Deer Tail Scientific
Duluth, Minnesota
deertailscientific.wordpress.com

Date:	July 14, 2022
To:	Gregory Pils, Director, Bureau of Environmental Analysis, Wisconsin DNR, Madison, WI Larry Lynch, Administrative Rules Coordinator, Wisconsin DNR, Madison, WI
Cc:	David Siebert, Administrator, Division of External Services, Wisconsin DNR, Madison, WI Jonathan Moody, USEPA – Region 5, Chicago, IL Krista McKim, USEPA – Region 5, Chicago, IL Dan Cozza, USEPA – Region 5, Chicago, IL
From:	Laura Gauger, Chair, Deer Tail Scientific[1], 231 E. Superior St. #1409, Duluth, MN 55802
RE:	The Wisconsin DNR's preliminary decision to grant Flambeau Mining Company a certificate of completion of reclamation for the 32-acre industrial outlot at the Flambeau Mine site, and, in tandem, issue a *Revised FMC Mining Permit* to delineate the mining company's ongoing obligations at the project site.
NB:	An electronic version of these comments can be found on a **DVD** inside the back cover, along with copies of all cited references.

Dear Mr. Pils and Mr. Lynch,

Enclosed please find my comments in opposition to the Wisconsin DNR's preliminary decision to grant Flambeau Mining Company (FMC) a certificate of completion (COC) for its reclamation of the 32-acre industrial outlot at the Flambeau Mine project site. Also enclosed are comments in opposition to certain elements of the *Revised FMC Mining Permit* proposed by the Department.

I realize Department officials are unlikely to reverse their decision on the COC or alter the *Revised FMC Mining Permit* under consideration, but the purpose of this mailing is much broader, and that is why I have cc'd the other individuals indicated above.

Dr. Robert E. Moran (Michael-Moran Associates, Golden, CO; remwater.org), a noted hydrogeologist who was retained by citizens several years ago to review historical and modern Flambeau Mine documents, concluded the following with regard to the Wisconsin DNR's regulation of the Flambeau project:

"In short, the Flambeau Mine is the poster child for a severely-flawed permitting and oversight process that has likely generated long-term public liabilities" (Moran, 2019).

The enclosed information deals with not only the present issue at hand (i.e., the COC and *Revised FMC Mining Permit),* but also lays bare the kinds of regulatory deficiencies identified by Dr. Moran and other experts retained by citizens over the years to evaluate the Flambeau project.

It is my hope that, by relaying these findings to you and the good people at the DNR and EPA cc'd above, perhaps similar problems can be avoided if/when new mining projects are permitted in the future.

Thank you.

Laura Gauger

Laura Gauger, Chair
Deer Tail Scientific

1. Deer Tail Scientific is a 501(c)3 nonprofit organization founded in 2017. As stated in its bylaws: *The mission of Deer Tail Scientific is to educate the public, government officials and tribal sovereign nations with fact-based information on: (1) the permitting, development, reclamation, environmental performance and economics of Wisconsin's Flambeau Mine; and (2) how the Flambeau Mine compares to other mines (closed, currently operating or proposed) in the Great Lakes region and beyond.*

Table of Contents

Tab	Topic
1	**Summary letter.**
2	**Summary Table.** The table lists a number of DNR regulatory decisions regarding the Flambeau Mine that, in net sum, demonstrate a *pattern* of regulatory mismanagement of the project. Each regulatory decision is discussed in greater detail under **Tabs 3-16**.
3	**Regulatory Issue:** How to regulate the discharge of contaminated runoff from the industrial outlot to Stream C. ***NB:*** *Historically, the industrial outlot is where the mine's ore crusher, rail spur, runoff detention ponds, waste water treatment plant, a portion of the mine's high-sulfur waste rock stockpile and several small buildings were located.* *Stream C is a Flambeau River tributary that crosses a portion of the Flambeau Mine industrial outlot, providing a hydric connection between the outlot and river. The stream, which discharges to the river roughly 0.4 mile downstream of the backfilled pit, was classified as navigable by the Wisconsin DNR during the mine permitting process in 1990 and is therefore a Water of the United States subject to protections under Section 303(d) of the federal Clean Water Act. Over the years, FMC has used Stream C as a conduit for carrying contaminated stormwater runoff from various passive water treatment systems constructed within the industrial outlot to the Flambeau River.*
4	**Regulatory Issue:** Where to locate surface water sampling sites for baseline and follow-up testing in the Flambeau River relative to the mine pit and Stream C's discharge point to the river – and what to include in the test panel. ***NB:*** *The open pit was located 140 feet from the Flambeau River and, per the terms of FMC's DNR-approved reclamation plan, is now backfilled with waste rock and other mining-related wastes (e.g., all of the filter sands and sludges from the mine's waste water treatment plant), some of it amended with limestone. According to FMC modeling: "all of the groundwater flowing through the [high-sulfur] waste rock in the reclaimed pit will exit the pit through the Precambrian rock in the river pillar and flow directly into the bed of the Flambeau River"* (Foth, 1989c). *In addition to contaminated groundwaters entering the Flambeau River from the backfilled pit, contaminated surface waters from the mine's industrial outlot also reach the river via Stream C, as noted above.*
5	**Regulatory Issue:** How to monitor for potential impacts to Flambeau River sediments and aquatic species (macroinvertebrates, crayfish and walleye), bearing in mind that the backfilled/reclaimed mine pit is just 140 feet from the river, and, in addition, Stream C discharges runoff from the industrial outlot to the river.
6	**Regulatory Issue:** How to monitor for potential impacts to endangered/threatened species discovered in the Flambeau River near the mine site prior to mine construction, bearing in mind that the backfilled/reclaimed mine pit is just 140 feet from the river, and, in addition, Stream C discharges runoff from the industrial outlot to the river.
7	**Regulatory Issue:** Where to drill wells within the industrial outlot for monitoring baseline and follow-up water quality.
8	**Regulatory Issue:** How to regulate groundwater contamination at the Flambeau Mine site vis-à-vis establishment of a "Compliance Boundary" for enforcement of groundwater quality standards.
9	**Regulatory Issue:** What to use as the numeric groundwater quality criteria for intervention boundary wells located between the backfilled mine pit and Flambeau River – and what to do if those standards are exceeded.
10	**Regulatory Issue:** How to process groundwater samples submitted for testing.
11	**Regulatory Issue:** What constituents to include in the groundwater test panel for the Flambeau project.
12	**Regulatory Issue (1989):** Whether to grant FMC an exemption to NR 132.18(1)(c), the Department rule that stated a mine shall not be constructed "within 300 feet of a navigable river or stream".
13	**Regulatory Issue (1989):** Whether to grant FMC an exemption to NR 132.18(1)(d), the Department rule that states a mine shall not be constructed "within a floodplain".
14	**Regulatory Issue (2007):** Whether to object to FMC's stated position that groundwater and Flambeau River environmental monitoring results should not be allowed into evidence at the hearing over the company's initial (2007) request for a Certificate of Completion of reclamation for the Flambeau Mine project site.
15	**Regulatory Issue (2018 and 2022):** Whether to grant FMC's 2018 petition to scale back environmental monitoring requirements at the reclaimed Flambeau Mine site, how to address public comment submitted on the matter, and whether to incorporate the same scaled-back monitoring plan into the *Revised FMC Mining Permit* under consideration in 2022.
16	**Regulatory Issue (2022)**: What to include as central "Findings of Fact" in the evaluation of FMC's 2022 request for a certificate of completion (COC) of reclamation of the 32-acre industrial outlot at the Flambeau Mine site.
17	**References.** ***NB:*** *Live links to all listed references are included in an electronic version of these comments that can be found on a DVD inside the back cover. The DVD also includes copies of all the references.*
18	**Figures.** ***NB:*** *Included are maps and diagrams establishing the layout (historical and current) of the Flambeau Mine project site, including the industrial outlot and its hydric connection to the Flambeau River via Stream C. Graphs and tables showing the extent of groundwater and surface water pollution at the project site are also provided, as are several photos of interest.*
19	**Credentials.**

Tab 1

Summary Letter.

Deer Tail Scientific
Duluth, Minnesota
deertailscientific.wordpress.com

Date: July 14, 2022

To: Gregory Pils, Director, Bureau of Environmental Analysis, Wisconsin DNR, Madison, WI
Larry Lynch, Administrative Rules Coordinator, Wisconsin DNR, Madison, WI

Cc: David Siebert, Administrator, Division of External Services, Wisconsin DNR, Madison, WI
Jonathan Moody, USEPA – Region 5, Chicago, IL
Krista McKim, USEPA – Region 5, Chicago, IL
Dan Cozza, USEPA – Region 5, Chicago, IL

From: Laura Gauger, Chair, Deer Tail Scientific, 231 E. Superior St. #1409, Duluth, MN 55802

RE: The Wisconsin DNR's preliminary decision to grant Flambeau Mining Company a certificate of completion of reclamation for the 32-acre industrial outlot at the Flambeau Mine site, and, in tandem, issue a *Revised Mining Permit* to delineate the mining company's ongoing obligations at the project site.

NB: An electronic version of these comments can be found on a **DVD** inside the back cover, along with copies of all cited references.

Dear Mr. Pils and Mr. Lynch:

My name is Laura Gauger, and I am the Chair of Deer Tail Scientific (DTS), a 501(c)3 nonprofit organization founded in 2017. As stated in our bylaws:

The mission of Deer Tail Scientific is to educate the public, government officials and tribal sovereign nations with fact-based information on: (1) the permitting, development, reclamation, environmental performance and economics of Wisconsin's Flambeau Mine; and (2) how the Flambeau Mine compares to other mines (closed, currently operating or proposed) in the Great Lakes region and beyond.

On behalf of DTS and myself as a private citizen, and, after reviewing pertinent documents on file with the Wisconsin Department of Natural Resources (DNR; "Department") regarding efforts put forth by Flambeau Mining Company (FMC; "Flambeau"; "company") to reclaim the Flambeau Mine site, I hereby register our opposition to the preliminary decision made by the Department to grant FMC a Certificate of Completion (COC) of reclamation for the 32-acre industrial outlot ("outlot") at the reclaimed Flambeau Mine site. We also hereby register our opposition to certain elements of the *Revised FMC Mining Permit* proposed by the Department.

In terms of my credentials to speak on this matter, I have been following developments at the Flambeau Mine site since the mid-1990s, have done numerous public records requests of the Department to obtain official documents, and have been a party to several different legal actions involving the mine over the years, including a 2007 contested case hearing over FMC's first attempt to obtain a COC of reclamation for the Flambeau Mine site and a 2011 federal Clean Water Act lawsuit filed against FMC over the pollution of a Flambeau River tributary that crosses a portion of the mine's industrial outlot (the same outlot at the heart of the present proceedings). Over the years I also solicited the help of several different experts to review historical and modern FMC documents and the company's environmental monitoring data, and those findings have been incorporated into my comments. For a summary of my Flambeau Mine-related activities over the years and the resumés of the cited experts, please see Tab-19.

There are four issues that, in my opinion, make the DNR's preliminary decision to grant the COC requested by Flambeau Mining Company particularly egregious, and a fifth issue related to the *Revised FMC Mining Permit* proposed by the Department that requires attention. Specifically:

1. **The same problem that resulted in FMC being denied a COC for the industrial outlot back in 2007 has not been fixed by the company.**

   Background: Flambeau Mining Company sought a COC for successful reclamation of the *entire* 181-acre Flambeau Mine site in 2007, resulting in a contested case hearing to which I was a party. The company ultimately was awarded a COC, but only for the 149-acre section of the mine site encompassing the backfilled pit[1] and *not* for mine's 32-acre industrial outlot. At issue was ongoing surface water contamination in a tributary of the Flambeau River that crosses a portion of the industrial outlot. The tributary, known as "Stream C" on company drawings, was characterized by the DNR as "navigable" in the 1990 *Environmental Impact Statement* (EIS) for the Flambeau project (WDNR, 1990) and identified as such in the *Flambeau Mine Permit* (WDHA, 1991). It is therefore a Water of the United States subject to protections under Section 303(d) of the federal Clean Water Act (CWA; "Act"). See Tab-18, Figures 1 through 7 for maps and diagrams showing the Flambeau Mine project site and its hydric connection to Stream C.

   Due to public and tribal involvement in the 2007 hearing process that highlighted the Stream C contamination issue, FMC was denied a COC for the industrial outlot per the terms of a *Stipulation and Order* negotiated by representatives of FMC, the opposing parties and the DNR (WDHA, 2007b). The *Stipulation and Order* also required FMC to conduct additional testing in Stream C (surface water and sediments) and the Flambeau River (surface water, sediments, crayfish and walleye) to better assess the impact of site reclamation on the stream and river.

   Stream C surface water data collected per the terms of the 2007 COC *Stipulation and Order,* in combination with other historical Stream C data on record with the DNR, led to a decision by the DNR and EPA to add the section of Stream C immediately south (downstream) of the Flambeau Mine's industrial outlot to Wisconsin's Section 303(d) list of impaired waters for both copper and zinc, effective April 2012 (USEPA, 2014). Since baseline water quality data for Stream C is lacking, FMC has tried to suggest that the copper and zinc concentrations in the stream were perhaps *naturally* high, but the DNR stated the following with regard to the probable source of the contamination in a report issued by the Department in April 2012 (WDNR, 2012b):

   "A review of FMC reports to DNR, and other Flambeau mine related documents, suggests several mining activities that could have resulted in the dispersal of copper-bearing ore throughout adjacent areas during the period the mine was in operation. Mining activities such as blasting, bulldozing, truck loading and unloading, ore crushing (up to 250 tons per hour) and rail car loading (State of Wisconsin 1991) could have generated quantities of fine dust that could have been transported by the wind and deposited on nearby areas."

   In addition, I happened to come across a memo sent by FMC to the Department in 2004 in which the company acknowledged the following (FMC, 2004):

   "Concern has been raised about the copper levels found in intermittent Stream C near the industrial outlot at the Flambeau Mine site. … Recent Stream C water quality data have shown levels of copper ranging from 18 to 30 ug/L. In 2003, Flambeau Mining Company evaluated the potential sources of the copper and determined that the rail spur area was the most likely source of the copper."

[1] The COC awarded to FMC in 2007 for the 149-acre portion of the mine site where the open pit and several other mine features were located during operations was based solely on FMC's completion of backfill operations according to plan and successful revegetation of the surface. Through legal maneuvering, the company succeeded in securing a ruling from the State of Wisconsin Division of Hearings and Appeals that eliminated consideration of the following factors in the certification process: (a) groundwater contamination within the mine's backfilled pit that significantly exceeded levels predicted by FMC's consultants; (b) documented violations of Flambeau Mine Permit standards in monitoring wells located between the backfilled pit and Flambeau River; and (c) data regarding potential adverse impacts of the mine on fish and other aquatic life in the Flambeau River (WDHA, 2007a). See Tab-14 for details.

Wisconsin's Section 303(d) list of impaired waters is updated by the Department every two years and, to this day, classifies the portion of Stream C downstream of the industrial outlot as impaired for copper (the zinc listing was removed after 8 years, effective 2020). In addition, the Department recently released its *draft* Section 303(d) list for 2022, including the following two recommendations with regard to Stream C (WDNR, 2021b):

- Maintain the impairment listing for the portion of Stream C located south *(downstream)* of the industrial outlot due to ongoing copper toxicity; and
- *Add* the portion of Stream C located *within the industrial outlot* to Wisconsin's Section 303(d) list for both copper and zinc toxicity, based on an impairment assessment completed by Department scientific staff in 2021 (WDNR, 2021a).

This latest recommendation from DNR staff to the EPA to ***maintain*** the impaired listing of Stream C ***immediately south (downstream) of the industrial outlot*** and to ***add*** an impairment listing for the portion of the stream ***within the industrial outlot*** clearly shows two things:

- The very problem that resulted in FMC being denied a COC for the industrial outlot back in 2007 *has not been fixed,* so it makes no sense for the State of Wisconsin to award the company a COC at this time; and
- The DNR decision-makers in Madison who are recommending that FMC be granted a COC for reclamation of the industrial outlot *appear to be ignoring the findings of their own scientific staff* who have determined that, despite several different surface water management plans implemented by FMC over the years as part of site reclamation, Stream C remains impaired.

You might be wondering how Stream C, a Water of the United States, could have ended up in such poor condition. In my opinion, the problem is rooted in DNR mismanagement of the Flambeau project. To see what I mean, please go to Tab-3 of my comments for information regarding questionable decisions made by DNR regulators over the years that have impacted the health of the stream.

Instead of acknowledging FMC's failure to effectively deal with the Stream C impairment issue, Department officials are now asking the public to look the other way and accept the company's claim that the industrial outlot has been successfully reclaimed. This cannot stand, especially in light of the "Ruling on Statement of Issues" that was handed down in the earlier (2007) COC proceedings for the Flambeau project site.

Specifically, the Administrative Law Judge at the 2007 contested case hearing ruled that "any on-site soil or sediment contamination issues, as well as those related to the erosion control and surface water management plan and the creation of wetlands or placement of biofilters required by the Reclamation Plan" were legitimate issues to be considered as part of the COC hearing process (WDHA, 2007a).

The above ruling is what allowed Stream C contamination issues to play a central role in the 2007 contested case hearing, ultimately resulting in a denial of the COC for the industrial outlot. Surely those same issues cannot be eliminated from consideration now, especially since, at the 2007 contested case hearing, representatives of FMC, the DNR and the objecting parties entered into a *Stipulation and Order* that included the following provision (WDHA, 2007b; emphasis added):

> 7. In order for the Industrial Outlot to obtain a COC in the future, the Outlot will need to meet the Administrative Law Judge's interpretation as set forth in the May 14th, 2007 Ruling on the Statement of Issues and any modifications thereto on the record at the contested case hearing on May 30,2007. This interpretation is that the definition of reclamation, which is found in section 293.01(23), Stats. applies as to whether FMC has achieved its reclamation plan, and that FMC will not be required to prove there will not be groundwater or surface water pollution that arises after the COC is issued in order to obtain the COC for the Industrial Outlot.

