4 Site Monitoring

Environmental monitoring at the reclaimed Flambeau Mine during 2009 included assessing the quality of groundwater and backfill pore water. Together with data obtained as part of the project monitoring plan, the Annual Report is also presenting the data obtained during 2009 monitoring completed in accordance with the May 31, 2007 Stipulation which includes fish and crayfish collection. All data obtained during environmental monitoring continues to show that Flambeau remains in compliance with all permit standards and the Flambeau River remains fully protected.

4.1 Groundwater Quality Sampling and Analysis

Quarterly groundwater monitoring was performed in accordance with descriptions provided in the Updated Monitoring Plan (July 1991), the Revised Mining Permit Quality Assurance/Quality Control Document (August 1991) and the Local Agreement. As a result of regulatory changes with respect to arsenic in groundwater, the Department requested that Flambeau consider analyzing groundwater samples for arsenic on a quarterly basis. In a letter dated August 5, 2004, Flambeau notified the Department that arsenic will be included in the quarterly monitoring program. Results of the 2009 monitoring were submitted to the Department Mine Reclamation Unit March 31, June 30, November 25, and January 27, 2010. Those reports are incorporated by reference.

Groundwater quality data from 2009 was generally consistent with recent past years' data with the exception of the fourth quarter iron and manganese results from MW1004P, an intervention boundary well. Upon review of the fourth quarter monitoring results it was recognized that the reported MW1004P iron result was higher than MW1004P's Alternate Concentration Limit (ACL) established for iron. Re-analysis of the same sample indicates a value well below the ACL. Manganese, while elevated, was not greater than the Mine Permit standard for Shallow Precambrian. MW1004P was resampled on December 30, 2009. The results from the December 30 resampling were notably decreased as compared to the initial MW1004P reported iron result and indicated high variation in the iron results within the short term time period. The initial results as well as the resample results were submitted to the Department Mine Reclamation Unit on January 20, 2010. This report is incorporated by reference. Flambeau intends to continue monitoring MW1004P on a quarterly basis with continued data review.

4.1.1 Backfilled Pit Water Quality Assessment

As part of the permitting effort for the Flambeau project, assessments were completed to determine if the reclaimed site would comply with the permitted groundwater quality standards at the compliance boundary and protect surface water quality in the Flambeau River. The original assessment relied on predicted post-mining hydrologic conditions to conclude that the Flambeau River would act as a hydrologic boundary for the pore water migrating from the pit backfill and that backfill pore water would not migrate to the downgradient compliance boundary. In addition, the original analysis showed that the flux of backfill pore water into the river would be so small relative to the flow in the river that surface water quality would not experience a measurable change.

In a document dated August 27, 1999, Flambeau provided to the Department an evaluation of water quality data with respect to compliance with groundwater quality permit standards and the protection of water quality in the Flambeau River. The August 1999 evaluation confirmed that Flambeau remains in full compliance with groundwater quality permit conditions, that in the future, groundwater quality will not be affected at the permitted compliance boundary, and that water quality in the Flambeau River will be protected.

In a document dated October 17, 2000, Flambeau submitted to the Department another assessment of the backfilled pit water quality that was prepared by SRK Consulting and Foth & Van Dyke. The memorandum evaluated data obtained since the pit was backfilled to assess the performance of the reclaimed mine site with respect to compliance with groundwater quality permit standards and the protection of water quality in the Flambeau River. The 2000 assessment was appended to the 2000 Annual Report.

This 2000 assessment reported that neutralization of the acidity in the backfill pore water was complete, concentrations of solutes in the backfill pore water are stable, the pit backfill was not affecting water quality in the Flambeau River, and the flux of pore water from the backfill will be negligible with respect to its potential impact on water quality in the Flambeau River.

SRK Consulting performed annual assessments reviewing results from the 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008 and 2009 monitoring of pore water quality. The monitoring results and assessments confirm the findings presented in the year 2000 monitoring results assessment.

