The end result should be more consistent implementation of stormwater controls and simplicity for the project designer.

One aspect of the protocol and program notably absent is a provision for interim product use during the time period that field data is collected. Similar programs both in the NW and NE provide limited use based on data generated using a defined laboratory protocol. This offsets some of the cost involved in meeting the field monitoring requirements as well as provides more opportunity for monitoring sites. In addition, allowance for testing in areas outside GA which can be shown relevant given defined rainfall and TSS PSD characteristics is critical.

Let me know if you have questions or if we can be of further assistance.

Best regards,

Jonathan McDonald, PE, CPSWQ, CPESC
Engineering Services Manager
Kristar Enterprises, Inc.
(800) 579-8819, x107

Guidance for Evaluating Emerging Stormwater Treatment Technologies

Georgia Technology Assessment Protocol (GTAP)

DRAFT – FOR REVIEW ONLY

Metropolitan North Georgia Water Planning District
October 2007 Draft

INTRODUCTION

In 2003, the Metropolitan North Georgia Water Planning District (District) adopted its Model Ordinance for Post-Development Stormwater Management for New Development and Redevelopment. This model ordinance defines a water quality treatment goal of 80% total suspended solids reduction on an annual average basis for post-development stormwater runoff to be met by stormwater management facilities and practices.

The Georgia Stormwater Management Manual (GSMM), published in 2001, provides guidance on meeting stormwater quality performance goals as well as design criteria for various structural stormwater controls, such as stormwater ponds, sand filters and filter strips. Section 3.3.10 of Volume 2 of the Manual discusses proprietary (manufactured, commercial) structural controls and includes basic guidelines for considering a proprietary system.

These guidelines, however, were not intended to be a rigorous set of testing protocols or procedures for evaluating the performance of a proprietary system. Furthermore, the lack of consistent review of monitoring and performance data has been a source of frustration for local governments, vendors and the development community.

As local governments are being asked to review and approve emerging stormwater treatment technologies, guidance is needed for a consistent testing protocol and a process for evaluating and accepting proprietary stormwater treatment systems.

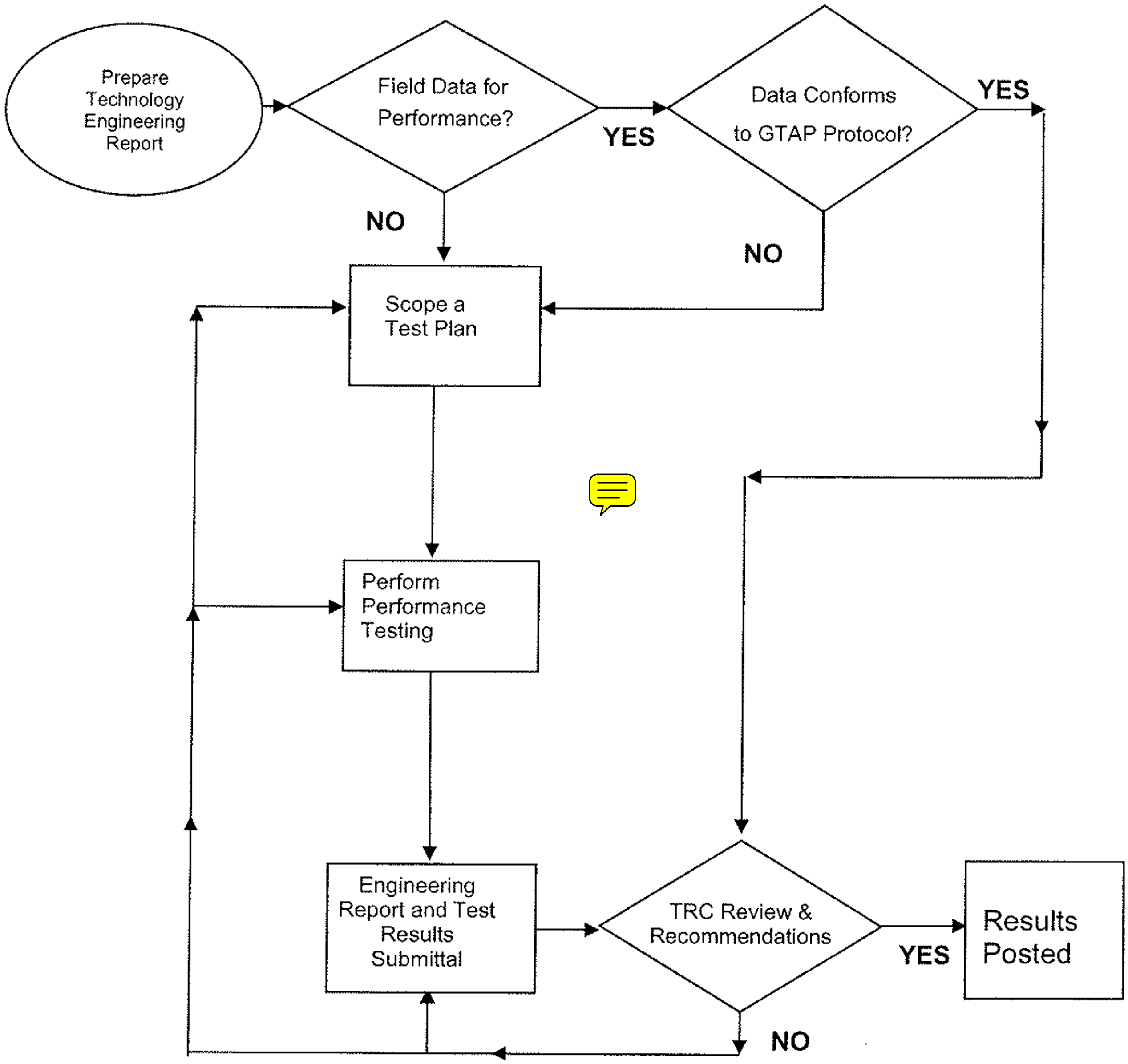
The GTAP's goal is to obtain accurate and relevant data to assess vendor performance claims and enable comparison to GSMM and District model ordinance performance standards.

