Technical Principles Related To Establishing the Limits of Jurisdiction for Section 404 of the Clean Water Act

April 2003

Robert J. Pierce, Ph.D., PWS, CWD
Wetland Science Applications, Inc.
P.O. Box 1022
Poolesville, Maryland 20837-1022

4 Do Pollutants Reach Navigable Waters?

4.1 Natural Soils and Sediments

Sediment as a pollutant (e.g., suspended sediment) is discharged into water bodies through conveyances such as storm sewers which are not regulated as waters of the U.S., although the discharge is regulated under the National Pollution Discharge Elimination System (NPDES) when it reaches navigable waters. The Environmental Protection Agency (EPA), Office of Water, April 1999, National Recommended Water Quality Criteria (EPA 822-Z-99-001) contain the standards for suspended sediments.

For example, in Washington, DC, there are over 600 miles of storm sewers with 8200 catch basins and 400 separate storm sewer discharges - many directly into the Potomac River. The stormwater system captures urban runoff from all the streets, paved driveways and parking lots and impervious roof surfaces, carrying high loads of soils and sediments eroded during storm events, accumulated from wind-blown dust off of bare soil and washed from vehicles as they pass through the city, not to mention petroleum products, cadmium from brake linings and assorted other pollutants, directly into traditionally navigable waters.

Furthermore, in one-third of the city (the older parts of DC), there are miles of combined sewers which carry both sanitary and storm water. During normal flows, the combined flow travels to the Blue Plains Wastewater Treatment Plant. However, during storm events, the flow exceeds the capacity of Blue Plains and the combined effluent discharges directly into traditionally navigable waters through 60 combined sewer outfalls. As little as 0.3 inches of rain will cause bypass flow of combined sewage directly into the Potomac River and as little as 0.2 inches of rain will cause bypass flow of combined sewage directly into the Anacostia River (http://www.dcwasa.com/education/css/default.cfm, 2003).

Neither the storm sewers nor the combined sewers are considered waters of the U.S., although both discharge sediments directly into navigable waters. Ditches are simply the open (unenclosed) equivalent of a storm sewer. Ditches are the precursor and "poor country cousin" version of what society has advanced to in the management of storm water in an urban environment. EPA has established a two-phased NPDES Storm Water Program. The Phase II Final Rule, published in the Federal Register on December 8, 1999, requires NPDES permit coverage for storm water discharges from: (1) Certain regulated small municipal separate storm sewer systems (MS4s); and (2) Construction activity disturbing between 1 and 5 acres of land (i.e., small construction activities). Thus, Phase II covers sediment discharges that might eventually enter navigable waters.

4.1.1 Nature of Dredged and Fill Material

The idea that the discharge of dredged or fill material into isolated waters, ephemeral drains or non-tidal ditches will pollute navigable waters located any appreciable distance from them lacks credibility. The discharge of fill material as has been classically regulated by the COE, results in the "discharge" of a "pollutant" that is far different from any other regulated by the CWA. Congress recognized the difference in the nature of discharges of dredged and fill material when it specifically carved-out Section 404 and named the Secretary of the Army to administer it.

The CWA [Sec 502 (6)] defines "rock, sand and cellar dirt" as pollutants. Being of natural origin, these materials rarely contain toxic substances in toxic amounts. The COE by its own policies requires that the fill material normally be from a clean, upland source, that it may not consist of unsuitable material (e.g., trash, debris, car bodies, asphalt, etc), that it be free from toxic pollutants in toxic amounts (65 FR 12896) that it be maintained in good condition (33 CFR 325 Appendix A, General Condition 2; 65 FR 12893) and that appropriate soil erosion and sediment controls be maintained in effective working order during construction (65 FR 12893). That is, the material is put in place to stay, not as a form of waste to be carried away.

Citizens who typically have the need to discharge fill material do so with the intent that the material will remain in place in perpetuity. Furthermore, in many locations throughout the nation, land use controls, a responsibility of state, not federal government, typically have requirements to minimize erosion and sediment runoff during and after construction as well as requiring the control of both quantity and quality of runoff from constructed facilities. Thus, the likelihood that a discharge of fill material will result in the addition of a pollutant to navigable waters located at any appreciable distance from the discharge is highly unlikely.