See Tabs 3 and 16 for more details.

2. **FMC's Flambeau River monitoring program, which was approved by the DNR as part of the 1991 permitting process and extended for five additional years per the terms of the 2007 *Stipulation and Order*, fails to provide conclusive evidence that either the stretch of the river adjacent to the reclaimed pit or the portion immediately downstream of the Stream C discharge point have been protected from mining impacts.**

   Background: FMC is required to submit an annual report to the DNR summarizing the company's most recent activities at the project site, including the results of any environmental monitoring studies. Typically, the report is accompanied by a cover letter that includes the following statement or variation thereof: *Monitoring and evaluations conducted during* [the previous year] *continue to document that the Flambeau River remains fully protected and Flambeau remains in full compliance with its permit standards* (FMC, 2021). Indeed, this has been FMC's central argument over the years as to why their mining operation and subsequent reclamation activities should be considered successful and deserving of a COC.

   Upon review by four different professional consultants[2] retained by citizens, however, FMC's Flambeau River surface water, sediment, crayfish and walleye data submitted to the DNR per the terms of the 2007 *Stipulation and Order*, in combination with other historical Flambeau River and groundwater monitoring data on record with the Department, demonstrates that FMC's assertion of the river being "fully protected" is, to quote one of the consultants, "not warranted" and therefore cannot be relied upon to justify the awarding of a COC for site reclamation. Ample documentation of concerns raised by the four consultants regarding FMC's river-monitoring program is provided later in my comments (see Tabs 4, 5 and 6).

3. **The United States Court of Appeals for the 7th Circuit set a bad precedent in a 2013 decision in a Clean Water Act lawsuit filed against FMC, and, if the COC currently under consideration is awarded, that bad precedent will be reenforced.**

   Background: I was one of the plaintiffs in a Clean Water Act lawsuit filed against FMC in the U.S. District Court for the Western District of Wisconsin in 2011. Detailed information about the case and links to various court documents are provided under Tab-3 of my comments. But, for now, please let me offer a brief summary.

   When filing the case, our legal argument was that FMC was in violation of the Clean Water Act because it had never obtained a federally-mandated National Pollution Discharge Elimination System (NPDES) permit from the State of Wisconsin (i.e., a WPDES permit) to regulate the discharge of contaminated stormwater runoff from a man-made detention basin or "biofilter" in the Flambeau Mine's industrial outlot (point source) to Stream C (a water of the U.S.), and that now the stream was impaired.

   FMC, on the other hand, sought to convince the court that the company's *mining permit* issued by the State of Wisconsin fulfilled the requirements of the Act, even though the permit had placed no restrictions on the amount of copper, zinc, iron and other pollutants discharged to Stream C from the detention basin.

   Judge Barbara Crabb (U.S. District Court for the Western District of Wisconsin) heard the case and ruled in our favor, clearly stating the following in her July 2012 Opinion and Order:

   "*Judgment is GRANTED in favor of plaintiffs on their claim that defendant discharged a pollutant from a point source that entered a water of the United States and that it did not have a permit issued under the Clean Water Act when it did so.*" She also noted that the Clean Water Act *"does not recognize good faith or lack of knowledge as defense; civil liability is strict."*

[2] Dr. David M. Chambers (geophysicist; Center for Science in Public Participation, Bozeman, MT; csp2.org); Dr. Kendra Zamzow (environmental geochemist; Center for Science in Public Participation, Chickaloon, AK; csp2.org); Dr. Ken Parejko (aquatic ecologist; Professor Emeritus, Department of Biology, University of Wisconsin-Stout, Menomonie, WI); and Dr. Robert E. Moran (hydrogeologist; Michael-Moran Associates, Golden, CO; remwater.org). See Tab-19 for resumés.

FMC proceeded to appeal the decision, sending it to the U.S. Court of Appeals for the Seventh Circuit, where Judges David Hamilton, Kenneth Ripple and Joseph Stadtmueller heard oral arguments in April 2013. A few months later the 3-judge panel handed down its ruling, reversing the judgment of the district court.

The higher court did not dispute our claim that FMC had discharged contaminated stormwater runoff from a point source at the Flambeau Mine site to a water of the United States on an ongoing basis since at least 2006 (statute of limitations) and that, as a result, the stream was now impaired. Rather, the panel focused its attention on the Wisconsin DNR's regulatory authority as the administrator of the Clean Water Act in Wisconsin and stated the following:

"… even if Flambeau's permit were legally invalid, we cannot, consistent with the requirements of due process, impose a penalty on Flambeau for complying with what Wisconsin deemed a valid WPDES permit."

Tell me, on what basis could DNR officials in Madison have deemed a permit that placed no restrictions on the amount of copper, zinc, iron and other pollutants discharged to a Water of the U.S. from a point source a "valid WPDES permit"? Yet, that's what ruled the day at the 7th Circuit hearing. In retrospect, it looks like, in addition to suing FMC, we should have sued the DNR.

The Court proceeded to rule that the *mining permit* issued by the State of Wisconsin to FMC *shielded* the company from prosecution under the Act. As noted above, it didn't matter to the appellate court that the state-issued permit had failed to include key provisions of the NPDES permit program, i.e., none of the Flambeau Mine permitting documents had included any restrictions on the amounts of contaminants that could be discharged to Stream C (a Water of the U.S.) from the mine's biofilter (a point source).

In effect, the appellate court's decision allowed errors made by the Wisconsin DNR in its administration of the Clean Water Act to shield FMC from prosecution.

It reminded me of another unfortunate experience I had with the DNR back in 2003. Even though Chapter NR 182 of the *Wisconsin Administrative Code* clearly requires the Department to establish a so-called "intervention boundary" at mine sites for the purpose of regulating groundwater contamination, I was told, in writing, by the Department's chief mining regulator that the Flambeau Mine had no such boundary (Lynch, 2003)[3]. Imagine my surprise when, several years later, I learned that the Flambeau Mine not only had a set of legally-established intervention boundary wells, but several were in violation of Flambeau Mine Permit standards and other relevant water quality criteria (see Tab-9 for more details; see Tab-18, Figures 20, 21 and 23 for intervention boundary well pollution graphs).

Back to the Clean Water Act case … **The 7th Circuit decision set a terrible precedent: It allowed a state-issued mining permit that set no discharge limits on pollutants entering a water of the United States from a point source to substitute for a NPDES permit.**

I realize that no one at the DNR can reverse the 7th Circuit decision as part of the current proceedings, but what happened in court back then is still relevant to the issues under consideration today. It is my hope that, by reviewing the court decision and seeing the injustice, perhaps *someone* at the DNR or EPA who is concerned that the Department faithfully execute its duties as the administrator of the Clean Water Act in Wisconsin will take notice of the malfeasance, try to remedy the situation, and put safeguards in place to make sure it never happens again.

[3] The Department stated the following in a December 2003 response to a public records request: *"The Flambeau operation was permitted prior to implementation in 1998 of the rule provisions that created the concept of the mandatory intervention boundary. Thus, a mandatory intervention boundary has not been established for the Flambeau Mining site"* (Lynch, 2003). I knew at the time that this could not be true, because Section NR 182.075(1)(c)3 of the *Wisconsin Administrative Code* that created the mandatory intervention boundary concept had been enacted in 1982 (as confirmed later by the Wisconsin Revisor of Statutes Bureau; WRSB, 2004). Still, I took the Department official at his word and only later discovered that the information he had provided was inaccurate. See Tab-9 for more details.

4. **The COC proposed by the DNR for the Flambeau project site includes no requirement for FMC to record, with the Rusk County Register of Deeds, any land use restriction related to the contaminated ground and surface waters at the project site. Nor does the COC make any mention of establishing a brownfield designation for the property with state or federal authorities.**

   Background: As stated by the DNR in its "Conclusions of Law" for the matter at hand: "Pursuant to NR 132.122(5)(b), Wis. Adm. Code, the Department is authorized, as part of a certificate of completion of reclamation, to require an operator to develop a land use restriction to limit incompatible uses and development of specified portions of the mining site and to record the land use restriction in the office of the register of deeds in the county in which the mining site is located."

   The above-cited DNR authority is relevant to the present matter because monitoring wells within the backfilled Flambeau Mine pit are registering contaminant levels that greatly exceed EPA drinking water standards, as are several wells located directly between the backfilled pit and Flambeau River, and, according to FMC's predictive modeling, contamination is expected to persist for 3,000 to 4,000 years (see Tab-9 for details). In addition, and as discussed above, Stream C, which crosses the mine's industrial outlot, has registered and continues to register elevated copper concentrations toxic to fish and other aquatic species.

   The above water quality problems at Flambeau cannot be ascertained by simply hiking over the backfilled pit or along the banks of Stream C – they are invisible to the naked eye. That's why a deed restriction and/or brownfield designation for the property is necessary in order to help protect the interests of any unsuspecting party who may be interested in purchasing the property in the future. Yet, the COC currently proposed by the DNR for Flambeau Mining Company does not require FMC to record any of the above-noted liabilities with the appropriate local, state or federal authorities, this despite the fact that the Department's own regulatory rules give them the authority to do so as part of the COC process. The Department's inaction on this matter makes no sense at all.

5. **The *Revised FMC Mining Permit* proposed by the DNR includes a provision for FMC to "conduct environmental monitoring and long-term care activities as described in the 2020 Updated Monitoring Plan," but, upon close review, said monitoring plan is insufficient to accurately track mining-related impacts to ground and surface waters at the Flambeau project site or impacts to aquatic species in the Flambeau River.**

   Background: Over the years, citizens have retained various professional consultants to review the environmental monitoring plans utilized by FMC at the Flambeau project site, and numerous deficiencies in study design and implementation have been identified. For example, FMC routinely *filters* all of its groundwater samples before running them in the lab, thereby artificially lowering the reported concentrations of contaminants (see Tab-10 for details). Another example is how the company has failed to establish any surface water sampling stations in the Flambeau River immediately adjacent to the backfilled pit, where, according to FMC modeling, contaminants are leaching into the river (instead, the nearest downstream sampling station in the river is a full 500 feet or so from the pit; see Tab-4 for details). Additional problems with the FMC monitoring plan are discussed throughout my comments.

   In late 2018, FMC sought approval from the DNR to update its environmental monitoring plan for the project site, but the new plan, which was approved by the Department in late 2019 and went into effect in 2020, included no substantive changes to the company's earlier protocols except to reduce the scope and frequency of monitoring. For example: (1) FMC now reports a more limited test panel of groundwater contaminants from its monitoring wells; (2) all previous requirements for testing walleye in the Flambeau River for heavy metal accumulation have been lifted; (3) the company now reports Flambeau River surface water quality on a *voluntary* basis only (i.e., it's no longer required); (4) et cetera (see Tab-15 for details). Notably, this is the same monitoring plan that the DNR proposes to keep in force as part of the *Revised FMC Mining Permit* currently under consideration.

When the DNR sought public comment on FMC's updated monitoring plan in 2019, I submitted detailed comments in opposition to the plan, backed by expert reports submitted in tandem. Yet, none of the concerns raised in my submission were addressed by the DNR when issuing its final decision. Later, when questioned as to its rationale for rejecting my comments and the information contained in the expert reports, the Department either could not or would not provide an explanation (see Tab-15 for details). This wasn't and isn't right, so I hereby resubmit those same comments and expert reports to the Department, this time in opposition to the DNR's proposal to use FMC's "2020 Updated Monitoring Plan" as the basis for future monitoring at the Flambeau project site (see Tab-15 for a copy of the original submittal).

I think you can see that the matter at hand regarding whether or not to grant Flambeau Mining Company a COC for their reclamation activities in the industrial outlot is more complicated than might first appear. A *series* of events have taken place over the years that have brought us to where we are today, and that history, in addition to the most recent environmental monitoring data from the mine's industrial outlot, must be taken into account if the State of Wisconsin is to make an informed decision on this matter. That is what I have attempted to do in the following pages.

To organize my thoughts and hopefully make it easier for you to follow, I have divided the information I would like to convey into discreet sections (each marked by a tab), as indicated in the *Table of Contents*. In Tab-2 you will find a *Summary Table* of the issues that are discussed in greater detail in Tabs 3 through 16. An electronic version of my comments, found on a DVD inside the back cover, also includes *live links* to any technical reports that have been cited, so that, if desired, you can verify the facts for yourself. For a full list of cited references (all of which are also included on the DVD), see Tab-17. In addition, any figures referenced in the text can be found under Tab-18, and, as noted earlier, you can go to Tab-19 to view the credentials of cited experts.

Before going any further, please let me say this: A review of decisions made by the DNR over the years with regard to the Flambeau Mine exposes a *series* of regulatory missteps on the part of Department officials that have allowed serious surface and groundwater pollution problems at both the *active* mine site in the 1990s and the *reclaimed* site in the 2000s to go underreported, unchecked and unpenalized. Dr. Robert E. Moran, a hydrogeologist who was commissioned by citizens several years ago to review historical and modern Flambeau Mine documents, summed it up like this :

"In short, the Flambeau Mine is the poster child for a severely-flawed permitting and oversight process that has likely generated long-term public liabilities" (Moran, 2019).

Dr. Moran's report also included an Appendix that succinctly listed *numerous* inadequacies in the DNR-approved environmental monitoring program for the Flambeau project (Moran, 2019a), all of which were discussed in greater detail within the body of his report. His findings, along with concerns voiced by other consultants retained by citizens over the years to review FMC's monitoring program and environmental data, are what form the basis of my comments.

Don't get me wrong! In my dealings with the DNR over the past 25 years or so on Flambeau-related issues, I have encountered many good people who clearly have taken their responsibility to protect the State's resources seriously. And to those individuals I say "Thank You." But, as documented in a 2007 book I co-authored about the Flambeau Mine (Churchill, 2007), there always seemed to be someone higher up in the ranks who, whenever an important decision had to be made that pitted corporate interests against the public interest in environmental protection, ultimately called the shots and did so in FMC's favor. You can see for yourself by downloading a free copy of the book from the *Deer Tail Scientific* website and going to "Department of Natural Resources, Wisconsin" in the index, where you will find numerous stories of what has transpired over the years (https://deertailscientific.wordpress.com/book/).

Regardless of *who* has been responsible for what Dr. Moran referred to as the "severely flawed" oversight of the Flambeau project over the years, the net result has been a whitewashing of what FMC has been allowed to do to our public waters. And now the DNR decision-makers in Madison appear to be poised, once again, to gloss over what has happened to the ground and surface waters at the Flambeau Mine site and declare the industrial outlot successfully reclaimed. This needs to stop.

As noted by Dr. Moran in his report referenced earlier (Moran, 2019):

"Flambeau ground and surface water quality is being and has been degraded—despite years of industry public relations statements touting the success of the FMC operation. Rio Tinto said in a 2013 public relations (PR) release regarding the Flambeau Mine: "Testing shows conclusively that ground water quality surrounding the site is as good as it was before mining." In efforts to encourage development of the other metal-sulfide deposits in northern Wisconsin and the Great Lakes region, the industry approach has been to simply repeat this false statement over and over, assuming that repetition will make it believed[4]. Unfortunately, the FMC data show otherwise."

For reasons elaborated upon in Tabs 2 through 16 of my comments, I believe the most beneficial actions the state could take at this time with regard to the FMC petition are the following:

- **COC**. Summarily deny FMC a certificate of completion for its reclamation activities in the industrial outlot until such time that the company effectively deals with the Stream C impairment issue (see Tab-3 for documentation of the problem).

- **WPDES PERMIT**. As part of the *Revised FMC Mining Permit* currently under consideration by the Department, include provisions for a WPDES permit regulating the discharge of pollutants from the stormwater detention basin in the industrial outlot to Stream C. This is something the Department has failed to do, in error, in *any* of the surface water management plans approved for the outlot pursuant to the original FMC Mining Permit. See Tab-3 for details.

- **STREAM C MONITORING.** As part of the *Revised FMC Mining Permit* or by other legal means, require FMC to conduct additional Stream C surface water quality monitoring until the stream is no longer impaired, including, for example, a requirement for the company to reactivate surface water sampling stations SW-C1, SW-C5 and SW-C6 in Stream C (see Tab-18, Figure 6 for map) and establish an appropriate upstream control so that a true assessment of ongoing contaminant loading from the industrial outlot to Stream C and the Flambeau River can be made[5]. Said permit should also include provisions to expand the test panel historically used by FMC for Stream C surface water monitoring to include parameters recommended by experts but which have not been reported by the company. See Tabs 3 and 15 for details.

  NB: *WDNR allowed all Stream C monitoring requirements to expire in 2018 despite the stream's ongoing inclusion on the EPA's 303(d) list of impaired waters.*

- **FLAMBEAU RIVER SURFACE WATER MONITORING.** As part of the *Revised FMC Mining Permit* or by other legal means, require FMC to conduct Flambeau River water quality monitoring *in the stretch of the river adjacent to and/or immediately downstream of the reclaimed pit and intervention boundary wells that are in violation of permit standards* (something the company *never* has done)[6], and, for comparative purposes, continue reporting water quality data from the upstream and downstream sampling stations utilized historically by the company (currently done by FMC on a *voluntary* basis only).

  In addition, FMC should be required to expand the test panel currently used by the company for Flambeau River surface water samples to include parameters recommended by experts but not being reported (e.g., sulfate, aluminum, arsenic, etc.). In particular, the DNR's failure to require FMC to report sulfate concentrations in the river

[4] A collection of *Mining Industry Promotional Materials Featuring the Flambeau Mine* has been compiled by Deer Tail Scientific for educational purposes (DTS, 2019c).