PURPOSE OF THIS GUIDANCE DOCUMENT

This guidance document's primary purpose is to establish a testing protocol and process for evaluating and reporting on the performance and appropriate uses of proprietary stormwater treatment technologies and systems for address post-construction stormwater runoff. It is not intended for use in evaluation erosion and sedimentation control technologies or products.

Stormwater treatment technologies and products that have been tested according to these protocols can receive consideration to have their results evaluated and made available publicly on the District website. Local governments in the District and Georgia are free to use this information to evaluate the suitability of these technologies or products in their community.

Figure 1. STORMWATER TREATMENT TECHNOLOGY EVALUATION PROCESS



Vendor/Manufacturer of the Technology

Technology Engineering Report

The vendor/manufacturer prepares a technology engineering report on their technology or product following the criteria in the GTAP. The report must clearly identify the vendor's performance claims including:

- Reduction of pollutants from stormwater runoff
- Applications of the technology to be verified, including siting, location, land use, and land activity limitations or restrictions
- Full range of operating conditions for the technology
- Minimum maintenance requirements to sustain performance
- Capital and projected annual costs, including operations and maintenance costs

Performance claims must include quantitative data (e.g., load reductions and removal efficiencies for specific pollutants or categories of pollutants, application and design criteria, costs, etc.), but may include additional qualitative claims (e.g., advantages over other technologies, installation or maintenance considerations). See page 11 for the complete list of requirements for the technology engineering report.

Performance Testing and Reporting

The vendor/manufacturer completes independent third-party performance field testing of the technology following the GTAP (see page 13). This includes:

- Performance testing project plan
- Testing data including rainfall data, influent and effluent concentrations
- Statistical analysis of data
- Data quality assurance summary
- Maintenance performed during the study period
- Evaluation of results

See page 13 for the complete list of requirements for performance testing reporting.

GEORGIA TECHNOLOGY ASSESSMENT PROTOCOL (GTAP)

Objectives of the Protocol

The objectives of this protocol are to characterize, with a reasonable level of statistical confidence, a technology's effectiveness in removing pollutants from stormwater runoff for an intended application and to compare test results with vendor's claims.

Requesting a TRC Review

Vendors seeking the review of their technology or product by the TRC in order to receive and evaluation of their testing data, or to obtain a pilot use use designation (PUD) should mail their submission to the following address:

Stormwater Treatment Technology Review Committee
Metropolitan North Georgia Water Planning District
40 Courtland Street NE
Atlanta, GA 30303

Protocol Limitations, Release of Liability, and Disclosure

This protocol has been published for the purpose of evaluating or generating performance claim data for stormwater treatment technologies for environmental certification and verification programs. The Metropolitan North Georgia Water Planning District accepts no responsibility or liability for performance of stormwater technologies being evaluated using this Protocol.

