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MANAGEMENT PROGRAM

**Report**

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# **Biofilter Management Plan**

**Copper Park Business & Recreation Area  
Formerly the Flambeau Industrial Outlot**

**Project I.D.: 06F007**

**Flambeau Mining Company  
Ladysmith, Wisconsin**

**January 2007**







January 12, 2007

Ms. Joanie Burns  
Wisconsin Department of Natural Resources  
PO Box 7921  
Madison WI 53707-7921

Dear Ms. Burns:

RE: Flambeau Industrial Outlot Biofilter Management Plan

On behalf of Flambeau Mining Company (Flambeau), Foth Infrastructure & Environment (Foth) has prepared this draft Biofilter Management Plan for the Copper Park Business & Recreation area, formerly called the Flambeau Industrial Outlot. This plan has been prepared in follow-up to the Construction Documentation Report (September, 2006) submitted to the Wisconsin Department of Natural Resources. This management plan is based on the 2006 construction activity results and the recent surface water quality results obtained from sampling points located upstream and downstream of the biofilter, and within Intermittent Stream C. A final report will be forthcoming.

If you have any questions regarding the information presented here, please contact me at (920) 496-6813.

Sincerely,

Foth Infrastructure & Environment, LLC

A handwritten signature in black ink that reads "James B. Hutchison".

James B. Hutchison, P.E.  
*Project Engineer*

**Construction Documentation Report  
Flambeau Copper Park Business & Recreation Area**

**Distribution**

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# Biofilter Management Plan Flambeau Copper Park Business & Recreation Area

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## **1 Summary**

The Copper Park Business & Recreation Area biofilter is located at the southeast corner of the former Flambeau Mining Company (Flambeau) mine site as shown on Figure 1. The plan area of the biofilter is approximately 200 ft x 200 ft (40,000 square feet) including a finger peninsula from the north bank. The biofilter is a best management practice that is being employed to manage stormwater runoff from a 20 acre drainage area comprised of the Copper Park Business & Recreation Area (also referred to as the industrial outlot) in the southeast corner of the former mine site as shown in Figure 1.

The purpose of the biofilter is to capture particulates in the surface water from the site prior to discharge to Intermittent Stream C. Surface water quality entering and leaving the biofilter prior to 2006 construction activities is documented in the Industrial Outlot work plan submitted to the Department on May 2, 2006. The construction activities during 2006 were described in the Construction Documentation Report submitted to the Department in September 2006. The 2006 construction activities included excavation and offsite landfilling of select soils and ditch material, placement of limestone gravel and large limestone cobbles (in surface water ditch swales) and paving asphalt over the parking lot areas. The purpose of the construction activities was to reduce particulate and dissolved solids loading to the biofilter.

This report presents recent surface water data (post 2006 construction) which documents a dramatic reduction of copper loading to the biofilter. This report will also present a biofilter management plan including monitoring of the biofilter.

## 2 Pre-2006 Construction Activities Conditions

The surface soils within the outlot area were not reclaimed by excavation and placement into the limestone amended mine pit backfill as originally planned due to the community's desire to save the mine buildings for reuse by the community and utilize the area as an industrial park. Flambeau Mining Company leased the facilities and surrounding area to the Ladysmith Community Industrial Development Corporation (LCIDC). Subsequently, the LCIDC subleased the Copper Park Business & Recreation Area to the Wisconsin Department of Administration (WDNR Ladysmith Service Center), Xcel Energy (electric line maintenance shop/storage), and City of Ladysmith (Copper Park Equestrian Trailhead). Based on monitoring that was completed by Flambeau Mining Company it was noted that the soils in the industrial outlot contributed to raising the copper and zinc concentrations of stormwater runoff delivered to the biofilter. Flambeau addressed this issue by monitoring surface water, identifying potential sources of copper and zinc and excavated and landfilled these soils during 2003 (rail spur reclamation) and again during the 2006 construction activities. Storm water was collected and monitored during 2004 and 2005 at internal site locations used to identify areas which acted as the source of copper and zinc in stormwater runoff delivered to the biofilter.

The stormwater quality data prior to 2006 construction activities along with the regulatory submittals were included in the Outlot Work Plan submitted to the Department in a document dated May 2, 2006. The inflow at the biofilter ranged from 0.53 to 2.0 mg/l copper with an average concentration of approximately 1.20 mg/l from September 2004 through September 2005 (9 separate sampling events). The approximate average of zinc over the same time period was 0.38 mg/l.

The biofilter effectively lowered the copper and zinc levels leaving the biofilter during this time period (September 2004 through September 2005). The average concentration of copper flowing out of the biofilter (6 sampling events) was 0.045 mg/l (96% reduction in copper). The average zinc levels flowing from the biofilter over the same time period (September 2004 through September 2005) was 0.0076 mg/l (a 98% reduction in zinc).