[5] In the past, FMC has portrayed sampling stations SW-C8 and SW-C9 as "background" for Stream C (see Tab-18, Figure 6 for map), but, as pointed out by the DNR in a 2006 memo, the area where these sampling stations are located has likely been affected by copper input from the mine, thereby "confound[ing] meaningful data interpretation" (WDNR, 2006). As of this writing, FMC has yet to establish an appropriate "background" sampling station for Stream C.

[6] As noted earlier, FMC modeling shows that contaminants are leaching into the Flambeau River from the backfilled pit. Yet, FMC's nearest downstream sampling station in the river (used both historically and currently) is a full 500 feet or so from the pit (i.e., by no means adjacent to or immediately downstream of the pit); see Tab-4 for details.

is problematic. Not only was the Flambeau Deposit classified as a "massive sulfide", but FMC's own consultant (Foth, Green Bay, WI) has acknowledged sulfate to be a *key indicator parameter* for tracking the movement of contaminated groundwaters (Foth, 2004). This, in combination with the fact that: (a) elevated sulfate concentrations have indeed been measured in monitoring wells located between the backfilled mine pit and Flambeau River (see Tab-18, Figure 23 for sample graph); and (b) sulfate has the potential to adversely impact aquatic vegetation (e.g., wild rice), makes FMC's failure to report sulfate concentrations in the river even more egregious. See Tab-4 for additional details.

In addition to the above, FMC should be required to monitor Flambeau River surface water quality immediately upstream of the Stream C discharge point to the river (something the company *never* has done), continue reporting water quality data from the sampling station immediately downstream of the Stream C discharge point (something initiated in 2007 for a five-year period per the terms of the 2007 *Stipulation and Order* but currently done by FMC on a *voluntary* basis only), and expand the test panel as indicated above.

- **FLAMBEAU RIVER SEDIMENTS AND BIOLOGICAL MONITORING.** As part of the *Revised FMC Mining Permit* or by other legal means, require FMC to conduct sediment and biological monitoring *in the stretch of the river adjacent to and/or immediately downstream of the reclaimed pit and intervention boundary wells that are in violation of permit standards* (something the company *never* has done) and, for comparative purposes, reactivate the upstream and downstream sediment and biomonitoring sampling stations utilized by the company. Also include requirements for follow-up studies on the endangered and threatened species found in the vicinity of the project site prior to mine construction (something the company has not done). See Tabs 5 and 6 for details.

- **INDUSTRIAL OUTLOT GROUNDWATER MONITORING.** As part of the *Revised FMC Mining Permit* or by other legal means, require FMC to install groundwater monitoring wells in the industrial outlot.

  NB: *The DNR never required FMC to install any monitoring wells in the industrial outlot, this despite the fact that: (a) the outlot housed some of the dirtiest activities during mine operations (e.g., ore crushing and rail car loading); (b) plastic liners utilized by the company in the outlot were of limited utility; (c) FMC actually encouraged the seepage of contaminated waters into the soils beneath the outlot when infiltration basins were installed in 2011; and (d) when the infiltration basins malfunctioned early on and were eventually reconfigured in 2015, no liners were installed .* See Tab-7 for details.

- **GENERALIZED GROUNDWATER MONITORING**. As part of the *Revised FMC Mining Permit* or by other legal means, require FMC to start following best practices and submit data from both filtered ***and*** unfiltered groundwater samples collected from its wells at the reclaimed mine site (instead of reporting data from filtered samples only, as is the company's routine practice). As noted earlier, FMC's practice of filtering all groundwater samples before running them in the lab artificially lowers the reported concentrations of contaminants. It is also important to report data from *unfiltered* samples because, as noted by hydrogeologist Robert Moran, "most families using private wells or springs and all farms, livestock, wildlife, fish and vegetation, etc. *use and consume unfiltered water*" (Moran, 2019). See Tab 10 for more details.

  In addition, FMC should be required to expand its groundwater test panel to include parameters recommended by experts but not being reported by the company (e.g., aluminum, antimony, nickel, uranium, etc.). See Tab 11 for details.

- **DEED RESTRICTION AND BROWNFIELD DESIGNATION.** As part of the *Revised FMC Mining Permit* or by other legal means, require FMC to develop a land use restriction to limit incompatible uses and development of specified portions of the mining site (e.g., no residential or commercial wells should be allowed within the backfilled pit area due to groundwater contamination – see Tab-9 for onsite pollution data) and record said land use restriction with the Rusk County Register of Deeds. In addition, steps should be taken to list the FMC property as a brownfield site with state and federal authorities.

- **DEPARTMENT POLICY RE: MONITORING ENDANGERED SPECIES AT MINE SITES.** Revise Department policy to assure that, in the future, any endangered or threatened species identified in the vicinity of a mine site are monitored for impacts, and, if necessary, protective measures are put in place.

  NB: *As noted above, the DNR never required FMC to do any follow-up studies on the endangered and threatened species found near the Flambeau project site prior to mine construction. S*ee Tab-6 for details.

- **DEPARTMENT POLICY RE: MONITORING WATERS OF THE U.S. AT MINE SITES.** Revise Department policy to assure that, in the future, any waters of the United States that could be impacted by a mining project are identified and properly monitored (baseline and follow-up) and that any mining-related discharges to those waters are subjected to WPDES permit requirements (something not done at Flambeau with regard to Stream C – see Tab-3).

In the present hearing process, I imagine Department officials may, as they have in the past, point to Wis. Stats. 107.32 and 289.41(1m)(c) in an effort to assure interested parties that FMC will indeed be responsible, in perpetuity, for any environmental problems that may arise at the Flambeau Mine site *in the future*. But that is not what we are talking about here. Even if one could interpret said statutes to require this type of perpetual responsibility (which, upon close review of the statutes and related Natural Resource (NR) rules is debatable), the present hearing is dealing with what FMC has *already* done to the water at the Flambeau Mine site (not some hypothetical situation that may arise in the future) and whether or not the company's reclamation efforts should therefore be considered "complete" at this time. Any attempt to try to shift the focus of the present hearing to *future* liability is a red herring.

Please take the time to read through my comments. As you will see, the enclosed information deals with not only the present issue at hand (i.e., the COC), but also lays bare a number of regulatory deficiencies identified by Dr. Moran and other consultants who, over the years, have reviewed FMC's environmental monitoring program. It is my hope that, by relaying these findings to you and your colleagues at the Department and EPA, perhaps similar problems can be avoided if/when new mining projects are permitted in the future.

Thank you.

Laura Gauger

Laura Gauger, Chair
Deer Tail Scientific

Tab 2

Summary Table.

The table lists a number of Wisconsin DNR regulatory decisions regarding the Flambeau Mine that, in net sum, demonstrate a *pattern* of regulatory mismanagement of the project.

Each regulatory decision listed in the Summary Table
is discussed in greater detail under Tabs 3-16.

Summary Table:
DNR regulatory decisions regarding the Flambeau Mine that, in net sum, demonstrate a *pattern* of regulatory mismanagement of the project

As noted in my cover letter, the matter at hand regarding whether or not to grant Flambeau Mining Company (FMC) a Certificate of Completion (COC) of reclamation for the 32-acre industrial outlot at the Flambeau Mine site is more complicated than might first appear. A *series* of events have taken place over the years that have brought us to where we are today, and that history, in addition to the most recent environmental monitoring data from the mine's industrial outlot, must be taken into account if the State of Wisconsin is to make an informed decision on this matter.

A review of decisions made by the Wisconsin Department of Natural Resources (DNR) over the years with regard to the Flambeau project exposes numerous regulatory missteps on the part of Department officials that have allowed serious surface and groundwater pollution problems at both the *active* mine site in the 1990s and the *reclaimed* site in the 2000s to go underreported, unchecked and unpenalized. Dr. Robert E. Moran[1], a hydrogeologist who was commissioned by citizens several years ago to review historical and modern Flambeau Mine documents, summed it up like this:

"In short, the Flambeau Mine is the poster child for a severely-flawed permitting and oversight process that has likely generated long-term public liabilities" (Moran, 2019).

Dr. Moran's report included an *Appendix* that succinctly listed *numerous* inadequacies in the DNR-approved environmental monitoring program for the Flambeau project (Moran, 2019a), all of which were discussed in greater detail within the body of his report. I have listed some of those inadequacies in the following summary table along with concerns voiced by three additional experts retained by citizens over the years to evaluate FMC's environmental monitoring program: Dr. David M. Chambers[2], Dr. Kendra Zamzow[3], and Dr. Ken Parejko[4] (see Tab-19 for resumés).

If you care to learn more about any of the items listed in the summary table, you can go to whichever tab is referenced in the last column of the table (Tabs 3 through 16). All of the information provided for your review is fully referenced, and I have also included an *electronic* version of my comments, including *live links* to all cited references, on a DVD inside the back cover. That way, if desired, you can verify the facts for yourself. For a full list of cited references (all of which are also included on the DVD), see Tab-17. For any referenced figures, see Tab-18.

I am hoping that, by seeing the details of what Department officials in Madison have done (or failed to do) over the years with regard to regulating the Flambeau project, perhaps *someone* in a position of authority at the Department or EPA will conclude that, yes, there has been a *pattern* of regulatory mismanagement and find a way to: (1) put an end to the whitewashing of what has happened to the ground and surface waters at the Flambeau Mine site; (2) ensure that FMC properly monitors the situation and institutes a reclamation plan that effectively deals with the water contamination issues; and (3) put safeguards in place to make sure similar problems are avoided if/when new mining projects are permitted in the future.

---

[1] Dr. Robert E. Moran (hydrogeologist), Michael-Moran Associates, Golden, CO; remwater.org.
[2] Dr. David M. Chambers (geophysicist), Center for Science in Public Participation, Bozeman, MT; csp2.org.
[3] Dr. Kendra Zamzow (environmental geochemist), Center for Science in Public Participation, Chickaloon, AK; csp2.org.
[4] Dr. Ken Parejko (aquatic ecologist), Professor Emeritus, Department of Biology, University of Wisconsin-Stout, Menomonie, WI.

DNR regulatory decisions regarding the Flambeau Mine that, in net sum, demonstrate a *pattern* of regulatory mismanagement of the project [NB: each of the listed items is fleshed out in greater detail in Tabs 3-16]		
Issue Under Consideration	**Wisconsin DNR Regulatory Decision/Misstep**	**Learn More**
How to regulate the discharge of contaminated runoff from the Flambeau Mine industrial outlot to Stream C. **NB:** (1) Historically, the industrial outlot is where the mine's ore crusher, rail spur, runoff detention ponds, waste water treatment plant, a portion of the mine's high-sulfur waste rock stockpile and several small buildings were located (see Tab-18, Figure 1). (2) Stream C is a Flambeau River tributary that flows through the eastern portion of the Flambeau Mine industrial outlot and flows southwest for about a half mile before discharging directly into the Flambeau River. The stream was classified as "navigable" by the Wisconsin DNR in the 1990 *Environmental Impact Statement* for the Flambeau project and is therefore a Water of the United States subject to protections under Section 303(d) of the federal Clean Water Act. Over the years, FMC has used Stream C as a conduit for carrying contaminated stormwater runoff from various passive water treatment systems constructed within the industrial outlot to the Flambeau River (see Tab-18, Figures 2, 3 and 5).	Despite Stream C's classification as a Water of the United States and its close proximity to the rail spur, ore crusher and other mine facilities, Department officials never required any baseline water quality testing in the stream (1988-90) or any testing during mine construction (1991-1993) or mine operations (1993-1997). And even though the Department approved a work plan for the mine's industrial outlot in 1998 (as part of site reclamation) whereby FMC was allowed to use Stream C as an outright conduit for carrying contaminated stormwater runoff from a newly-constructed 0.9-acre biofilter in the outlot to the Flambeau River, the DNR still failed to require FMC to report any Stream C water quality data. Nor did the Department impose *any* restrictions on the amounts of contaminants that FMC could discharge from the biofilter (a point source) to the stream. All of this clearly ran afoul of the requirements of the National Pollution Discharge Elimination System (NPDES) permit program enshrined in the Clean Water Act. FMC started to report limited Stream C water quality data in 2002 and, as noted by Dr. David M. Chambers[1] in a 2009 Flambeau Mine report, copper concentrations in Stream C have significantly exceeded both chronic and acute water quality criteria (Chambers & Zamzow, 2009). FMC has reconfigured the biofilter on several different occasions to try to address the problem (most recently in 2015), but discharges from the detention basin to the stream remain unregulated by the Department. A graph showing the extent of copper contamination in Stream C immediately downstream of the industrial outlot demonstrates how the stream has paid the price for the DNR's inaction (see Tab-18, Figure 8). In 2012, Stream C was added to Wisconsin's Section 303(d) list of impaired waters for copper toxicity linked to the mine operation, and it remains listed to this day. Since baseline water quality data for Stream C is lacking, FMC has tried to suggest to the public that copper concentrations in the stream were perhaps *naturally* high, and some DNR officials have parroted the talking point. But, in a little-known 2004 memo to the Department, FMC acknowledged the following: *"Concern has been raised about the copper levels found in intermittent Stream C near the industrial outlot at the Flambeau Mine site. … In 2003, FMC evaluated the potential sources of the copper and determined that the rail spur area was the most likely source of the copper"* (FMC, 2004).	**Tab-3**

[1] Citizens retained *Center for Science in Public Participation* (Bozeman, MT; csp2.org) in 2009 to assess groundwater and surface water contamination at the reclaimed Flambeau Mine. Dr. David M. Chambers (geophysicist) assessed FMC's surface water data, and Dr. Kendra Zamzow (environmental geochemist) focused on groundwater issues. Two separate reports were issued (Chambers & Zamzow, 2009; and Chambers, Zamzow & Parejko, 2009), both of which were submitted to the Wisconsin DNR in 2009 and again in 2019 in efforts to inform Department decisions on issues of concern.

Issue Under Consideration	Wisconsin DNR Regulatory Decision/Misstep	Learn More
Where to locate surface water sampling sites for baseline and follow-up testing in the Flambeau River relative to the mine pit and Stream C discharge point – and what to include in the test panel. **NB:** The 32-acre Flambeau pit was located 140 feet from the Flambeau River and, per the terms of FMC's reclamation plan, is now backfilled with sulfide-containing waste rock and other mining-related wastes (e.g., all of the filter sands and sludges from the mine's waste water treatment plant), some of it amended with limestone. No liner was laid down in the pit before backfilling to retard contaminant migration. FMC's 1989 *Mining Permit Application* stated the following with regard to expected groundwater flow paths: *"… all of the groundwater flowing through the Type II* [high-sulfur] *waste rock in the reclaimed pit will exit the pit through the Precambrian rock in the river pillar and flow directly into the bed of the Flambeau River. Since this flow path is very short and occurs entirely within fractured crystalline rock, there will be little if any dispersion or retardation of the dissolved constituents in the groundwater. … Since there will be no dispersion, dilution, or retardation, in the river pillar, the concentrations of these constituents in the groundwater leaving the pit will be the same as the concentrations entering the river bed"* (Foth, 1989c). In addition to contaminated groundwaters entering the Flambeau River from the backfilled pit, contaminated surface waters from the mine's industrial outlot also reach the river via Stream C (see Tab-3).	As noted by Dr. Robert E. Moran[2], a hydrogeologist who was retained by citizens to conduct a comprehensive review of historical and modern FMC documents (Moran, 2019): *"Monitoring* [of Flambeau River surface waters] *was unacceptably limited both in terms of the number and location of sampling sites and the number of constituents reported. FMC established only two sampling sites in the Flambeau River, one upstream of the project site (SW-1) and the other (SW-2) roughly 500 feet downstream of the mine pit. No sampling was done in the mixing zones associated with either of the mine's two engineered outfalls to the Flambeau River (Outfall-001 and Outfall-002) or immediately adjacent to the pit."* In addition, Dr. Moran noted that FMC's so-called "downstream" monitoring site in the river (SW-2) is actually "*upstream of the discharge point of Stream C, a small Flambeau River tributary that crosses the FMC property and historically has been used as a conduit for conveying contaminated storm water runoff from the mine site to the Flambeau River*" (see Tab-18, Figure 7 for Flambeau River sampling site locations). In terms of the second issue raised by Dr. Moran, that of the sparse test panel utilized by FMC for Flambeau River surface water samples, a review of FMC's annual reports and DNR-approved environmental monitoring plans for the Flambeau project reveals that the Department has not even required FMC to routinely report *sulfate* in river water samples (FMC, 2018a; Foth, 2020), this despite the fact that: (a) the Flambeau Deposit was classified as a "massive sulfide"; (b) FMC's own consultant (Foth) has acknowledged sulfate to be a key indicator parameter for tracking the movement of contaminated groundwaters (Foth, 2004); (c) elevated sulfate concentrations have been detected in monitoring wells located between the backfilled mine pit and Flambeau River (see Tab-18, Figure 23); and (d) excessive sulfate concentrations are known to have adverse impacts on surface waters (e.g., wild rice production).	**Tab-4**
How to monitor for potential impacts to Flambeau River sediments and aquatic species (macroinvertebrates, crayfish and walleye), bearing in mind that the backfilled/reclaimed mine pit is just 140 feet from the river, and, in addition, Stream C discharges stormwater runoff from the industrial outlot to the Flambeau River roughly 0.4 mile downstream of the backfilled pit.	A series of expert reports authored by Dr. Ken Parejko[3], an aquatic ecologist who was retained by citizens to review Flambeau Mining Company's DNR-approved Flambeau River sediments and bio-monitoring program, reveals *numerous* flaws in study design and unacceptable levels of reporting errors (Parejko, 2009a – Sediments), (Parejko, 2009b – Macroinvertebrates), (Parejko, 2009c – Crayfish), (Parejko, 2009d – Walleye, & (Chambers, Zamzow & Parejko, 2009 – Recommendations). In addition, the DNR never required FMC to provide, nor did the company of its own volition provide any statistical analyses of the company's river-monitoring data to justify any conclusions drawn about whether or not the mine was adversely impacting the river. Dr. Parejko, who did perform the indicated statistical analyses, concluded that FMC's claims of the Flambeau River being fully protected from mine impacts were "over-reaching" and "not warranted".	**Tab-5**

[2] Citizens retained Dr. Robert E. Moran (hydrogeologist; Michael-Moran Associates, Golden, CO; remwater.org) in early 2017 to conduct a comprehensive review of historical and modern FMC documents and water quality data. He issued a summary of his initial findings in April 2017 (Moran, 2017), and the complete report was issued in 2019, posthumously (Moran, 2019) with the help of Dr. David M. Chambers (geophysicist; Center for Science in Public Participation, Bozeman, MT; csp2.org). Both reports were submitted to the Wisconsin DNR in 2019 in efforts to inform Department decisions on issues of concern.

