

**MINNEHAHA CREEK WATERSHED DISTRICT**

**Rulemaking Task Force  
August 28<sup>th</sup> 2008**

**6:30 pm**

**City of Minnetonka Community Center  
14600 Minnetonka Blvd  
Minnetonka, MN 55345  
(952) 939-8390**

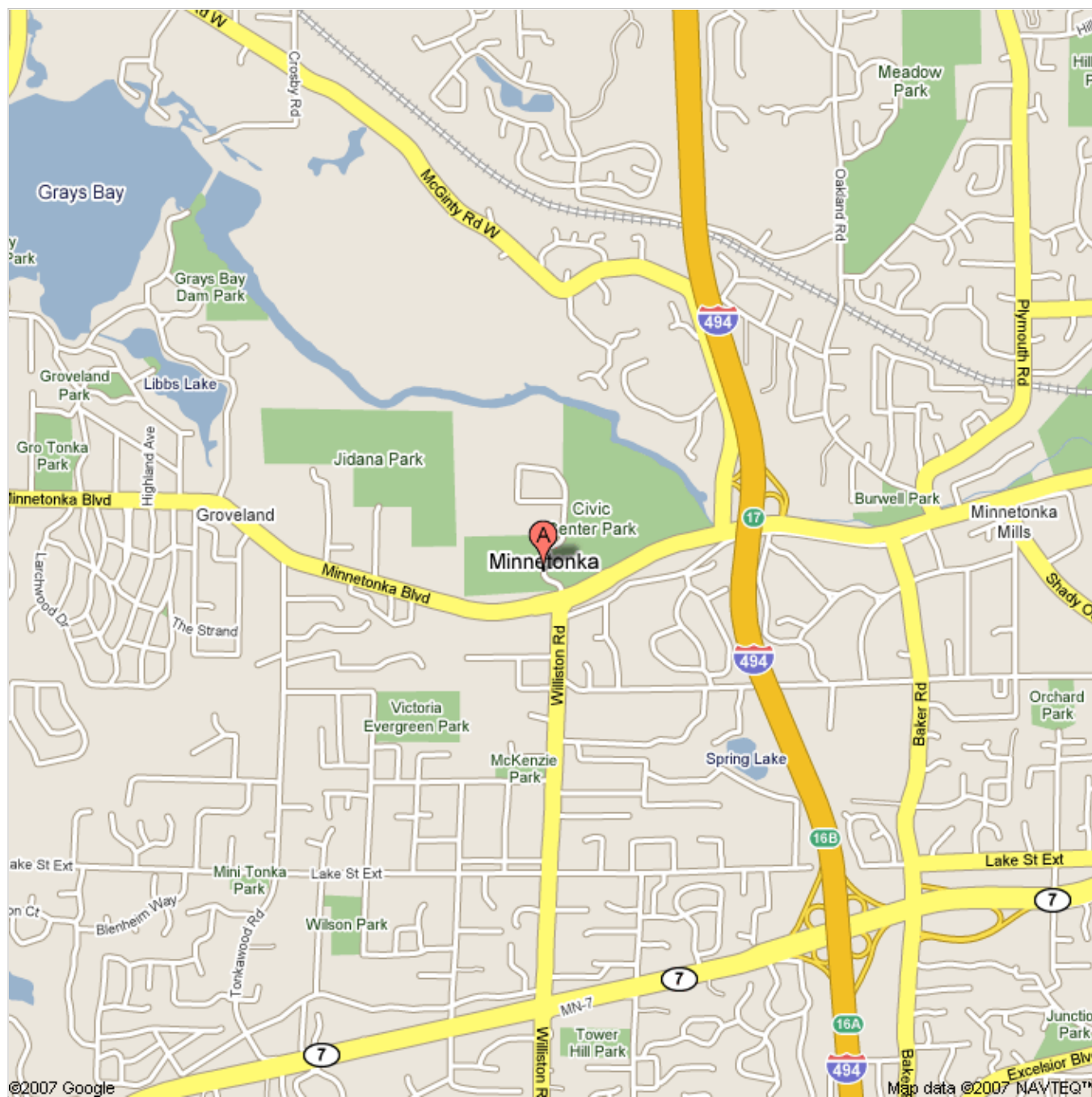
**Minnetonka Mills Room (Lower Level)**

**AGENDA**

- |    |  |         |
|----|--|---------|
| 1. | Review Meeting Summary from 7-23-08 (Louis Smith)                | 10 min  |
| 2. | Recap Buffer Policy Discussion to Date (James Wisker)            | 10 min  |
| 3. | Review of EOR Analysis on 50' Buffer Performance<br>(If Desired) | 10 min  |
| 3. | Outstanding Policy Items/Proposals (Open Forum)                  | 30 min  |
| 4. | 2 <sup>nd</sup> Discussion/Vote on Wetland Buffer Widths         | ~30 min |



Results 1-1 of about 1 for  
**community center near  
Minnetonka, MN**



- A. Minnetonka **Community Center**  
14600 Minnetonka Blvd, Minnetonka, MN  
(952) 939-8390

# MINNEHAHA CREEK WATERSHED DISTRICT

## RULEMAKING TASK FORCE

### Summary of July 23, 2008 Meeting

**Task Force Members Present:** Tom Cesare, Jim Johnston, Steve Mohn, Ethel Smith, James Vagle, Tim Smith, Tony Goldenstein, David Newman, Tom Casey, Bill Bushnell.

**MCWD Managers Present:** Jim Calkins, Jeff Casale.

**MCWD Staff Present:** James Wisker, Louis Smith.

#### Update on Rulemaking Process

James Wisker provided a status report on the rulemaking process. Draft rule amendments will be distributed in late August or early September after an initial review by the Board of Managers. Task Force members will have 30-60 days to review these amendments, and depending upon the nature of comments, additional meetings will be scheduled to consider them.

#### Review of June 26, 2008 Meeting Summary

The Task Force reviewed the summary of the June 26, 2008 meeting. Tom Casey stated that it is important to have more discussion of the wetland management classifications and policies to address degraded wetlands. James Wisker stated that this issue would be discussed further, with particular attention on the restorability of degraded wetlands. There being no further comments, the Meeting Summary was approved as distributed.

