A Review of Sediment Pond Reclamation and Permanent Dry Ponds

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Purpose and Scope:

The purpose of this review is to assess the long-term effectiveness of sediment pond reclamation and the permanent retention of dry ponds. The review concerns ponds constructed since 1972, with a priority placed on ponds constructed in larger drainages or streams. These ponds are a priority because these are the ponds most likely to have erosion or stability problems due to the higher flows in streams and large drainages. The results of the review will assist with future decisions in the regulatory and AML programs regarding sediment control structures.

Background:

Since the implementation of Ohio=s 1972 Strip Mine Law, thousands of sedimentation ponds have been constructed. In many instances, these ponds filled with sediment and were either cleaned out or reclaimed. Because cleaning out or totally removing ponds is a difficult and costly operation, most ponds were reclaimed in place. This is particularly true for ponds that were located in natural stream channels with larger drainage areas. While their location made them logical places to capture sediment, the location also made them difficult to reclaim. Ponds were often constructed well below the mining site, in areas with difficult access. Typically, the pond would be dewatered, the dam graded out, and an overflow channel established. In some cases, dry ponds were left as permanent structures. Dry ponds usually had perforated riser pipes that would impound water and sediment during heavy flows, but would normally be dry. More recently, the majority of sediment ponds are being left as permanent impoundments. This is beneficial for wildlife, aesthetics, and reducing peak discharge from the site. Permanent ponds also complement many land uses, and, as such, are routinely maintained by the landowners. This may not be the case with dry ponds or reclaimed ponds, as they may not serve any function complementary to common land uses such as farming or recreation.

Ohio has long been aware of sediment pond issues. In 1991, their Pond Management Task Force (PMTF) issued recommendations including the acceptable reclamation of ponds and accumulated sediment. In 1996, Ohio issued Policy/Procedure Directive (PPD) 96-1, which built upon the 1991 recommendations by providing standards for the reclamation of ponds.

Methodology:

OSM located pond sites by canvassing Ohio's inspection staff and the coal industry, in addition to reviewing aerial photos of older mine complexes. After locating the pond sites on topographic maps, OSM reviewed the ponds in the field and photographed them to show their condition. OSM completed a pond reclamation data sheet for each site. A total of 41 reclaimed pond sites and ten dry ponds were reviewed. Five other permanent ponds, thought to be reclaimed, were also reviewed. The exact dates of when the ponds were reclaimed were mostly unavailable, but most were permitted under "B" or "C" permits and reclaimed from the mid 1970's to the mid 1980's. So the age of the reclamation sites reviewed could be as much as 25 years old.

Findings and Recommendations:

Finding: The majority of the accumulated sediment is retained in reclaimed ponds.

Discussion: Of the 41 ponds reviewed, only eight had evidence of significant sediment loss. In all eight cases, a new channel was eroded through the accumulated sediment in the reclaimed ponds losing perhaps as much as 20 percent of the accumulated sediment. However, in all eight cases, the channels were mostly stable due to natural succession with weeds and saplings. There were two ponds where no observations could be made due to beavers damming up the stream and flooding over the sites. There were also several ponds with lesser erosion such as washing of rock channels in places or side cutting in the channels. Reclamation techniques varied somewhat, but generally involved grading down the dam to the level of the accumulated sediment and constructing a rock channel to drain the reclaimed area. One pond was reclaimed by constructing a permanent pipe discharge structure through the reclaimed area. It is now used for farming.

Of the eight ponds with substantial sediment loss, five were located in drainages between 212 and 410 acres. Three were located in drainages from 20.9 to 59 acres in size. As expected, large drainages are harder to stabilize due to the higher, more erosive flow encountered. However, this information would indicate that drainage size is not the only factor.

OSM observed several things with regard to other factors causing erosion:

1) Lacks of positive drainage into the rock channel - Several of the reclaimed pond sites were very flat, which allowed heavy flows to erode new channels outside of the rock channels. Where the reclaimed areas were graded for positive drainage by placing the channel at the bottom of a shallow "v," this did not occur.
2) Sharp breaks in the channel profile - Washouts in the rock channel itself were most prevalent where the channels broke sharply over the face of the graded dam. Where channel profiles were more gradual, this did not occur.
3) Corrugated metal pipe (CMP) left in place as discharge structures from the reclaimed ponds - Several pond sites had CMP risers left to discharge normal flows and rock channels to pass storm flows. On one site, the CMP had corroded, causing piping through the graded dam. This in turn caused erosion through the graded face of the dam. Another observation was made on a permanent pond where the CMP riser fell over, due to piping, and drained this large pond.