B. Specific Performance Claims

An applicant must make a performance claim that identifies the technology's intended use and predict the technology's capabilities to remove contaminants and/or control the quantity of stormwater runoff. Performance claims should be objective, quantifiable, replicable, and defensible. Claims that are overstated should be avoided, as they may not be achievable.

Stormwater treatment technologies are typically evaluated for contaminant removal efficiency, although pollution prevention claims also are possible. An example of a stormwater treatment performance claim could be:

> *"The Model X system can capture and treat WQ volume for a 10-acre runoff area. Under these conditions, a total suspended solid (TSS) removal rate of 85%± 5% (at a 95% confidence level) can be achieved with inflow TSS concentrations greater than 100 mg/l."*

Appendix A provides the permitted calculation methods for calculating pollutant removal.

samplers are installed and positioned properly to ensure that samples are representative of influent runoff and effluent runoff, (i.e., sample the influent as close as possible to the inlet of the system and sample the total treated effluent). For systems that bypass runoff, the influent location will be directly upstream of the system and before the flow is split between the treatment system and the bypass. The second, effluent sampling location will be directly downstream of the treated flow (i.e., the technology or treatment system outlet) and after the effluent joins the bypass. If the treated effluent flow does not join the bypass, the second location will allow sampling of the total flow after the treatment unit outlet.

flow column in the absence of adequate mixing. Samples should be collected at a location where the stormwater flow is well-mixed.

Stormwater Facility Design and Sizing

Sizing of the test facility must be based on meeting applicable performance goals by treating the water quality volume, or the design flow rate coinciding with treating the water quality volume.

Storm Event Criteria for Sampling

A minimum number of 15 storm or discrete flow rate sampling events is required per application. The storms should be representative of the entire annual hydrologic range of storm events and constitute at least 20% of the total annual rainfall. It is recommended that sampling events be evenly distributed over the testing period to capture seasonal influences on storm conditions and system performance.

Each storm event for sampling must meet the following criteria:

- At least 0.15 inch of total rainfall.
- A minimum inter-event period of 6 hours, where cessation of flow from the system begins the inter-event period.
- A minimum storm duration of one hour.
- Flow-weighted composite samples covering a minimum of 70% of the total storm flow, including as much of the first 20 % of the storm as possible. Note: composite samples are not appropriate for all parameters (see below).
- A minimum of 10 water quality samples (i.e., 10 influent and 10 effluent samples) should be collected per storm event. For composite samples, a minimum of 5 subsamples is acceptable (i.e., 2 composites with 5 subsamples = 10 water quality sample minimum or 1 composite sample with 10 subsamples = water quality sample minimum). If a storm is too small for 10 samples, an average of 10 samples per storm may be substituted. However, more than 10 samples per storm event should be collected wherever possible.
- Flow measurements must be taken to predict or calculate pollutant loads. The mass of pollutants in the discharge should be based on flow rates and pollutant concentrations or another reasonable approach.

Stormwater Sampling Methods

Programmable automatic flow samplers with continuous flow measurements should be used unless it is demonstrated that alternate methods are superior or that automatic sampling is infeasible. Grab samples should only be used for certain constituents, in accordance with accepted standard sampling protocols, unless it is demonstrated that alternate methods are superior. Constituents that typically require grab sampling include: pH, temperature, cyanide, total phenols, residual chlorine, oil and grease, total petroleum hydrocarbons (TPH), *Escherichia coli*, total coliform, fecal coliform, fecal streptococci, and enterococci.

Note: Time-weighted composite samples are not acceptable, unless flow is monitored and the event mean concentration can be calculated from the data.

Table 1. PARTICLE SIZE DISTRIBUTION FOR PHYSIOGRAPHIC REGIONS IN GEORGIA

Area	**General Soil Type**	**Assumed PSD Sand-Silt-Clay**	**Suitable Laboratory Surrogate**
Highlands	Silty Loam	30-60-10	Sil-Co-Sil 106
Piedmont	Silty Clay Loam	20-60-20	Sil-Co-Sil 106
Plains	Sandy Clay Loam	50-20-30	Sil-Co-Sil 250
Coastal	Sandy Loam	60-20-10	OK-110

For field testing performance results, an analysis of the inflow PSD is required. The purpose of the requirement is to collect consistent information on particle size that will aid in evaluating system performance. PSD measurements will provide a frame of reference for comparing variability in performance between storms and between different sites. These measurements are an important tool with which to assess performance since performance is likely to be affected by particle size. For example, it is likely that performance will drop with a substantial increase in fine soil particles. Conversely, it is anticipated that performance will be high with sandy sediments.

