

# **DEPARTMENT OF ENVIRONMENTAL PROTECTION**

## **FINAL RECOMMENDATIONS OF THE LONG TERM OPERATION, MAINTENANCE AND REPLACEMENT WORKGROUP**

**November 15, 2001**

An increasing number of watershed groups, as well as many Federal, State and local agencies, have become active in watershed restoration over the past several years. As a result, a large number of restoration projects are being funded and constructed. Water quality and aquatic habitat improvements are occurring as these projects are implemented. The need for long-term operation, maintenance and replacement (O, M & R) has been increasingly recognized as a requirement to ensure the success of watershed restoration projects. In Pennsylvania, a total of nearly \$93 million of public money has been spent on these projects since 1988 (see attachment A). The establishment of the Growing Greener grant program has greatly accelerated this effort. The failure to maintain the systems being constructed under these projects could have detrimental impacts to watersheds that are beginning to support an increasing number of stream uses. As a result of growing concern over this issue, the Department's Greener Team established a workgroup to provide recommendations to address this need. This workgroup consists of individuals from Federal, State and local governments, as well as private consultants and watershed group officials. All have had extensive experience in the operation and maintenance of watershed restoration projects.

It is important to note that, for the purpose of defining needs and determining costs, the workgroup defined long-term O, M & R as system operation and maintenance, plus one system replacement at the end of the design life of the project. Also of note is a decision by the group to include all publicly funded watershed restoration projects constructed through 2001, when determining costs associated with existing systems.

### **O, M & R Plan**

An O, M & R Plan, developed by the project sponsor, is an integral part of providing for operation and maintenance of watershed restoration projects. The basic elements of an O, M & R plan include: a written agreement with the entities responsible for O, M & R, identification of tasks to be completed, development of a schedule and determination of responsible parties and costs. Plans must become a "deliverable" of all new implementation grants. For existing projects that have no O M & R plan, site-specific plans will need to be developed prior to receiving funds to address O, M & R.

Operation, maintenance and replacement concerns should begin at the initial site inventory of a project and continue through all phases of project development. Water quality information, along with flow measurements, should be looked at critically with

respect to future operation and maintenance. If a site requires intense operation and maintenance to function, the sponsors of the project need to understand the intensity and potential cost. Once the decision is made to move ahead with project design, the focus should be to make the operation and maintenance of the system as easy as possible. Prior to project implementation, the sponsors need to understand what it is they need to do and at what frequency. Additional training may need to be provided to facilitate a more detailed understanding of operation and maintenance.

In developing an O, M & R plan, the following should be considered:

**Operations** - Sponsors need to demonstrate an understanding of, and the ability to perform, routine duties, such as:

- Inspections (including water sampling and flow measurements);
- Litter control;
- Vegetation control;
- Mechanical maintenance (including flushing);
- Insect and vector control;
- Physical stability and erosion control.

**Maintenance** - Sponsors need to demonstrate an understanding of, and the ability to perform, more intensive items that may take considerable dollars and time to accomplish, such as:

- Removal and disposal of accumulated precipitate or sediment;
- Maintenance of channels;
- Industrial cleaning of pipes;
- Repairing damage after major storm events;
- Repairing cracks or leaks;
- Adding limestone, compost, sand or gravel;
- Repairing vandalism damage;
- Adjusting grade or outlet structures.

**Replacement** - Systems have a designed life expectancy; once that design life is exceeded, much of the system will need to be recharged or replaced. Replacement will involve much of the same effort originally needed to construct the system. Changes in technology and water quality and quantity will need to be considered to determine if the size and/or design of the system must be changed. Replacement considerations include:

- Estimating BMP (Best Management Practice) design life;
- Determining replacement responsibility, including a successor, in the event of the original project sponsor's inability to carry out these responsibilities;
- Determining approximate costs for the following possible needs: removing accumulated sediments, replacing defective valves, water control structures, re-sizing the system to accommodate changed water quality or

quantity, recharging organic matter layer on wetlands, recharging limestone rock.

An O, M & R Plan should include:

- Narrative describing O, M & R needs and identifying responsible parties
- Signed maintenance agreement with all parties, including property owners
- O, M & R Site Map that includes BMP's, flushing points, monitoring points (water sample locations, benchmark cross sections, etc.)
- Site specific instructions
- "As-built" plans

### **Long-term Cost Analysis**

Long-term costs are analyzed in many business and government applications. The starting point for most analyses is a spreadsheet that projects costs over the lifetime of the BMP. Costs are often divided into tasks such as site inspections, sample collection, sample analysis, sludge management, flushing, and reconstruction. A long-term cost spreadsheet should be developed for all projects early in the planning process. The construction of this spreadsheet will help sponsors to recognize long-term responsibilities and also encourage them to identify mechanisms that will legitimately lessen the long-term costs of their projects.

The workgroup collected information on long-term costs of BMPs by reviewing existing policies, interviewing technology experts, and by analyzing current cost data. The workgroup did not find established O, M & R cost estimates for mine drainage treatment systems, so estimates were developed from Department, Natural Resources Conservation Service (NRCS), non-profit and consultant experiences. These data were used to develop spreadsheets that projected long-term O, M & R costs for specific mine drainage BMPs. Development of the spreadsheets required assumptions about the time period over which to project costs and whether to include a BMP replacement in the extrapolation. The workgroup decided to analyze 25 years of costs and to include one replacement in the calculation.

The spreadsheets were analyzed in two ways. The first method was to calculate the present value of the long-term costs. The method requires financial assumptions about rates of inflation and investment return. The result of this calculation is a sum of money that, if the financial assumptions are realized, will yield proceeds adequate to cover all anticipated long-term costs. Our analyses assumed a 3% inflation rate and a 6% rate of return, or a net rate of return of 3%. While this may seem conservative, it is consistent with long-term economic trends in the U.S. It is also consistent with similar analyses of long-term AMD treatment costs being conducted by the Department for permitted mines. The present value analysis yields a sum of money that can be placed into perspective by comparing it to the BMP's original construction cost. On average, the present value of the long-term O, M, & R costs were approximately 60% of the construction costs. Thus,

if the Department wanted to fully fund a \$100,000 passive treatment project, it should plan on placing \$60,000 in an interest-bearing account at the time of construction. If the cost projections and financial assumptions are correct, no more funds should be required for 25 years.

A second analytical method calculated the annual costs of an on-going O, M & R program. Instead of paying all the anticipated long-term costs in the first year, only those expenses anticipated for the current year would be paid. Each year, for 25 years (the workgroup's analytical timeframe), the annual O, M & R costs would be paid. We calculated the average annual cost by summing all anticipated O, M & R costs and dividing by the analytical period (25 years). This average O, M & R cost was related to the construction cost to calculate the O, M & R factor. On average, most AMD passive treatment technologies had an average annual O, M & R factor of 4%. Thus, a \$100,000 project would require an average of \$4000 per year in annual costs. The actual costs would vary widely because major maintenance costs and replacement costs – both high expense items – occur infrequently and generally toward the end of the BMP lifetime. The factor does not account for inflation. Since most watershed restoration projects have been constructed relatively recently, not accounting for inflation shouldn't be a problem at this time. If the Department decides to fund O, M & R using the O, M & R factor, it should regularly adjust the base value of construction to account for inflation in the future.

The estimated O, M & R factors varied with the type of watershed restoration project. Table 1 shows the range in factors. Most of the BMPs being implemented with Growing Greener funds are in the 3-5% range. While the AMD factors were based on actual experiences of several workgroup members, the non-AMD estimates were derived from informal surveys of the following sources: NRCS, the Center for Watershed Protection, the Keystone Stream Team, PA DEP, MD DOE, Universities and consultants. These sources were able to provide good input concerning O & M (particularly the NRCS, which just completed an evaluation of agricultural BMP's by June C. Grabemeyer, Agriculture Economist, East Lansing, MI), but were less certain about replacement costs. The group decided that 4% was a good average O, M & R factor to use in estimating long-term costs for all types of restoration projects, for the purpose of estimating funding needs.

**Table 1: Average O, M & R Factor for Watershed Restoration BMP's**

Agricultural BMPs	4%
Stream Restoration BMPs	4%
Stormwater Management BMPs	3%
AMD Vertical Flow Systems	5%
AMD Anoxic Limestone Drain Systems	4%
AMD Compost Anaerobic wetlands	4%
AMD Pyrolusite© Systems	3%
AMD Open Limestone Channels	1%

The workgroup broke down the long-term O, M & R factor into cost categories. For a passive treatment system that has a 5% annual factor, system reconstruction accounted for 40% of the costs, routine operations (inspections, sampling, flushing) accounted for 20%, water sample analyses accounted for 10%, and general and unscheduled maintenance and repairs accounted for 30%. This breakdown was valuable because it showed that well-organized project sponsors should be able to cover up to 60 % of the estimated O, M & R costs by assuming all or part of the non-replacement responsibilities.

The workgroup decided to use the O, M & R factor method to analyze costs and make recommendations concerning the amount of funds needed to address O, M & R on a long-term basis. This determination was made based on feedback received from Executive Staff and others that up-front, lump sum funding of O, M & R was not likely to be pursued by the Department.

A difficult issue within the analysis of long-term costs was the cost of lab analyses of water monitoring samples collected. The water sampling cost analysis was based on the Department's cost of \$65 per sample (approximate cost of the Bureau of Abandoned Mine Reclamation's 711 Standard Analysis Code, used for routine AMD samples). Private laboratories experienced with AMD analysis can provide reliable analyses for \$15-35 per sample, although inexperienced private labs sometimes provide inconsistent results. Two possible options were discussed with regard to sample analyses. One is for the Department to consider certifying private laboratories for AMD analysis and encourage watershed groups to use private labs, thereby decreasing long-term costs. Another option is for the Department to develop a regular funding source for analyses of watershed samples currently being collected under Mineral Resource Management's collector numbers. Costs can be reduced by determining a Standard Analysis Code that provides the minimum number of parameters needed to evaluate system performance. The advantages of this option are that lab results would be made available more easily to the Department and the quality assurance issues are addressed. However, it may be possible to address the quality assurance issue with private labs through a certification process. The workgroup has decided to recommend both options so that watershed groups can utilize what works best on an individual basis. The workgroup believes that the Bureau of Mining and Reclamation's existing SOAP/ROAP certification process is the best vehicle to use to certify private labs.

### **Implementation (Funding Engine)**

Various funding options were reviewed by the workgroup to provide for the sustainability of existing and future facilities that benefit the general public and improve the water resources of the Commonwealth.

True sustainability needs local community ownership and involvement. Public-private partnering develops healthy interdependence (working relationship) between state agencies and the watershed residents, including volunteers, students, service groups, private industry, environmental professionals, and other interested parties.

Some project sponsors have developed and are implementing long-term plans; however, many groups currently do not have the means or ability to do this.

The workgroup developed recommendations for a support strategy to enable groups to provide for long term O, M & R. It includes the following:

- Commonwealth: develop a source of funding and create a grant funding category for the O, M & R of existing and future construction projects;
- Sponsor: provide available resources for total or partial O, M & R;
- Other: provide additional O, M & R support by use of the Bureau of Abandoned Mine Reclamation (BAMR) construction/maintenance crews, the 12<sup>th</sup> Congressional District Equipment Center, and local/private industry.

#### Funding Options:

The workgroup calculated the approximate initial annual funding needed to address long-term O, M & R at \$1.86 million, using the following method. This amount, discussed in both options below, has been calculated by determining the cost of providing for 50% of the average 4% O, M & R factor of \$93 million for existing projects. This amount is expected to cover major maintenance (10%, or approximately 1/3 of the expected total maintenance costs) and replacement (40%) needs. It is expected that watershed groups and their local partners, Department assistance with lab costs and BAMR and 12<sup>th</sup> Congressional District Equipment Center assistance with maintenance will make up the remaining 50% of the O, M & R factor.

The following are two alternatives developed by the workgroup as possible solutions to the funding challenges associated with long-term O, M & R. One of these alternatives, or a combination thereof, may ultimately be seen as the appropriate funding solution.

#### Option 1: Funding O, M & R on an annual-basis (“pay as you go”)

- Up to 10% of Growing Greener funds are earmarked for funding of O, M & R projects; the amount not spent for O, M & R is released to provide additional new project funding.
- The Secretary's approval is needed if demand is such that more than 10% of Growing Greener funds are necessary.
- Some of the 10% is held back for emergency O, M & R projects, with this money released for new project funding at the end of the fiscal year.
- The delivery system would be the existing Growing Greener Grant Center, using an additional funding category on the grant application form.

#### Advantages:

With this option, if the O, M & R amount is not fully requested, then the balance would be available for funding new projects. At the current Growing Greener funding level of \$50 million per year, it is expected that less than 10% of this amount will cover all major maintenance and replacement needs for the foreseeable future (expected to be about \$1.86 million for existing projects).

#### Disadvantages:

This option requires the continuation of Growing Greener beyond year five. At this time, continuation is considered likely, but is not a certainty. Also, if Growing Greener is continued, the funding level may be reduced, thereby reducing the amount available for O, M & R. Another disadvantage is that it will take away from money to be spent on new projects, unless the Legislature authorizes increased Growing Greener funding to make up the difference.

#### Option 2: Funding O, M & R for the long-term ("set aside")

- The PA legislature provides an annual budget appropriation for long-term needs (or, an existing funding source is found within the Department) at an initial rate of \$1.86 million per year.
- The amount appropriated will need to increase annually based upon the amount spent on construction projects annually. For example, if \$25 million worth of projects is constructed in 2002, there will be \$93 million plus \$25 million, or \$118 million worth of constructed projects; therefore, \$2.36 million will need to be appropriated for O, M & R the following year (50% of 4% factor multiplied by \$118 million).
- The annual appropriation would be placed in a "set-aside" fund administered and managed by the Commonwealth. Applicants would apply for funds using the established Growing Greener framework. Any money left over at the end of the year would stay in the fund. The fund would be allowed to build up so that, when needs become greater (as systems need replaced or major floods or other catastrophes occur), the funds would be available to cover that need.

#### Advantages:

This option would leave the current project funding amounts for Growing Greener intact and would not be dependent upon the continuation of Growing Greener beyond year five. It would allow an accumulation of funds to deal with long-term needs that are expected to increase as systems age and need to be replaced.

## Disadvantages:

This option would require legislative action to appropriate funds. It would require the establishment and administration of an interest-bearing fund. It would require tracking of implementation projects from all public funding sources in order to know how much new construction takes place on an annual basis, to determine funding amounts.

## **Actions Needed by the Department for Implementation**

- Select a funding option and appropriate funds for O, M & R support of existing and future projects.
- Develop a fund/program management system, including a Growing Greener O, M & R project category and related activities (including changes to scoring and application guidance).
- Require the development of O, M & R plans prior to the provision of O, M & R funds for existing projects and as a deliverable under construction contracts for new projects.
- Provide O, M & R training for watershed groups via Growing Greener workshops and watershed conferences, with assistance from others.
- Improve DEP capacity to assist groups with O, M & R:
  - Provide improved capacity of BAMR's construction crews to assist with major maintenance.
  - Dedicate funds to support Mineral Resource Management sponsored lab analysis for watershed groups and determine an appropriate Standard Analysis Code.
  - Adopt SOAP/ROAP lab criteria and cost guidelines for watershed sample analysis.



## Appendix A

### Publicly Funded Restoration Projects

	NRCS	319	BAMR	WRPA	OSM	G2	Totals
<b>1988</b>	\$125,000	\$0	\$0	\$0	\$0	\$0	\$125,000
<b>1989</b>	\$150,000	\$0	\$0	\$0	\$0	\$0	\$150,000
<b>1990</b>	\$0	\$75,000	\$0	\$0	\$0	\$0	\$75,000
<b>1991</b>	\$75,000	\$200,000	\$0	\$0	\$0	\$0	\$275,000
<b>1992</b>	\$12,000	\$225,000	\$0	\$0	\$0	\$0	\$237,000
<b>1993</b>	\$0	\$400,000	\$0	\$0	\$0	\$0	\$400,000
<b>1994</b>	\$0	\$675,000	\$0	\$0	\$0	\$0	\$675,000
<b>1995</b>	\$152,066	\$850,000	\$0	\$0	\$0	\$0	\$1,002,066
<b>1996</b>	\$0	\$1,000,000	\$0	\$0	\$0	\$0	\$1,000,000
<b>1997</b>	\$183,959	\$275,000	\$1,502,626	\$0	\$0	\$0	\$1,961,585
<b>1998</b>	\$34,314	\$1,700,000	\$1,664,737	\$0	\$0	\$0	\$3,399,051
<b>1999</b>	\$274,454	\$3,400,000	\$2,470,041	\$688,458	\$262,240	\$25,350,000	\$32,445,193
<b>2000</b>	\$109,284	\$2,700,000	\$643,873	\$296,558	\$567,800	\$21,050,000	\$25,367,515
<b>2001</b>	\$200,000	\$3,700,000	\$1,390,401	\$0	\$321,400	\$20,140,000	\$25,751,801
							\$92,864,211