Recommendations:

1) Ensure that there is positive drainage into rock channels used to drain the reclaimed pond.
2) Construct the gradient of the rock channel as gradual as possible.
3) Do not use CMP in any permanent reclamation feature.

Finding: Permanent dry ponds are an effective long-term method of retaining sediment.

Discussion: Of the ten permanent dry ponds reviewed, none showed evidence of sediment loss. All embankments were intact, although CMP risers had corroded off on three of the ponds. Ultimately, the discharge sections will also corrode and cause failure of the embankments. Five ponds had risers still in place, one CMP, three concrete, and one PVC. The drainage areas ranged from 17.6 acres to 372 acres. Three rock dams, which are another form of dry dam, were also reviewed on a 1993 AML project. These ponds also showed no signs of sediment loss or instability. The drainage areas ranged from 30 acres to 169 acres.

Recommendations: Consider using dry dams and rock dams on both AML and regulatory sites where sediment and runoff control is needed. PVC or concrete risers should be used in dry dams in lieu of CMP.

Finding: The majority of reclaimed pond sites are some form of wetland.

Discussion: Of the 41 reclaimed ponds, ten dry ponds, and the three rock dams reviewed, 35 of the sites would qualify as wetlands based on the vegetation present. Nearly all of the reclaimed ponds or dry dams with drainage areas of 100 acres or more were wetlands. Ponds that did not show any significant sediment loss or channeling through the accumulated sediment, mainly had cattails with little to no standing water. Ponds with channeling through the accumulated sediment had mostly dewatered. Wet meadow weeds and trees have grown in. However, none developed into a high quality wetland. The Ohio Division of Wildlife now owns several of these sites (Crown City and Tri Valley Wildlife areas). The Division of Wildlife would like to make the pond sites more attractive to waterfowl by creating more open water areas. However, this is difficult to accomplish since most of the pond embankments have been lowered to the level of the accumulated sediment. To provide the freeboard needed to create open water areas, significant amounts of earthwork would be necessary.

Recommendation: When reclaiming pond sites where wetlands are desirable, the retention of open water areas should be considered in the reclamation plan to maximize the wildlife values of the site.

Finding: Reclaimed pond sites do not appear to prevent the movement of fish where they are present.

Discussion: In two instances, minnows were observed in reconstructed stream channels above the cattail wetlands in the reclaimed ponds. In both instances, the drainage above the ponds had been totally affected by mining. This shows that at least some fish were able to get through the wetland areas from un-mined downstream sections, in spite of the lack of a visible channel. In several of the areas where channels eroded through the sediments, the washed rock formed haphazard pools and riffles. Minnows were also observed in these areas as well.

Summary: This study shows that, although there was some sediment loss that could have been prevented, the majority of sediment accumulated in reclaimed sediment ponds and has been retained in place. Grading for positive drainage, constructing channels with gradual slopes, and avoiding the use of corrugated metal pipe, improve the stability of reclaimed ponds.

This review found that permanent dry ponds were shown to be an effective method of collecting and retaining sediment. The study also showed that the majority of reclaimed ponds are low quality wetlands that could be improved by the creation of more open water areas. The reclaimed ponds do not appear to prevent the movement of fish to areas upstream of the pond reclamation.

These findings show that in-stream ponds and dry dams can be an effective means of sediment control that is both long-term and environmentally acceptable.

Appendix A: Photos

Significant channel erosion in pond #32 (note filter fabric from rip rap channel hanging into eroded channel that formed alongside the original channel)

Eroded channel on pond #31 (on left) and erosion eating back into the accumulated sediment (on right) – note how the riprap has fallen into the erosion

Eroded channel and reclaimed pond #2 healed over by 25 years of natural succession

Pond #14 where a new channel has eroded around the corroded galvanized outlet

Failure of a drop inlet structure due to piping caused by corroded CMP

Dry pond #1 which catches 180.7 acres of drainage

Dry pond #8 showing typical construction using perforated riser pipe.

Low quality wetland cover in pond #14 that is typical of reclaimed ponds

Minnows were observed in this channel above pond #24,which is spring-fed.

This is the same channel above the spring

Pond #3 taken over by beaver dams

Appendix B: Listing of Sites Reviewed