An annual assessment was again performed by SRK Consulting reviewing the results from the 2009 monitoring of pore water quality. The February 2010 memorandum, Flambeau Project – Backfilled Pit 2009 Monitoring Results is found in Appendix A. The results from the 2009 monitoring period generally are in agreement with the results from previous years and support the conclusions previously identified. In general the results indicate that the objectives of the lime amendment program had been met and that any acidity that had been present in the waste rock has been neutralized. The results further indicate that concentrations of major ions in the pore water are stable. For most of the backfill porewater, sulfate concentrations are controlled by gypsum dissolution/precipitation. However, isolated zones are developing where backfill gypsum equilibrium conditions do not exist (e.g. around well MW-1014C). The results provide ample evidence that the porewater in these areas is being displaced by inflowing groundwater. For example, concentrations of sulfate and other solutes are decreasing around Well MW-1014C without any evidence that precipitation reactions are causing the decrease.

Other observations can be summarized as follows:

- Redox conditions are approximately stable in some wells (e.g. wells MW-1013C and MW- 1014C) but continue to fluctuate in others (e.g. wells MW-1013B, MW-1014A and MW-1014B).
- Manganese concentrations in MW-1013B continue to fluctuate (within a narrow range), however, they are nearly constant or slightly decreasing in the remaining wells since 2007.

- While iron concentrations in well MW-1013C appear to be stabilizing, they are very low and stable in other wells, with the exception of MW-1013.
- Equilibrium modeling also suggest that iron oxy-hydroxides precipitates are converting to more stable phases, such as goethite or hematite, and therefore that soluble iron concentrations are unlikely to increase in the future for these wells.

4.1.2 Trend Analysis

Groundwater and Flambeau River surface water sample results collected for the 2009 monitoring program were added to the analytical monitoring historical database as in previous years. These results were statistically tested and graphically displayed to determine whether any significant increasing or decreasing trends are occurring in the groundwater or surface water chemistry. Groundwater quality results, trend graphs and statistical test results are included as Attachment 1 of Appendix B for the quarterly monitoring parameters and Attachment 2 of Appendix B for the annual monitoring parameters. Surface water quality results, trend graphs and statistical test results are included as Attachment 3 of Appendix B. Hydrographs are included as Attachment 4 of Appendix B. Note that the references to these Attachments need reference to the memo to which they are attached. Otherwise, the reader is going to be searching for Attachments to this annual report.

Intervention boundary wells included in the trend analyses are MW-1000PR, MW-1002, MW-1002G, MW-1004P, MW-1004S, MW-1005, MW-1005P, MW-1005S, and MW-1010P. The in-pit wells included in the trend analyses are MW-1013, MW-1013A, MW-1013B, MW-1013C, MW-1014, MW-1014A, MW-1014B and MW-1014C. Wells MW-1015A and MW-1015B (also included in the analyses) were constructed in January 2001 approximately 1000 ft. northwest of the backfilled pit and adjacent to the compliance boundary.

Many of the concentration trends noted from the statistical trend tests reflected small but consecutive changes in actual concentration. The more significant trends occurred mainly with the quarterly monitoring parameters in the intervention boundary wells MW-1000PR, MW-1004P, MW-1005 and MW1015B, and the in-pit wells MW-1013B, MW-1013C, MW-1014, MW-1014A, MW-1014B and MW-1014C. Of the trend results listed above, the following are the main conclusions:

<u>Intervention Boundary Wells</u>

- Several parameters in MW-1000PR (alkalinity, hardness, iron, manganese, sulfate, TDS and conductivity) exhibited an immediate increase in concentrations at the beginning of the post-mining period. Of these, hardness, manganese, sulfate, TDS and conductivity quickly began to again decrease, and long-term statistically decreasing trends continue to be indicated for these parameters. A statistically increasing long-term trend is indicated for alkalinity, however, the rate of increase slowed considerably following 2002 and no current statistically significant trend is indicated for the short-term results.

- A long-term statistically increasing trend is indicated for iron and manganese in MW-1004P with concentration increases beginning generally around 2002. This followed a

longer period of decreased concentrations which initiated in 1993. No statistically significant short-term (5-year) trend is indicated since the results between January of 2005 and June of 2009 fluctuate randomly (at concentrations near or below pre-1993 levels). The latest two sampling events of October and December of 2009 show increased concentrations of these two parameters; however re-testing results indicate large variation within the results of even the same sampling event.

