

## Chapter 8

# NEW OPPORTUNITIES FOR SEDIMENT REDUCTION

### Conservation Buffer Initiative

The original NRCS Soil Conservation Plan relied almost solely on conservation tillage to achieve sediment reduction. Filter strips were not thought to be a viable component of the plan. At the time the original plan was prepared, there were no good tools available to persuade farmers to agree to widespread installation of grass filter strips in the watershed. Additionally, those filter strips that were installed were sometimes too narrow to bring about significant sediment trapping. This situation has now changed.

In 1997 the Natural Resources Conservation Service, and other Conservation Partners, unveiled the National Conservation Buffer Initiative. The Conservation Buffer Initiative is a 5 year plan with a goal of installing 2 million miles of conservation buffers by the year 2002. Conservation Buffers are soil conservation practices that filter and trap sediment, pesticides, nutrients and other pollutants and contaminants. The buffers include such conservation practices as grass filter strips, wetland restorations, wetland sediment traps, riparian forest buffers, grass waterways, and field windbreaks.

The conservation buffer practices can now be enrolled in the Conservation Reserve Program (CRP) under the Continuous Signup Provisions. Farmers receive an annual rental payment in return for enrolling these practices in the program. Enrollment is via a 10 to 15 year contract which ensures long-term participation and long-term benefits.

### Conservation Buffer Analysis for the Maumee Watershed

Extensive installation of properly designed conservation buffers could have a far reaching effect on sediment reduction in the watershed. However, no watershed specific data exists to quantify the numerical extent of these benefits. As part of this pilot project, NRCS prepared an analysis of the effect of buffer installation on dredging amounts (Analysis Of Conservation Buffer Effectiveness For The Toledo Harbor Project, NRCS, Davis et. al., 1998). The objectives of the analysis were to:

1. Quantify the effect of conservation buffers on sediment reduction in the harbor.

2. Determine the average savings in yards of dredging saved per acre of buffer installed.
3. Develop a buffer model to predict the cumulative effect that widespread installation of conservation buffers would have on project goals.
4. Determine how the benefits of buffers interacted with the practice of conservation tillage.

The analysis was based on a literature review of studies documenting the effectiveness of conservation buffers (Findlay et al., 1991), the gross erosion estimates for the 1992 reference condition in the watershed, and the 1997 Ohio conservation tillage transect data. A copy of the complete analysis is attached (Appendix 4).

### **Buffer Analysis Model & Assumptions**

The buffer analysis model was a spreadsheet which calculated before and after erosion and sediment delivery rates as new conservation buffers were applied to the watershed in different amounts. The after condition was compared to the 1992 reference condition. The model allowed for simultaneously varying the rate of conservation tillage applied to the landscape and credits for reduced erosion rates on the land taken out of production and devoted to buffers. Several assumptions were used in developing the model. These included:

1. It was assumed that buffers would be properly designed filter strips, filter basins, constructed wetlands, or sod waterways. Filter strips would be grass or tree strips adjacent to streams and watercourses in the flatter areas of the watershed. These strips would range in width from a minimum of 20 feet to a maximum of 100 feet. Consultations with field personnel indicated the average buffer width commonly used would be 35- 45 feet.  
  
Filter basins or constructed wetlands would be circular or rectangular filter areas at the discharge outlets of drainage swales in the more rolling areas of the watershed.
2. The maximum area effectively protected by each one acre of buffer was assumed to be 15 acres. Beyond this ratio buffers would not be effective. This figure was used to calculate how many acres of buffers would be need to be applied in the watershed when “x” per cent of the fields were protected by buffers.
3. Based on literature reviews and field experiences, the buffers were assumed to trap 25% of the sediment which passed through each acre of buffer.
4. The fields draining into the buffers were protected by conservation tillage at the same percentage rate as the watershed as a whole.

### **Buffer Analysis Findings**

The findings of the analysis were as follows:

1. **Buffers could be highly effective in reducing sediment delivery to Toledo Harbor and make a significant contribution to achieving the soil conservation goal of reducing dredging by 130,000 cubic yards.** Applying buffers to 30% of the corn and soybean fields could result for 29,000 cubic yards of sediment reduction and would represent approximately 20% of the goal. This level of treatment would require 58,330 acres of new conservation buffers (above 1992 conditions) to be installed in the watershed. Chart 8 shows the sediment reduction which can be achieved by various different levels of buffers and conservation tillage.
2. **Buffers and conservation tillage act together to increase sediment reduction amounts to greater levels than either can achieve independently.** Chart 8 shows the symbiotic interaction of buffers and conservation tillage which multiplies sediment reduction efforts. The effectiveness of conservation buffers is interconnected with the level of conservation tillage applied to the landscape. Each acre of buffer on the average, reduces dredging amounts by .383 to .497 cubic yards.