### **3 2006 Construction Activities**

The construction activities were documented in the Construction Documentation Report dated September 2006 which was submitted to the Department.

The gravel parking lot was excavated to a minimum of 4 inches. Five locations where higher levels of copper were identified by sampling and testing were excavated deeper, until lower levels of copper were encountered. The average copper concentration in the soil prior to removal was approximately 1,140 mg/kg (ppm). The average concentration of the exposed subgrade after removal was approximately 38 mg/kg (ppm). The exposed subgrade after removal was then overlain with filter fabric and limestone gravel to asphalt subgrade or topsoil subgrade.

#### 4 Post-2006 Construction Conditions

The 2006 construction activities were completed at the end of June. Since then four rounds of sampling of stormwater around and within the biofilter have been performed. The results indicate a dramatic drop of copper (and zinc) in the stormwater runoff entering the biofilter (inflow).

#### Post 2006 Construction Surface Water Test Results

Sampling Date	BFSW-C1 (inflow) ug/l	BFSW-C2 (outflow) ug/l
7/26/2006	60	not sampled (Stream C not flowing)
8/3/2006	140	33
10/4/2006	95	16
11/28/2006	80	34
Average	94	28

Comparing the pre and post construction copper concentrations at the biofilter inflow shows a significant drop of 92% in the post construction samples (1.20 ppm pre vs. 0.094 ppm post).

Comparing the pre and post construction copper concentrations at the biofilter outflow shows a significant decrease of nearly 40% (0.045 ppm pre, vs. 0.028 ppm post).

All of the surface water data obtained during July, August, October and November of 2006 is shown in ug/l or ppb in the attached Table 1.

An estimate of the volume of sediment being deposited annually within the biofilter due to erosion is approximately 0.1 inch per year. The drainage area and associated calculations are attached.

## 5 Biofilter Management Plan

Monitoring of the biofilter will consist of two monitoring events a year. The events will target high flow and low flow regimes. Therefore, the target monitoring dates will be as follows:

Event	Target Dates
1	April
2	September

In the event that there is a no precipitation event during the target dates, the target date will be expanded until a precipitation event occurs.

Parameters to be monitored will be:

- ◆ copper
- ◆ zinc
- ◆ conductivity
- ◆ hardness
- ◆ pH

The locations of monitoring the biofilter will be the inflow and outflow locations, upstream and downstream locations (BFSW-C1, BFSW-C2, SW-C8 and SW-C5 respectively).

This monitoring will occur for 3 years or until stabilization has occurred.

### 5.1 Biofilter Management Plan

Monitoring of the biofilter will consist of a once per annum measurement of the water depth and available freeboard of the biofilter. The monitoring will be done during February of each year. When the sum of the water depth and freeboard becomes less than 3 feet then the sediment within the biofilter will be excavated, characterized and managed consistent with the NR 500 code.



**Table 1**  
**Post 2006 Construction Surface Water Test Results**  
 Copper Park Business & Recreation Area  
 Stormwater Sampling

Date	BFSW-C1 (Biofilter Inflow)				BFSW-C2 (Biofilter Outflow)				SW-C5 (Downstream Stream C)				SW-C8 (Stream C Watershed - Upstream West Hwy 27)			
	Cond uhmo/cm	Copper ug/l	Hardness mg/l	pH, Lab su	Zinc ug/l	Cond uhmo/cm	Copper ug/l	Hardness mg/l	pH, Lab su	Zinc ug/l	Cond uhmo/cm	Copper ug/l	Hardness mg/l	pH, Lab su	Zinc ug/l	
7/26/2006	89	60	52	7.64	31											
8/3/2006	477	140	27	6.24	20	127	33	25	6.70	9.7	158	74	23	6.99	83	
10/4/2006	196	95	37	5.86	30	218	16	21	6.55	6.9	99	23	18	6.85	48	
11/28/2006	68	80	26	6.30	19	109	34	23	6.23	8.2	141	46	31	5.94	92	
						Sample not collected. Stream C not flowing.										
						Stream C not flowing.										
						No sample collected										
						No surface water. Sample location dry.										

Prepared by: JIM  
 Checked by: JBH1

# **Appendix A**

## **SLAMM Program Calculations**

# Flambeau Mine, Bio-filter Annual Run-Off Mass Deposition Calculations

11-Dec-06

## Sediment loading of the biofilter calculation summary.

### Existing Case

Annual Loading from SLAMM Program:	3.5 Cubic Yards 94.5 Cubic Feet <sup>1</sup>
Assumed unit weight of sediment:	115 pounds per cubic foot
Annual tons per year:	5.4 TONS <sup>2</sup>
Existing area of bottom of bio-filter:	21700 Square Feet <sup>3</sup>
Annual sediment thickness added to bio-filter:	0.05 inches <sup>4</sup>

Using a safety factor of 2, the annual sediment thickness added to bio-filter:  $2 \times 0.05$  inches = 0.1 inch/year.