[3] Citizens retained Dr. Ken Parejko (aquatic ecologist; Professor Emeritus, Department of Biology, University of Wisconsin-Stout, Menomonie, WI) in 2009 to review FMC's Flambeau River sediments and biomonitoring programs. He generated five separate reports, all of which were submitted to the DNR in 2009 and again in 2019 in efforts to inform Department decisions on issues of concern.

Issue Under Consideration	Wisconsin DNR Regulatory Decision/Misstep	Learn More
How to monitor for potential impacts to endangered and threatened species discovered in the Flambeau River near the mine site prior to mine construction, bearing in mind that the backfilled/reclaimed mine pit is just 140 feet from the river, and, in addition, Stream C discharges stormwater runoff from the industrial outlot to the Flambeau River roughly 0.4 mile downstream of the backfilled pit. **NB:** A number of endangered or threatened mussel and dragonfly species were discovered in the Flambeau River near the mine site in 1991, shortly before construction of the open pit was set to begin. The discovery was considered significant enough by the courts to impose a temporary injunction on mine construction while a *Supplemental Environmental Impact Statement* regarding the species was prepared by the Wisconsin DNR.	The DNR failed to require FMC to conduct any follow-up testing to determine the fate of any of the endangered or threatened species found in the Flambeau River. As noted by Dr. Ken Parejko in his macroinvertebrate report cited earlier (Parejko, 2009b): *"The lack of appropriate close monitoring of any endangered or threatened species in ecosystems potentially impacted by mining activities should be viewed as a significant shortcoming of efforts to protect these ecosystems."*	**Tab-6**
Where to drill wells within the industrial outlot for monitoring baseline and follow-up groundwater quality.	Even though the ore crusher, crushed ore stockpile, rail spur, several different holding ponds (for contaminated runoff), and a portion of the mine's high-sulfur waste rock stockpile were all located within the area currently known as the "Industrial Outlot", Department officials did not require FMC to establish any monitoring well (MW) locations within this area for either baseline or follow-up water quality testing. **Hence, no groundwater quality data, baseline or follow-up, exists for the Industrial Outlot** (see Tab-18, Figure 12 for monitoring well locations)**.** Considering that other monitoring wells drilled by FMC nearby to the industrial outlot are showing contaminant levels that "greatly exceed baseline data and relevant water quality standards and aquatic life criteria" (Moran, 2019), surely it would be premature for the State of Wisconsin to award a "Certificate of Completion" to FMC for its reclamation of the Industrial Outlot without having any evidence of the current status of the groundwater beneath it.	**Tab-7**
How to regulate groundwater contamination at the Flambeau Mine site vis-à-vis establishment of a "Compliance Boundary" for enforcement of groundwater quality standards. **NB:** The DNR-established compliance boundary for the Flambeau project encircles the project site (backfilled mine pit, industrial outlot, etc.) and also extends to the opposite (west) side of the Flambeau River from the mine.	See Tab-18, Figure 13 for a diagram showing the Flambeau Mine compliance boundary. As noted by hydrogeologist Robert E. Moran in his report cited earlier (Moran, 2019): *"The Wisconsin DNR failed to define viable compliance measures for the FMC operation as revealed by the following:* • *The state-established compliance boundary for enforcement of ground water quality standards extends to the opposite (west) side of the Flambeau River from the mine. Because there is no groundwater monitoring across the Flambeau River, the boundary ignores possible impacts to the water quality of the river, and to groundwater on the west side of the river;* • *The compliance wells are inadequate in number and location; only one set of nested wells (MW-1015A/B) is located anywhere near the* [3.5-mile long] *compliance boundary … and it appears to be positioned outside the main ground water flow path identified by FMC"* (see Tab-18, Figure 14). FMC consultant Foth has maintained that the Flambeau River serves as a barrier to groundwater migration in a westerly direction, so no monitoring is needed beyond the river (Foth, 1989c). Dr. Moran, however, who referred to Foth's narrative predictions regarding groundwater impacts at the Flambeau project site as "largely naïve geochemically and hydrogeologically", pointed out that the river is only about 5 ft deep in the vicinity of the 225-ft deep mine pit (see Tab-18, Figure 16).	**Tab-8**

Issue Under Consideration	Wisconsin DNR Regulatory Decision/Misstep	Learn More
What to use as the numeric groundwater quality criteria for intervention boundary wells located between the backfilled mine pit and Flambeau River – and what to do if those standards are exceeded.	Instead of relying on DNR scientific staff to determine appropriate groundwater quality criteria for the Flambeau Mine's intervention boundary wells that would be protective of the Flambeau River, Department officials allowed FMC to determine what some of those standards were to be, based on the company's *predictive modeling* of contaminant concentrations expected within the waters of the backfilled pit (WDHA, 1991; see page 92 of the document). Not only did those concentrations have nothing to do with what would be protective of the river, but the FMC predictions turned out to be highly inaccurate (Moran, 2019; see pages 49-50) (see Tab-18, Figure 17 for sample graph). Despite the fact that some of the FMC-generated permit standards as well as other relevant water quality standards and criteria have been and continue to be exceeded in several intervention boundary wells near the river, no citations have been issued (see Tab-18, Figures 20, 21 and 23 for sample graphs). Dr. Moran summed up the situation as follows: *"Some of the ground water compliance criteria and standards applicable to the project were generated via largely-useless predictions made by FMC's consultant. … Despite numerous exceedances of these and other relevant standards and criteria, the DNR has taken no meaningful enforcement actions. Thus, the contaminated FMC ground waters represent a 'sacrifice zone'"* (Moran, 2019).	Tab-9
How to process groundwater samples submitted for testing.	The DNR has allowed and continues to allow FMC to *filter* all Flambeau groundwater samples before running them in the lab instead of requiring the company to follow best practices and report both filtered (dissolved) *and* unfiltered (total) concentrations. The latter, of course, undoubtedly would expose higher levels of contamination, as discussed at length by Dr. Robert Moran in his report cited earlier (Moran, 2019). Reporting totals is also important because, as noted by Dr. Moran: "… most families using private wells or springs and all farms, livestock, wildlife, fish and vegetation, etc. *use and consume unfiltered water."* This apparent trick of the trade, whereby a mining company's publicly-available groundwater monitoring data only reflects analyses of filtered samples, from which, as Dr. Moran noted, *"some, if not most of the chemical components have been removed by the filtering,"* was slipped by DNR regulators in not only the original *Quality Assurance Plan* approved by the Department for the Flambeau project (Foth, 1993), but the updated monitoring plan recently approved (Foth, 2020).	Tab-10

Issue Under Consideration	Wisconsin DNR Regulatory Decision/Misstep	Learn More
What constituents to include in the groundwater test panel for the Flambeau project.	In addition to allowing FMC to report only *filtered* groundwater data from their wells at the Flambeau Mine project site (see Tab-10), it appears the Wisconsin DNR fell victim to yet another trick of the trade used by the mining industry to limit liability for emergent water pollution problems. Here is what hydrogeologist Robert Moran observed with regard to the *limited scope of constituents* included in the DNR-approved groundwater test panel used by FMC (Moran, 2019): *"Most metal-mine projects with which I have familiarity, both domestically and internationally, begin with company-compiled baseline data that may appear to be extensive, but which inevitably suffer from huge gaps that make ascribing technical and legal responsibility for later impacts extremely difficult. The same is true for the Flambeau baseline data, which was compiled by FMC and their consultants. For example, a comparison of the 1989 EIR baseline data reported by FMC – ground water and surface water – with test panels later adopted for routine monitoring shows that many trace constituents detected and reported in 1989 were lost to follow-up monitoring (e.g., uranium and aluminum) and others were never determined to begin with or at least reported publicly (e.g., antimony)."* Dr. Kendra Zamzow[4] voiced similar concerns years earlier in a 2009 Flambeau Mine report. In particular, she suggested that nickel, cobalt, aluminum, uranium and radioactivity should be added to FMC's groundwater test panel (Chambers & Zamzow, 2009). The Department, however, did not act on her well-reasoned recommendations.	Tab-11
The DNR's 1989 decision to grant FMC an exemption to NR 132.18(1)(c) of the *Wisconsin Administrative Code*, the Department rule that stated a mine shall not be constructed "within 300 feet of a navigable river or stream". The exemption allowed FMC to construct the Flambeau Mine pit 140 feet from the Flambeau River. **NB:** NR 132.18(1)(c) has since been amended and renumbered to NR 132.110(1)(c). The current setback requirement specified in the rule is 500 feet, which further brings into question the DNR's 1991 decision to allow FMC to construct the Flambeau pit just 140 feet from the Flambeau River.	FMC needed a variance to the DNR's 300-foot setback rule because it wanted to dig its pit 140 feet from the Flambeau River to capture additional ore. To put it into perspective, consider this: There are 12 city blocks in a mile, so granting the variance meant the pit would be less than 1/3 of a block from the river. The public voiced concerns over the company's plans, but FMC assured them the bedrock between the pit and river provided "a barrier stronger than the Hoover Dam" and would hold back any contaminants (see Tab-18, Figure 22). Only later did citizens learn that the claim was false and disingenuous, as FMC's 1989 *Mining Permit Application* had stated the following with regard to the company's own modeling (Foth, 1989c): *"… all of the groundwater flowing through the Type II [high-sulfur] waste rock in the reclaimed pit will exit the pit through the Precambrian rock in the river pillar and flow directly into the bed of the Flambeau River. Since this flow path is very short and occurs entirely within fractured crystalline rock, there will be little if any dispersion or retardation of the dissolved constituents in the groundwater. … Since there will be no dispersion, dilution, or retardation, in the river pillar, the concentrations of these constituents in the groundwater leaving the pit will be the same as the concentrations entering the river bed."* Despite knowing the above, the DNR recommended granting FMC a variance to the Department's 300-foot setback rule, and it was written into the *Flambeau Mine Permit* (WDHA, 1991).	Tab-12

[4] Citizens retained *Center for Science in Public Participation* (Bozeman, MT; csp2.org) in 2009 to assess groundwater and surface water contamination at the reclaimed Flambeau Mine. Dr. David M. Chambers (geophysicist) assessed FMC's surface water data, and Dr. Kendra Zamzow (environmental geochemist) focused on groundwater issues. Two separate reports were issued (Chambers & Zamzow, 2009; and Chambers, Zamzow & Parejko, 2009), both of which were submitted to the Wisconsin DNR in 2009 and again in 2019 in efforts to inform Department decisions on issues of concern.

Issue Under Consideration	Wisconsin DNR Regulatory Decision/Misstep	Learn More
The DNR's 1989 decision to grant FMC an exemption to NR 132.18(1)(d) of the *Wisconsin Administrative Code*, the Department rule that states a mine shall not be constructed "within a floodplain". **NB:** NR 132.18(1)(d) has since been renumbered to NR 132.110(1)(d).	The DNR granted FMC an exemption to the Department's floodplain rule, allowing the Flambeau Mine and all its features (pit, waste rock stockpiles, wastewater detention ponds, etc.) to be constructed within the floodplain of the Flambeau River (WDHA, 1991). Apparently neither FMC nor the Department thought there was any substantial risk of flooding at the project site. Unfortunately, though, Ladysmith experienced a "hundred-year flood" while the mine was in operation, resulting in the Flambeau River coming to within 20 horizontal and 4 vertical feet of spilling into the mine pit, a near-catastrophe (see Tab-18, Figure 24).	Tab-13
The DNR's failure to object to FMC's demand that groundwater and Flambeau River environmental monitoring results not be allowed into evidence at the contested case hearing over the company's initial (2007) request for a Certificate of Completion (COC) of reclamation for the Flambeau Mine project site. **NB:** Flambeau Mining Company sought a COC for successful reclamation of the *entire* 181-acre Flambeau Mine site in 2007, resulting in a contested case hearing. FMC's position was that the issues to be considered at the hearing were *"simple"* and should be *"limited to essentially 'checking off' whether FMC has or has not completed certain specified reclamation tasks and met specified revegetation performance standards"* (FMC, 2007b). Any discussion of performance standards related to groundwater quality, Flambeau River surface water quality or the protection of fish and other aquatic species in the Flambeau River was considered off limits by FMC. The company ultimately was awarded a COC, but only for the 149-acre section of the mine site encompassing the backfilled pit and *not* for mine's 32-acre industrial outlot. .	The DNR's failure to object to FMC's position that the scope of the COC hearing should be limited to those topics deemed appropriate by the company doomed the hearing, for the most part, to a discussion of issues that were topical rather than substantive in nature, as reflected in the *Ruling on Statement of Issues* handed down by the Administrative Law Judge (WDHA, 2007a). In effect, the Department's acquiescence on this matter allowed FMC to set most of the terms for what defined successful reclamation, and the bar was set very low. The following issues were among those disallowed from consideration at the 2007 contested case hearing, even though they were directly related to the success (or lack thereof) of FMC's reclamation efforts (WDHA, 2007a): • groundwater contamination within the reclaimed mine pit that significantly exceeded levels predicted by FMC in permitting documents; • exceedances of Flambeau Mine Permit standards in monitoring wells located between the reclaimed pit and Flambeau River; and • data regarding potential adverse impacts of the mine on fish and other aquatic life in the Flambeau River (including endangered and threatened species found near the project site prior to mine construction). Instead of factoring the above issues into its decision regarding whether or not FMC had successfully reclaimed the backfilled pit, the DNR awarded the company a COC for that portion of the project site based solely on the company's completion of backfill operations according to plan and successful revegetation of the surface.	Tab-14
The DNR's 2019 decision to grant a request from FMC to scale back environmental monitoring requirements at the reclaimed Flambeau Mine site; and the DNR's decision to incorporate the same scaled-back monitoring plan into the *Revised FMC Mining Permit* under consideration in 2022.	Despite the precarious groundwater situation at the reclaimed Flambeau Mine site (see Tab-9 for details) and the ongoing impairment of Stream C in the mine's industrial outlot (see Tab-3 for details), the DNR approved the scaled-back monitoring plan proposed in late 2018 by FMC with little modification. When later questioned as to its rationale for rejecting science-based recommendations and expert reports submitted in opposition to the plan during the public hearing process, the Department could provide no explanation. In addition, the DNR now proposes to incorporate the same scaled-back monitoring plan into the *Revised FMC Mining Permit* currently under consideration even though the above-noted surface and groundwater contamination problems persist.	Tab-15

Issue Under Consideration	Wisconsin DNR Regulatory Decision/Misstep	Learn More
What to include as central "Findings of Fact" in the evaluation of FMC's 2022 request for a certificate of completion (COC) of reclamation of the 32-acre industrial outlot at the Flambeau Mine site. **NB:** As noted above, Flambeau Mining Company sought a COC for successful reclamation of the *entire* 181-acre Flambeau Mine site in 2007, resulting in a contested case hearing. The company ultimately was awarded a COC, but only for the 149-acre section of the mine site encompassing the backfilled pit and *not* for mine's 32-acre industrial outlot. At issue was ongoing surface water contamination in a tributary of the Flambeau River that crosses a portion of the industrial outlot. As part of the 2007 proceedings, a legally-binding *Stipulation and Order* was handed down that, among other things, identified issues to be considered if/when FMC reapplied for a COC covering the industrial outlot.	When presenting its "Findings of Fact" in support of the Department's decision to grant the COC sought by FMC in 2022, the DNR failed to incorporate a key provision of the *Stipulation and Order* handed down in 2007 that identified issues to be considered in any future hearing over the COC. As a result of the omission, critical issues impacting the advisability of granting the COC were not addressed or even acknowledged by the Department when rendering its decision to grant the COC.	Tab-16
References.		Tab-17
Figures.		Tab-18
Credentials.		Tab-19

Tab 3

Regulatory Issue:

How to regulate the discharge of contaminated stormwater runoff from the Flambeau Mine industrial outlot to Stream C.

DNR Regulatory Mismanagement of the Flambeau Project

Tab-3

Issue under consideration:
How to regulate the discharge of contaminated runoff from the Flambeau Mine industrial outlot to Stream C.

NB:
(1) Historically, the industrial outlot is where the mine's ore crusher, rail spur, runoff detention ponds, waste water treatment plant, a portion of the mine's high-sulfur waste rock stockpile and several small buildings were located (see Tab-18, Figure 1 for schematic).

(2) Stream C is a Flambeau River tributary that originates in an area just northeast of where the rail spur was located during mining, flows through the eastern portion of the Flambeau Mine industrial outlot and then meanders in a southwesterly direction for about a half mile before discharging directly to the Flambeau River. As such, Stream C provides a hydric connection between the industrial outlot and river (see Tab-18, Figures 2 through 7 for maps and diagrams showing the hydric connection).