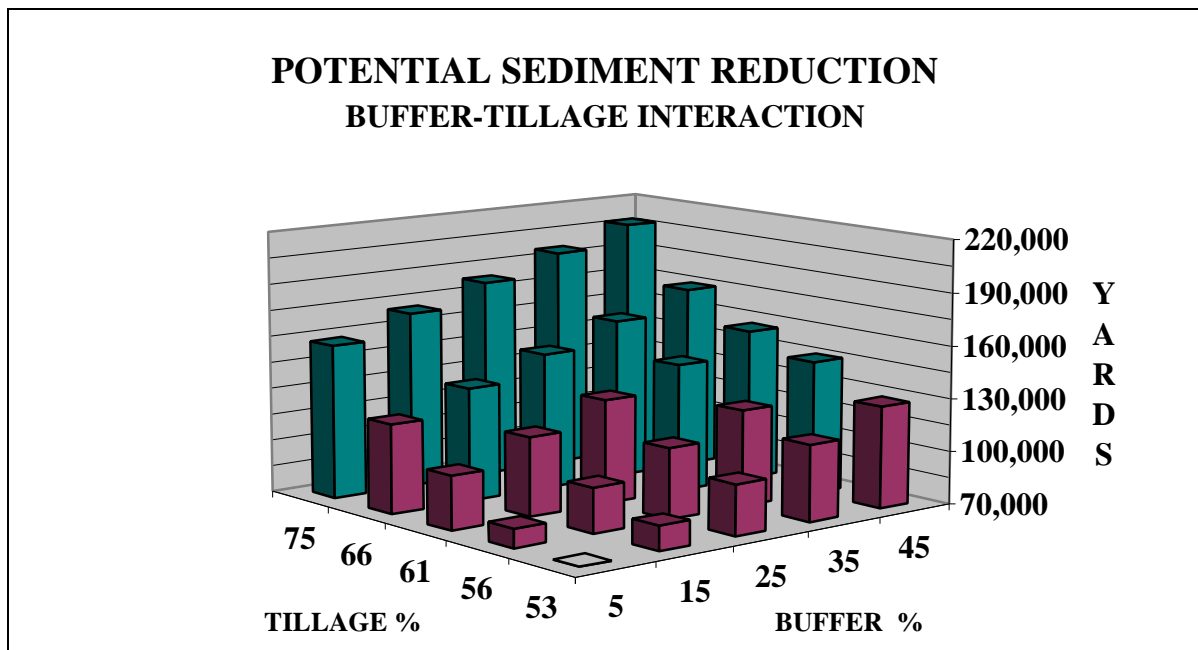


Chart 8 Impact of conservation tillage and buffers interaction on sediment reduction.

3. **Buffers can insure that the 130,000 cubic yards goal is still attainable even if the original project goal of 75 per cent of the watershed in conservation tillage is not attained.** Additionally, if the project goals for conservation tillage can be attained, buffers

can result in the Soil Conservation Plan contribution exceeding the original Toledo Harbor Project goals. Chart 9 shows in blue various combinations of buffer and tillage systems that would exceed project goals.