Furthermore, because of the sparse vegetative cover, drylands may naturally produce very high concentrations of suspended sediment loads (Bull and Kirkby 2002, Reid 2002). Concentrations as high as 68 percent solids have been documented in flash flood flows in ephemeral channels (Reid 2002). Record levels of bedload flux during in-bank flows that exert only moderate levels of boundary shear stress occur because of the lack of an armor layer on the stream bed which is common in the sediment poor conditions typical of the vegetated terrain in humid regions. These levels may be six orders of magnitude greater than streams of similar size in humid environments and at least an order of magnitude higher than that in perennial streams of similar size (Reid 2002). This being the case, the likelihood of a detectable quantity of suspended sediment being eroded from an intentionally placed and protected fill in an ephemeral channel in drylands is exceedingly small.

Assume, for argument's sake, however, that we could detect suspended sediment originating from an intentional fill above the natural background levees. The fate of suspended sediment that was discharged into an ephemeral channel will depend upon the physical characteristics of the channel and the storm event that has initiated the flow as well as the distance from origin to final disposition.

4.2 Transport of Pollutants

It has been said that "the solution to pollution is dilution." In fact, if the volume of pollutant is small enough in comparison to the volume of dilutant, this is true. We can pick as the threshold for a determination of pollutant conveyance to a navigable water, either the water quality standard for that pollutant or the level of detectability. To avoid debate, the threshold to select is detectability. In general, most known pollutants can be detected by modern instrumentation at levels below those set for water quality standards.

Construction practices virtually never entail discharges of fill material into flowing waters. The discharges are either timed to coincide with dry periods in the year, or cofferdams are constructed to dewater the receiving area before the fill is placed. Even if there were minor flows in an ephemeral drain or non-tidal ditch when the fill was discharged, the idea that clean earthen material (and especially gravel and rock that is normally the base for construction in wetter environments) that is protected from erosion and used as the foundation for some facility could travel in detectable amounts the tens and in many cases hundreds of miles from ephemeral channels to navigable waters is technically indefensible.

As the size of a particle increases, so does the velocity of water necessary to initially sheer it and then transport it downstream (Leopold 1994). Materials travel as either suspended load or bedload. Because of their size, neither rock nor sand will be transported any appreciable distance in ordinary flow conditions. Under flood events of high enough magnitude, these coarse particles can be moved, but likely as bedload which will settle-out as soon as velocities decrease which typically happens when a stream widens or when small streams connect to larger ones and on the inside of bends on streams typically forming bars or shoals. Thus, bedload normally does not transport great distances and is unlikely to reach a traditionally navigable water if it is far distant from the origin.

The finer fractions of the sediment remain suspended with a lower velocity and, thus, can travel further. Of the pollutants listed in the CWA, rock, sand and cellar dirt are the three likely to be involved in a Section 404 fill activity. The finer fraction, i.e., the silts and clays which may be a part of cellar dirt, have the potential for being transported the greatest distance. Yet as discussed above, the simple fact that transmission losses are often extremely high in low-order streams especially in drylands, means that even the fine fractions of the soils will settle-out long before they can reach a navigable water if it is far distant from the origin.

The situation where the water-borne, suspended sediments would never reach a navigable water because of transmission losses is discussed above. However, there are some situations where water may not completely infiltrate through transmission losses but be so diluted by inflow from other tributaries by the time it reaches a traditionally navigable water, that it would be undetectable. The Potomac River network is an example.

The COE considers the Potomac River to be navigable upstream to Wills Creek in Cumberland, Maryland. The USGS maintains a gage station (01603000) on the North Branch Potomac River a short distance downstream from its confluence with Wills Creek (Figure 20). USGS has been collecting peak stream-flow data at the station since 1889 and daily flow data since 1929. Between 1906 and 1994, USGS also collected water quality data at varying intervals.

The mean annual flow at the North Potomac station is approximately 1,293 cfs. The forth highest peak discharge since 1889 (59,200 cfs) occurred on January 19, 1996. The mean daily flow for this event was 29,400 cfs.

Since 1980, the USGS has maintained gage 01594936 (Figure 21) on the North Fork Sand Run (a small, perennial stream) near Wilson, Maryland. Sand Run is located approximately 75 miles upstream of navigable waters (Figure 22). The mean annual flow on Sand Run is approximately 4.51 cfs. The highest recorded flow (400 cfs) occurred on January 19, 1996.

