

Thousand Acre Pond Dam
Athol, MA
Site Reconnaissance

Massachusetts Department of Fish & Game
Riverways Program
Boston, MA

June 2007



Fuss & O'Neill
78 Interstate Drive
West Springfield, MA 01089



THOUSAND ACRE POND DAM SITE RECONNAISSANCE
Riverways Program

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1.0 INTRODUCTION

Thousand Acre Brook in Athol and Phillipston, MA is impounded by two structures owned by the Town of Athol. Fuss & O'Neill has been retained by the Massachusetts Department of Fish & Game Riverways Program (Riverways) to perform site reconnaissance and opinion of cost for removal of the lower dam, Thousand Acre Pond Dam. Phillipston Reservoir Dam is located further upstream and is not yet under consideration for removal. Thousand Acre Pond Dam was visited on June 13, 2007 by Gabrielle Stebbins of Riverways, Dana Cooley of the Town of Athol DPW, and Jon Zahner of Fuss & O'Neill. This report summarizes the observed site conditions, information provided by the owner, potential restoration concepts, recommendations for further evaluation, and opinion of costs.

1.1 Dam Removal Benefits

The benefits of dam removal generally fall into two categories: elimination of potential dam safety hazards and improving ecological habitat. Many aging dams are no longer serving the purpose for which they were constructed. Although dam maintenance and repair can be expensive, unmaintained structures often pose a risk to downstream properties and populations.

In general, dams degrade stream ecosystems by slowing flowing water and causing sediment to accumulate within the impoundment. Organisms suited for a moving water system have physical adaptations that make them intolerant to ponded conditions. For instance, many coldwater salmonids (e.g. brook trout) and macroinvertebrates have adapted to cold water, high oxygen content, and the food that this system provides. The increased surface area of impounded water increases solar exposure, raising the temperature within and downstream of the impoundment. Increased temperature results in decreased capacity of the water to hold oxygen, a condition which is compounded by decomposition of organic matter at the pond bottom. Many coldwater organisms cannot function in warmer, lower oxygen water and are often extirpated from a stream following dam construction.

Dams trap nutrients by preventing sediment and organic litter from moving downstream during normal flows. During large storm events, run of river dams can release large quantities of trapped sediment, thus smothering downstream habitat such as fish nests. The more obvious ecological impact of a dam is the barrier that it presents to fish passage. Trout and other river species migrate seasonally to reproduce and find refuge from extreme temperatures. Fish also migrate daily to find optimal conditions for feeding and shelter. Dams without a provision for fish passage prevent this seasonal and daily upstream migration.

2.0 THOUSAND ACRE POND DAM

2.1 General Site Conditions

Thousand Acre Pond Dam impounds a 0.9 acre reservoir which provided 8 acre-ft of storage for the Athol water system. The impoundment is situated in a remote forested area accessible by rough logging roads. The dam consists of a concrete spillway and earthen embankment constructed around 1900. The 78 ft long 23 ft tall concrete portion of the dam includes an



intake screening chamber on the right side. A low level inlet is reported to exist within the intake chamber, but it was not visible during this site visit. The concrete is in fair condition with minor spalling and cracking. The wooden lid of the intake chamber is very deteriorated and no longer covers a portion of the 23 ft deep chamber. Fuss & O'Neill and Riverways recommended that the town of Athol take immediate action to repair the lid to prevent a hiker from falling into the chamber.

The 90 ft long, 20 ft high earthen embankment to the right of the concrete section has tree and brush growth on the downstream slope but is otherwise in fair condition. Flow from the spillway is channeled against bedrock by a 3 ft tall concrete and masonry training wall. The dam was recently determined to be a non-jurisdictional structure by DCR Office of Dam Safety.

The Athol water system has switched to groundwater wells and no longer depends on surface water supplies. Since being abandoned as a water supply reservoir, no other use of the reservoir is known.

Thousand Acre Pond was at normal pool elevation (at the spillway crest) at the time of the site visit. Despite the height of the dam, the pond is less than 1 acre in surface area. This suggests that the natural channel is fairly steep through this reach with a probable slope of 7%.