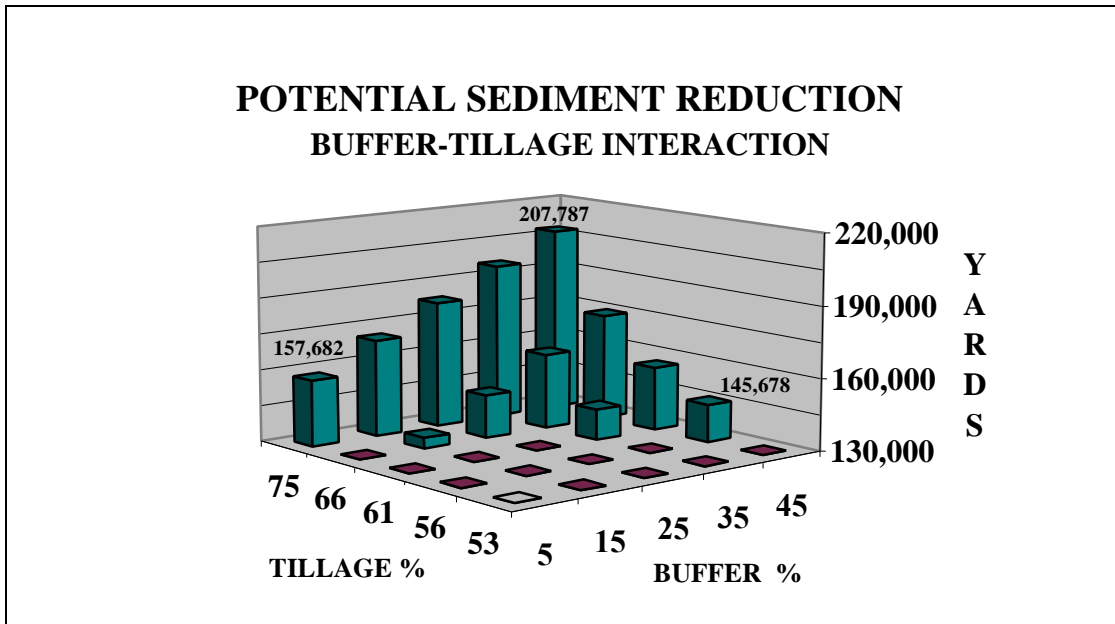


Chart 9 Combinations of buffer and conservation tillage amounts that would achieve the Soil Conservation Program goals.

4. It would be possible, but not likely, to achieve the Soil Conservation Program goals by either conservation tillage or conservation buffers alone. However, if only one of the practices is applied to the landscape very high amounts are necessary to achieve the goal. Combining the two practices will make the project goals more realistic and easier to achieve.
5. **Buffer effectiveness is very elastic due to the low erosion rates and high levels of conservation tillage in the watershed.** This makes the magnitude of the buffer contribution to sediment reduction fairly predictable. Chart 10 shows that the buffer contributions do not diminish very much even when an extremely conservative range of estimates of buffer efficiencies is used. This increases the confidence level of the analysis.