(3) Stream C was classified as navigable in the 1990 *Environmental Impact Statement* for the Flambeau project (WDNR, 1990) and identified as such in the *Flambeau Mine Permit* (WDHA, 1991). It is therefore a Water of the United States subject to protections under Section 303(d) of the federal Clean Water Act. Over the years, FMC has used Stream C as a conduit for carrying contaminated stormwater runoff from the industrial outlot to the Flambeau River. It discharges to the river roughly 0.4 mile downstream of the backfilled pit.

Wisconsin DNR Regulatory Decision/Misstep:
Despite Stream C's classification as a Water of the U.S and its close proximity to the rail spur, ore crusher and other mine facilities, Department officials never required any baseline water quality testing in the stream (1988-90) or any testing during mine construction (1991-1993), mine operations (1993-1997) or early reclamation activities (1997-2001). Nor did the Department, in either the Mine Permit or *any* of the subsequently-approved reclamation plans (not even the most recent plan approved in 2015), impose *any* restrictions on the amounts of contaminants that FMC could discharge to the stream. All of this clearly ran afoul of the requirements of the National Pollution Discharge Elimination System (NPDES) permit program enshrined in the Clean Water Act.

A graph showing the extent of copper contamination in Stream C over the years at sampling station SW-C1 (immediately downstream of the Flambeau Mine industrial outlot) demonstrates how the stream has paid the price and continues to pay the price for the DNR's inaction (see Tab-18, Figure 8).

Discussion:
The *Flambeau Mine Permit,* approved by the Wisconsin Division of Hearings and Appeals in January 1991 (WDHA, 1991), failed to include any monitoring requirements or protective measures for Stream C. The DNR's failure to include any such provisions was particularly egregious because the stream, which crosses the eastern portion of the industrial outlot, ran nearby to where various mining-related facilities with the potential to generate metal-laden dusts and contaminated stormwater runoff were located. Here is how DNR scientific staff described the risk factors for Stream C contamination in a 2012 report (WDNR, 2012b).

"*A review of FMC reports to DNR, and other Flambeau mine related documents, suggests several mining activities that could have resulted in the dispersal of copper-bearing ore throughout adjacent areas during the period the mine was in operation. Mining activities such as blasting, bulldozing, truck loading and unloading, ore crushing (up to 250 tons per hour) and rail car loading (State of Wisconsin 1991) could have generated quantities of fine dust that could have been transported by the wind and deposited on nearby areas. Some losses of fine particulate ore and ore oxidation products from rail car spillage on the rail spur (FMC 2004) are also likely.*"

Another potential source of contamination to Stream C was *stormwater runoff* from the mine's rail spur and mammoth high-sulfur waste rock stockpile, both located within feet of the stream (see Tab-18, Figure 1). Yet, no monitoring requirements for Stream C surface water quality were imposed by the DNR.

Department officials also approved a work plan for the industrial outlot in 1998 (as part of site reclamation) whereby FMC was allowed to use Stream C as an outright conduit for carrying contaminated stormwater runoff from a newly-constructed 0.9-acre biofilter in the outlot to the Flambeau River (see Tab-18, Figures 2 and 3; please note that the "0.9-acre Biofilter" shown in the figures is in the same location as the "Surge Pond" shown in Tab-18, Figure 1). Even then, however, Department officials still failed to require any monitoring of the stream's water quality or place any restrictions on the amounts of contaminants discharged from the biofilter to the stream. In other words:

The Department repeatedly failed to fulfill its duty, as the administrator of the Clean Water Act in Wisconsin, to implement a central requirement of the NPDES permit program.

Reports submitted by FMC to the DNR reveal that, between 1999 and 2001, copper concentrations in the *biofilter outlet* to Stream C ranged from 25 ug/L (4.5 times the ATC[1]) to 91 ug/L (17 times the ATC) (FMC, 1999; FMC, 2001a; FMC, 2002), but it wasn't until June 2002 that FMC reported any water quality data for Stream C itself (FMC, 2003). At that time, the copper concentration at a surface water (SW) sampling location immediately south (downstream) of the industrial outlot (sampling site SW-C1) was 30 ug/L, about 8 times the ATC. At the stream's outlet to the Flambeau River (SW-C6), it was 22 ug/L, 3.4 times the ATC (see Tab-18, Figure 6 for sampling site locations). No citations were issued.

Despite the above-noted violations of state water quality standards, the Department failed to require FMC to report any additional Stream C surface water quality data until 2004, at which point toxic copper concentrations (and sometimes zinc) were again reported in the stream. Consistent with those findings, a 2005 *Bioassessment of Stream C* conducted by FMC found the following: "The stream appears to be very limited in biota in all aspects including aquatic vegetation, macroinvertebrate populations, and fish" (FMC, 2005).

Additional monitoring requirements for Stream C were finally instituted in 2007, but not on the Department's initiative. Rather, it was the result of citizen and tribal participation in a contested case hearing over FMC's initial (2007) request for a Certificate of Completion (COC) of reclamation for the 181-acre project site (including the 32-acre industrial outlot). Due to ongoing surface water contamination in Stream C, the objecting parties were able to secure a *Stipulation and Order* from the Administrative Law Judge that not only excluded the industrial outlot from the COC, but required FMC to report, among other things, additional Stream C and Flambeau River water quality data for a 5-year period (2007-2012) (WDHA, 2007b). See Tab-18, Figure 7 for the surface water sampling locations required per the terms of the *Stipulation and Order*.

For a graphic representation of the Stream C monitoring data collected pursuant to the *Stipulation and Order* (and additional Stream C data collected over time), see Tab-18, Figure 8. It's clear that Stream C was/is in trouble.

In 2009, citizens solicited the help of geophysicist David M. Chambers and environmental geochemist Kendra Zamzow[2] to identify any areas of concern with regard to surface and groundwater contamination at the reclaimed Flambeau Mine site. While Dr. Zamzow focused on groundwater issues (see Tabs 9 and 11), Dr. Chambers offered the following observations with regard to FMC's biofilter, Stream C and Flambeau River water quality data (Chambers & Zamzow, 2009):

"It should be noted that copper in Stream C … exceeds Wisconsin water quality standards both at the discharge from the wetland/biofilter and from Stream C as it flows into the Flambeau River. … With copper levels significantly exceeding both chronic and acute water quality criteria, it is likely that these high metal levels are contributing to the lack of aquatic life in Stream C. These levels also suggest that better monitoring of Stream C and the Flambeau River below Stream C should be done."

[1] As defined in NR 105.03(2) of the *Wisconsin Administrative Code*, "Acute Toxicity Criterion" or "ATC" means the maximum daily concentration of a substance which ensures adequate protection of sensitive species of aquatic life from the acute toxicity of that substance and will adequately protect the designated fish and aquatic life use of the surface water if not exceeded more than once every 3 years." Wisconsin's ATC for copper is hardness-dependent and calculated according to formulas appearing in Section NR 105.06 of the *Code* If, for example, a water sample has a hardness of 35 mg/L, the ATC for copper is 5.8 ug/L, but if the hardness increases to 50 mg/L, the ATC increases to 8.1 ug/L.

[2] Citizens retained *Center for Science in Public Participation* (Bozeman, MT; csp2.org) in 2009 to assess groundwater and surface water contamination at the reclaimed Flambeau Mine. Dr. David M. Chambers (geophysicist) assessed FMC's surface water data, and Dr. Kendra Zamzow (environmental geochemist) focused on groundwater issues. Two separate reports were issued (Chambers & Zamzow, 2009; and Chambers, Zamzow & Parejko, 2009), both of which were submitted to the Wisconsin DNR in 2009 and again in 2019 in efforts to inform Department decisions on issues of concern.

Dr. Chambers continued: "*The discharge from the outlet of the wetland treatment system* [i.e., biofilter] *should meet Wisconsin water quality standards at that point. There is not enough dilution in Stream C to effectively dilute contaminants, so any contaminant will impact aquatic organisms along most or all of the length of Stream C. Because of this fact, Stream C is being presently used as a conduit for contaminated water from the mine site to the Flambeau River, where dilution by the large volume of water in the river occurs*."

In his 2009 report, Dr. Chambers also commented on the Flambeau River water quality data that had been submitted by FMC to the DNR in 2007 and 2008 per the terms of the 2007 *Stipulation and Order.* Acknowledging that the number of data points was limited, he still was able to make several observations with regard to copper concentrations measured at sampling sites SW-2 and SW-3 in the river (see Tab-18, Figure 6 for sampling site locations). In particular, he noted that, in April 2008, the copper concentration at SW-3 (immediately downstream of the Stream C discharge point) was approximately *double* the Wisconsin chronic water quality standard, while the copper concentration measured at SW-2 (downstream of the backfilled mine pit but upstream of the Stream C discharge point) was *below* the standard. Dr. Chambers concluded that more data was needed to better assess the situation and included specific recommendations in his report for how best to accomplish.

For example, FMC had reported water quality data near Stream C's outlet to the Flambeau River (sampling site SW-C6) on only a few occasions, most recently in 2005. Dr. Chambers found this unacceptable and stated the following:

"In order to address the question of the amount of copper contamination entering the Flambeau River from Stream C, and the increase in copper at SW-3, water quality samples should be taken in Stream C just prior to its discharge point into the Flambeau River. This should be done by reactivating sampling station SW-C6, which was sampled from September, 2004 to June, 2005."

Unfortunately, however, the DNR placed no such requirement on FMC. Nor did they act on Dr. Chambers' recommendation to increase sampling frequency in Stream C and expand the test panel to look for the presence of other potential contaminants. Similar recommendations, unheeded by the Department, were also made by Dr. Chambers with regard to water samples collected in the Flambeau River at sampling stations SW-1, SW-2 and SW-3 (Chambers, Zamzow & Parejko, 2009; see Tab-4 for details specific to FMC's river-monitoring program).

In late 2010, citizens explored the possibility of petitioning the DNR to add Stream C to Wisconsin's Section 303(d) list of impaired waters and solicited the help of Dr. Chambers once more, this time to review all of FMC's biofilter and Stream C water quality data on file with the Wisconsin DNR (including, as a subset, data submitted by FMC per the terms of the 2007 *Stipulation and Order*). As part of his review, Dr. Chambers organized the FMC data into a comprehensive spreadsheet covering the time period of 1999-2010 (Chambers, 2010). Since the data showed repeated exceedances of Wisconsin surface water quality criteria for copper and zinc, the table was submitted to the DNR in support of the citizen petition (WDNR, 2012a - see electronic pages 3 and 22-34 of the report for Stream C monitoring data)[3].

Commendably, DNR scientific staff in the Department's Spooner and Park Falls field offices conducted their own study of Stream C (including, among other things, data collection at sampling site SW-C6 in Stream C) and issued a report in April 2012 entitled *Surface Water Quality Assessment of the Flambeau Mine Site.* In it, they concluded the following (WDNR, 2012b):

"Water quality monitoring done at the site between 2002 and 2011 showed that Stream C and its contributing drainageways contained copper and zinc concentrations that frequently exceeded acute toxicity criteria (ATC). On average, copper exceeded ATC's in 92% of samples, and zinc exceeded ATC's in 46% of samples."

[3] When the DNR issued their compilation of "Public Data Submittals" in 2012, for some unknown reason they failed to include some of the most incriminating biofilter data that had been included in the table compiled and submitted by Dr. Chambers. His data table, in its entirety, can be accessed online (Chambers, 2010).

As a separate matter, Stream C *sediment* data collected per the terms of the 2007 *Stipulation and Order* also demonstrated a potential connection between mining activities and Stream C contamination issues. As noted in a 2009 report authored by aquatic ecologist Ken Parejko[4], the one-time sampling event in Stream C showed "very high copper concentrations compared with those found in Flambeau River sediments at any other time or place in the FMC study." He concluded: "Unusually high copper and zinc concentrations in a sampling site within the bed of intermittent Stream C indicate a possible entrance-point for some potential toxins into the Flambeau River" (Parejko, 2009a).

With all of the above data at its disposal, the Department's scientific staff proceeded to recommend to the Environmental Protection Agency (EPA; "Agency") that Stream C be added to Wisconsin's 303(d) list of impaired waters, effective April 2012, and the Agency concurred. There were a few oddities with the listing, however:

- The official EPA approval document listed only the portion of Stream C *immediately south (downstream)* of the industrial outlot as impaired (USEPA, 2014), this despite the fact that the portion of the stream *within* the outlot was also registering elevated copper and zinc concentrations that exceeded state standards, as documented in the Public Data Submittal (WDNR, 2012a); and

- The EPA approval document listed the source of the Stream C pollution as "unknown", even though, as noted earlier, Department field staff had clearly identified FMC's mining activities as the probable source of the contamination (WDNR, 2012b). In addition, while FMC *publicly* tried to suggest that the copper and zinc concentrations in Stream C were perhaps *naturally* high, the company itself acknowledged the following in a 2004 memo to the DNR obtained through a public records request:

  "Concern has been raised about the copper levels found in intermittent Stream C near the industrial outlot at the Flambeau Mine site. … In 2003, Flambeau Mining Company evaluated the potential sources of the copper and determined that the rail spur area was the most likely source of the copper" (FMC, 2004)**.**

In early 2011, even before Stream C was officially added to Wisconsin's 303(d) list of impaired waters, the Wisconsin Resources Protection Council (WRPC; Tomahawk, WI), Center for Biological Diversity (CBD; Tucson, AZ) and Laura Gauger (Duluth, MN) filed a complaint against Flambeau Mining Company in the U.S. District Court for the Western District of Wisconsin, alleging ongoing violations of the federal Clean Water Act at the Flambeau Mine site (WRPC, 2011a). The plaintiffs' legal argument was that FMC was in violation of the Act because it had never obtained a federally-mandated National Pollution Discharge Elimination System (NPDES) permit to regulate the discharge of contaminated stormwater runoff from the man-made detention basin or "biofilter" in the mine's industrial outlot (point source) to Stream C (a water of the U.S.), and now the stream was impaired. FMC, on the other hand, sought to convince the court that the company's *mining permit* issued by the State of Wisconsin fulfilled the requirements of the Act (even though the permit had placed no restrictions on the amount of copper, zinc, iron and other pollutants discharged to Stream C from the detention basin).

In April 2012, U.S. District Judge Barbara Crabb handed down an opinion and order regarding various motions for summary judgment filed by the two parties (WRPC, 2012a). The ruling was overwhelmingly in the plaintiffs' favor, including Judge Crabb's conclusion that FMC's state-issued mining permit did *not* qualify as a permit under the federal Clean Water Act.

A week-long trial was held in Madison, Wisconsin in May 2012. Key evidence submitted by the plaintiffs included the Wisconsin DNR study cited above (WDNR, 2012b). In it, the Department's scientific staff assessed, among other things, copper and zinc concentrations in Stream C and the stormwater detention basin at issue. They looked at old data, collected new data and found that toxicity standards set to protect fish and other aquatic species were *routinely* exceeded in the stream. The plaintiffs also submitted a sworn affidavit to Judge Crabb detailing the DNR's recommendation to the EPA in late 2011 that Stream C be added to the Agency's 2012 Section 303(d) list of impaired waters for copper and zinc toxicity (WRPC, 2011b) .

[4] Citizens retained Dr. Ken Parejko (aquatic ecologist; Professor Emeritus, Department of Biology, University of Wisconsin-Stout, Menomonie, WI) in 2009 to review FMC's Flambeau River sediments and biomonitoring programs. He generated five separate reports (Parejko, 2009a – Sediments; Parejko, 2009b – Macroinvertebrates; Parejko, 2009c – Crayfish; Parejko, 2009d – Walleye; and Chambers, Zamzow & Parejko, 2009 – Recommendations), all of which were submitted to the DNR in 2009 and again in 2019 in efforts to inform Department decisions on issues of concern.

FMC, too, had key evidence for the judge to consider. After the lawsuit was filed by the plaintiffs, but before it went to trial, the company implemented a new reclamation work plan at the mine site that involved converting the biofilter (the source of the pollution at the heart of the plaintiffs' complaint) into an infiltration basin with no outlet to Stream C (Foth, 2011; see Tab-18, Figure 4). The idea was that the contaminated water would now seep into the earth instead of discharging to Stream C, a plan that plaintiffs viewed as a thinly-veiled attempt by FMC to undercut their case. The company's consultant for the project, James Hutchison of Foth Engineering (Green Bay, WI), presented information about the infiltration basin to the court, seeming to suggest that any problems that might have existed at the mine site were now fixed. During the trial, Hutchison even assured the Judge, under oath, that the new infiltration basin would withstand a 100-year flood event.

Judge Crabb issued her final opinion & order in July 2012 and ruled in the plaintiffs' favor (WRPC, 2012b). She wrote:

"*Judgment is GRANTED in favor of plaintiffs on their claim that defendant discharged a pollutant from a point source that entered a water of the United States and that it did not have a permit issued under the Clean Water Act when it did so.*"

She also noted that the Clean Water Act *"does not recognize good faith or lack of knowledge as defense; civil liability is strict."*

In her ruling, Judge Crabb also opined on the *seriousness* of the FMC violation. Surprisingly, and despite the fact that the Wisconsin DNR report submitted into evidence had shown Stream C to be impaired, she characterized the pollution of the stream as *"de minimis".* She also approvingly noted of various efforts undertaken by FMC over the years to remediate the mine site, including the company's recent conversion of the biofilter at issue to an infiltration basin. With regard to the new infiltration basin, she wrote: *"it is reasonable to expect that [it] will improve on the efficiency of the biofilter."* Taking these factors into account, Judge Crabb concluded that any penalties assessed to FMC for their violation of the Act should be minimal and fined the company only $275. In an unusual move, she also denied the prevailing party (the plaintiffs) an award of their attorney fees.