Based on water depth measurements obtained off the upstream face of the dam, the sediment depth adjacent to the structure in the vicinity of the spillway is 5 ft to 6 ft. The sediment load in this pond is likely limited to organic muck due to the undeveloped nature of the watershed and the upstream presence of the Thousand Acre Swamp and Phillipston Reservoir. There is no record of the impoundment being drawn down for maintenance of the dam, and it is unlikely that dredging has occurred.

2.2 Restoration Overview

Thousand Acre Pond Dam is the first structure on this cold water fishery upstream of the Millers River. The objective of dam removal would be to improve cold water habitat and expand habitat range, including the potential for fish passage for brook trout and other resident species. Removal of the dam would open approximately 5 miles of stream length for habitat and spawning needs in an area identified as Priority Habitat for Rare Species.

2.2.1 Full Dam Removal

Full removal of the concrete dam and earthen embankment is a feasible approach to restoration of this reach of Thousand Acre Brook. The majority of effort for removal of this structure would be concrete demolition and disposal. It is assumed that about 500 cubic yards of sediment would have to be excavated once the pond level has been dropped.

Based on the estimated channel slope of 7% and presence of ledge outcrops in the spillway area, it is possible that a natural drop in the channel could be exposed upon removal of the dam. This may pose a challenge to fish passage depending on the height of such a drop.



The fairly steep topography of this reach would likely guide the watercourse back to its original geometry and bed material if it was not excessively disturbed during dam construction. Little lateral meandering would be expected as this reach re-establishes itself unless a significant depth of sediment exists in the impoundment. Even if some meandering does occur, no structures would be affected.

2.2.2 Partial Dam Removal

A number of scenarios exist for partially removing the dam. One such alternate would be to remove the earthen embankment but leave the concrete structure in place. The drawback to this option is that the 23 ft tall concrete dam and intake chamber would be largely exposed. This may present a safety hazard to recreational users. A similar alternate is to remove the concrete portions but leave the majority of the earth embankment in place. A portion of the earth embankment could be removed or re-graded to provide a more natural stream corridor. Minimal safety hazard would be posed by this option. Additional feasibility studies would be needed to ensure habitat goals are met in the event that a partial dam removal alternative is chosen.

2.3 Recommendations for Further Evaluation

The following table summarizes the recommendations regarding the need to perform additional evaluation and design for removal of Thousand Acre Reservoir Dam.

Task	Recommendation	Explanation
Overall project management	Maybe	Athol DPW often preoccupied
Surveying and mapping (bathymetry?)	Yes	Limited topo for permitting, wetland flagging, min. bathy.
Sediment characterization	Yes	Volume/gradation needed for reuse/disposal planning
Contaminant testing	No	Undeveloped watershed
Sediment management planning	Yes	Assume excavation & disposal
Hydrology & hydraulics	Maybe	Cursory H&H for fish passage if desired, no hydraulic model
Upstream impacts (wetlands & ponds)	Yes	Permitting will require pond ecology impact assessment
Rare species presence & management	Yes	MassGIS Database: EH835 & PH 1233 (Species unknown)
Resident species & ecosystem needs	Maybe	If fish passage is desired
Surrounding infrastructure concerns	No	No structures in vicinity
Permitting	Yes	Local Con Comm; USACE PGPII



Historic assessment	Unlikely	No visible remnants, nothing listed in MassGIS database
Structure removal plan (const. access)	Yes	Temporary stream crossing required
Conceptual design plans	No	No competing alternatives
Engineering design plans	Yes	Required for permitting
Project reporting	Maybe	If rare species impacts are anticipated
Replacing current dam uses	No	No known uses
Community outreach approach	Yes	Local volunteer groups will spearhead effort*
Property ownership	No	Town owns all land

* Athol Bird and Nature Club, Millers River Environmental Center, Millers River Watershed Council

2.4 Opinion of Cost

Fuss & O'Neill has prepared an Order of Magnitude Opinion of Cost for removal of Thousand Acre Reservoir Dam. Two scenarios were considered: The following table is a summary of the detailed cost worksheets found in Appendix B.