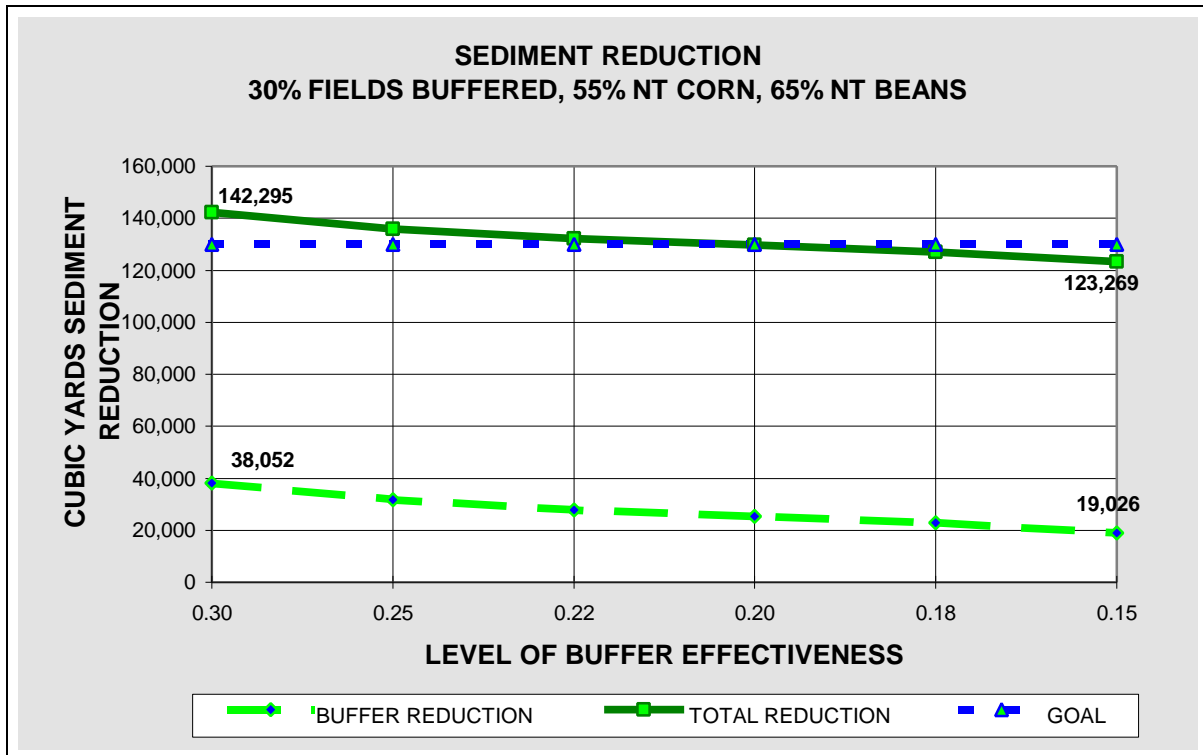
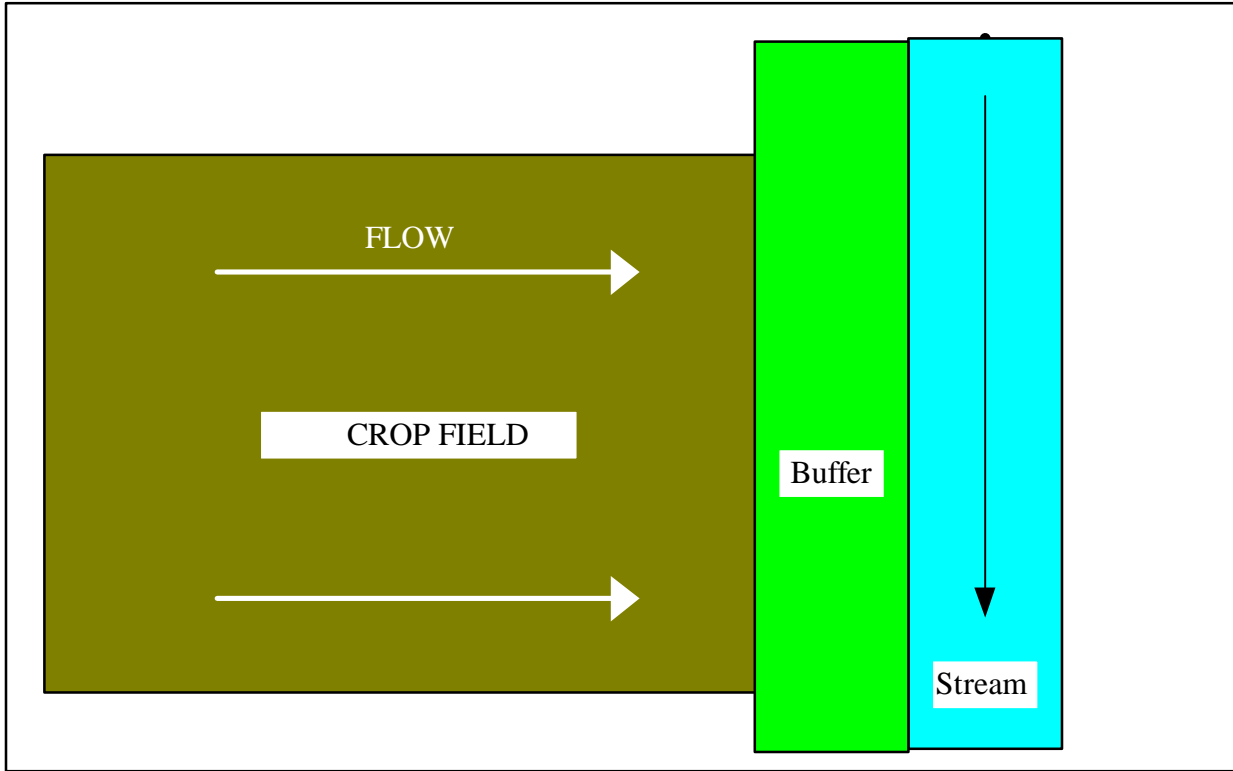


Chart 10 Changes in sediment reduction due to buffer at differing levels of buffer efficiencies.