Laser diffraction methods are effective for analyzing particles smaller than 250 microns. Therefore, particles greater than 250 microns must be removed with a sieve prior to PSD analysis. These large-sized particles will be analyzed separately to determine the total mass of particulates greater than 250 microns. This protocol functions as a supplement to the existing protocols provided by the manufacturers of laser diffraction instruments such that the larger-sized particles in the sample can also be measured.

Accumulated Sediment Sampling Procedures

As appropriate to demonstrate facility performance, and to confirm the stormwater sampling-based percent removal data, measure the sediment accumulation rate. Practical measurement methods would suffice, such as measuring sediment depth, immediately before each sediment cleaning and when testing is completed. The following sediment constituents should be analyzed:

- Percent total solids
- Total volatile solids
- Particle size distribution (PSD)

The sediment sample should be a composite from several grab samples (at least four) collected from various locations within the treatment system to ensure that the sample represents the total sediment volume in the treatment system. For QA/QC purposes, collect a field duplicate sample (see following section on field QA/QC). The sediment sample should be kept at 4°C during transport and storage prior to analysis. If possible, remove and weigh (or otherwise quantify) the sediment deposited in the system.

DATA QUALITY ASSURANCE AND QUALITY CONTROL

Quality assurance and quality control (QA/QC) describe the measures that will be employed to ensure the representativeness, comparability, and quality of field samples for the performance testing of stormwater technologies.

Sample Data Quality Assurance and Control

The following elements should be including in the QA/QC plan and procedures:

- Equipment decontamination
- Preservation
- Holding time
- Volume
- QC samples (spikes, blanks, splits, and field and lab duplicates)
- QA on sampling equipment (e.g., calibration of automatic samplers and flow measurement devices)
- Packaging and shipping
- Identification and labeling
- Chain-of-custody

Equipment decontamination:

Describe how sampling equipment (sampler head and suction tubing) will be decontaminated between sampling events to prevent sample cross-contamination. It is recommended that the suction tube be replaced at least once during the test period and more frequently if runoff is highly contaminated.

Quality Control samples:

1. Equipment rinsate blanks: Equipment rinsate blanks should be collected to verify that equipment is not a source of sample contamination. Equipment rinsate blanks are collected by passing reagent-grade water through clean equipment and collecting samples for chemical analyses. These samples are to be analyzed as regular samples with all appropriate quality control performed.

   It is recommended that equipment rinsate blanks be collected at the inlet monitoring station where stormwater is expected to contain the highest contaminant concentrations. However, if the inlet station is difficult to access (e.g., confined space entry required), the rinsate blank may be collected from the outlet station. Two separate rinsate blanks should be collected during the initial equipment startup and testing, and at least one additional blank should be collected midway through the sampling program. More frequent blank samples may need to be collected if site conditions warrant (e.g., following an event with unusually high contaminant concentrations).

   The equipment rinsate blank collection procedure should be described in the QA/QC plan. Include a description of the location and number of samples that will be collected, sample collection and processing procedures, and sample documentation (e.g., length of time that sampler was in place prior to collecting the blank, how much stormwater passes through the sample prior to collecting

Recordkeeping:

Maintain a field logbook to record any relevant information noted at the collection time or during site visits. Include notations about any activities or issues that could affect the sample quality (e.g. sample integrity, test site alterations, maintenance activities, and improperly functioning equipment). At a minimum, the field notebook should include the date and time, field staff names, weather conditions, number of samples collected, sample description and label information, field measurements, field QC sample identification, and sampling equipment condition, as well as any measurements tracking sediment accumulation. In particular, note any conditions in the tributary basin that could affect sample quality (e.g., construction activities, reported spills, other pollutant sources). Provide a sample field data form in the QA/QC plan.

Health and Safety Plan: A health and safety plan should be developed and included with the QA/QC plan covering installation, operation, and maintenance of the technology. Specifically, the plan should address hazard identification and mitigation, engineered controls and procedures, personal protective equipment, and training. Also, where related to the stormwater technology, include: collecting stormwater samples in confined spaces (manholes, storm sewer lines, and utility vaults); collecting high flow stormwater samples from culverts, drainage channels, and sedimentation basins during storms; and chemical, biological or physical hazards associated with the technology.