#### Wetland Buffer Formulas

Mr. Wisker reviewed the past discussion on wetland buffer frameworks, noting that the Task Force had selected a basic approach to determining widths based upon a scoring system that uses the underlying criteria for wetland management classifications. He presented a refined matrix that is based upon the previous input from the Task Force. Task Force members discussed the process for individual site review and function and value assessment of wetlands as it connects to the delineation process. Mr. Wisker also distributed articles that provided literature reviews on the benefits and functions of wetland buffers. The Task Force discussed these functions and values in terms of filtration, abstraction, wildlife habitat, and ecological integrity.

The Task Force discussed the development of incentives to diversify and restore buffer vegetation, with a possibility of reducing the size of buffer if a permit applicant improves buffer vegetation quality.

The Task Force members endorsed the general approach presented by Mr. Wisker, suggesting adding a factor for consideration of the restoration of wetland vegetation and reduction of buffer size as one possible incentive; Mr. Wisker stated he would also consider adding a factor to address wildlife amphibian habitat. Task Force members also discussed the critical importance of slope and soil types in terms of buffer function and success.

Tom Casey highlighted that buffers can provide property value amenities as one additional function.

Mr. Wisker then directed a balloting exercise for the Task Force members to express their preferences for minimum and maximum buffers, in light of all of the information presented and discussed to date. The results of this balloting were as follows:

- 20' - 4 minimums
- 25' - 2 minimums
- 30' - 2 minimums
- 50' - 4 maximums
- 70' - 1 maximum
- 75' - 2 maximums
- 100' - 1 maximum
- 300' - 1 maximum

Mr. Wisker agreed that he would continue to refine the formula and matrix in light of these recommendations from the Task Force.