For my example, I postulate that a developer, constructing a residential subdivision in January 1996, graded 100 ft of an ephemeral stream at the upstream end of the North Fork Sand Run. The

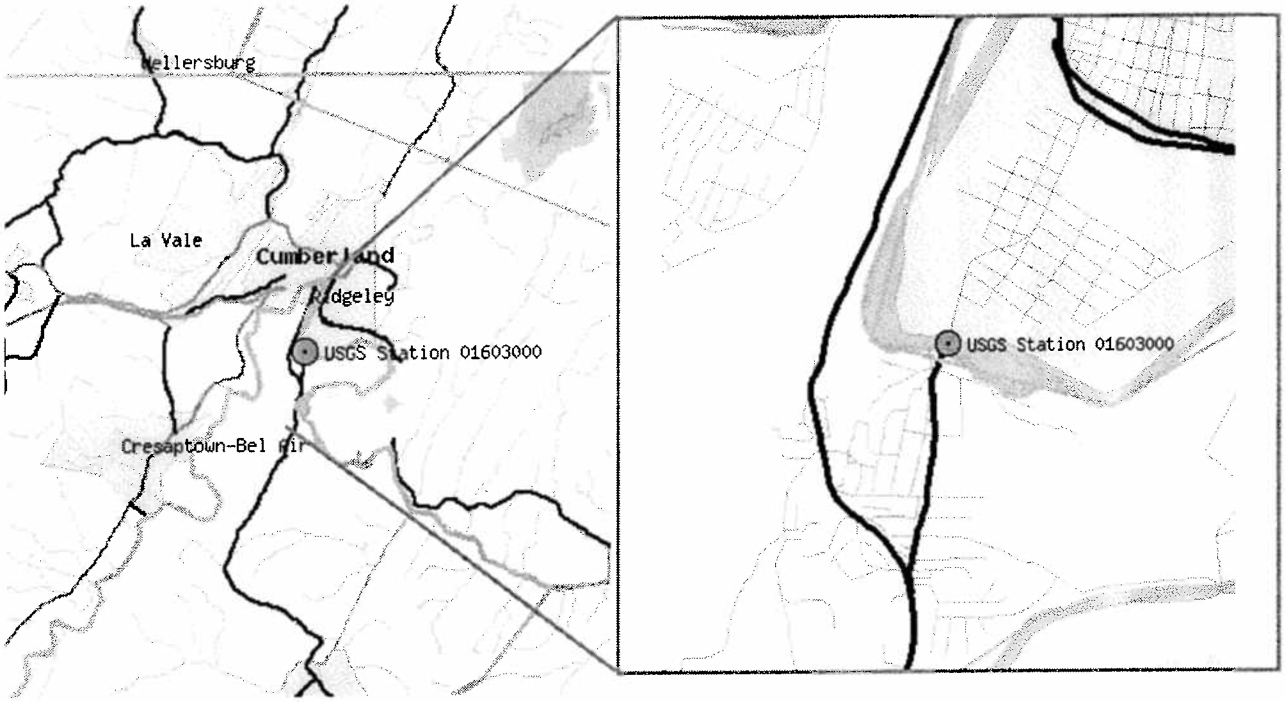

Figure 20. North Branch Potomac River USGS stream gage station 01603000.

ephemeral channel averaged 3 feet wide and 0.5 feet deep. Thus, a total of 150 ft^3 of soil filled the channel.

The following "worst case" assumptions are made:

1. During the storm on January 19, 1996, all of the 150 ft^3 of soil was washed downstream and flowed through the gage and into the North Fork Potomac River;

2. The water from Sand Run can flow unimpeded to navigable waters at Cumberland, Maryland;

3. All of the fill material will remain suspended for the entire 75-mile trip to Cumberland

The mean daily flow in Sand Run on January 19, 1996, was 140 cfs which equates to a volume of 12,096,000 cf (277.69 acre-ft) during the entire day. The concentration of the suspended solids originating from the fill in the ephemeral channel would have averaged 12.4 ppm. The average daily flow in the Potomac River at Cumberland, Maryland on January 19, 1996, was 2,540,160,000 cf (58,314.05 acre-ft). Based on the above assumptions, the concentration reaching navigable waters would be 0.06 ppm. Thus, even under a worst case scenario, the concentration would be below detection limits for instruments routinely used to measure suspended sediment.