APPENDIX A:

TREATMENT EFFICIENCY CALCULATION METHODS

Calculate several efficiencies, as applicable. Consider lag time and steady-state conditions to calculate loads or concentrations of effluents that represent the same hydraulic mass as the influent. State the applicable performance standard on the table or graph.

For technologies sized for long residence times (hours versus minutes), cumulative performance of several storms, wet season or annual time periods must be considered. For short residence times (several minutes), event mean comparisons are recommended and for discrete short-time step residence times (few minutes), lag times should be considered for influent/effluent comparisons.

Method #1: Individual storm reduction in pollutant concentration.

The reduction in pollutant concentration during each individual storm calculated as:

100 (flow-weighted influent concentration – flow-weighted effluent concentration)/flow-weighted influent concentration

Method #2: Aggregate pollutant loading reduction.

Calculate the aggregate pollutant loading removal for all storms sampled as follows:

100(A-B)/A

Where: A= (Storm 1 Influent concentration) * (Storm 1volume) + (Storm 2 Influent concentration) * (Storm 2volume) +...(Storm N influent concentration) * (Storm Nvolume)

B = (Storm 1 Effluent concentration) * (Storm 1volume) + (Storm 2 effluent concentration) +...(Storm N effluent concentration) * (volume of Storm N)

Concentrations are flow-weighted, and flow = average storm flow or total storm volume (vendor's choice)

Method #3: Individual storm reduction in pollutant loading.

100(A-B)/A

Where: A= (Storm 1 Influent concentration) * (Storm 1volume)

B= (Storm 1 Effluent concentration) * (Storm 1volume)

D5906-96, Standard Guide for Measuring Horizontal Positioning During Measurements of Surface Water Depths.

D5073-90 (1996), Standard Practice for Depth Measurement of Surface Water.

D5413-93 (1997), Standard Test Methods for Measurement of Water Levels in Open-Water Bodies.

D5243-92 (1996), Standard Test Method for Open-Channel Flow Measurement of Water Indirectly at Culverts.

D5130-95, Standard Test Method for Open-Channel Flow Measurement of Water Indirectly by Slope-Area Method.

D5129-95, Standard Test Method for Open Channel flow Measurement of Water Indirectly by Using Width Constrictions.

D3858-95, Standard Test Method for Open-Channel flow Measurement of Water by Velocity-Area Method.

D5614-94 (1998), Standard Test Method for Open Channel Flow Measurement of Water with Broad-Crested Weirs.

D5242-92 (1996), Standard Test Method for Open-Channel Flow Measurement of Water with Thin-Plate Weirs.

D5640-955, Standard Guide for Selection of Weirs and Flumes for Open-Channel Flow Measurement of Water.

D5089-95, Standard Test Method for Velocity Measurements of Water in Open Channels with Electromagnetic Current Meters.

D4409-95, Standard Test Method for Velocity Measurements of Water in Open Channels with Rotating Element Current Meters.

D5390-93 (1997), Standard Test Method for Open Channel Flow Measurement of Water with Palmer-Bowlus Flumes.

D1941-91 (1996), Standard Test Method for Open Channel Flow Measurement of Water with the Parshall Flume.

D4375-96, Standard Practice for Basic Statistics in Committee D-19 on Water.

E178, Practice for Dealing with Outlying Observations.

F1779-97, Standard Practice for Reporting Visual Observations of Oil on Water.

F1084-90 (1995), Standard Guide for Sampling Oil/Water Mixtures for Oil Spill Recovery Equipment.

Steve Haubner

From: John Moll [johnmoll@crystalstream.com]

Sent: Friday, April 11, 2008 12:18 PM

To: Steve Haubner

Subject: MWQPA Comments on GTAP

Attachments: GTAP Comments.doc; Royal Environmental GTAP comment.doc; Environment 21 -GTAP Review.pdf; AquaShield GTAP Comments.doc; Hydro International GTAP Comments.doc; MWQPA GTAP Cover Letter.doc

Hello Steve,

The Manufactured Water Quality Products Association is newly formed, but has attracted most of the top companies in our industry to help found the Association. We will have our final organizational meeting at Alden Labs in June, where the founders will invite another 100 or so charter members. In the interim, we met in Louisville at the Urban Water Management Conference where the GTAP effort was brought up as a matter of discussion. Many of our members were unaware of your efforts, and as you can imagine, helping increase awareness of proposed rule changes that affect us as stakeholders is an important function of the Association.