Elements of Judge Crabb's decision were appealed by both parties, sending the case to the U.S. Court of Appeals for the 7th Circuit in Chicago, IL. Oral arguments were heard in April 2013, and the 3-judge panel overseeing the case (Judges David Hamilton, Kenneth Ripple and Joseph Stadtmueller) ultimately ruled in FMC's favor (WRPC, 2013). The Court did not dispute our claim that FMC had indeed discharged contaminated stormwater runoff from a point source at the Flambeau Mine site to a water of the United States on an ongoing basis since at least 2006 (statute of limitations) and that, as a result, the stream was now impaired. Rather, the higher court focused its attention on the DNR's regulatory authority as the administrator of the Clean Water Act in Wisconsin and stated the following:

"… even if Flambeau's permit were legally invalid, we cannot, consistent with the requirements of due process, impose a penalty on Flambeau for complying with what Wisconsin deemed a valid WPDES permit."

Tell me, on what basis could DNR officials in Madison have deemed a permit that placed no restrictions on the amount of copper, zinc, iron and other pollutants discharged to a Water of the U.S. from a point source a "valid WPDES permit"? Yet, that's what ruled the day at the 7th Circuit hearing. In retrospect, it looks like, in addition to suing FMC, we should have also sued the DNR.

The Court proceeded to rule that the *mining permit* issued by the State of Wisconsin to FMC *shielded* the company from prosecution under the Act. As noted above, it didn't matter to the appellate court judges that the state-issued permit had failed to include key provisions of the NPDES permit program, i.e., none of the Flambeau Mine permitting documents had included any restrictions on the amounts of contaminants that could be discharged to Stream C (a Water of the U.S.) from the mine's biofilter (a point source).

In effect, the appellate court's decision allowed errors made by the DNR in its administration of the Clean Water Act to shield FMC from prosecution, and it set a terrible precedent:

The 7th Circuit decision allowed a state-issued mining permit that set no discharge limits on pollutants entering a water of the United States to substitute for a NPDES permit.

Since FMC was now the prevailing party in the case, the plaintiffs were also ordered to reimburse the company a portion of its legal expenses, as reported prominently by various news outlets (Austin, 2014). My share, as a citizen co-plaintiff, was $20,500.

For online access to additional legal briefs and other documents related to the Flambeau Mine Clean Water Act lawsuit, go to: https://flambeaumineexposed.wordpress.com/legal-actions/clean-water-act-case-2012-3/.

Shortly after the Flambeau Mine Clean Water Act lawsuit was decided, the plaintiffs learned that Judge Crabb's faith in FMC's newly-constructed infiltration basin to "improve on the efficiency of the biofilter" had been misplaced. The basin malfunctioned and nearly overtopped (see below photo), as did a second infiltration basin constructed nearby as part of the same work plan. Instead of being able to withstand a 100-year flood event, as Foth's James Hutchison had told the Court under oath, the infiltration basins could not even withstand Rusk County's Spring melt (see photo below).

This photo of the infiltration basin in the Flambeau Mine industrial outlot was taken in Spring 2013, when the basin nearly overtopped and had to be pumped (Photo Credit: Wisconsin DNR, April 12, 2013).

The Wisconsin DNR confirmed the infiltration basin malfunction problem in internal emails and photos obtained through a public records request (WDNR, 2013) and the following email message sent to me in response to an inquiry (WDNR, 2014):

"In brief, we have been monitoring the situation with the basins and have noted that the basins were nearly filled to capacity during the Spring 2013/14 melts and exceptionally large rainfall events. When that happens, FMC is required to activate pumps to lower the water level in the basins. We have shared our concerns with FMC that periodic pumping is not a long-term solution to the problem. It is our understanding that FMC is working on a solution and will be submitting something for our review in the near future."

In 2015, FMC decided to scrap the infiltration basins altogether and submitted yet another reclamation work plan to the Department, this time reverting back to an engineered biofilter with a drainage channel and culvert connecting it to Stream C (Foth, 2015). For a schematic, see Tab-18, Figure 5 (please note that the new biofilter is in the same location as the "Surge Pond" shown in Tab-18, Figure 1, the original biofilter shown in Tab-18, Figure 3 and the east infiltration basin shown in Tab-18, Figure 4). The plan was subsequently approved by the DNR. **Remarkably, however, and in brazen disregard for Judge Crabb's determination that FMC's state-issued mining permit did *not* qualify as a permit under the federal Clean Water Act, the Department once again failed to impose any restrictions on the amounts of contaminants that could be discharged to the stream from the biofilter.**

The biofilter constructed by FMC in the industrial outlot in 2016 (pursuant to the 2015 work plan) remains in place to this day, and, just like with the company's earlier attempts at cleaning up the Stream C contamination problem, it has failed to do the job – i.e., copper concentrations in the stream remain elevated (see Tab-18, Figure 8 for graph).

All-in-all, FMC has implemented *six* different work plans over the years in an effort to clean up Stream C as part of site reclamation. Dr. Robert E. Moran[5], a hydrogeologist retained by citizens to review historical and modern FMC documents, commented on these numerous work plans in a report published in 2019 and included a table listing all six plans with the corresponding surface water quality data reported by FMC after implementation (Moran, 2019c; see Tab-18, Figure 9 for excerpt). No matter what type of reclamation plan was implemented by the company, copper concentrations in the stream still came back at levels exceeding the copper ATC (see Tab-18, Figure 8). Here is how Dr. Moran described the situation (Moran, 2019):

"Contaminated discharges from the southeast corner of the FMC site, also known as the "industrial outlot," have resulted in Stream C being added to the Environmental Protection Agency impaired waters list for exceedances of acute aquatic toxicity criteria for copper and zinc and have caused the State of Wisconsin to withhold issuance of a Certificate of Completion of mine reclamation for this portion of the mine site. Since 1998, FMC has instituted six different work plans to address this soil and water contamination issue. As of fall 2016, copper levels in the Flambeau River tributary still exceed the acute toxicity criterion, despite passive water treatment."

In fall 2018, the last time FMC was required to report Stream C water quality data to the Wisconsin DNR per the terms of the permit associated with its most recent (2015) reclamation plan, copper concentrations in the stream ranged from 10-22 ug/L, roughly 2-4 times higher than the upper limit set under Wisconsin law to protect fish and other aquatic species (FMC, 2019). So, once again, it's clear that the company's reclamation efforts have failed to effectively address the problem. Yet, when I contacted the DNR in 2020 to see if the Department would be requiring any additional monitoring of the stream, here is what I was told via email (WDNR, 2020):

"FMC completed their Stream C monitoring requirements in 2018. The DNR does not have monitoring data for Stream C in 2019, and does not intend to monitor Steam C in 2020. … Unfortunately, there is no plan to modify or amend the Chapter 30 permit to require additional testing."

Considering that Stream C is a Water of the United States, the above response is unacceptable. In effect, the Department is allowing FMC's responsibility to properly reclaim the part of the mine site contributing to the Stream C contamination (i.e., the industrial outlot) to slip between the cracks.

One ray of hope for Stream C, however, was delivered by the Department's scientific staff in late 2021, when they issued their *draft* Section 303(d) list of impaired waters for 2022. Upon reviewing the most recent Stream C data that FMC had provided to the Department (2016-2018), they issued a *2022 Water Quality Assessment for Stream C* (WDNR, 2021a) and, based on those findings, recommended the following changes to Wisconsin's Section 303(d) list of impaired waters (WDNR, 2021b):

- Maintain the impairment listing for the portion of Stream C located south *(downstream)* of the industrial outlot due to ongoing copper toxicity; and
- *Add* the portion of Stream C located *within the industrial outlot* to Wisconsin's Section 303(d) list for both copper and zinc toxicity.

This latest recommendation from DNR scientific staff to ***maintain*** the impaired listing of Stream C ***immediately south (downstream) of the industrial outlot*** and to ***add*** an impairment listing for the portion of the stream ***within the industrial outlot*** clearly shows two things:

[5] Citizens retained Dr. Robert E. Moran (hydrogeologist; Michael-Moran Associates, Golden, CO; remwater.org) in early 2017 to conduct a comprehensive review of historical and modern FMC documents and water quality data. He issued a summary of his initial findings in April 2017 (Moran, 2017), and the complete report was issued in 2019, posthumously (Moran, 2019) with the help of Dr. David M. Chambers (geophysicist; Center for Science in Public Participation, Bozeman, MT; csp2.org). Both reports were submitted to the Wisconsin DNR in 2019 in efforts to inform Department decisions on issues of concern.

- The very problem that resulted in FMC being denied a COC for the industrial outlot back in 2007 *has not been fixed,* so it makes no sense for the State of Wisconsin to award the company a COC at this time; and

- The DNR decision-makers in Madison who are recommending that FMC be granted a COC for reclamation of the industrial outlot *appear to be ignoring the findings of their own scientific staff* who have determined that, despite several different surface water management plans implemented by FMC over the years as part of site reclamation, Stream C remains impaired.

Instead of acknowledging FMC's failure to effectively deal with the Stream C impairment issue, Department officials are now asking the public to look the other way and accept the company's claim that the industrial outlot has been successfully reclaimed. This cannot stand, especially in light of the "Ruling on Statement of Issues" that was handed down in the earlier (2007) COC proceedings for the Flambeau project site.

Specifically, the Administrative Law Judge at the 2007 contested case hearing ruled that "any on-site soil or sediment contamination issues, as well as those related to the erosion control and surface water management plan and the creation of wetlands or placement of biofilters required by the Reclamation Plan" were legitimate issues to be considered as part of the COC hearing process (WDHA, 2007a).

The above ruling is what allowed Stream C contamination issues to play a central role in the 2007 contested case hearing, ultimately resulting in a denial of the COC for the industrial outlot. Surely those same issues cannot be eliminated from consideration now, especially since, at the 2007 contested case hearing, the *Stipulation and Order* referenced earlier (and to which FMC, the DNR and the objecting parties were all signatories) included the following provision (WDHA, 2007b; emphasis added):

> 7. In order for the Industrial Outlot to obtain a COC in the future, the Outlot will need to meet the Administrative Law Judge's interpretation as set forth in the May 14th, 2007 Ruling on the Statement of Issues and any modifications thereto on the record at the contested case hearing on May 30,2007. This interpretation is that the definition of reclamation, which is found in section 293.01(23), Stats. applies as to whether FMC has achieved its reclamation plan, and that FMC will not be required to prove there will not be groundwater or surface water pollution that arises after the COC is issued in order to obtain the COC for the Industrial Outlot.

See Tab-16 for more details.

Tab 4

Regulatory Issue:

Where to locate surface water sampling sites for baseline and follow-up testing in the Flambeau River relative to the mine pit and Stream C's discharge point to the river – and what to include in the test panel.

DNR Regulatory Mismanagement of the Flambeau Project

Tab-4

Issue under consideration:

Where to locate surface water sampling sites for baseline and follow-up testing in the Flambeau River relative to the mine pit and Stream C discharge point – and what to include in the test panel.

NB: The 32-acre Flambeau pit was located 140 feet from the Flambeau River and, per FMC's approved reclamation plan, is now backfilled with waste rock and other mining-related wastes (e.g., all of the filter sands and sludges from the mine's waste water treatment plant), some of it amended with limestone. No liner was laid down in the pit before backfilling to retard contaminant migration. See Tab-18, Figure 2 for schematic.

In addition to FMC modeling that shows contaminated groundwaters entering the Flambeau River from the backfilled mine pit, contaminated stormwater runoff from the mine's industrial outlot reaches the river via Stream C (see Tab 3 for details).

Wisconsin DNR Regulatory Decision/Misstep:

As noted by hydrogeologist Robert E. Moran[1] in a comprehensive review of historical and modern FMC documents published in 2019 (Moran, 2019):

"Monitoring [of Flambeau River surface waters] *was unacceptably limited both in terms of the number and location of sampling sites and the number of constituents reported. FMC established only two sampling sites in the Flambeau River, one upstream of the project site (SW-1) and the other (SW-2) roughly 500 feet downstream of the mine pit. No sampling was done in the mixing zones associated with either of the mine's two engineered outfalls to the Flambeau River (Outfall-001 and Outfall-002) or immediately adjacent to the pit."*

In addition, Dr. Moran noted that FMC's so-called "downstream" monitoring site in the river (SW-2) was actually "*upstream of the discharge point of Stream C, a small Flambeau River tributary that crosses the FMC property and historically has been used as a conduit for conveying contaminated storm water runoff from the mine site to the Flambeau River."* A third sampling station (SW-3) was finally added to FMC's river-monitoring program in 2007 to assess water quality just below the Stream C discharge point, not on the Department's initiative, but as a result of citizen and tribal participation in a contested case hearing over FMC's initial (2007) request for a Certificate of Completion of reclamation for the entire project site.

In terms of the second issue raised by Dr. Moran, that of the sparse test panel utilized by FMC for Flambeau River surface water samples, a review of FMC's annual reports and DNR-approved environmental monitoring plans for the Flambeau project reveals that the Department has not even required FMC to routinely report *sulfate* in river water samples (FMC, 2018a; Foth, 2020), this despite the fact that: (a) the Flambeau Deposit was classified as a "massive sulfide"; (b) FMC's own consultant (Foth) has acknowledged sulfate to be a key indicator parameter for tracking the movement of contaminated groundwaters (Foth, 2004); (c) elevated sulfate concentrations have been detected in monitoring wells located between the backfilled mine pit and Flambeau River (see Tab-18, Figure 23 for sample graph); and (d) excessive sulfate concentrations are known to have adverse impacts on surface waters (e.g., wild rice production).

Discussion:

As noted above, the 32-acre Flambeau pit was located only 140 feet from the Flambeau River and, per the terms of FMC's reclamation plan, is now backfilled with sulfide-containing waste rock and other mining-related wastes (e.g., all of the filter sands and sludges from the mine's waste water treatment plant), some of it amended with limestone.

No liner was laid down in the pit before backfilling to retard contaminant migration, and FMC's 1989 *Mining Permit Application* stated the following with regard to expected groundwater flow paths (Foth, 1989c):

[1] Citizens retained Dr. Robert E. Moran (hydrogeologist; Michael-Moran Associates, Golden, CO; remwater.org) in early 2017 to conduct a comprehensive review of historical and modern FMC documents and water quality data. He issued a summary of his initial findings in April 2017 (Moran, 2017), and the complete report was issued in 2019, posthumously (Moran, 2019) with the help of Dr. David M. Chambers (geophysicist; Center for Science in Public Participation, Bozeman, MT; csp2.org). Both reports were submitted to the Wisconsin DNR in 2019 in efforts to inform Department decisions on issues of concern.

"… all of the groundwater flowing through the Type II [high-sulfur] *waste rock in the reclaimed pit will exit the pit through the Precambrian rock in the river pillar and flow directly into the bed of the Flambeau River. Since this flow path is very short and occurs entirely within fractured crystalline rock, there will be little if any dispersion or retardation of the dissolved constituents in the groundwater. … Since there will be no dispersion, dilution, or retardation, in the river pillar, the concentrations of these constituents in the groundwater leaving the pit will be the same as the concentrations entering the river bed."* See Tabs 9 and 12 for more details.

Dr. Moran also noted the following with regard to probable groundwater flow paths at the reclaimed Flambeau Mine site (Moran, 2019):

"FMC hydrogeological and pit water quality data indicate that the river and pit waters are likely interconnected—at least at shallow depths—with flow directions changing seasonally as the respective water levels (head relationships) vary. Shallow ground waters from the backfilled pit are likely migrating downgradient, around, under, and possibly through the mine's slurry cutoff and diaphragm walls into the Flambeau River and surrounding alluvial sediments. The overall hydrogeological relationships suggest that the deeper ground waters may be migrating under the river sediments via fractures and faults."

Despite all of the above, the DNR failed to require FMC to establish any Flambeau River surface water sampling stations adjacent to or immediately downstream of the mine pit either before or during mine operations or as part of any environmental monitoring associated with site reclamation (See DNR-approved FMC monitoring plans for the Flambeau project: Foth, 1991; Foth, 2020). **The net result it that the Flambeau River waters most likely to be impacted by contaminant migration from the backfilled Flambeau Mine pit remain unmonitored to this day.**

In addition to contaminated groundwaters entering the Flambeau River from the backfilled pit, contaminated surface waters from the mine's industrial outlot also reach the river via Stream C, as described earlier (see Tab-3). It wasn't until 2007, however, that FMC finally established a Flambeau River surface water sampling station near the Stream C discharge point (see details below).

Following is a list of the Flambeau River surface water sampling stations utilized by FMC at one time or another over the years (see Tab-18, Figure 7 for map with sampling site locations):

- **SW-1** (upstream of the project site)
    - The DNR-approved monitoring plan for the Flambeau project required FMC to report Flambeau River water quality data from a single upstream sampling site (SW-1) for ten years only, starting in 1991 (baseline) and ending in 2000 (two years after the pit was backfilled with mining waste) (Foth, 1991).
    - As of 2001, the DNR has been depending on FMC to *voluntarily* report additional surface water quality data from SW-1, and the company has continued to report a limited panel of test results in its annual reports, to date (e.g., see FMC 2017 Annual Report, Appendix B, Attachment 3).
- **SW-2** (roughly 500 feet downstream of the mine pit)
    - The DNR-approved monitoring plan for the Flambeau project required FMC to report Flambeau River water quality data from a single downstream sampling site (SW-2) for ten years only, starting in 1991 (baseline) and ending in 2000 (two years after the pit was backfilled with mining waste) (Foth, 1991).
    - As of 2001, the DNR has been depending on FMC to *voluntarily* report additional surface water quality data from SW-2, and the company has continued to report a limited panel of test results in its annual reports, to date (e.g., see FMC 2017 Annual Report, Appendix B, Attachment 3).
    - The SW-2 sampling site is *upstream* of where Stream C has been discharging stormwater runoff from the industrial outlot into the river since at least 1998.
- **SW-3** (just below the Stream C discharge point to the Flambeau River)
    - SW-3 was added to the testing regime in 2007, not on the Department's initiative, but as a result of citizen and tribal participation in a contested case hearing over FMC's initial (2007) request for a Certificate of Completion (COC) of reclamation for the entire 181-acre project site (including the 32-acre industrial outlot). Due to ongoing surface water contamination in Stream C, the objecting parties were

SW-3 (cont.)

able to secure a *Stipulation and Order* at the hearing that not only excluded the industrial outlot from the COC, but required FMC to, among other things, establish a surface water monitoring station in the Flambeau River just below the Stream C discharge point (SW-3) and report water quality data from all three test locations in the river (SW-1, SW-2 and SW-3) twice a year for a 5-year period, 2007-2012 (WDHA, 2007b; Foth, 2007).