- NOTE:
1. Cubic Feet =  $3.5 \text{ CY} \times 27 \text{ CF/CY} = 94.5 \text{ CF}$
  2. Tons =  $3.5 \text{ CY} \times 27 \text{ CF/CY} \times 115 \text{ LBS/CF} \times 1 \text{ ton}/2000 \text{ LBS} = 5.4 \text{ tons}$
  3. Area =  $(160' \times 110') + (30' \times 50') + (130' \times 20') = 21,700 \text{ SF}$
  4. Annual sediment thickness = Annual Loading (CF)/Existing bottom area(SF) =  $94.5 \text{ CF}/21700 \text{ SF} = 0.0044 \text{ ft} = 0.05 \text{ inches}$ .

Developed by: JBH1  
Checked by: SRB

flambeau1.INP

Data file name: C:\Program Files\winSLAMM\flambeau1.dat  
 SLAMM Version V9.1  
 Rain file name: C:\Program Files\winSLAMM\GB1982.RAN  
 Particulate Solids Concentration file name: C:\PROGRAM FILES\WINSLAMM\PART.PSC  
 Runoff Coefficient file name: C:\PROGRAM FILES\WINSLAMM\RUNOFF.RSV  
 Particulate Residue Delivery file name: C:\PROGRAM FILES\WINSLAMM\DELIVERY.PRR  
 Residential Street Delivery file name: C:\PROGRAM FILES\WINSLAMM\WI\_STR04.STD  
 Institutional Street Delivery file name: C:\Program Files\winSLAMM\WI\_STR04.std  
 Commercial Street Delivery file name: C:\Program Files\winSLAMM\WI\_STR04.std  
 Industrial Street Delivery file name: C:\Program Files\winSLAMM\WI\_STR04.std  
 Other Urban Street Delivery file name: C:\Program Files\winSLAMM\WI\_STR04.std  
 Freeway Street Delivery file name: C:\Program Files\winSLAMM\WI\_STR04.std  
 Pollutant Relative Concentration file name: C:\PROGRAM FILES\WINSLAMM\POLL.PPD  
 Seed for random number generator: 42  
 Study period starting date: 01/02/82 Study period ending date: 12/28/82  
 Date: 12-08-2006 Time: 08:42:26

- Fraction of each type of Drainage System serving study area:
1. Grass Swales 0
  2. Undeveloped roadside 0
  3. Poor condition (or very flat) 1
  4. Fair condition 0
  5. Good condition (or very steep) 0

Site information: Flambeau Bio-filter

Source Area	<==== Areas for each source (acres) =====>				
	Residential Areas	Institutional Areas	Commercial Areas	Industrial Areas	Other urban Areas
Roofs 1	0.00	0.00	0.00	1.00	0.00
Roofs 2	0.00	0.00	0.00	0.00	0.00
Roofs 3	0.00	0.00	0.00	0.00	0.00
Roofs 4	0.00	0.00	0.00	0.00	0.00
Roofs 5	0.00	0.00	0.00	0.00	0.00
Paved Parking/Storage 1	0.00	0.00	0.00	3.50	0.00
Paved Parking/Storage 2	0.00	0.00	0.00	0.00	0.00
Paved Parking/Storage 3	0.00	0.00	0.00	0.00	0.00
Unpaved Prkng/Storage 1	0.00	0.00	0.00	0.00	0.00
Unpaved Prkng/Storage 2	0.00	0.00	0.00	0.00	0.00
Playground 1	0.00	0.00	0.00	0.00	0.00
Playground 2	0.00	0.00	0.00	0.00	0.00
Driveways 1	0.00	0.00	0.00	0.00	0.00
Driveways 2	0.00	0.00	0.00	0.00	0.00
Driveways 3	0.00	0.00	0.00	0.00	0.00
Sidewalks/walks 1	0.00	0.00	0.00	0.00	0.00
Sidewalks/walks 2	0.00	0.00	0.00	0.00	0.00
Street Area 1	0.00	0.00	0.00	0.00	0.00
Street Area 2	0.00	0.00	0.00	0.00	0.00
Street Area 3	0.00	0.00	0.00	0.00	0.00
Large Landscaped Area 1	0.00	0.00	0.00	15.50	0.00
Large Landscaped Area 2	0.00	0.00	0.00	0.00	0.00
Undeveloped Area	0.00	0.00	0.00	0.00	0.00
Small Landscaped Area 1	0.00	0.00	0.00	0.00	0.00
Small Landscaped Area 2	0.00	0.00	0.00	0.00	0.00
Small Landscaped Area 3	0.00	0.00	0.00	0.00	0.00
Isolated/Water Body Area	0.00	0.00	0.00	0.00	0.00
Other Pervious Area	0.00	0.00	0.00	0.00	0.00
Other Dir Cnctd Imp Area	0.00	0.00	0.00	0.00	0.00
Other Part Cnctd Imp Area	0.00	0.00	0.00	0.00	0.00
<b>Total</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>20.00</b>	<b>0.00</b>