To place concentrations into perspective, historic data relating suspended sediment concentrations to discharge at USGS gage station 01603000 can be reviewed. From 1966 to 1993, 61 suspended solids measurements were made during a range of flow conditions. The data are presented as Figure

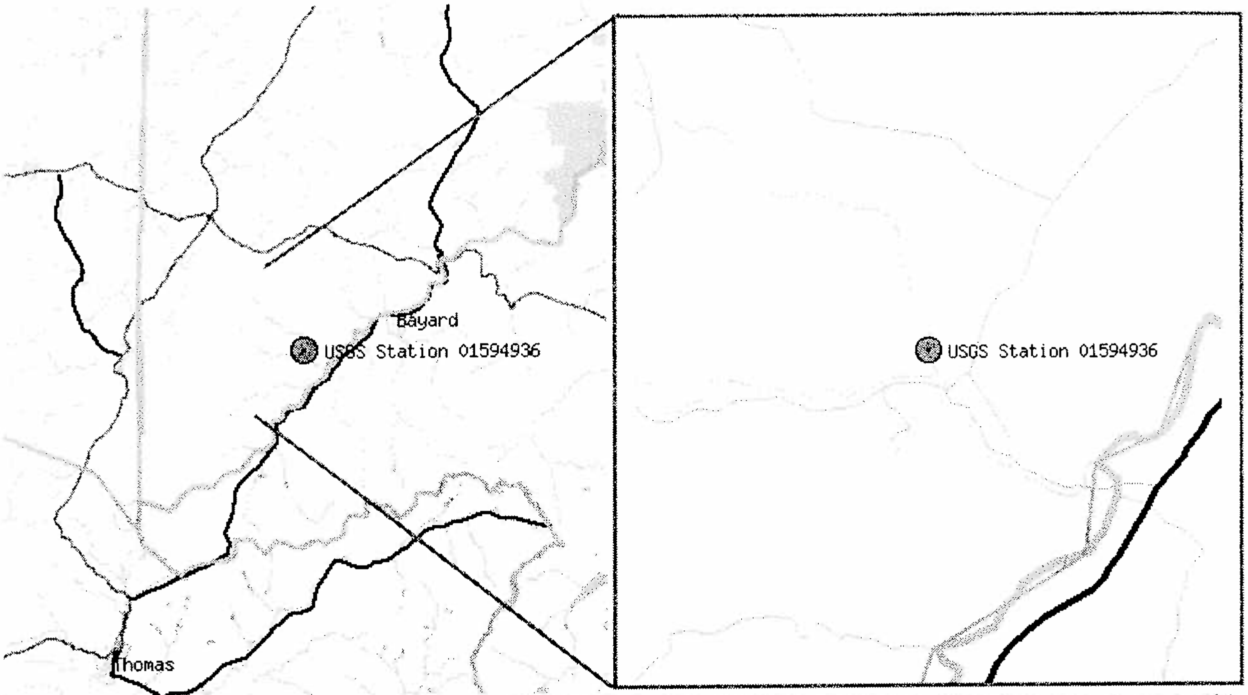

Figure 21. North Fork Sand Run USGS stream gage 01594936.