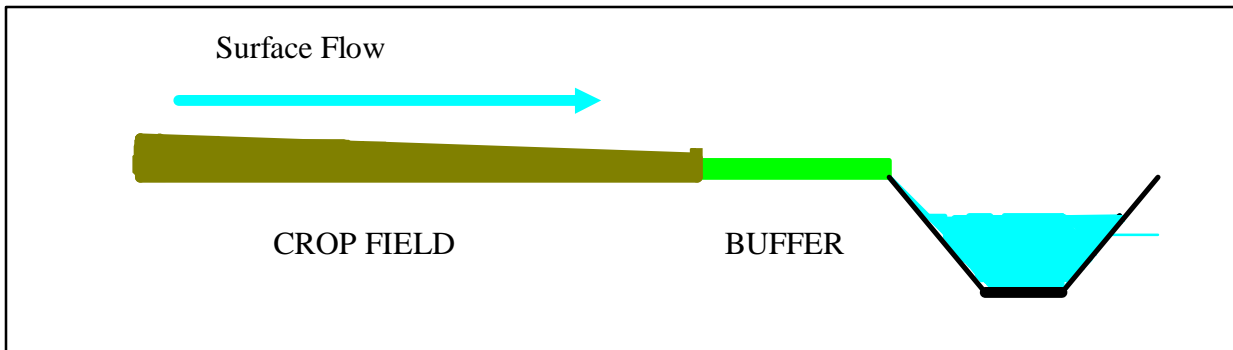
- Two different types of buffers will be needed due to differences in landscape topography within the watershed. Filter strips are an existing commonly used and understood practice that will be applicable to the flatter fields in the watershed. (Figure 1)

However, the more rolling topography of the watershed is more suited to buffer “areas” which will be circular or square sedimentation basins. This will be new technology. The implementation will require enhancement and clarification of current incentive programs and technical standards, landowner education, demonstration projects, and follow-up evaluations in order to facilitate development of a long-term widespread program in the rolling upland areas of the watershed. Figure 2 shows a conceptual view of how buffers would fit in a rolling landscape.

Accelerating the rate of installation of both types of buffers will necessitate accelerated technical assistance (personnel) beyond that presently available from both NRCS and SWCD staff. Landowners will need on-site technical assistance in the field to insure that the buffers are designed and installed properly to get the maximum sediment reduction benefits.

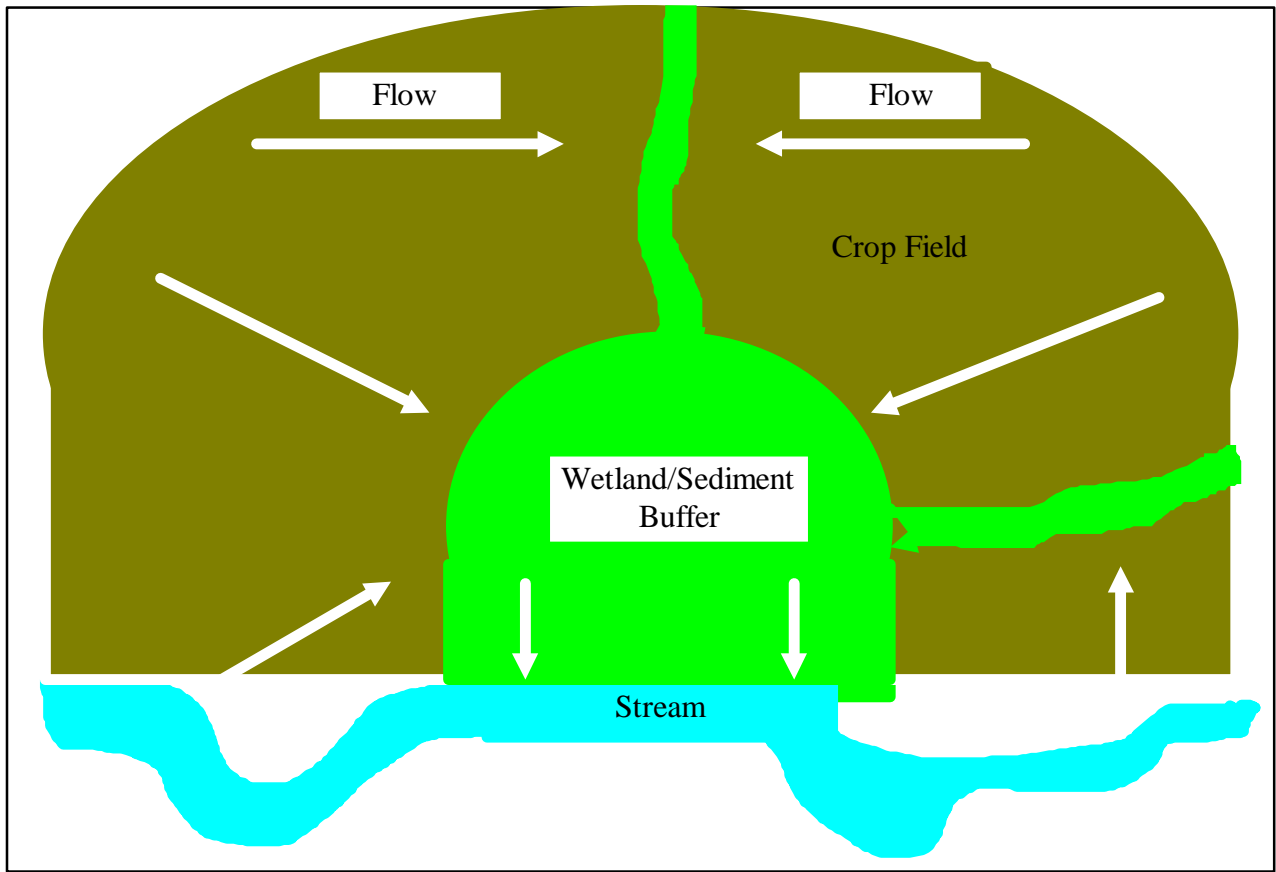


Top View

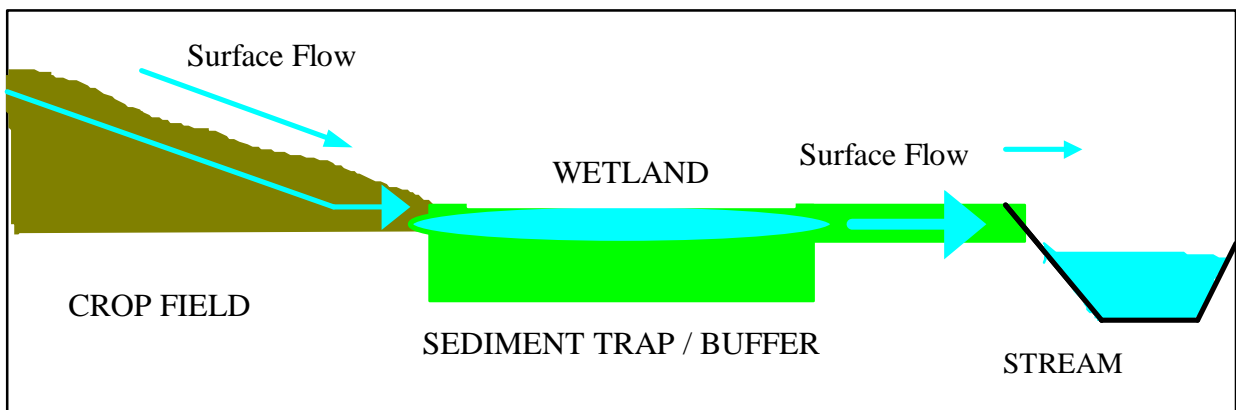


Profile View

**Figure 1 Conceptual View of Flat Field w/ Filter Strip Serving as Conservation Buffer**



Top View



Profile View

**Figure 2 Conceptual View of Wetland/Sediment Basins as Conservation Buffers in Sloping Topography**

**Sediment Modeling and Source identification**

Targeting of sediment reduction efforts within the Maumee Watershed is very difficult for several reasons. These include:

1. The size of the watershed, uniformity of the watershed, and the low erosion rates combine to make a situation unique to many soil conservation programs. Whereas many programs and funding sources are directed at reducing erosion rates to the tolerable soil loss (“T”), many soils in the watershed are already eroding at or below “T”. Solving the sedimentation problem will require lowering rates below what traditional soil conservation programs are designed for and calls for innovative approaches to designing and funding conservation programs.

The large watershed size, the high percent cropland and lower erosion rates also combine to create the need for treatment of many acres if the harbor is to be impacted. Whereas many watersheds contain small amounts of critical areas that can be isolated and treated, the Toledo Harbor problem is influenced by millions of acres with similar erosion rates.