Even with short notice, some of our members have sent comments for us to forward to your group, and others will send comments later today. We set a noon deadline for comments to be sent to our office, and some could not quite make it. Two that I know of are Stormcepter (Imbrium) and Ultra-Tech International.

I am attaching a cover letter, and the comments I have assembled from the group. Please let us know if we can be of further assistance in any way.

John Moll
CEO
CrystalStream Technologies
800-748-6945
www.crystalstream.com

MWQPA

Manufactured Water Quality Products Association
2090 Sugarloaf Parkway Suite 135
Lawrenceville, Georgia 30045
MWQPA@crystalstream.com
FAX: 770-979-6954

April 11, 2008

Steve Haubner
Water Resources Engineer
The Metropolitan North Georgia Water Planning District

Re: GTAP

Dear Mr. Haubner:

The Executive Committee for the Association hosted a meeting in Louisville, KY that included current members and other manufacturers as invited guests. One of the topics that came up was the GTAP Draft document, and the need for manufacturers to comment on the proposal. I am attaching this transmittal letter to an email to you today, along with the comments of some of our members. Other members have indicated that they will send their comments directly to you and mention their affiliation with the MWQPA in their transmittal. I will follow this email with hard copies of the member's comments via regular mail. Please feel free to contact any of our members directly about their comments.

The intent of our association is to help organize manufacturers as a group to comment as stakeholders on any proposed rules changes. You will note that we are not submitting an orchestrated response, as our members have differing views, and manufacture products with widely varying capabilities and applications. You can easily contact all of our members at once by sending communications to my email (johnmoll@crystalstream.com) or to the email listed above for the Association.

If your meetings to review the comments are public, the Association is requesting that you inform us of the date, so we can have a representative present, and so that we can notify our members who wish to be present individually.

We want to thank you and the committee working on this project for the efforts you are making to clarify and organize the approval process for manufactured products in Georgia.

Sincerely,

John Moll
Manager
MWQPA, LLC

From:	Iraclidis, Anastasis (Taso) [airaclidis@cemexusa.com]
Sent:	Thursday, April 10, 2008 4:07 PM
To:	Steve Haubner
Cc:	Price, Ted; Carrasco, Ernie; Shook, Mike
Subject:	GTAP Public Comments
Attachments:	ARC Comments.doc

Hello Steve,

Thank you for the opportunity to submit comments on the protocols and procedures to be used for the evaluation of storm water devices in Georgia. Attached please find Rinker's comments.

We at Rinker Materials, manufacturer of the Stormceptor feel the ARC's effort to characterize available storm water devices as proven technologies will facilitate decisions during the local plan approval stages while also being useful to the engineering community at large.

As you are aware, Stormceptor is a commercially demonstrated technology with over 22,000 units sold to date. The technology is backed by R&D efforts second to none and local engineering support across a variety of stormwater applications. We at Rinker Materials therefore, look forward with enthusiasm to provide the necessary Stormceptor documentation to the TRC. However, there are elements within the GTAP that we may not be able to meet, such as providing independent engineering studies with Georgia soil condition and the exactness of 15 rain events. We do hope such will not disqualify this proven and highly engineered technology from being used to treat Georgia's storm water. We at Rinker and Imbrium, patent holders, look forward to working with the committee to establish proof of performance as well as the technical and commercial benefits and features of Stormceptor at the highest level of confidence possible.

We hope Georgia will continue to meet its environmental obligations to storm water treatment with engineered solutions backed by excellent technical support services that have been the trademark of Stormceptor for over 15 years.

Once again, thank you for the opportunity to comment and I look forward to working with you and your staff.

Taso Iraclidis - ***Rinker Concrete Division***
Lithonia, Ga. 30058
Tel: 772-559-8024
Fax: 770-482-8937

Section 3.2 - **Pilot Use Designation**

Original text: "A Pilot Use Designation (PUD) allows limited use of a technology or product (upon TRC review of a technology engineering report) for the sole purpose of collecting additional field performance data. Local governments may allow PUD technologies to be installed in new development or redevelopment situations provided that the vendor and/or developer agree (s) to conduct additional field testing based on the GTAP and agree to remove/retrofit installations that fail to meet performance claims."

