WRP Technical Note SD-CP-2.1
May 1994

Surface Water Sedimentation Processes in Wetlands

PURPOSE: This technical note summarizes the sedimentation processes which control erosion, deposition, and transport of sediment in wetland environments. Related terminology is explained for those lacking specific experience in sedimentation when faced with the evaluation of wetland permits. Future technical notes will cover detailed information on the evaluation of sedimentation in wetlands.

BACKGROUND: Sedimentation in a wetland environment is affected by the hydrology and hydraulics of the wetland and surrounding area. The wetland cannot be isolated from the surrounding environment as erosion and/or deposition on areas outside the wetland may have a profound effect on the sedimentation characteristics within the wetland. The wetland type (i.e. riverine, tidal, depressional, bottomland hardwood, etc.) is also important when evaluating sedimentation. In a riverine bottomland hardwood environment inflowing sediment loads may be transported through the wetland with little deposition. In a depressional wetland all sediment inflow is retained, reducing in wetland size and/or depth.

FACTORS AFFECTING WETLAND SEDIMENTATION: The major factors affecting sedimentation in wetlands include:

- Inflowing Sediment Load. The amount of sediment moving into the wetland when considered with the hydraulics determines the location and amount of sedimentation. Generally, the higher the load and the coarser (larger grain sizes) the material, the more deposition will occur in the wetland.

- Size Distribution of Inflowing Sediment and Wetland Bed Material. The size distribution (percentages of sands, silts, and clays) will determine where deposition will occur within the wetland. If the sediment sizes are primarily in the sand range, deposition can be expected in and near channels and nearby areas where velocity is reduced. For clay and silt sizes, deposition can be expected throughout the wetland. Erosion will normally occur only in areas of high velocity or high turbulence, usually near outlets or along channels and concentrated flow paths in the wetland.

- Velocity and Turbulence of Water. The velocity of the water in the wetland will be the major factor in determining which sediment sizes will be deposited there and where deposition takes place. The amount of turbulence within the flow will have an effect and is correlated with the velocity structure. For erosion, soil type, amount of plant cover, degree of soil compaction, and velocity and turbulence determine the amount and size distribution that will be eroded. The eroded size distribution will be controlled by the bed material of the wetland and the flow velocity.

- Wave Action. Waves within a wetland from wind or boat traffic will have an effect on sedimentation. The usual effects are to redistribute sediment that has been deposited by other means and to cause bank failure/erosion due to wave induced forces. Wave erosion can be significant where large areas of open water exist or where boat traffic is uncontrolled.

- Wind Erosion and Deposition. Wind can be a major driving force of either erosion or deposition in wetlands that are dry for portions of the year. Large depressional wetlands in North Dakota have drifts of aeolian sediment up to 3 feet deep in vegetation around the edges of the dry wetlands. Sediment appears to originate from the dry areas in the wetland where there is no cover to prevent wind erosion. Deposition in vegetated areas can also occur when soil is blown from nearby unprotected non-wetland areas.

- Residence Time. The amount of time water spends in a wetland will affects the deposition of silts and clays. The longer the residence time, the higher the percentage of sediment that can be settled from the water. If significant turbulence is present in the flow (flow through vegetation for example) fine particles such as silts and clays may not deposit even though residence time in the wetland may be considerable.

- Density and Type of Vegetation. The type of vegetation in the wetland, i.e. hardwood trees with little undergrowth or dense cattails or bulrushes, will be important in determining the velocity of flow through the wetland as well as deposition patterns. Studies on a dense growth of bulrushes (*scirpus validus*) indicated that sediment deposited both upstream of and within the bulrush stand. This is apparently due to higher velocities and turbulence within the stand of bulrushes as compared to the relatively still water upstream. The volume of the channel occupied by the bulrushes was about 4 percent of the total volume.

CONCLUSIONS: This technical note reviews important factors in the determination of sedimentation in wetlands. When these factors are used in combination with hydraulic parameters an estimate of expected sedimentation can be made using standard engineering procedures. Several methods are available for estimation of historical, current or future sedimentation such as those discussed in WRP Technical Note SD-CP-4.1 (Jan 93) as well as many computer models.

REFERENCES:

Kleiss, B. A. (Jan 1993). *Methods for Measuring Sedimentation in Rates in Bottomland Hardwood (BLH) Wetlands*, WRP Technical Note SD-CP-4.1, U.S. Army Waterways Experiment Station, Vicksburg, MS.

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