Freeway Source Area	Area (acres)
Roofs 1	0.00
Roofs 2	0.00
Roofs 3	0.00
Roofs 4	0.00
Roofs 5	0.00
Paved Parking/Storage 1	0.00
Paved Parking/Storage 2	0.00
Paved Parking/Storage 3	0.00
Unpaved Prkng/Storage 1	0.00
Unpaved Prkng/Storage 2	0.00
-----	
Total	0.00
Total of All Source Areas	20.00
-----	
Total of All Source Areas	20.00
less All Isolated Areas	20.00
=====	

Source Area Control Practice Information

Land Use: Industrial

Roofs 1 Source area number: 91

The roof is pitched

The Source Area is directly connected or draining to a directly connected area

Paved Parking/Storage 1 Source area number: 96

The Source Area is directly connected or draining to a directly connected area

Large Landscaped Area 1 Source area number: 111

The SCS Hydrologic Soil Type is Clayey

The building density is low

Drainage System

Outfall

Control Practice 1 : Wet Detention Ponds

1. Area served by detention ponds (acres)= 20

2. Particle Size Distribution file name: C:\PROGRAM

FILES\WINSLAMM\MIDWEST.CPZ

3. Initial stage elevation (ft): 0

4. Peak to Average Flow Ratio: 3.8

5. Outlet Characteristics:

Outlet number 1

Outlet type: Broad Crested Weir

1. Weir crest length (ft): 5

2. Weir crest width (ft): 5

3. Discharge Coefficient (ft): 0

4. Height of weir opening (cfs): 1

5. Height of datum to bottom of weir opening: 5

6. Pond stage and surface area

Outflow	Entry	Stage	Pond Area	Natural Seepage	Other
	Number	(ft)	(acres)	(in/hr)	(cfs)
	0	0.00	0.0000	0.00	0.00
	1	0.01	0.8500	0.00	0.00
	2	1.00	0.8500	0.00	0.00
	3	2.00	0.8500	0.00	0.00
	4	3.00	0.8500	0.00	0.00

flambeau1.INP

5 6.00 0.8500 0.00 0.00

Pollutants to be Analyzed and Printed:

Pollutant Name

Pollutant Type

Solids  
Solids

Particulate  
Total

Flambeau1 - Output Summary.txt

SLAMM for Windows Version 9.1.1.2  
 (C) Copyright Robert Pitt and John Voorhees 2003  
 All Rights Reserved

Data file name: C:\Program Files\winslamm\Flambeau1.dat  
 Data file description: Flambeau Bio-filter  
 Rain file name: C:\Program Files\winslamm\GB1982.RAN  
 Particulate Solids Concentration file name: C:\PROGRAM FILES\WINSLAMM\PART.PSC  
 Runoff Coefficient file name: C:\PROGRAM FILES\WINSLAMM\RUNOFF.RSV  
 Particulate Residue Delivery file name: C:\PROGRAM FILES\WINSLAMM\DELIVERY.PRR  
 Residential Street Delivery file name: C:\PROGRAM FILES\WINSLAMM\WI\_STR04.STD  
 Institutional Street Delivery file name: C:\Program Files\winslamm\WI\_STR04.std  
 Commercial Street Delivery file name: C:\Program Files\winslamm\WI\_STR04.std  
 Industrial Street Delivery file name: C:\Program Files\winslamm\WI\_STR04.std  
 Other Urban Street Delivery file name: C:\Program Files\winslamm\WI\_STR04.std  
 Freeway Street Delivery file name: C:\Program Files\winslamm\WI\_STR04.std  
 Pollutant Relative Concentration file name: C:\PROGRAM FILES\WINSLAMM\POLL.PPD  
 Model Run Start Date: 01/02/82 Model Run End Date: 12/28/82  
 Date of run: 12-08-2006 Time of run: 08:42:13  
 Total Area Modeled (acres): 20

Runoff Volume (cu ft)	Percent Runoff Volume Reduction	Particulate Solids Conc. (mg/L)	Particulate Solids Yield (lbs)	Percent Particulate Solids Reduction
728081	0.00%	349.2	15860	0.00%
728081	0.00%	349.2	15860	0.00%
728081	0.00%	214.9	9762	38.45%
552654	24.09%	13.55	467.0	97.06%

Source Area Total without Controls:  
 Total Before Drainage System:  
 Total After Drainage System:  
 Total After Outfall Controls:

