NCDOT TURBIDITY REDUCTION OPTIONS FOR BORROW PITS*

Tier I Methods
January 1, 2009

Method	Description	Positive Aspects	Negative Aspects	Comments
Pit Dewatering Basin (Compensatory BMP)	These are detention basins that include a forebay and baffle where pit water is pumped and allowed time for suspended material to settle. The baffle is constructed with coir fiber material. Flashboard riser can be used to control the water level. Outlet comprised of rigid riser/barrel.	Basins are easy to build and maintain. They provide further treatment before pit water is discharged to the environment on a continuous basis	Basins are only 69-72% effective at removing total suspended solids under normal conditions. If turbidity (>50 NTUs) is encountered then additional BMPs may be needed. These types of basins alone are ineffective at removing fine or colloidal particles.	Outlet water should be drawn from the surface. Basin sized according to pump capacity and detention time.
Non Compensatory BMPs				
1) ***Land Application*** *(Irrigation)*	Water from pit is pumped to irrigate agricultural crops	Rain and pit water are used by agricultural crops and there is no non-discharge permit required.	Irrigation activity can have no discharge into surface waters and there is no violations of the Capacity Use permit. Limits exist as to the distance that irrigation pipe can be extended.	No chemicals can be added to water being applied.
2) ***Silt Bag***	Pit water is pumped through a water permeable fabric bag resting on a bed of washed aggregate to increase bag discharge area. PAM can also be introduced in the pump system for enhanced sediment removal	Easy to install and remove bag. Effective at removing large size particles. Only a small footprint is required.	Silt bag is limited to a certain flow rate and bag does not remove fine or colloidal particles unless a PAM treatment is also used.	Addition of PAM may cause floc to seal bag.
3) ***Aluminum Sulfate*** *(Alum)*	A granular coagulant material added by spreader to pit water and settle out suspended material. Maximum rate is 25 lb./1,000 cu. ft. of water and keep below 250 PPM sulfate.	Inexpensive and relatively easy to apply. Works well on clay particles. PAM can also be used when a re-suspension occurs	A toxicity (tox.) test is required because of a potential pH shift. Also, a background test of iron and aluminum present in the pit should be conducted. May take 1-2 days to clear water.	pH needs to be above 5.5 to avoid toxic level of aluminum. May need lime for pH adjustment.
4) ***Gypsum***	A powdered coagulant material added by spreader to pit water and settles out suspend-ed material. Maximum rate is 30 lb per 1,000 cu ft of water to keep below 250 ppm sulfate	Relatively easy to spread and takes around two-days to clear the water column before pumping from water surface.	Requires much larger quantities of material (100 times) that of aluminum sulfate and a toxicity (tox) test. Can resuspend in large pits on windy days.	Also can produce pH shifts.
5) ***Polyacrylamides*** *(PAMs)*	A broad range of flocculants in liquid, powder, & solid forms to chemically bind sediment particles together and settle out	Works well under a variety of conditions. Does not affect pH and is not toxic to aquatic organisms at recommended levels.	Needs technical oversight for setup and water test for best product and equipment match. May not work on some clay materials.	Keep sulfate levels below 250 ppm. Use only anionictypes. Should not be applied directly to surface waters of the state. Instead, application should be through a pit dewatering basin or other structure. Use PAMs approved by DWQ.

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Tier II Methods**

January 1, 2009

Method ***Non Compensatory BMPs***	Description	Positive Aspects	Negative Aspects	Comments
6) ***Well Point Pumping*** *(Soil Filtration)*	Pit is dewatered by a series of shallow wells surrounding the pit at approximately 20' intervals	Water can be directly discharged to the environment without tox. testing	Runoff is a problem and can create turbid waters in the pit. Must be treated before being discharged to the environment usually with flocculant because drawdown of pit exceeds filtering capacity of soil.	If iron levels are high in pit water, discharge must pass through a stilling basin.
7) ***Impoundment*** *(Detention)*	Large detention basin used for storage, evaporation, and sedimentation of pumped water from the pit	There would be a slow release from this basin after material has settled out and discharged through an outflow pipe	In some areas, land for impoundment may be hard difficult to find due to the size and location of the basin. Very fine material will not settle in some cases.	Storm events often resuspend settled particles.
8) ***Cell Mining***	The borrow pit is divided into cells and water is pumped out of one cell into another so a specific cell can be mined dry	There is no immediate discharge from the pit	Extra movement of discharged water from one cell to another within the pit. Wastewater from the pit will have to be discharged some time during the active life of the pit.	Limiting factor may be volume of water to be moved.
9) ***Sand - Media Filtration***	Water from the pit is passed through a floc sock if needed and into multi-chamber sand media filter for treatment	Treated water can be discharged directly to the environment.	The rental rate for this equipment is very costly. May want to consider buying equipment and moving system around to different locations.	Proper pump rate and prefiltration must take place and monitored closely. Can be used after flocculants.
10) ***Wet Mining***	Material from pit is removed wet and placed on higher ground to drain before being moved to job site	There is no discharge from the pit	Material from pit is handled twice, land needed for stockpiling material, and time needed for pile to dry.	No water quality impact (self contained)

NOTES:

* 1) An evaluation of the pit soil's cation exchange capacity should be considered as the contractor develops his bid.

** 2) Tier II Methods will be considered when 401 WQ Certification requires protection for rare or unique resources

3) Many of these turbidity reduction techniques can be combined to provide further treatment