- As noted by Dr. David Chambers in a 2009 Flambeau Mine report[2], any contaminant entering the Flambeau River from Stream C is "probably being diluted to below the water quality standard as it enters the Flambeau River just above SW-3" (Chambers & Zamzow, 2009). Therefore, to better assess the question of the *amount* of copper or any other contaminant entering the river from the industrial outlot, it would have been preferable if the negotiated *Stipulation and Order* had, in addition to establishing the SW-3 sampling station in the river, also required FMC to report water quality data from within Stream C itself at the point of discharge. As noted by Dr. Chambers, this could have easily been done by reactivating sampling station SW-C6 in Stream C, which had been sampled by FMC in 2004 and 2005 and then, without explanation, dropped from the company's surface water monitoring program. Unfortunately, however, FMC did not agree to reactivate the SW-C6 sampling site as part of the 2007 *Stipulation and Order* (see Tab-18, Figure 7 for stipulated sampling site locations; see Tab-3 for more details regarding FMC's Stream C monitoring program).
- The temporary requirement imposed on FMC in 2007 to add the SW-3 sampling site to the river monitoring program for a 5-year period provided additional useful data regarding Flambeau River surface water quality downstream of the mine, but even though 8 of the 10 samples collected at SW-3 between Fall 2007 and Spring 2012 registered higher concentrations of copper than samples collected at SW-2 (including at least one that was approximately *double* the Wisconsin chronic water quality standard, as noted by Dr. Chambers in his 2009 report), the Department still allowed the SW-3 reporting requirement to expire in 2012[3]. For a summary table of the copper concentrations reported at SW-2 and SW-3 between 2007 and 2012 and how those concentrations compared to applicable surface water quality standards, please see a data table assembled by Dr. David Chambers (Tab-18, Figure 10).
- As of 2013, the DNR has been depending on FMC to *voluntarily* report additional surface water quality data from SW-3 to the Department, but no such test results have been included in any of the company's annual reports, to date. A February 2022 public records request of the Wisconsin DNR for any such data on file yielded a SW-3 data table compiled by FMC for the time period of September 2007 through November 2021 (WDNR, 2022a; also see Tab-18, Figure 11). Unfortunately, however, the reported test panel was quite limited and failed to include certain constituents of interest (e.g., sulfate).

- **Additional Flambeau River Sampling Sites Reported by FMC**
  - No such sites exist.
  - Most notably, the DNR has failed to require FMC to do any sampling in the stretch of the Flambeau River adjacent to or immediately downstream of the mine pit, this despite the fact that, as discussed above, FMC's modeling showed that "*all of the groundwater flowing through the Type II* [high-sulfur] *waste rock in the reclaimed pit will exit the pit through the Precambrian rock in the river pillar and flow directly into the bed of the Flambeau River*" (Foth, 1989c).
  - As noted by Dr. Moran in his Flambeau Mine report, the DNR also failed to require FMC to do any sampling in the mixing zones associated with either of the mine's two engineered outfalls to the Flambeau River (Outfall-001 and Outfall-002) during mine operations.

[2] Citizens retained *Center for Science in Public Participation* (Bozeman, MT; csp2.org) in 2009 to assess groundwater and surface water contamination at the reclaimed Flambeau Mine. Dr. David M. Chambers (geophysicist) assessed FMC's surface water data, and Dr. Kendra Zamzow (environmental geochemist) focused on groundwater issues. Two separate reports were issued (Chambers & Zamzow, 2009; and Chambers, Zamzow & Parejko, 2009), both of which were submitted to the Wisconsin DNR in 2009 and again in 2019 in efforts to inform Department decisions on issues of concern.

[3] If you care to review the Flambeau River surface water data reported by FMC for SW-1, SW-2 and SW-3 for the 5-year time period required per the terms of the 2007 *Stipulation and Order* (2007-2012), it can be found in the appendix section of FMC's annual reports: 2007 FMC Annual Report; 2008 FMC Annual Report; 2009 FMC Annual Report; 2010 FMC Annual Report; 2011 FMC Annual Report; and 2012 FMC Annual Report. For information specific to the exceedance of Wisconsin's chronic water quality standard for copper at sampling site SW-3, please see Tab-3.

Besides focusing on issues related to sampling site locations, Dr. Moran and Dr. Chambers also took issue with the limited test panel approved by the DNR for Flambeau River surface water samples. Here is what Dr. Chambers stated (Chambers & Zamzow, 2009):

"*Copper is demonstrably the contaminant of concern. … A more thorough monitoring program would also look for the presence of other potential contaminants, since it is rare that only one metal is present at elevated levels.*

Recommendation: It is also recommended that once per year, in the spring sampling event, a full suite of metals and their associated indicator parameters be sampled, until water quality exceedances cease. These parameters should include Conductivity (field), pH (field), Total Suspended Solids, Total Dissolved Solids, Aluminum, Arsenic, Cadmium, Chromium, Cobalt, Copper, Lead, Mercury, Nickel, Selenium, Silver, Uranium/Radioactivity, Zinc, Hardness, Iron, Manganese, and Sulfate."

Dr. Moran agreed with Dr. Chambers' concern over the limited test panel reported by FMC and leveled a criticism against the Wisconsin DNR regarding the same. Here's what he said (Moran, 2019):

"Because the west end of the Flambeau pit is within roughly 140 ft. of the Flambeau River, Wisconsin regulators should have required FMC to report all water quality constituents from both ground and surface waters that have relevant standards and criteria (during both baseline and routine monitoring), to determine whether FMC releases might be damaging to any of the relevant water uses: human consumption; aquatic life; agricultural and irrigation …. Such data would have required collection of both field-filtered & acidified and unfiltered & acidified samples for analysis of a much wider list of chemical constituents than reported by FMC, employing appropriate detection limits."

Dr. Moran also specifically took issue with FMC's failure to report sulfate concentrations in Flambeau River surface waters on a routine basis. He noted that, according to information contained in FMC's annual reports, sulfate had not been included in any of the test panels run between July 1991 and April 1999, including the years of active mining (FMC, 1992; FMC, 2001b). While FMC did report some post-reclamation sulfate concentrations between late 1999 and 2012, it was once again dropped from the test panel in 2013 and, as clearly shown in FMC's annual reports and most recent DNR-approved monitoring plan, remains unreported to this day (FMC, 2018a; Foth, 2020).

It's remarkable that the Wisconsin DNR would not have insisted on sulfate being part of FMC's Flambeau River surface water test panel. Not only was the Flambeau Deposit classified as a "massive sulfide", but, as noted by Dr. Moran, *"Foth and FMC have acknowledged [sulfate] as a key indicator parameter for tracking the movement of contaminated ground waters (Foth, 2004)"* (Moran, 2019). This, in combination with the fact that elevated sulfate concentrations have indeed been measured in monitoring wells located between the backfilled mine pit and Flambeau River (see Tab-18, Figure 23 for sample graph) and sulfate has the potential to adversely impact surface waters (e.g., wild rice production) makes the DNR's failure to monitor sulfate concentrations even more egregious.

So how did such a minimalist approach to monitoring Flambeau River surface water quality manage to slip through the cracks at the Department? Commendably, the DNR-approved environmental monitoring plan for the Flambeau project had included the following provision: "Parameters tested, methods and procedures [for sampling of surface water in the Flambeau River] will be those included in the WPDES permit" (Foth, 1991). Unfortunately, however, the Department dropped the ball and never included any such provisions in the Wisconsin Pollution Discharge Elimination System permits issued for the mine operation. Instead, the WPDES permits only dealt with effluents "prior to discharge to the Flambeau River" (WDHA, 1991; WDNR, 1992b; WDNR, 1996). In effect, FMC was allowed to set its own terms for which parameters to monitor in the river itself.

FMC continues to claim in its annual reports that the Flambeau River "remains fully protected", and, if you *only* look at the limited monitoring data reported by FMC over the years from sampling sites SW-1 and SW-2 (and, more recently, SW-3), you might be inclined to agree. But there is a bigger picture here that suggests the DNR's approach

to monitoring for surface water impacts from the Flambeau Mine is more like "Don't Ask – Don't Tell". Dr. Moran summed it up as follows:

"At present, it is not possible to demonstrate that Flambeau River chemical constituent concentrations have been degraded by FMC activities. This is partly due to the totally-inadequate surface water monitoring data made public by FMC. … FMC's surface water monitoring program is inadequate to define potential impacts due to, among other things, inappropriate monitoring locations, an inadequate list of monitored chemical constituents, and unclear reporting of Dissolved versus Total and Field versus Lab test results. This, in combination with FMC's failure to submit any new biomonitoring or river sediment data to the Wisconsin DNR since 2011, especially when earlier studies suggested a possible mining effect, brings into question the company's claim that the river 'remains fully protected'."

(For information regarding the inadequacies of FMC's biomonitoring and river sediments monitoring program, please see Tabs 5 and 6.)

Tab 5

Regulatory Issue:

How to monitor for potential impacts to Flambeau River sediments and aquatic species (macroinvertebrates, crayfish and walleye), bearing in mind that the backfilled/reclaimed mine pit is just 140 feet from the river, and, in addition, Stream C discharges runoff from the industrial outlot to the river.

History of DNR Regulatory Mismanagement of the Flambeau Project

Tab-5

Issue Under Consideration:
How to monitor for potential impacts to Flambeau River sediments and aquatic species (macroinvertebrates, crayfish and walleye), bearing in mind that the backfilled/reclaimed mine pit is just 140 feet from the river, and, in addition, Stream C discharges stormwater runoff from the industrial outlot to the Flambeau River roughly 0.4 mile downstream of the backfilled pit.

Wisconsin DNR Regulatory Decision/Misstep:
A series of expert reports authored by Dr. Ken Parejko[1], an aquatic ecologist retained by citizens in 2009 to review Flambeau Mining Company's DNR-approved Flambeau River sediments and biomonitoring program, reveals *numerous flaws in study design* and *unacceptable levels of reporting errors*. In addition, the DNR never required FMC to provide, nor did the company of its own volition provide any statistical analyses of the company's river-monitoring data to justify any conclusions drawn about whether or not the mine was adversely impacting the river. Dr. Parejko, who did perform the indicated statistical analyses, concluded that FMC's claims of the Flambeau River being fully protected from mine impacts were "over-reaching" and "not warranted".

Background:
Annual testing of Flambeau River sediments, macroinvertebrates, crayfish and walleye was required per the terms of FMC's 1991 monitoring plan approved by the DNR (Foth, 1991). The last of the mandatory test requirements ended in 2001 (four years after the pit was backfilled), but the program was partially reinstated in 2007 due to citizen and tribal involvement in a contested case hearing over FMC's request for a Certificate of Completion (COC) of reclamation for the 181-acre project site (including the 32-acre industrial outlot). A *Stipulation and Order* handed down by the Administrative Law Judge called for an additional five rounds of crayfish and walleye data (2007-2011) and one more round of sediment data (2008) to be collected by FMC in order to better assess the impact of site reclamation on the river (WDHA, 2007b). The company complied, using the original study protocols (Foth, 2007).

Citizens solicited the help of Dr. Ken Parjeko in 2009 to review FMC's Flambeau River monitoring program and evaluate all of the data reported by the company from 1988 (baseline) to 2008 (the most recent sampling event on record at the time), spanning a 20-year rime period. Dr. Parejko analyzed FMC's study design, performed statistical analyses of the FMC data (since FMC had failed to do so) and authored 4 separate reports covering each of the areas of study:

- Flambeau River Sediments (Parejko, 2009a);
- Flambeau River Macroinvertebrates (Parejko, 2009b);
- Flambeau River Crayfish (Parejko, 2009c); and
- Flambeau River Walleye (Parejko, 2009d)

Through the course of his review, Dr. Parejko found *numerous* sampling and reporting issues in FMC's Flambeau River monitoring program such as: (1) insufficient baseline data; (2) changes in sampling locations; (3) inconsistency in sampling methodology; (4) insufficient replication; (5) insufficient spatial and temporal co-location of sampling sites; (6) unacceptable levels of reporting errors; and (7) a failure of FMC to do any follow-up testing of endangered species identified in the Flambeau River near the mine site. These deficiencies prompted him to coauthor a fifth report with specific recommendations for augmenting FMC's monitoring program (Chambers, Zamzow & Parejko, 2009). Said recommendations, however, were never embraced by the DNR or implemented by the company.

[1] Citizens retained Dr. Ken Parejko (aquatic ecologist; Professor Emeritus, Department of Biology, University of Wisconsin-Stout, Menomonie, WI) in 2009 to review FMC's Flambeau River sediments and biomonitoring programs. He generated five separate reports, all of which were submitted to the DNR in 2009 and again in 2019 in efforts to inform Department decisions on issues of concern.

Discussion:
FMC is required to submit an annual report to the DNR summarizing the company's most recent activities at the project site, including the results of any environmental monitoring studies. Typically, the report is accompanied by a cover letter that includes the following statement or variation thereof: *Monitoring and evaluations conducted during* [the previous year] *continue to document that the Flambeau River remains fully protected and Flambeau remains in full compliance with its permit standards* (FMC, 2021). Indeed, this has been FMC's central argument over the years as to why their mining operation and subsequent reclamation activities should be considered successful and deserving of a COC.

In 2006, just prior to FMC's first attempt to obtain a COC of reclamation for the Flambeau project site, the company included a discussion section and series of appendices in its annual report to showcase all of the Flambeau River sediment/macroinvertebrate/crayfish/walleye data collected over the years. No matter if they were talking about sediments or walleye or anything in between, FMC claimed the data showed "no impacts due to mine activities" (FMC, 2007a).

In light of FMC's repeated claim that their mine has not impacted the Flambeau River, the following observations made by Dr. Parejko in his reports are particularly striking (emphasis added):

Sediments (Parejko, 2009a):
"In its 2006 sediment report (Flambeau River Sediment Memorandum, FMC 2006 Annual Report) FMC's consultants state that... "Data from the years of sediment analysis indicate that, in general, no increase or decrease in parameter concentration in sediments is occurring. Moreover, downstream samples continue to compare favorably with upstream sediment samples indicating no impacts due to mine activities during the closure time window." Because of lack of baseline information, and the sampling issues mentioned above (most importantly, lack of within-site replication), and also when considering the results of statistical analyses in Table 3, which show in some cases significantly higher downstream than upstream metal concentrations in sediment, ***the statement from the 2006 sediment report that there is* "no increase or decrease in parameter concentration in sediments...[and that] downstream samples continue to compare favorably with upstream sediment samples"** ***is questionable. It is also certainly not possible, especially given the limitations of the monitoring outlined above, to state with any reasonable certainty whether there has or has not been impacts due to mine activities.*** *…*

Inadequate baseline data and sample replication, combined with changing sampling procedures make it very difficult to draw any conclusions regarding the presence or absence of a mining-related effect on the sediment of the Flambeau River. The combined observation of statistically significant increased copper concentrations in crayfish (whole-body specimens), walleye (liver tissue) and sediment (when 2008 downstream copper measurements are included) downstream from the mine site raises the possibility of a causal relationship. Unusually high copper and zinc concentrations in a sampling site within the bed of intermittent Stream C indicate a possible entrance-point for some potential toxins into the Flambeau River. In hindsight, having additional historic data from Stream C and the Flambeau River would prove very useful."

Macroinvertebrates (Parejko, 2009b)**:**
"Due to a lack of baseline data, flaws in FMC's study design and inconsistencies in the reporting of data, ***it is not possible to ascertain with any degree of certainty whether or not the Flambeau Mine has had or may presently be having an impact on macroinvertebrate biota in the Flambeau River****. In addition, the lack of follow-up studies on the fate of endangered and threatened species identified in and around the Flambeau River prior to mining is unacceptable.*

There is enough evidence however to suggest that there were declines in some macroinvertebrate species down-stream from the mine during the course of its operation, e.g. especially the Plecoptera and the Gastropoda. While it is not possible to identify the Flambeau Mine itself as the *cause of these changes, or* a *significant cause of several, it is also not possible to say with any reasonable certainty that the Flambeau Mine did* not *play a part, however slight or however significant, in these observed changes."*

Dr. Parejko continued: *"Exactly what the changes in the macroinvertebrate communities have been, and how long they might last, is difficult to say unless the river continues to be carefully monitored and study design issues are resolved. To have a better understanding of possible effects visavis any future mining projects in Wisconsin, the biomonitoring protocols should be improved with consideration of the recommendations noted herein, including especially the reliability of the data as reported and the inclusion of studies to evaluate the fate of any threatened or endangered species identified at the project site."*

Crayfish (Parejko, 2009c)**:**

"[Results of statistical tests] *indicate that copper concentrations in the crayfish changed significantly over the years of testing, and specimens collected at the two sampling sites located downstream from the mine had significantly higher levels of copper than the upstream crayfish … . While it is not possible to prove a mining effect on crayfish copper concentrations, the FMC 2006 annual report statement that:* "Based on all data collected, including that which was collected in 2006, there are no impacts to crayfish relative to metal uptake whether we are looking at upstream/downstream effects or effects due to time (active mining phase, mine site reclamation, or post-reclamation" *should be considered* ***over-reaching****. …*

While levels of copper in the crayfish showed an overall increase both upstream and downstream from the mining activity, it was significantly higher at both downstream sites than upstream, and ***the gap between downstream and upstream sites widened over time, suggesting a possible mine effect.*** *Copper levels did not appear to reach toxic or otherwise harmful levels in this organism during the time period in question (1991-2008), although one's confidence in that inference is lessened by the monitoring protocols used. Monitoring should continue and procedures be improved to strengthen any inferences made regarding the effect, if any, of mining activities on the benthic invertebrates such as crayfish. "*

Walleye (Parejko, 2009d)**:**

"While the wide variation and differing patterns of metal concentrations in walleye liver – and fillets – suggests that other environmental factors in the river other than those connected with mining had an important influence on these values, the data presented and the lack of replication make it impossible to conclude that FMC's activities had no effect on metal concentrations in walleye. Therefore the conclusion FMC drew in their 2006 annual report that "Based on review of the data, it is concluded that the operation of the mine, including the time window when reclamation and habitat restoration activities are being conducted, has had no impact on the concentrations of metals which are observed in the liver or tissue of walleye" *is* ***not warranted****. …*

There was considerable among-year variation in metal concentrations in the walleye livers and fillets, which is typical for trace element concentrations in aquatic biota. Based on both visual inspection of the data and statistical analyses, there appears to have been an increase in walleye liver copper concentrations subsequent to mining, with downstream concentrations being significantly higher than upstream concentrations. This suggests a possible mining effect. The same can be said for crayfish whole-body specimens, as discussed in a separate report, although the elevation in copper levels appeared to be less pronounced in crayfish.