## Memorandum

DATE: August 25<sup>th</sup>, 2008  
TO: MCWD Rulemaking Task Force  
FROM: James Wisker  
RE: August 28<sup>th</sup> Rulemaking Meeting

### **SUMMARY OF POLICY DISCUSSIONS TO DATE:**

The Rulemaking Task Force has devoted several meetings to discussing Rule D, Wetland Protection policy.

These meetings were prefaced with educational presentations regarding the importance and efficacy of wetland buffers regarding, water quality, habitat, flood control, abstraction, screening, erosion control, shading etc.

The Rulemaking Task Force recognized the importance of wetland buffers as a regulatory management tool in areas of development and redevelopment and moved into discussion on how to best determine an appropriate width for a wetland buffer.

MCWD Staff presented to the Task Force the idea of using the District's Functional Assessment of Wetlands (FAW) as a basis for determining wetland buffer width. The FAW categorizes wetlands based on their individual characteristics into: Preserve, Manage 1, Manage 2 and Manage 3. District staff proposed to use these classifications to determine how wide a particular buffer should be. This approach would result in larger buffers for the highest quality wetlands and smaller buffers for lower quality resources.

The Rulemaking Task Force voted against this approach on the basis that two wetlands may have identical management classifications but different baseline characteristics. For example, a wetland may be listed as Preserve due to its *exceptional* rating for vegetative diversity while another wetland may be Preserve because it is listed as *high* for shoreline protection.

The Rulemaking Task Force argued that any system to determine buffer width should take into account these differences and requested that MCWD staff develop a formulaic, performance based approach to calculating buffer widths.

Staff presented for review, a weighted criteria approach that allocates a specific buffer width and a weighting value to each of the characteristics measured in the FAW (Table 1).

*Table 1.*

<b>Criteria</b>	<b>Buffer Benefit<sup>2</sup></b>	<b>Criteria Rating</b>	<b>Recommended Buffer (ft)</b>	<b>Weighted Buffer<sup>3</sup></b>
Vegetative Diversity	0.3	Medium	16	4.8
Stormwater Susceptibility	0.2		0	0
Wetland Water Quality	0.3		0	0
Hydrologic Regime	0.2	High	20	4
Buffer Soil Type	0.3		0	0
Buffer Slope (%)	0.4		0	0
Downstream Water Quality Protection	0.3	Exceptional	24	7.2
Shoreline Protection	0.2	Low	8	1.6

TOTAL BUFFER  
WIDTH

17.6

The Rulemaking Task Force favored this approach and requested that the formula also take into account the following pieces of information that were determined to correlate to buffer width:

- **Restoration Potential of a Wetland**
  - Task Force Representatives wanted to ensure that degraded wetlands did not continue to be degraded due to lower quality wetlands being provided smaller buffers.
- **Buffer Vegetation Plan**
  - The Task Force felt that smaller buffers may be permitted by the District if an applicant provides a robust landscape/vegetation plan that includes a period of monitoring and maintenance. The rationale being that a higher quality buffer will outperform a lower quality buffer of the same width.
- **Wildlife/Amphibian Habitat**
  - Amphibian Habitat was a criteria originally removed from Table 1 as it was felt to overlap with other criteria. Subsequent meetings revealed further discussion on this topic and a desire to include it as a basis for determining appropriate buffer width.

Following the review of Table 1 as a basis for determining wetland buffer widths, the Rulemaking Task Force received additional literature on the performance of wetland buffers relative to their width.

This information included numerous published, peer reviewed journal articles on buffer width as it relates to nutrient removal, volume reduction, species richness and vegetative diversity.

The Rulemaking Task Force then proceeded to participate in a voting exercise to illustrate a preferred range of widths for wetland buffers. With only 10 members present, the results were:

- 20' - 4 minimums
- 25' - 2 minimums
- 30' - 2 minimums
- 50' - 4 maximums
- 70' - 1 maximum
- 75' - 2 maximums
- 100' - 1 maximum
- 300' - 1 maximum

#### **NEXT STEPS:**

The Rulemaking Task Force will be expected to review its progress in crafting policy for Rule D at the August 28<sup>th</sup> Meeting.

Following review, the Task Force will be asked to discuss any other outstanding policy items that should be addressed by District Staff, Board and the Technical Advisory Committee. These issues will then be explored into more detail before the Rulemaking Task Force reviews draft rule language.