Revised to: "A Pilot Use Designation (PUD) allows a qualified manufacturer or vendor to continue to sell the product within limitations suggested by other interim verification of lab data or available field results such as the TARP (Technology Acceptance Reciprocity Partnership) protocol. The manufacturer/vendor may continue selling while manufacture/vendor completes third party performance field testing to collect field/performance data per GTAP, TARP tier II or other acceptable protocol for the purpose of submitting the results to the TRC for final verification.

Section 3.3.1 – **Roles and Responsibilities**

Original text: "Meeting, as needed, (two to four times per year) to review new submittals and revise/update the GTAP and website; and"

> **Revised to:** Meeting quarterly or as needed to review new submittals and revise/update the GTAP and website; and

Section 4.1 – **Treatment Performance Goals – Stormwater Performance Guidelines**

> **Original text:** "The performance goal applies to the water quality design storm volume or flow rate, whichever is applicable."
>
> **Revised to:** The performance goal applies to the water quality design storm volume or flow rate, or the use of continuous simulation such as USEPA SWMM of local hydrology data whichever is applicable

Section 6.0 – **Performance Testing Reporting**

Request to add test data results that show/demonstrate retention of previously deposited sediment during peak flow events "scour prevention". This requirement is presently not being requested by the protocol.

Section 7.1.1 – **Sampling Locations**

Original text: "To accurately measure system performance, samples must be collected from both the inlet and outlet from the treatment facility"

Revised to: To accurately measure system performance, samples must be collected from both the inlet and outlet from the treatment technology (BMP).

Section 7.1.2 – **Stormwater Facility Design and Sizing**

Original text: "**Stormwater Facility Design and Sizing"**

Revised to: **Stormwater Technology (BMP) Design and Sizing"**

Original text: "Sizing the test facility…"

Revised to: **Sizing the test technology (BMP)**

Original text: "Sizing of the test facility must be based on meeting applicable performance goals by treating the water quality volume, or the design flow rate coinciding with treating the water quality volume."

Revised to: Sizing of the test technology or BMP must be based on meeting applicable performance goals by treating the water quality volume, design flow rate coinciding with treating the water quality volume or treating the rainfall volume as predicted by allowing continuous simulation of local historical rainfall data.

MWQPA

Manufactured Water Quality Products Association
2090 Sugarloaf Parkway Suite 135
Lawrenceville, Georgia 30045
MWQPA@crystalstream.com
FAX: 770-979-6954

This comment was from Royal Environmental’s John Stark:

Thank you for keeping Royal in the loop! This Georgia protocol seems very similar to the WSDOE TAPE but is not referenced on page 25. Will there be an opportunity in reciprocity for the TAPE and Georgia's final document? Thank you, John

Steve Haubner

From: Phyl Kimball [phyl@spillcontainment.com]

Sent: Friday, April 11, 2008 3:04 PM

To: Steve Haubner

Cc: 'John Moll'

Subject: COMMENTS on GTAP Protocols for Evaluating Emerging Stormwater Treatment Technologies

Mr. Haubner,

Thank you for the opportunity to comment on the **GTAP Protocols for Evaluating Emerging Stormwater Treatment Technologies**. As a manufacturer of numerous stormwater BMPs and also as a member of the new **Manufactured Water Quality Products Association (MWQPA)** we would like to share some observations on your proposed manual.

As you may be aware there are many recent studies that indicate that TSS is a poor indicator of the performance of stormwater BMPs. Heavy reliance on this testing protocol should be considered carefully as data is now available to show that TSS severely underestimates the true pollutant/sediment loading that is contained in stormwater runoff.

A second observation is that the evaluation of stormwater BMPs require a field testing component (15 qualifying rain events) and do not allow for any type of simulation/controlled testing evaluation. We might suggest that you consider adding a testing component like a rainwater field simulator similar to the one recently constructed at the University of Central Florida's Stormwater Academy http://www.stormwater.ucf.edu/ . The testing of BMPs in a controlled/lab setting can often provide consistent and accurate pollutant loading and removal efficiency information.

Smaller stormwater BMPs like catch basin inserts/filters and curb inlet inserts/filters are now being evaluated frequently in a controlled lab setting in lieu of the field testing trials. Having participated in extensive field testing of our stormwater BMPs we might share some of the challenges that we have witnessed. The proposed 15 rain events can take several years to capture as has been our personal experience. We encountered frequent delays as we suffered numerous challenges with malfunctioning automated sampling devices.

Thanks again for the opportunity to share these thoughts and please call if we might be of assistance.