- Alkalinity continues a moderately decreasing trend in MW-1005.

- Statistically increasing trends are indicated for redox and conductivity in MW-1015B. Redox has generally increased from 2004 through 2009. Conductivity on the other hand increased in January of 2007, with levels remaining relatively consistent both prior to and following that date. A statistically decreasing short-term trend is indicated for manganese, with concentrations continuing to decrease after an increase observed during 2003.

In-Pit Wells

- A long-term statistically increasing trend is denoted for copper in MW-1013B, which had increasing concentrations from 2002 through 2008. No short-term trend is indicated, however, since copper decreased in concentration during 2009.

- Long-term and 5-year increasing trends are observed for iron in MW-1013C. The 2009 iron concentrations, however, appear to have stabilized.

- MW-1014 has had moderate decreasing trends of manganese and pH.

- Long-term decreasing trends were noted for iron and manganese in MW-1014A. Prior to 2002 iron was observed at concentrations over 1 mg/L, but has generally been at non-detectable levels or slightly over since 2004. From 2000 to 2009 manganese concentrations reduced by over a factor of 10, currently at less than 400 µg/l.

- Moderate long-term decreasing trends were observed for hardness, manganese and TDS and conductivity in MW-1014B. A decreasing trend was also noted for redox in the short-term results.

- Decreasing trends continue in MW-1014C for hardness, iron, manganese, sulfate, TDS and conductivity.

Few significant trends were noted for the annual groundwater parameters of barium, cadmium, calcium, chloride, chromium, lead, magnesium, mercury, potassium, selenium, silver, sodium, and zinc. Of the somewhat moderate trends, MW-1000PR has had a decreasing trend of calcium, magnesium and zinc, MW-1013A has had a decreasing trend for barium, and MW-1014B and MW-1014C have had decreasing trends of zinc.

No statistically significant trends were observed in the surface water monitoring results, with the exception of a statistically increasing trend of sulfate for SW-2. This trend, however, reflects relatively smaller consecutive changes in actual concentration, currently only a little above the detection limit.

Figure 4-1 (Groundwater Potentiometric Surface Contour Map) shows the groundwater potentiometric surface using data obtained during October 2009. Figure 4-2 (Mine Pit Cross section A-A') shows a profile of hydraulic head along the cross section through the pit backfill. The Potentiometric Surface Contour Map shows that the horizontal direction of groundwater flow is consistent with historical data, i.e., westward towards the Flambeau River. The hydraulic cross section displayed in Figure 4-2 continues to show a predominant pattern of downward groundwater movement at the pit backfill wells with convergent flow toward the Flambeau River.

38,000 E
39,000 E
40,000 E
41,000 E
42,000 E
43,000 E
43,000 N
42,000 N
41,000 N
40,000 N
39,000 N

N

LEGEND

1130 — POTENTIOMETRIC SURFACE CONTOUR

1135 — INFERRED POTENTIOMETRIC SURFACE ELEVATION CONTOUR

MW-1001G 1111.13 — GROUNDWATER MONITORING WELL AND MEASURED GROUNDWATER ELEVATION (FT MSL)