Finally, during the August 28<sup>th</sup> Meeting, the Task Force will participate in an additional voting exercise to reaffirm previous votes and to achieve a higher level of participation.

These votes on buffer widths along with the formulaic approach and outstanding policy issues will be presented to the Board of Managers and Technical Advisory Committee for review before being formed into draft rule language.

#### **ADDITIONAL BUFFER RESEARCH UNDERWAY:**

The Rulemaking Task Force requested that the District review the 2001 EOR/MCWD Wetland Buffer Report in order to determine why a group of wetland buffers smaller

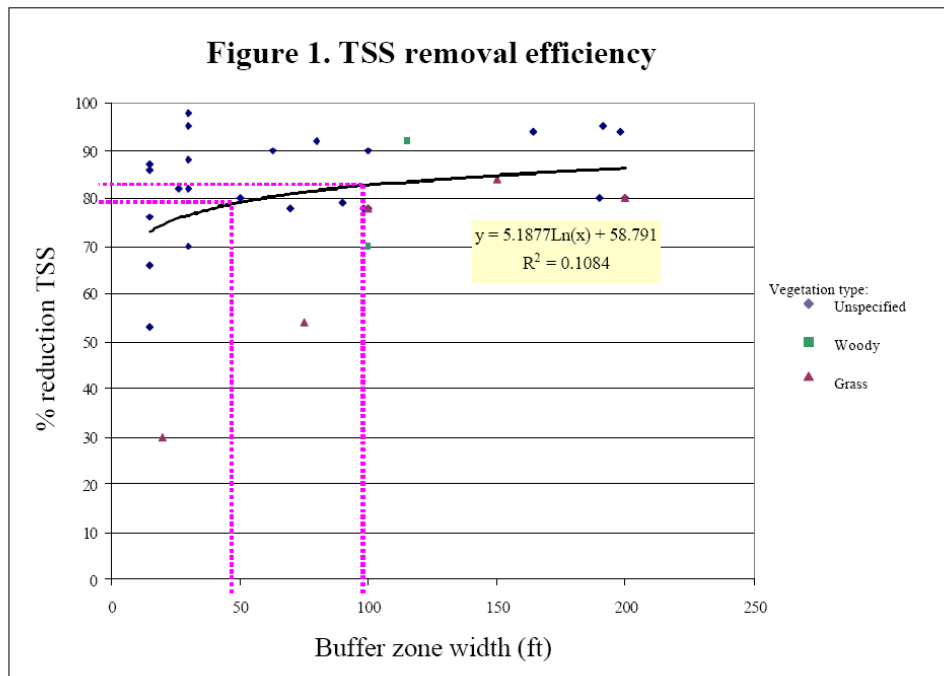
than 50 feet out-performed larger buffers in the area of total suspended solids removal.

The summary of this analysis is attached for review.

Date | July 31, 2008  
 To | James Wisker and Natalie White, MCWD  
 CC |  
 From | Nancy-Jeanne LeFevre and Gary Oberts  
 Regarding | Work Order #08-014  
 Further Assessment of Buffer Widths