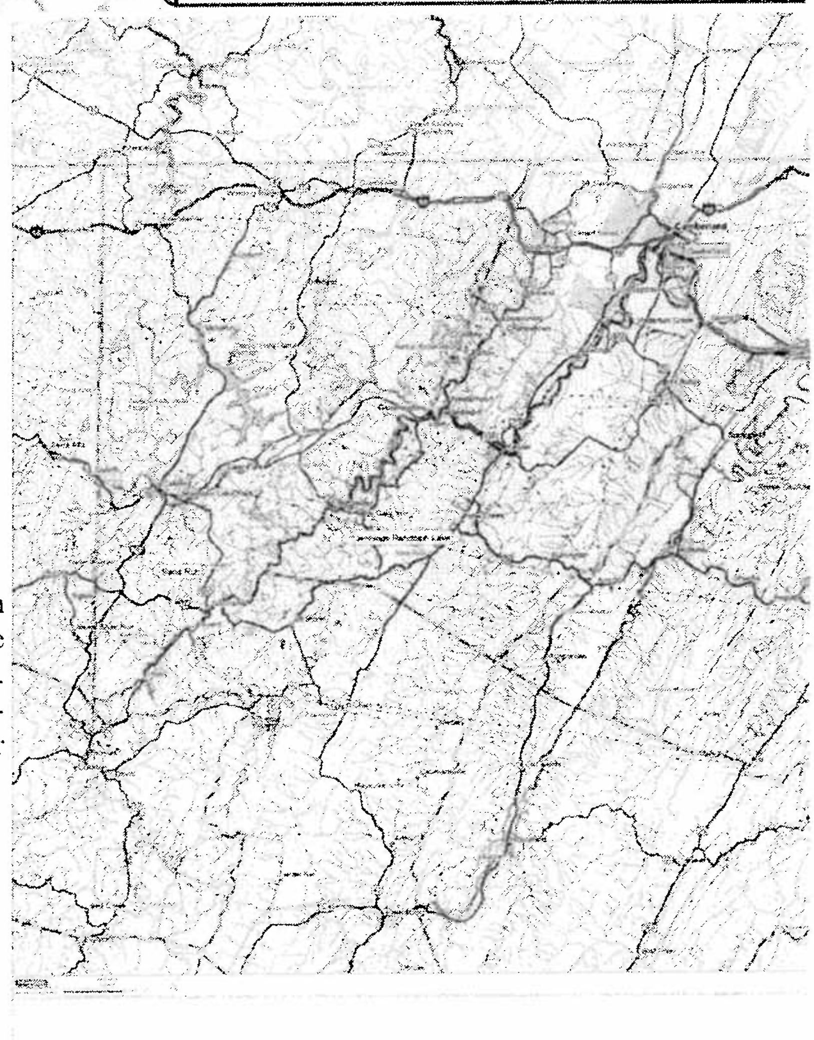

Figure 22. Locations of Sand Run 75 miles upstream of navigable waters at Cumberland, Md. Jennings Randolph Lake is an impoundment of the Potomac River located between the two.

23. While no measurements were made in mean daily discharges exceeding 18,000 cfs, the maximum observed concentration of suspended sediment was 1,980 ppm. Assuming that this or a higher concentration of suspended sediment occurred in 1996 when the mean daily discharge was 29,400 cfs, then the concentration of suspended sediment that reached navigable waters was no more than 0.0003 percent of what was in the water from other sources.

While the extremely low concentration that I have described might theoretically reach navigable waters under the assumptions I have made, albeit in undetectable concentrations, an assessment of the validity of the assumptions is important.

1. It is highly improbable that all of the material would have washed downstream because of state and NPDES requirements for construction erosion control and best management practices routinely employed in Maryland.

2. Water from Sand Run does not flow unimpeded to navigable waters in Cumberland. In actuality, the Jennings Randolph Lake is located between Sand Run and Cumberland (Figure 22). Because of the stilling action of the reservoir, it is highly unlikely that any suspended sediments that might have originated in the ephemeral stream at the upstream end of Sand Run and remained in suspension to the reservoir would have passed through the dam and reached navigable waters at Cumberland, Maryland.

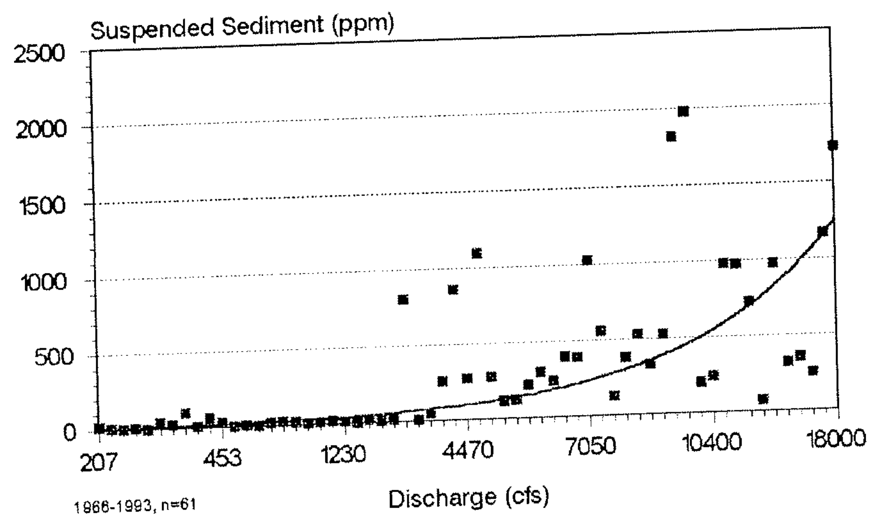

Figure 23. A comparison of suspended sediment concentrations to stream flow at the North Branch Potomac River USGS stream gage station measured during the period from 1966 to 1993.