2. The configuration of the watershed makes modeling the source of the sediment difficult. The 4 million acre watershed is shaped like a bowl. The central areas with the lowest erosion rates are nearest the main channels and tributaries, where any erosion is most easily transported to the harbor.

The outer areas of the watershed are more distant from the harbor and the transport mechanisms. However, these areas are more sloping and contain the highest erosion rates in the watershed. Even though transport is more difficult, more sediment is available to feed the transport process.

As a result of all this, the difference in quantities of sediment exported from the various sub watersheds may be very subtle.

3. The surface textures of the soils throughout the watershed contain high concentrations of fine clay particles. Once these particles are detached as part of the erosion process, they can stay in suspension for a long time and can be transported long distances. This implies that erosion prevention will be as important or more important than transport issues.
4. The watershed has extensively developed manmade drainage systems. These drainage systems accelerate the rate with which water leaves crop fields and increases the concentrated flow network within the basin. The combined effect of the easily transported soils and the concentrated flow network is to increase the amount of eroded material that is delivered to the stream systems within the watershed and thus is available for transport to the harbor.

All of these factors combine to make it difficult to identify and isolate any one area areas as the source of the sediment problem. Additionally, the size of the watershed makes it very difficult to effectively apply computer simulation models to predict such areas. One tool that could be employed would be effective long term sediment monitoring of the major sub-watersheds. While excellent long term sediment data exists on the Maumee at the outlet, long term data is lacking for all of the various tributaries. Better sediment data on each of the major tributaries could make it easier to isolate the major sources of sediment. Two opportunities exist to help developed better sediment data on a sub-watershed basis. These opportunities are the Water Resources Development Act (WRDA) and the U.S. Geological Survey NWAQA Studies.

### **Water Resources Development Act**

The Water Resources Development Act of 199\_ (WRDA) authorized sediment transport modeling studies for the Great Lakes. The U.S. Army Corps of Engineers has selected Toledo Harbor and the Maumee River as one of the initial study sites. As part of the Toledo Harbor Project commitments NRCS is cooperating with the Corps on this project and participating as a member of the study team. This project has the potential to help increase the understanding of the sediment transport process within the watershed and increase the effective use of future Soil Conservation Program funds.

However, because of the sheer magnitude to the scope of this watershed, computer modeling or simulation alone will never provide a ‘magic bullet’ solution to the sediment problem. Such modeling can be most effective when coupled with long term sediment monitoring data collected from the major sub watersheds in the Maumee Basin. One of the recommendations of this report is that Water Resources Development Act planners consider establishing additional long term sediment monitoring stations of the major tributaries of the Maumee where they do not now exist.

### **National Water Quality Assessment Program (NWQA)**

The National Water Quality Assessment Program (NWQA) is a program of the United States Geological Survey to assess water quality in selected watersheds across the United States. One of these watersheds is the Maumee River Watershed. As part of the NWQ project the USGS has recently reactivated and/or added sediment gauges to some of the tributaries within the Maumee Watershed. Data which could help provide a better understanding of the sediment picture is beginning to come in from some of these stations. NRCS is currently cooperating with USGS to provide it conservation tillage data on a sub-watershed basis and to help evaluate the data for any relationships between the levels of conservation tillage adoption within a watershed and the sediment loads that are measured.

NRCS considers the data being collected by USGS very valuable and one of the recommendations of this report is that long term monitoring be continued at the existing stations. It is also recommended that consideration be given to eliminating any gaps in the current network of stations. One such gap would be that the Blanchard River Watershed which is currently unmonitored for sediment. This is a sizable watershed with significant erosion rates and sediment data from the Blanchard would be very useful to the NRCS Soil Conservation Program.

**Clearly the opportunities exist for gaining additional understanding of the erosion, transport, and sedimentation process within the Maumee River and the Toledo Harbor.**

These opportunities should be pursued and can lead to more efficient and cost effective Soil Conservation Programs as part of the Long Term Management Strategy. However, it should be noted that while modeling and monitoring may result in better use of program funds, they will not eliminate the need to treat very large number of acres within the watershed if the sediment reduction goal is to be reached. **They should be considered one more tool in the sediment reduction toolkit, but not be viewed as a replacement for a widespread and comprehensive Soil Conservation Program utilizing conservation tillage and buffers on a majority of the watershed farms.**