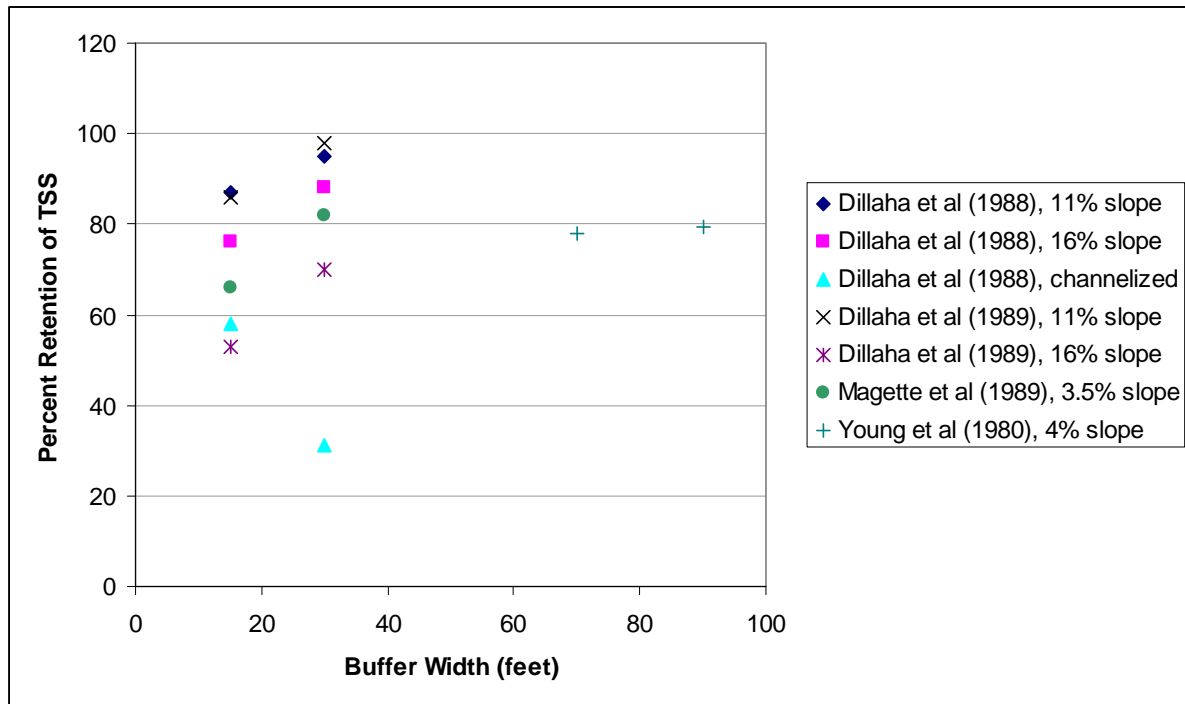
### Findings

EOR's 2001 buffer study (*Benefits of Wetland Buffers: A Study of Functions, Values and Size*) prepared for the Minnehaha Creek Watershed District included, among other things, an analysis of TSS retention as a factor of buffer width. Figure 1 from that study (also Figure 1 here) represented data from a variety of original research that was previously evaluated in literature reviews. For this EOR analysis, the original research from data points of buffers less than 50 feet, as well as data points from buffers greater than 50 feet but less than 80% retention were reviewed to find trends that might distinguish: 1) the buffer characteristics of less than 50 foot buffers that performed better and worse than 80%; and, 2) the buffer characteristics of greater than 50 foot buffers that performed less than 80% retention.



**Figure 1 TSS removal efficiency as a function of buffer width from EOR's 2001 buffer study *Benefits of Wetland Buffers: A Study of Functions, Values and Size*.**

The main studies providing data points for less than 50 foot buffers (TSS only) on the EOR figure from the buffer report are Dillaha et al. (1988), Dillaha et al. (1989) and Magette et al. (1989). The main study providing data points for buffers greater than 50 feet and less than 80% retention are from Young et al. (1970). Where original data sources from the exact points on the EOR graph could not be identified from the referenced literature reviews, additional results within these original studies often filled in the gaps. Figure 2 identifies the retrieved original research corresponding to the data points in EOR’s 2001 buffer study.



**Figure 2 Retention of TSS of buffers of various width and original data source.**

Upon analysis of the original research, several findings shine light on the results obtained. All of the buffers studied have very similar characteristics (see Table 1). In general, buffers studied were grass, silt loam or sandy loam soils, and of various widths and slopes. Table 2 summarizes characteristics of the experimental set-up for each of the studies. All of the buffers studied had agricultural source areas (mostly feedlots). Although these land uses might be different than those draining to buffers within the MCWD, the origin of the TSS should have no effect on the ability of a buffer to treat it. Other physical factors are far more important than the source area land use.