ITEM	PARTIAL REMOVAL	FULL REMOVAL
Engineering	\$25,000	\$25,000
Permitting, Construction Admin	\$25,000	\$25,000
Demolition of spillway	-	\$25,000
Sediment/embankment excavation	\$15,000	\$27,000
Other site/restoration work	\$31,000	\$26,000
Contingency (30%)	\$29,000	\$38,500
Total (Range)	\$88,000 - \$188,000	\$117,000 - \$251,000

3.0 CONCLUSIONS

Dam removal, partial or full, is a feasible concept for restoration of the lower reach of Thousand Acre Brook. The town of Athol is not likely to be highly motivated to remove this structure based on its recent classification as a non-jurisdictional structure by DCR Office of Dam Safety. However, the safety hazard posed to passive recreation users of the area by the existing structure may be an incentive to pursue removal. Additionally, there is a strong commitment to environmental protection and restoration by a number of Athol residents including the Athol Bird and Nature Club and the Millers River Environmental Center that could support the undertaking of this project.

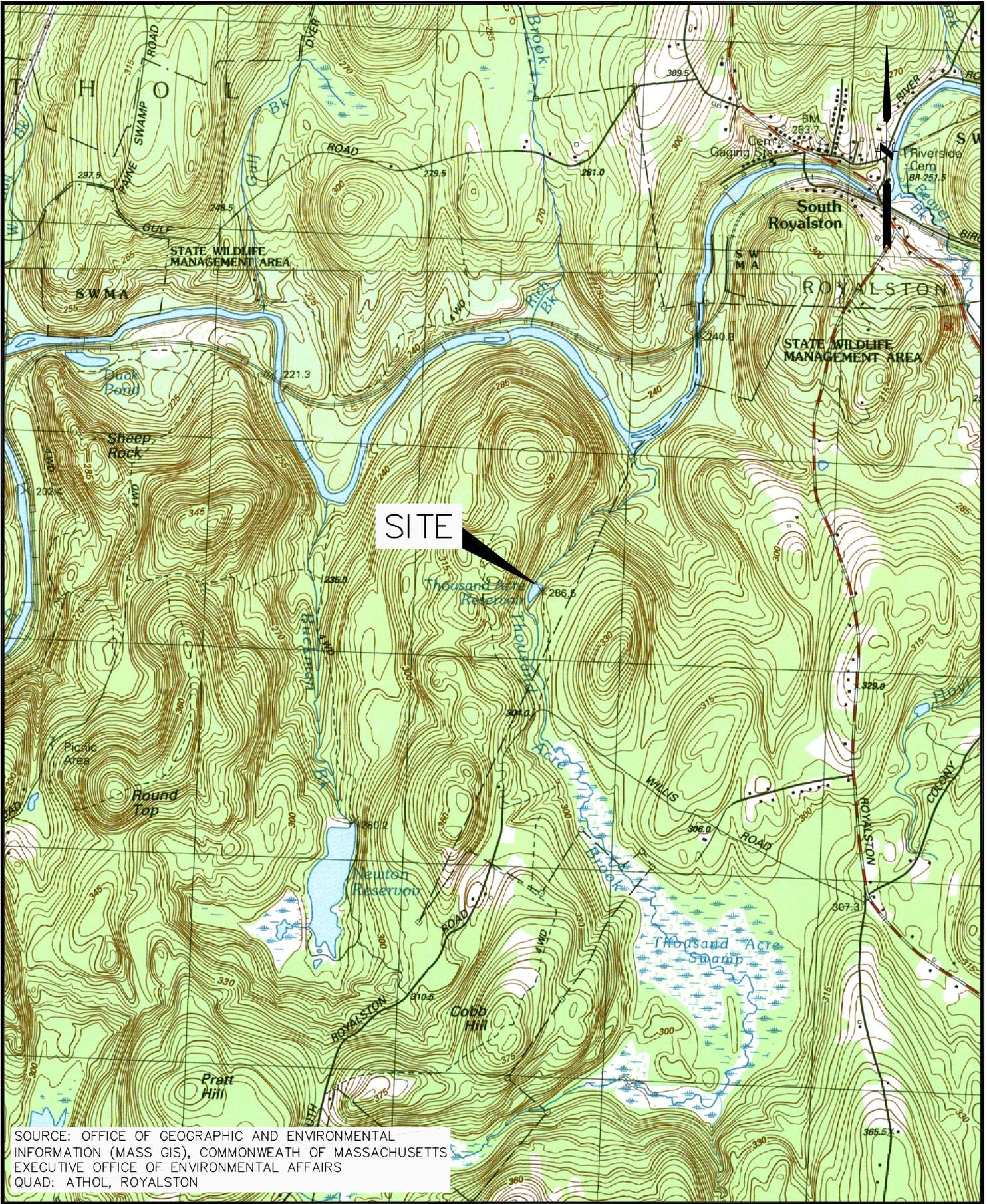


Although removal of Thousand Acre Dam could be expensive, there are many grant programs designed to encourage fish passage restoration. No such programs exist for dam repair or replacement. The likelihood of state or federal funding for a dam removal project is continually improving as environmental restoration gains greater attention. The factors which would either facilitate or hinder dam removal include:

Advantage	Disadvantage
<ul style="list-style-type: none">• No infrastructure impacts• No remaining impoundment uses• Low contaminated sediment potential• Small impoundment size• High quality ecological resource area• Strong support from local environmental organizations	<ul style="list-style-type: none">• Moderately difficult site access• Large volume of concrete



FIGURES



SOURCE: OFFICE OF GEOGRAPHIC AND ENVIRONMENTAL INFORMATION (MASS GIS), COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
 QUAD: ATHOL, ROYALSTON

SCALE:	
HORZ.:	1" = 2000'
VERT.:	
DATUM:	
HORZ.:	
VERT.:	
GRAPHIC SCALE	



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RIVERWAYS PROGRAM
 LOCATION MAP
 THOUSAND ACRE RESERVOIR DAM

ATHOL

MASSACHUSETTS

PROJ. No.: 20051066.E10
 DATE: JUNE 2007

FIG 1



APPENDIX A
PHOTOS



Photo 1: Overview of dam from left abutment



Photo 2: Overview dam from right abutment



Photo 3: Spillway



Photo 4: Intake chamber, note rotted lid



Photo 5: Downstream face of spillway, note bedrock



Photo 6: Downstream channel



Photo 7: Overview of impoundment



Photo 8: Access bridge (crosses inflow stream)



APPENDIX B
OPINION OF COST
WORKSHEET

FUSS & O'NEILL, INC.146 HARTFORD ROAD
MANCHESTER, CONNECTICUT

OPINION OF CONSTRUCTION COST		DATE PREPARED :	27-Jun-07			
Type: Order of Magnitude						
PROJECT : Thousand Acre Pond Dam Removal		BASIS :				
LOCATION : Athol, MA						
DESCRIPTION: Partial Removal Alternate						
DRAWING NO. :		ESTIMATOR : JAZ	CHECKED BY : PWM			
<p>OPINION OF CONSTRUCTION COST - ORDER OF MAGNITUDE: An opinion of cost made without detailed engineering data. Costs may be estimated by comparison with similar projects. It is normally expected that an estimate of this type would be accurate within plus 50% or minus 30%. Since Fuss & O'Neill has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor(s)' methods of determining prices, or over competitive bidding or market conditions, Fuss & O'Neill's opinion of probable Total Project Costs and Construction Costs are made on the basis of Fuss & O'Neill's experience and qualifications and represent Fuss & O'Neill's best judgment as an experienced and qualified professional engineer, familiar with the construction industry; but Fuss & O'Neill cannot and does not guarantee that proposals, bids or actual Total Project or Construction Costs will not vary from opinions of probable cost prepared by Fuss & O'Neill. If prior to the bidding or negotiating Phase the Owner wishes greater assurance as to Total Project or Construction Costs, the Owner shall employ an independent cost estimator.</p>						
ITEM NO.	ITEM	UNIT MEAS.	NO. UNITS	PER UNIT	TOTAL COST	
SOIL AND EROSION CONTROL						
02291	Sedimentation and Erosion Control	L.S.	1	3,000.00	\$3,000.00	
SITE PREPARATION WORK						
	Temporary stream crossing	L.S.	1	1,000.00	\$1,000.00	
	Access road repairs	L.S.	1	3,000.00	\$3,000.00	
02110	Clearing Embankment	L.S.	1	2,000.00	\$2,000.00	
WATER CONTROL						
02199	Control of Water (assumes LLO operable)	L.S.	1	2,000.00	\$2,000.00	
DEMOLITION						
03300	Concrete (assumes off-site disposal)	C.Y.	0	60.00	\$0.00	
EARTHWORK						
02210	Sediment excavation (assumes on-site disposal)	C.Y.	200	30.00	\$6,000.00	
	Embankment excavation (assumes on-site disposal)	C.Y.	600	15.00	\$9,000.00	
SLOPE PROTECTION						
02271	Natural material	C.Y.	100	100.00	\$10,000.00	
SITE STABILIZATION WORK						
	Seed impoundment area	LS	1	5,000.00	\$5,000.00	
GENERAL CONDITIONS						
	Mobilization & Demobilization	L.S.	1	5,000.00	\$5,000.00	
ENGINEERING/PERMITTING						
	Engineering	L.S.	1	25,000.00	\$25,000.00	
	Permitting	L.S.	1	20,000.00	\$20,000.00	
	Construction Admin	L.S.	1	5,000.00	\$5,000.00	
	SUBTOTAL				\$96,000.00	
	CONTINGENCY (30%)				\$28,800.00	
	TOTAL COST (ROUNDED TO NEAREST \$1,000)				\$125,000.00	
				RANGE	\$88,000.00	\$188,000.00