WT-5 — WETLAND STAFF GAUGE

1132.02• — ASTERISK DENOTES ELEVATION REPRESENTED BY GROUNDWATER CONTOUR

PZ-1012 1104.54
1113.25 PZ-1007S
PZ-1011 1133.52
1088.91 MW-1002G MW-1002 1088.96•
1086.54• MW-1015A
WT-5
MW-1015B 1086.53
1091.93 OW-10
OW-43 1086.53
OW-42 1099.81
1107.18 MW-1003P MW-1003 1107.13•
MW-1014 1117.09• MW-1014A 1114.28 MW-1014B 1111.21 MW-1014C 1106.57
PZ-1006G 1132.02• PZ-1006 DRY PZ-1006S 1130.73
PZ-1009G 1140.46 PZ-1009 1140.29•
MW-1004S 1104.28 MW-1004 1104.19• MW-1004P 1103.10
DRY ST-9-23A ST-9-23 1117.70•
1110.93• MW-1013 MW-1013A 1096.23 MW-1013B 1096.47 MW-1013C 1097.80
PZ-S3 1115.62
MW-1005P 1135.44 MW-1005 1135.95• MW-1005S 1135.59
PZ-S1 1093.61•
PZ-R1 1089.67
MW-1010P 1086.42•
ST-9-26 1108.96
OW-39 1094.33•
MW-1000PR 1086.56
MW-1000R 1086.74
OW-7 1106.62
MW-1001P 1111.41 MW-1001 1111.82• MW-1001G 1111.13
PZ-1008 1134.96•
PZ-1008G 1134.99

100 1090 1095 1100 1105 1110 1115 1120 1125 1130 1135

Flambeau Mining Co.
2009 Annual Report

Foth Infrastructure & Environment, LLC			
REVISED	DATE	BY	DESCRIPTION
CHECKED BY:	SVF	DATE:	JAN. '10
APPROVED BY:	SVD1	DATE:	JAN. '10
APPROVED BY:		DATE:	

Foth
Foth Infrastructure & Environment, LLC

FLAMBEAU MINING COMPANY

FIGURE 4-1
OCTOBER, 2009
GROUNDWATER POTENTIOMETRIC SURFACE CONTOUR MAP

Scale: 0 250' 500' | Date: JANUARY, 2010

Prepared By: JOW | Checked By: SVF | 08F777

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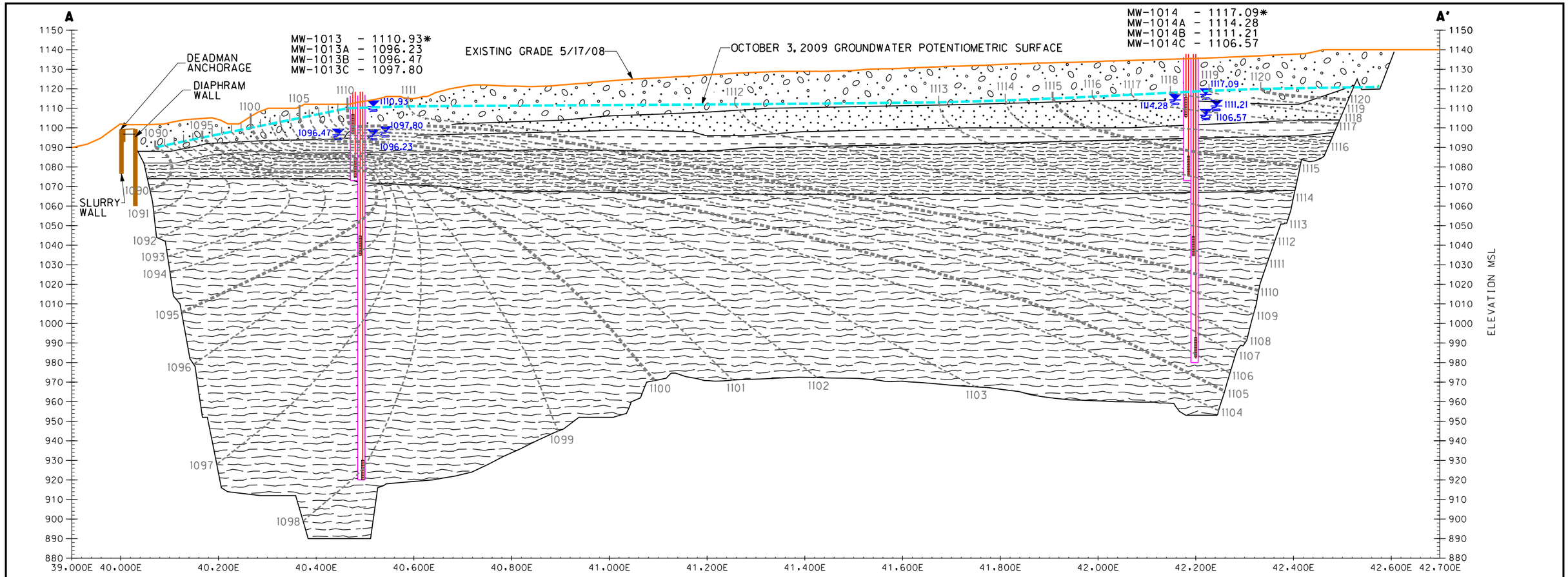
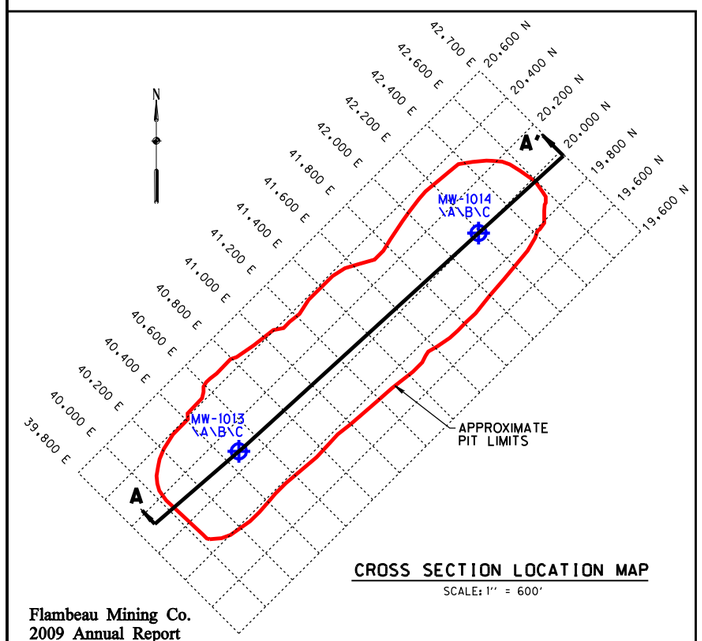
2/4/2010 bjwl





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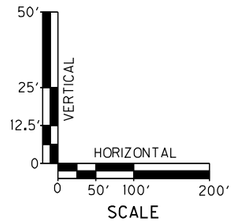
MINE PIT COORDINATES
SECTION A - A'

LEGEND

- TILL
- SANDSTONE
- SAPROLITE
- TYPE I MATERIAL
- TYPE II MATERIAL
- 1111.19* ASTERISK INDICATES LEVEL WAS USED TO DEVELOP OCTOBER 3, 2009 GROUNDWATER POTENTIOMETRIC SURFACE
- LINE OF EQUIPOTENTIAL



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REVISED	DATE	BY	DESCRIPTION

CHECKED BY:	SVF	DATE:	JAN. '10
APPROVED BY:	SVD1	DATE:	JAN. '10
APPROVED BY:		DATE:	

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FIGURE 4-2
MINE PIT CROSS SECTION A - A'
WITH IN-PIT GROUNDWATER
MONITORING WELLS

Scale: SEE BAR SCALE	Date: JANUARY, 2010	
Prepared By: JOW	Checked By: SVF	08F777

X:\GB\IE\2008\08F777\cad\09_mon_rpt\09_mon_rpt_Fig4-2.dgn
2/4/2010 bjw1

4.2 Wetland Monitoring and Biofilter Management

During 2009 Flambeau monitored wetland surface flows and industrial outlot 0.9-acre biofilter stormwater.

In accordance with Section 3.1.4.3 of the Updated Monitoring Plan, Flambeau continues to monitor water level measurements at least three times per year (spring, summer, and autumn) in Wetland 1. Wetland surface flows will be monitored in Wetland 1 until the Department approves a future request from Flambeau to discontinue monitoring.

Stormwater monitoring associated with the 0.9-acre biofilter was completed in accordance with the Biofilter Management Plan submitted to the Department on January 12, 2007. As stated in the Biofilter Management Plan, stormwater monitoring will continue for at least three years.