**Table 1 Buffer characteristics of various buffer studies.**

	<b>Young et al (1980)</b>	<b>Dillaha et al (1988)</b>	<b>Dillaha et al (1989)</b>	<b>Magette et al (1989)</b>
Width	90 feet & 70 feet	15 feet & 30 feet	15 feet & 30 feet	15 feet & 30 feet
Soils	Unknown	Silt loam	Silt loam	Sandy loam
Buffer Vegetation	Grass	Grass	Grass	Grass
Slopes	4%	11% & 16%	11% & 16%	3.5%

**Table 2 Experimental conditions of various buffer studies.**

	<b>Young et al (1980)</b>	<b>Dillaha et al (1988)</b>	<b>Dillaha et al (1989)</b>	<b>Magette et al (1989)</b>
Simulated rainfall (gal/sf)	3.70 (2.5 in/hr)	2.60 (2.0 in/hr)	4.91 (2.0 in/hr)	4.74 (1.9 in/hr)
TSS Loading* (lb/ac)	1,890 & 3,670	9,370 & 20,970	3,510 & 7,980	2,470 & 600
Source Area (hydraulic length in feet)	Feedlot (45 ft)	Feedlot (60 ft)	Fallow cropland (previously no-till corn) (60 ft)	Feedlot (72 ft)
Ratio of Hydrologic Length of source area to buffer width	0.5 0.64	4.0 2.0	4.0 2.0	4.8 2.4

\*For all studies, based on TSS flushed from control plot.

The Dillaha et al. studies (1988 and 1989) studies were performed with the same soils, vegetation and set of slope conditions (see Table 1). Data indicate that plots of greater slope (16% as compared to 11%) have lower TSS retention, corresponding to the findings identified in the EOR buffer study and many other buffer studies. Data also indicate that buffers of the same characteristics provide greater TSS retention with increased width [in the Dillaha et al. (1988 and 1989) studies, 30 ft as compared to 15 ft]. The Dillaha et al. studies also show buffers with the same characteristics performing on either side or close to the 80% performance standard. At the 16% slope, results for the Dillaha et al. 1988 study and the Dillaha et al. 1989 study were 88% and 70%, respectively, at a 30-foot width and 76% and 53%, at the 15-foot width. Similar variability was identified within the Magette et al. (1989) study, where standard deviations for multiple tests on a single plot were as large, and in some cases larger, than the average,

indicating that average result was often violated in individual tests and also that individual tests fell on either side of the 80% performance standard. Magette et al. (1989) also could not identify a predictable trend to indicate when sediment flushing out the end of the filter strip might occur, yet obtained an average of 82% for the 30 foot buffer. Variability in performance within individual studies in the studies mentioned are not clearly based upon buffer characteristics.

There is a likely reason for the variable performance of buffers with similar (if not the same) characteristics. Plots with short buffers and high loading rates literally fill up with sediment. Dillaha et al. (1988 and 1989) both discuss sediment fronts that actually cover the vegetation from the high sediment loads experienced (see Table 2 for TSS loading rates). This front advances down the buffer as vegetation is overtopped. High sediment loading alone can more easily generate higher percent retention, at least in the short-term; that is, very dirty water is easier to clean than relatively clean water until all of the buffer sites are filled with sediment. In addition, as buffers fill with such heavy sediment loads, percent retention varies with each rainfall application. Over the course of six rainfall simulation applications in one test for one of the Dillaha et al. (1988) plots (15-foot buffer, 16% slope), percent retention of TSS drastically decreased from 90% in the first application to 77%, 66%, 74%, 41%, and 53% in the second to sixth applications, respectively. The EOR graph reflects the average of 2 sets of tests (76%), which ends up not far from the 80% performance standard. A graph of the sustained performance of the short buffers tested in the Dillaha et al. (1988 and 1989) studies might, therefore, show a percent retention in TSS of more in the ballpark of 50% rather than in the 70-high 80% range. Results from test plots with long buffers and more realistic sediment loads are likely to illustrate the sustained performance of the buffers (e.g. rates found in the Young et al. (1980) study, 78% and 79.5%). Again, increased width beyond 50' does not necessarily guarantee increased performance.

An additional study, not previously plotted on the EOR graphs but shown in Figure 2, identified a probable cause for those buffers of less than 50 feet that performed below the 80% standard and, in fact, within the low 30% to 60% range. Percent retention of TSS averaged 58% and 31% from plots in the Dillaha et al. (1988) study that were constructed with a cross slope to simulate concentrated flow. These data were not previously reported in the EOR buffer study, but a recommendation in that report urged introduction of diffuse flow only into buffer areas. Shallow sheet flow is more effective for TSS retention than deeper channelized flow where water flows at higher velocities and carries more sediment farther.

Another trend that stands out from looking at the original sources of the TSS retention data is that at a 16% slope, the Dillaha et al. (1988) study buffers performed better overall than Dillaha et al. (1989) buffers. Though buffer characteristics were effectively the same; there were two differences in experimental setup between these studies. The rain simulation application rate was 2.60 gal/sq ft (3.9 in) in the 1988 study and almost twice that at 4.91 gal/sf (7.9 in) in the 1989 study. The source areas were also different with a feedlot in the 1988 and fallow cropland that was previously no till corn in the 1989. Knowing that results may be in part related to

different TSS loading rates, the data is most likely the result of the significant difference in rain simulation application rates. Data suggest that higher rainfall application (volume) results in lower percent retention, although the rate of application was the same. In the Dillaha et al. (1989) study, percent TSS retention decreased markedly with the second set of rainfall simulations. In addition, a similar agricultural buffer study from Ghaffarzadeh et al. (1992) also found storm intensity to influence the quantity of runoff which ultimately drove the amount of sediment load and deposition. These findings appear to have significant implications on the importance of experimental setup for obtaining realistic results. Please note here comments in the March 21, 2008 EOR review of the Westwood study, which used only 0.3 - 0.6 gallons per square foot of drainage area, as opposed to the several gallons per square foot used in the reference studies.

Another trend related to experimental setup was found in the original data related to the hydraulic length of the test watersheds. All of these experiments were around 60 feet long and had ratios of hydraulic length of the source area versus the buffer width between 0.5 and 4.8. The Dillaha et al. (1988 and 1989) studies indicate that performance diminishes as the ratio of drainage area hydraulic length to buffer width increases. Given the small drainage areas to these features, the Dillaha et al. (1989) study recognizes that performance is probably *overestimated*. In addition, bigger drainage areas are important because when flow has this longer distance to travel, it is likely to concentrate in natural drainage ways and cross the buffer in a few localized areas as concentrated flow. Where concentrated flow occurs, substantially longer buffers are required. Comparing the Young et al. (1980) study (over 50') to the Magette et al. (1989) study (buffers at similar slopes and less than 50'), the trend appears to have held. The Magette et al. (1989) study had a much higher source area hydraulic length to buffer width ratio than the Young et al. (1980) study and required a 70-90 foot buffer to perform at the same level as the 30 foot Magette et al. sites. That being said, the relative difference in hydraulic length to buffer width ratios is small considering a more realistic ratio might be in the range of 10 to 30. In addition, the Magette et al. (1989) study resulted in slightly higher results due to the drainage area treatment on half of the tests. Runoff was reduced significantly using litter in the drainage area and, therefore, raised the percent TSS retention and may offset the implications for the Young et al. (1980) data. Many buffer characteristics can affect the extent of channelization including, but not limited to, slope and plant root density. In summary, the data appear to show that a small watershed-to-buffer area ratio is desirable for enhanced performance.

Since characteristics of the drainage determine input to buffers including TSS load, runoff and flow characteristics (e.g. channelized versus shallow sheetflow), performance predictability of buffers is always going to be variable. These studies and the results originally portrayed in Figure 1 show that buffers less than 50 feet behave less predictably (about 30-98% removal) with respect to TSS removal than buffers over 50' (about 70-95%).

### **Note on Comparison to Westwood Study**

EOR prepared an analysis (March 21, 2008) of some research performed by Westwood Professional Services. This current work order does not include any work to compare the findings of this follow-up work with the Westwood findings. We encourage the MCWD staff to scrutinize the findings here with the Westwood report relative to vegetation (mostly grass versus nine-year old prairie), the volume of synthetic rainfall used (several gallons per square foot versus 0.3-0.6), the drainage area contributing to the buffers (600 to 1100 square feet versus 250 square feet) and soil type (variable loams versus HSG B, well drained and permeable soil).