Best regards, Phyl

Phyl Kimball

National Stormwater Manager

UltraTech International, Inc.

11542 Davis Creek Court • Jacksonville, FL 32256

Toll Free: 800.353.1611 x 211 • Local: 904.292.1611 x 211

Fax: 904.292.1325 • Email: phyl@stormwater-products.com

Dennis E. Chase
290 Crabapple Road
Fayetteville, GA 30215
770-719-8425

March 20, 2008

GTAP Public Comments
C/O Joy Hinkle, Principal Program Specialist
Metropolitan North Georgia Water Planning District
40 Courtland Street NE
Atlanta, GA 30303

Dear Ms. Hinkle:

Attached are comments on the GTAP draft document.

If you have any questions regarding my comments, please contact me at the above address or by phone.

Thank you.

Dennis E. Chase

Attachment

D.E. Chase

Comments Re: Guidance for Evaluating Emerging Stormwater Treatment Technologies
Georgia Technology Assessment Protocol (GTAP)

My first concern regarding this protocol is: why would any company, or city or other user of stromwater treatment technologies do all of this work in the first place? This is a complex and very time-consuming effort and if the only benefit is to have it listed on a web site, I can't see why it would be implemented. Perhaps there are benefits or consequences for not complying that have not been presented, but if none exist, then this is an effort that few will utilize. However, it if is deemed a useful effort or a requirement, then I have the following general comments.

The subject document is very technical. Clarity is vital but it does not exist in this paper. I urge the District to either hire an editor or contract with a source that provides assistance with basic writing techniques. Even though this is a draft document, the many structural problems become a distraction making it difficult to be sure that important "Protocol" issues are in place and/or addressed and, of utmost importance, understandable!

Foremost among my concerns is the extensive number of lists of elements, criteria, inclusions or conditions. For each use of such lists, the document is inconsistent when presenting them. Some are numbered, some use bullets, some are properly punctuated – most are not. Perhaps one of the worst examples is on page 11 under Section 6.0 Performance Testing Reporting. Nineteen points are presented for inclusion and all are given as sentences when none are actually sentences. Simple, straightforward writing techniques could be utilized to present such a list but instead the District uses this method. One assumes that the District would like the companies using this document to view it as professionally written and follow that lead by producing a high-quality document in response. As presently written, that is not a likely result.

There are a number of other basic errors, beginning with:

- Page 2 where the word "use" is included twice in one sentence,
- Page 3, under Section 2.0 third sentence "address" should be "addressing",
- Page 4, under Section 3.1, first bullet ". . . claims outlined "in" the . . .",
- Page 6, under Section 3.2, a form is to be found in an appendix – what appendix? I could find no such form, and,
- Page 8, under Section 4.2, the first bullet doesn't make sense. Should it say "Provides removal of most coarse solids . . ."?

There are probably other instances of basic errors throughout the rest of the document.

The document cites references as though the reader could find the title of such a document in a bibliography – yet, no bibliography is included. One example is on page 19, under Section 8.3 where an EPA document from 1983 is referenced. There are other references that are included but cannot be located in an Appendix or the more appropriate bibliography.

The use of acronyms is deplorable. A seemingly endless list of letters could be made up from these few pages, yet they are used in odd places, employed in less than useful situations (i.e. PUD), and identified several times while some are not identified at all. Also, one or two are identified and then never used again. A technically complex document such as this should use only a very few acronyms that are well known, those that stand for difficult to read organizations (i.e. MNGWWPD) or are, in fact, used frequently enough to make them helpful to the reader.

Specific comments:

Page 4, under Section 3.1, Bullet 2 of the second set of bullets needs to be re-written. The instruction states that the criteria must be used, but this second bullet is so subjective that the reader/user will not know what is wanted. A "criteria" should be just that, a very clearly identified requirement that is to be addressed. There should be no question about what is wanted.

Page 16, under Section 7.4.3, states that sediment depth may be one of the measurement methods used. My question is, measured where, when, how? There must be more to it than this for it to be included as an example.

Conclusion:

My general impression is that this document is stressing sediment as a topic for testing. Only a short mention of chemistry is made in Section 7.3 under Stormwater Sampling Methods, yet section 4.0, Treatment Performance Goals does not even consider chemistry as a performance requirement. Either those constituents listed on page 14 (Section 7.3) are important enough to set requirements or they are not. Why even mention them if our only concern is total suspended solids?