4.2.1 Wetland Surface Flows

In May 2001, Flambeau submitted a Wetland Area Hydrographic Assessment prepared by Foth & Van Dyke evaluating the wetland water elevations and recommending cessation of monitoring of wetland surface water elevations, with the exception of Wetland 1, in accordance with the Updated Monitoring Plan. Based upon the Wetland Area Hydrographic Assessment, Flambeau requested the Department's approval of cessation of monitoring wetland surface water elevations for Wetlands 5C, 6C, 7 and 10A. During April 2002, the Department concurred with Flambeau's request to decrease the extent of wetland water level monitoring.

In accordance with Section 3.1.4.3 of the Updated Monitoring Plan, Flambeau monitors water level measurements at least three times per year (spring, summer, and autumn). Water levels in Wetland 1 (Staff Gauge WT-5) were measured three times during 2009, spring, summer and fall. Standing water was observed during the spring. During 2009 inconsistent precipitation patterns did not allow a recovery from lowered ground water tables and drought conditions. Since Wetland 1's condition resulted from natural causes and regional climatic conditions, mitigation water was not added during 2009 as was also the case between 2002 and 2008.

Measurements from Wetland 1 were provided to the Department on January 26, 2010; the report is incorporated by reference. Figure 4-1 shows the staff gauge location.

4.2.2 Biofilter Management

The Biofilter Management Plan requires monitoring stormwater during two events annually for at least three years. Parameters monitored are copper, zinc, conductivity, hardness and pH. During 2009 stormwater samples were collected during April and October. Results were submitted to the Department on July 3, 2009 and December 29, 2009, respectively. The 2009 average biofilter inflow copper concentration was 38.5 µg/l and the average outflow copper concentration was 16.5 µg/l. During 2009 the 0.9-acre biofilter continued to effectively reduce the concentrations of copper leaving the biofilter.

4.3 Surface Subsidence

Pursuant to Section 3.1.7 of the Updated Monitoring Plan (July 1991), with 2008 being the tenth year after reclamation activities were performed in the area of the pit, a review of the surface topography in the area of the pit was performed in 2008.

The results of the 2008 subsidence analysis indicated a general increase of 0.6 feet these results were consistent with the results of the review of the surface topography in the area of the pit completed in 2001 when the general subsidence across the site was less than a half a foot which is within the accuracy of the mapping technique and the largest settlement observed in isolated areas by mapping was 1.5 feet.

Subsequent subsidence surveys are to occur in the twentieth (2018) and fortieth (2038) year after reclamation activities in the area of the pit are completed.

Aerial Photography (Color and Infrared)

In accordance with Section 3.1.6 of the Updated Monitoring Plan (July 1991), aerial and color infrared photography was completed in the late summer for four consecutive years following completion of closure and will continue every five years throughout the long-term care and maintenance period to monitor success of revegetation. Year 2005 was the fourth year of the four consecutive years for aerial and color infrared photography since the submittal of the NOC in 2001. Aerial and color infrared photography was completed on August 3, 2006 for a fifth additional year and results were presented in the 2006 Annual Reclamation Report.

In the November 7, 2002 submittal of the 2002 Aerial and Color Infrared Photography, Flambeau requested a reduction of the area of coverage for the photography based upon the substantial rebound of groundwater around the reclaimed mine site. Flambeau proposed that the photography cover the reclaimed mine site and 500 feet beyond the site's perimeter including the area of Wetland 1. In a letter dated July 9, 2003, the Department authorized Flambeau to reduce the breadth of the aerial and color infrared photography as requested.

With the long-term care phase of the Flambeau project beginning with the May 2007 COC, aerial and color infrared photography will be conducted every five years – occurring during 2012, 2017, 2022, 2027, 2032, 2037, 2042 and 2047.

4.4 Other Activities

Other site monitoring was performed during 2009 including monitoring set forth as part of the Stipulation agreement of May 31, 2007.

The Stipulation Monitoring Work Plan and associated Quality Assurance Project Plan were submitted on December 7, 2007. Stipulation monitoring during 2009 included surface water quality and biota sampling in the Flambeau River. The data from these monitoring events was submitted to the agreement parties on February 2, 2010. This submittal is included in Appendix C of this report.