Also please recall that the Westwood report could not be compared to the 2001 EOR analysis for solids because Westwood used total solids (TS – sum of particulate and dissolved solids) rather than total suspended solids (TSS – all particulate) as its measure of performance.

The positive findings of the Westwood report noted in the EOR March analysis still appear to be valid. That is: all of the ideal buffer conditions characteristic of the Westwood site validate the original 2001 MCWD analysis; and, steep slopes can be mitigated if ideal buffer soil, vegetation, and flow conditions are met.

### **Conclusions**

Based on the follow-up review of individual studies that were incorporated into the original 2001 MCWD buffer study, the following conclusions can be drawn:

1. The 2001 MCWD study observed that buffer widths greater than 50' might not show a concomitant increase in effectiveness. The 70' and 90' buffers studied by Young et al. (1980) at only 4% slope and less than 80% TSS removal would confirm that finding.
2. Data indicate that buffers of the same characteristics provide greater TSS retention with increased width. In studies performed with the same soils, vegetation and set of slope conditions (see Table 1), plots of greater slope (16% as compared to 11%) have lower TSS retention, with the exception of the channelized flow study (Dillaha et al. 1988) (see Conclusion #4 below).
3. The detailed studies showed that plots with short buffers and high loading rates gradually fill up with sediment and a sediment front moves down the buffer and eventually out the down-gradient side. This and other aspects of the research indicate that buffers handling high loads of solids will have a limited lifetime.
4. Non-laminar flow on those buffers studied (Figure 2) that were less than 50' dramatically decreased performance.
5. The volume of water applied on similar buffers less than 50' is a factor in the effectiveness of the buffer, with more volume added leading to less effective performance. This supports limited watershed-to-buffer width ratios.
6. Buffer performance diminishes as the ratio of drainage area hydraulic length to buffer width increases because of the tendency with this increase to concentrate flow. In other words, a small watershed-to-buffer area ratio is better for TSS removal.
7. Buffers less than 50' wide behave with less predictability than buffers over 50'.

8. The findings of this follow-up study confirm the findings and recommendations from the MCWD 2001 study of buffer effectiveness. It appears from the details found in the original research upon which the 2001 study was based that the 50' buffer width is desirable to obtain consistent and predictable performance for TSS removal. Reductions in this width should be considered only when the following factors can be shown:
- Shallow laminar flow
  - Small watershed-to-buffer width ratio
  - Favorable soil (highly permeable) and vegetation (deep-rooted, good coverage, well established)
  - Very shallow slopes

### References

Dillaha, T.A., J.H. Sherrard, D. Lee, S. Mostaghimi and V.O. Shanholtz, 1988. *Evaluation of Vegetative Filter Strips As A Best Management Practice for Feed Lots*. Journal of the Water Pollution Control Federation, **60**(7):1231-1238.

Dillaha, T.A., R.B. Reneau, S. Mostaghimi and D. Lee, 1989. *Vegetative Filter Strips for Agricultural Nonpoint Source Pollution Control*. Transactions of the American Society of Agricultural Engineers, **32**(2):513-519.

Ghaffarzadeh, M., C.A. Robinson and R.M. Cruse, 1992. *Vegetative Filter Strip Effects on Sediment Deposition from Overland Flow*. Agronomy Abstracts from the American Society of Agronomy Division S-6 - Soil and Water Management Conservation, page 324.

Magette, W.L., R.B. Brinsfield, R.E. Palmer and J.D. Wood, 1989. *Nutrient and Sediment Removal by Vegetated Filter Strips*. Transactions of the American Society of Agricultural Engineers, **32**(2):663-667.

Young, R.A., T. Huntrods and W. Anderson, 1980. *Effectiveness of Vegetated Buffer Strips in Controlling Pollution from Feedlot Runoff*. Journal of Environmental Quality, **9**(3):483-487.