FUSS & O'NEILL, INC.146 HARTFORD ROAD
MANCHESTER, CONNECTICUT

OPINION OF CONSTRUCTION COST		DATE PREPARED :		27-Jun-07		
Type: Order of Magnitude						
PROJECT : Thousand Acre Pond Dam Removal		BASIS :				
LOCATION : Athol, MA						
DESCRIPTION: Full Removal Alternate						
DRAWING NO. :		ESTIMATOR : JAZ		CHECKED BY : PWM		
<p>OPINION OF CONSTRUCTION COST - ORDER OF MAGNITUDE: An opinion of cost made without detailed engineering data. Costs may be estimated by comparison with similar projects. It is normally expected that an estimate of this type would be accurate within plus 50% or minus 30%. Since Fuss & O'Neill has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor(s)' methods of determining prices, or over competitive bidding or market conditions, Fuss & O'Neill's opinion of probable Total Project Costs and Construction Costs are made on the basis of Fuss & O'Neill's experience and qualifications and represent Fuss & O'Neill's best judgment as an experienced and qualified professional engineer, familiar with the construction industry; but Fuss & O'Neill cannot and does not guarantee that proposals, bids or actual Total Project or Construction Costs will not vary from opinions of probable cost prepared by Fuss & O'Neill. If prior to the bidding or negotiating Phase the Owner wishes greater assurance as to Total Project or Construction Costs, the Owner shall employ an independent cost estimator.</p>						
ITEM NO.	ITEM	UNIT MEAS.	NO. UNITS	PER UNIT	TOTAL COST	
SOIL AND EROSION CONTROL						
02291	Sedimentation and Erosion Control	L.S.	1	3,000.00	\$3,000.00	
SITE PREPARATION WORK						
	Temporary stream crossing	L.S.	1	1,000.00	\$1,000.00	
	Access road repairs	L.S.	1	3,000.00	\$3,000.00	
02110	Clearing Embankment	L.S.	1	2,000.00	\$2,000.00	
WATER CONTROL						
02199	Control of Water (assumes LLO operable)	L.S.	1	2,000.00	\$2,000.00	
DEMOLITION						
03300	Concrete (assumes off-site disposal)	C.Y.	420	60.00	\$25,200.00	
EARTHWORK						
02210	Sediment excavation (assumes on-site disposal)	C.Y.	500	30.00	\$15,000.00	
	Embankment excavation (assumes on-site disposal)	C.Y.	800	15.00	\$12,000.00	
SLOPE PROTECTION						
02271	Natural material	C.Y.	50	100.00	\$5,000.00	
SITE STABILIZATION WORK						
	Seed impoundment area	LS	1	5,000.00	\$5,000.00	
GENERAL CONDITIONS						
	Mobilization & Demobilization	L.S.	1	5,000.00	\$5,000.00	
ENGINEERING/PERMITTING						
	Engineering	L.S.	1	25,000.00	\$25,000.00	
	Permitting	L.S.	1	20,000.00	\$20,000.00	
	Construction Admin	L.S.	1	5,000.00	\$5,000.00	
	SUBTOTAL				\$128,200.00	
	CONTINGENCY (30%)				\$38,460.00	
	TOTAL COST (ROUNDED TO NEAREST \$1,000)				\$167,000.00	
				RANGE	\$117,000.00	\$251,000.00