

Company Name Glacial Minerals, Inc.

Project 16803011-GVO-1

Site Name Vosburg



AMD TREAT

Costs

AMD TREAT MAIN COST FORM

AMDTREAT

<u>Passive Treatment</u>	<u>A</u>	<u>S</u>	
Vertical Flow Pond			\$0
Anoxic Limestone Drain			\$0
Anaerobic Wetlands			\$0
Aerobic Wetlands	1	0	\$3,654
Manganese Removal Bed			\$0
Oxic Limestone Channel			\$0
Limestone Bed			\$0
BIO Reactor			\$0
Passive Subtotal:			\$3,654
Active Treatment			
Caustic Soda			\$0
Hydrated Lime			\$0
Pebble Quick Lime			\$0
Ammonia			\$0
Oxidants			\$0
Soda Ash			\$0
Active Subtotal:			\$0
Ancillary Cost			
Ponds	1	0	\$5,000
Roads			\$0
Land Access			\$0
Ditching			\$0
Engineering Cost			\$0
Ancillary Subtotal:			\$5,000
Other Cost (Capital Cost)			\$0
Total Capital Cost:			\$8,654
Annual Costs			
Sampling	1	0	\$597
Labor	1	0	\$910
Maintenance	1	0	\$303
Pumping			\$0
Chemical Cost			\$0
Oxidant Chem Cost			\$0
Sludge Removal			\$0
Other Cost (Annual Cost)			\$0
Land Access (Annual Cost)			\$0
Total Annual Cost:			\$1,810
Other Cost			

Water Quality

Calculated Acidity mg/L

Alkalinity mg/L

Calculate Net Acidity (Acid-Alkalinity)

Enter Net Acidity manually

Net Acidity (Hot Acidity) mg/L

Design Flow gpm

Typical Flow gpm

Total Iron mg/L

Aluminum mg/L

Manganese mg/L

pH su

Ferric Iron mg/L

Ferrous Iron mg/L

Sulfate mg/L

Filtered Fe mg/L

Filtered Al mg/L

Filtered Mn mg/L

Specific Conductivity uS/cm

Total Dissolved Solids mg/L

Dissolved Oxygen mg/L

Typical Acid Loading tons/yr

**Total Annual Cost: per
1000 Gal of H2O Treated \$1.720**

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COMMENTS:

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AMD TREAT AEROBIC WETLANDS

AMDTREAT

Aerobic Wetlands Name

**Opening Screen
Water Parameters**

**Influent Water
Parameters
that Affect
Aerobic Wetlands**

Calculated Acidity
 mg/L

Alkalinity
 mg/L

Calculate Net Acidity (Acid-Alkalinity)

Enter Net Acidity manually

Net Acidity (Hot Acidity)
 mg/L

Design Flow
 gpm

Typical Flow
 gpm

Total Iron
 mg/L

Aluminum
 mg/L

Manganese
 mg/L

pH
 su

9. Length to Width Ratio Length : Width

10. Slope of Wetland Sides Run of Slope : Rise of Slope

11. Freeboard Depth ft

12. Free Standing Water Depth ft

13. Organic Matter Depth ft

14. Organic Matter Unit Cost \$/yd3

15. Organic Matter Spreading Unit Cost \$/yd3

16. Excavation Unit Cost \$/yd3

17. Wetland Planting Unit Cost \$/acre

Liner Cost

No Liner

Clay Liner

18. Clay Liner Unit Cost \$/yd3

19. Thickness of Clay Liner ft

Synthetic Liner

20. Synthetic Liner Unit Cost \$/yd2

SIZING METHODS Select One

Aerobic Wetland Based on Metal Removal Rates

1. Iron Removal Rate g/m2/day

2. Mn Removal Rate g/m2/day

Aerobic Wetland Based on Dimensions

3. Top Length at Freeboard ft

4. Top Width at Freeboard ft

Aerobic Wetland Based on Iron Oxidation Kinetics

5. Rate Constant moles/sec

6. Effluent Fe Concentration mg/l

7. Dissolved Oxygen mg/l

8. H2O Temperature °C

21. Clearing and Grubbing?

22. Land Multiplier ratio

23. Clear/Grub Acres acres

24. Clear and Grub Unit Cost \$/acre

Aerobic Wetland Sizing Summaries

25. Length at Top of Freeboard	100.00	ft
26. Width at Top of Freeboard	40.00	ft
27. Freeboard Volume	199	yd3
28. Water Surface Area	3,196	ft2
29. Water Volume	56	yd3
30. Organic Matter Volume	100	yd3
31. Excavation Volume	156	yd3
32. Clear and Grub Area	0.0	acres
33. Liner Area	0	ft2
34. Retention Time	42	hrs

Aerobic Cost Summaries

35. Organic Matter Cost	2,451	\$
36. Excavation Cost	863	\$
37. Liner Cost	0	\$
38. Clear and Grub Cost	0	\$
39. Wetland Planting Cost	340	\$
40. Total Cost	3,654	\$

Record Number 1 of 1



AMD TREAT PONDS

AMDTREAT

Pond Name

Pond Design Based On:

Retention Time

1. Desired Retention Time hours

2. Include Sludge Removal?

3. Sludge Removal Frequency times/year

4. Titration?

5. Sludge Rate gal sludge/
gal H2O

6. Percent Solids %

7. Sludge Density lbs./gal

Pond Size

8. Pond Length at Top of Freeboard ft

9. Pond Width at Top of Freeboard ft

	Run	Rise	
10. Slope Ratio of Pond Sides	<input type="text" value="2.0"/>	:	<input type="text" value="1"/>
11. Freeboard Depth	<input type="text" value="2.0"/> ft		
12. Water Depth	<input type="text" value="4.0"/> ft		
13. Excavation Unit Cost	<input type="text" value="5.50"/> \$/yd3		
14. Total Length of Effluent / Influent Pipe	<input type="text" value="0.00"/> ft		
15. Unit Cost of Pipe	<input type="text" value="0.00"/> \$/ft		

Liner Cost

No Liner

Clay Liner

16. Clay Liner Unit Cost \$/yd3

17. Thickness of Clay Liner ft

Synthetic Liner

18. Synthetic Liner Unit Cost \$/yd2

19. Clearing and Grubbing?

20. Land Multiplier ratio

21. Clear/Grub Acres acres

22. Clear and Grub Unit Cost \$/acre

23. Revegetation Cost \$/acre

24. Cost of Baffles \$

Calculated Pond Dimensions per Pond

25. Length at Top of Freeboard ft

26. Width at Top of Freeboard ft

27. Freeboard Volume yd3

28. Water Volume yd3

29. Estimated Annual Sludge yd3/yr

30. Volume of Sludge per Removal yd3/removal

31. Excavation Volume acre ft

32. Excavation Volume yd3

33. Clear and Grub Area acres

34. Liner Area yd2

35. Calculated Retention Time hours

Ponds Sub-Totals per Pond

36. Excavation Cost \$

37. Pipe Cost \$

38. Liner Cost \$

39. Clearing and Grubbing Cost \$

40. Revegetation Cost \$

41. Baffle Cost \$

42. Estimated Cost \$

43. Accept Minimum Pond Cost?

The Recommended Minimum Construction Cost of Building a Pond is \$ 5,000

44. Recommended Minimum Cost \$

45. Total Cost \$

Opening Screen Water Parameters

Influent Water Parameters that Affect Ponds

Calculated Acidity mg/L

Alkalinity mg/L

Calculate Net Acidity (Acid-Alkalinity)

Enter Net Acidity manually

Net Acidity (Hot Acidity) mg/L

Design Flow gpm

Typical Flow gpm

Total Iron mg/L

Aluminum mg/L

Manganese mg/L

Record Number
1 of 1

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Printed on 03/31/2008

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AMDTREAT

**AMD TREAT
SAMPLING**

Sampling Name

Estimate Sampling Cost

1. Unit Labor Cost \$/hr

2. Collection Time per Sample hours/sample

3. Travel Time hr

4. Sample Frequency samples/mo

5. Lab Cost Per Sample \$/sample

6. Number of Sample Points points

Enter Established Annual Sampling Cost

7. Actual Annual Sampling Cost \$

Sampling Sub-Totals

8. Yearly Sample Analysis Cost \$

9. Yearly Travel Cost \$

10. Yearly Collection Cost \$

\$

Record Number 1 of 1

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AMDTREAT

AMD TREAT

LABOR

Labor Name

Estimate Labor Cost

1. Site Visits per Week

2. Site Labor Time per Visit hours

3. Travel Time per Visit hours

4. Unit Labor Cost \$/hour

Enter Established Annual Labor Cost

5. Actual Annual Labor Cost \$

6. Total Cost \$

Record Number 1 of 1

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AMDTREAT

AMD TREAT

MAINTANENCE

☛ Estimate Maintenance Cost

- 1. Percent of Active Cost %
- 2. Percent of Passive Cost %
- 3. Percent of Ancillary Cost * %
- 4. Percent of Other Capital Cost %

☛ Enter Established Annual Maintenance Cost

5. Annual Maintenance Cost \$

Maintenance Sub-Totals

- 6 Total Maintenance Active Cost \$
- 7. Total Maintenance Passive Cost \$
- 8. Total Maintenance Ancillary Cost \$
- 9. Total Maintenance Other Capital Cost \$
- 10. Total Maintenance Cost \$**

* Ancillary Cost does int include Cost for Land Access and Engineering Cost

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AMD TREAT RECAPITIALIZATION COST

AMDTREAT

Calculation Period yrs Inflation Rate % Net Return Rate %

Recapitalization Name

A. Description of Item	B. Unit Cost Per Item	C. Quantity	D. Total Item Cost	E. Life Cycle	F. Number of Periods	G. Total PV
1. Wetland	3,654	1	3,654	20	3	3,995
2. Pond	5,000	1	5,000	20	3	5,466
3.	0	0	0	0	0	0
4.	0	0	0	0	0	0
5.	0	0	0	0	0	0
6.	0	0	0	0	0	0
7.	0	0	0	0	0	0
8.	0	0	0	0	0	0
9.	0	0	0	0	0	0
10.	0	0	0	0	0	0
11.	0	0	0	0	0	0
12.	0	0	0	0	0	0
13.	0	0	0	0	0	0
14.	0	0	0	0	0	0
15.	0	0	0	0	0	0
16.	0	0	0	0	0	0
17.	0	0	0	0	0	0
18.	0	0	0	0	0	0
19.	0	0	0	0	0	0
20.	0	0	0	0	0	0

Total Capital Cost \$ PV Grand Total \$