… Had the study protocol included within-year replication of liver samples instead of only one composite sample per site per year, one's ability to draw statistically defensible conclusions from the study at hand would have been significantly enhanced."

After Dr. Parejko's reports were issued in 2009, FMC submitted three more rounds of crayfish and walleye data (2009-2011) to the Department per the terms of the 2007 *Stipulation and Order,* using the same study protocols employed earlier[2]. Dr. Parejko was later asked to review those results, and he concluded that the few data points

[2] If you care to review the Flambeau River sediments and biomonitoring data reported by FMC for the 5-year time period required per the terms of the 2007 *Stipulation and Order* (2007-2012), it can be found in the appendix section of FMC's annual reports: 2007 FMC Annual Report; 2008 FMC Annual Report; 2009 FMC Annual Report; 2010 FMC Annual Report; 2011 FMC Annual Report; and 2012 FMC Annual Report.

reported by FMC for the three years, and high variability between the years, meant that, for the most part, further statistical analysis was likely to be fruitless. He did, however, offer the following observations:

- Iron in Crayfish and Walleye: Iron concentrations measured in *crayfish and walleye* tissue between 2009 and 2011 showed a lot of variability, as they did in previous years' samples. While both tissues showed a clear trend toward increasing values, the increase occurred both upstream and downstream, suggesting that perhaps tissue iron concentrations vary naturally from site to site, year to year, and individual to individual, and any differences or trends observed in the 2009-2011 data are not mine-related.

- Copper in Crayfish: Copper concentrations measured in *crayfish tissue* between 2009 and 2011 were somewhat higher downstream than upstream, the same pattern observed in samples before and during mining operations. Whether this difference between upstream and downstream crayfish copper is a mining-related effect is hard to say, but FMC's 2006 claim that their earlier data showed "no impacts to crayfish" should be considered over-reaching.

- Copper in Walleye: Copper concentrations measured in *walleye liver tissue* dropped precipitously between 2009 and 2011, but the decline occurred both upstream and downstream, suggesting some other driving force than mining operations behind them.

The reports issued by Dr. Parejko in 2009 provide an exhaustive review of FMC data covering the 20-year time period of 1988 (baseline) to 2008 (post reclamation). Since there apparently is little more to be said for the 2009-2011 crayfish and walleye data other than noted above, the conclusions drawn by Dr. Parejko in his original reports remain relevant and applicable to any discussion of how the Flambeau Mine operation may have impacted the Flambeau River.

It is clear from Dr. Parejko's analysis that the DNR-approved Flambeau River sediments and biological monitoring program conducted by FMC was not scientifically sound. Fortunately, though, he also presented specific recommendations to the Department for how to "*continue and augment FMC's monitoring program to better track potential impacts of the Flambeau Mine on the associated ecosystem.*" In addition, he included more general recommendations, based on perceived shortcomings of monitoring at the Flambeau Mine site, for how the Department could *"improve the utility of similar monitoring programs undertaken in the future"* (Chambers, Zamzow & Parejko, 2009).

I urge the Department to review and take stock of Dr. Parejko's recommendations and formulate a plan to beef up FMC's Flambeau River monitoring program so that any conclusions regarding the success or failure of the company's reclamation efforts are based on sound science instead of the feel-good statements from FMC that, as noted by Dr. Parejko, are "questionable," "over-reaching" and "not warranted."

Tab 6

Regulatory Issue:

How to monitor for potential impacts to endangered/threatened species discovered in the Flambeau River near the mine site prior to mine construction, bearing in mind that the backfilled/reclaimed mine pit is just 140 feet from the river, and, in addition, Stream C discharges runoff from the industrial outlot to the river.

History of DNR Regulatory Mismanagement of the Flambeau Project

Tab-6

Issue Under Consideration:
How to monitor for potential impacts to endangered and threatened species discovered in the Flambeau River near the mine site prior to mine construction, bearing in mind that the backfilled/reclaimed mine pit is just 140 feet from the river, and, in addition, Stream C discharges stormwater runoff from the industrial outlot to the Flambeau River roughly 0.4 mile downstream of the backfilled pit.

Wisconsin DNR Regulatory Decision/Misstep:
The DNR failed to require FMC to conduct any follow-up testing to determine the fate of any of the endangered or threatened species discovered near the mine site.

Discussion:
A number of endangered or threatened mussel and dragonfly species were discovered in the Flambeau River near the Flambeau Mine site in 1991, shortly before construction of the open pit was set to begin. The discovery was considered significant enough by the courts to impose a temporary injunction on mine construction (LCO, 1991) while a *Supplemental Environmental Impact Statement* regarding the species was prepared by the Wisconsin DNR (WDNR, 1992a).

Here is how the situation was described in a 2009 report authored by Dr. Ken Parejko[1], an aquatic ecologist retained by citizens to review FMC's Flambeau River sediments and biomonitoring program (Parejko, 2009b):

"Several species of Wisconsin endangered or threatened species of invertebrates were found in the Flambeau River in the vicinity of the mine site in May/June 1991, after mine permits had been issued by Hearing Examiner David Schwarz but prior to the commencement of mining. The subsequent discovery of endangered species by WDNR divers who were working on an unrelated project resulted in a lawsuit filed by the Lac Courte Oreilles [LCO] *Ojibwe and Sierra Club in July 1991. The issue was deemed serious enough by the courts that a temporary injunction on mine construction was handed down by Judge George Northrup (Dane County Circuit Court, Madison, WI) in August 1991. As the Judge wrote:*

> All permits issued [to FMC] which relate to either site preparation or mining operations and activities shall be suspended pending completion of a Supplemental Environmental Impact Study by the Department of Natural Resources.

As a result of survey work completed during the supplemental EIS process, a number of Wisconsin endangered or threatened species were confirmed to exist in the vicinity of the mine site, including the following: the purple wartyback mussel, the bullhead mussel, and three species of dragonflies (the pygmy snaketail, extra-striped snaketail, and St. Croix snaketail.) …

It appears that beyond the DNR survey of the Flambeau River, FMC was not asked to, nor did they, undertake additional monitoring to ascertain the location and/or populations trends of these species near the mine. … The lack of appropriate close monitoring of any endangered or threatened species in ecosystems potentially impacted by mining activities should be viewed as a significant shortcoming of efforts to protect these ecosystems."

[1] Citizens retained Dr. Ken Parejko (aquatic ecologist; Professor Emeritus, Department of Biology, University of Wisconsin-Stout, Menomonie, WI) in 2009 to review FMC's Flambeau River sediments and biomonitoring programs. He generated five separate reports (Parejko, 2009a – Sediments; Parejko, 2009b – Macroinvertebrates; Parejko, 2009c – Crayfish; Parejko, 2009d – Walleye; and Chambers, Zamzow & Parejko, 2009 – Recommendations), all of which were submitted to the DNR in 2009 and again in 2019 in efforts to inform Department decisions on issues of concern.

Tab 7

Regulatory Issue:

Where to drill wells within the Flambeau Mine industrial outlot
for monitoring baseline and follow-up water quality.

History of DNR Regulatory Mismanagement of the Flambeau Project

Tab-7

Issue under consideration:
Where to drill wells within the industrial outlot for monitoring baseline and follow-up groundwater quality.

Wisconsin DNR Regulatory Decision/Misstep:
Even though, during mine operations, the ore crusher, crushed ore stockpile, rail spur, several different holding ponds (for contaminated runoff), and a portion of the mine's high-sulfur waste rock stockpile were all located within the area currently known as the industrial outlot, Department officials did not require FMC to establish any monitoring well (MW) locations within this area for either baseline or follow-up water quality testing. Nor did the Department require FMC to install any monitoring wells in the outlot in 2011, when the company constructed three infiltration basins as part of site reclamation to handle contaminated stormwater runoff within the outlot. **Hence, no groundwater quality data, baseline or follow-up, exists for the industrial outlot.**

Discussion:
Several different maps and diagrams can be used to establish site conditions relevant to the discussion of FMC's groundwater monitoring program:

- See Tab-18, Figure 1 for a schematic of the Flambeau Mine project site showing where various facilities were located during mining operations.
- See Tab-18, Figure 3 for an enlarged view of the reclaimed Industrial Outlot, as it existed between 1998 and 2011.
  [NB: The "0.9-acre Biofilter" shown in Figure 3 is in the same location as the lined "Surge Pond" in Figure 1, and it retained the surge pond liner.]
- See Tab-18, Figure 4 for a schematic of the Industrial Outlot after it was reconfigured per the terms of a May 2011 work plan implemented by FMC as part of site reclamation.
  [NB: The "East Infiltration Basin" shown in Figure 4 is in the same location as the "0.9-acre Biofilter" in Figure 3, but the liner was removed.]
- See Tab-18, Figure 5 for a schematic of the Industrial Outlot after it was reconfigured once more, this time per the terms of a May 2015 work plan implemented by FMC as part of site reclamation. The configuration shown in the figure remains current to the present day.
  [NB: The runoff detention pond shown in Figure 5 that drains to Stream C is in the same location as the "East Infiltration Basin" shown in Figure 4, and it is unlined].
- See Tab-18, Figures 12, 13 and 14 for groundwater monitoring well (MW) locations.

The closest groundwater monitoring well to the industrial outlot is the MW-1001 nest, located just beyond the outlot's far western edge (see Tab-18, Figure 12). Even if MW-1001 were somehow construed to be an outlot well, however, the DNR only required FMC to report groundwater *elevation* data from it over the years, no groundwater *quality* data.

Considering how some of the dirtiest mining activities took place in the industrial outlot (e.g., ore crushing and rail car loading) and how Stream C, which traverses the eastern portion of the outlot, was subsequently added to the EPA's list of impaired waters for copper and zinc contamination linked to the mine operation (see Tab-3 for details), the failure of the DNR to require FMC to monitor the groundwater beneath the industrial outlot can be considered a regulatory misstep.

Some might argue that no monitoring wells were/are needed in the Flambeau Mine industrial outlot because, during the years of active mining, 60-mil plastic liners were placed beneath the mine's 27-acre high-sulfur waste rock stockpile, ore crusher, crushed ore stockpiles, surge pond and runoff pond (see Tab-18, Figure 1). But there are four basic problems with that line of reasoning:

1. Only a *portion* of the industrial outlot was lined during mine operations, even though the entire outlot was located within an area prone to the accumulation of metal-laden dust. As a result, the unlined areas (e.g., the rail spur) would still be prone to seepages of contaminated stormwater runoff. Here is how the situation was described by DNR scientific staff in a 2012 report (WDNR, 2012b):

   "*A review of FMC reports to DNR, and other Flambeau mine related documents, suggests several mining activities that could have resulted in the dispersal of copper-bearing ore throughout adjacent areas during the period the mine was in operation. Mining activities such as blasting, bulldozing, truck loading and unloading, ore crushing (up to 250 tons per hour) and rail car loading (State of Wisconsin 1991) could have generated quantities of fine dust that could have been transported by the wind and deposited on nearby areas. Some losses of fine particulate ore and ore oxidation products from rail car spillage on the rail spur (FMC 2004) are also likely.*"

2. The groundwater beneath the lined areas of the industrial outlot was not necessarily protected from contamination. As documented in FMC's annual reports issued during the years of active mining, every single one of the liners in the outlot had to be repaired on numerous occasions (FMC, 1995; FMC, 1996; FMC, 1997; and FMC, 1998). In fact, so many repairs were needed that each of the reports included an appendix entitled "Liner Repair Documentation", complete with photos. The reported rips and tears, of course, were only the ones that could be seen on exposed sections of the liners. It's unclear if even more went unseen and/or unrepaired.

   In addition, some of the rips and tears in the liners were not repaired very quickly. For example, Cooper Engineering Company (FMC's contractor for liner repairs) wrote a letter to FMC in July 1997 in which they documented the repair of seven different holes in the liner beneath the surge pond in the industrial outlot. In that letter, Cooper stated that the holes had probably been there since 1995 (i.e., *2 years*) (Cooper, 1997).

3. FMC actually *encouraged* the seepage of contaminated waters into the soils beneath the industrial outlot by virtue of a stormwater management plan implemented in 2011 that called for reconfiguring the outlot's 0.9-acre stormwater detention basin (biofilter) into an infiltration basin. Said plan called for pulling the biofilter's HDPE liner and blocking the existing outlet to Stream C so that the contaminated waters would seep into the earth instead of discharging to the stream (Foth, 2011) (see Tab-3 for details). Dr. David Chambers[1], who was retained by citizens to review the plan, submitted comments to the DNR during the public hearing process, including a recommendation that, if the plan were approved, "shallow monitoring wells should be installed downgradient of the infiltration basin to monitor the quality of the water that will eventually infiltrate into Stream C and the Flambeau River" (Chambers, 2011). Dr. Chambers also included a diagram with recommended locations for the wells (see Tab-18, Figure 15).

   Department officials failed to act on any of Dr. Chambers' recommendations and instead allowed FMC to pull the biofilter's liner without requiring the installation of any new monitoring wells in the industrial outlot. Several years later, after the infiltration basin proved unable to handle spring melt volumes and large rainfall events, FMC reconfigured the basin once more, this time reverting to a plan similar to the original biofilter plan that had

[1] Citizens retained Dr. David M. Chambers (geophysicist; Center for Science in Public Participation, Bozeman, MT; csp2.org) in 2011 to review a reclamation plan advanced by FMC for the industrial outlot (Foth, 2011) that called for creating three infiltration basins within the outlot as part of site reclamation. Dr. Chambers' comments were subsequently submitted to WDNR during the public hearing process (Chambers, 2011).

allowed overflow from the detention basin to discharge to Stream C. Unlike the original biofilter, however, the new one was not lined (Foth, 2015) (see Tab-3 for details). With the Department's approval of said plan in late 2015, FMC was allowed to resume its earlier practice of discharging contaminated waters from the industrial outlot's biofilter to Stream C without a WPDES permit, except now a portion of the contaminated water would also be able to seep into the soils *beneath* the outlot.

4. Some of the monitoring wells drilled by FMC in the vicinity of the industrial outlot are showing high levels of contamination that "greatly exceed baseline data and relevant water quality standards and aquatic life criteria", as noted in a report authored by Dr. Robert E. Moran[2] (Moran, 2019). For example:

   - MW-1013B (located within the backfilled mine pit) has registered manganese concentrations as high as 42,000 ug/L, as compared to a baseline median of 230 ug/L for the overall project site (see Tab-18, Figure 17 for graph).

   - MW-1000PR (located between the backfilled mine pit and Flambeau River) has registered sulfate concentrations as high as 680 mg/L, as compared to baseline of 10 mg/L (see Tab-18, Figure 23).

   - Etc. (see Tab-9 for additional groundwater pollution data from the FMC wells and Tab-18, Figures 18 through 21 for additional graphs).

   Might the groundwaters beneath the industrial outlot be highly contaminated from mining activities as are MW-1013B and MW-1000PR and many other wells at the project site? Unfortunately, we do not know.

In light of all the above, surely it would be premature for the State of Wisconsin to award a certificate of completion to FMC for its reclamation of the industrial outlot without having any evidence of the current status of the groundwaters beneath it.

[2] Citizens retained Dr. Robert E. Moran (hydrogeologist; Michael-Moran Associates, Golden, CO; remwater.org) in early 2017 to conduct a comprehensive review of historical and modern FMC documents and water quality data. He issued a summary of his initial findings in April 2017 (Moran, 2017), and the complete report was issued in 2019, posthumously (Moran, 2019) with the help of Dr. David M. Chambers (geophysicist; Center for Science in Public Participation, Bozeman, MT; csp2.org). Both reports were submitted to the Wisconsin DNR in 2019 in efforts to inform Department decisions on issues of concern.

Tab 8

Regulatory Issue:

How to regulate groundwater contamination at the Flambeau Mine site vis-à-vis establishment of a “Compliance Boundary” for enforcement of groundwater quality standards.

History of DNR Regulatory Mismanagement of the Flambeau Project

Tab-8

Issue Under Consideration:

How to regulate groundwater contamination at the Flambeau Mine site vis-à-vis establishment of a "Compliance Boundary" for enforcement of groundwater quality standards.

NB: The DNR-established compliance boundary for the Flambeau project encircles the entire project site (backfilled mine pit, industrial outlot, etc.) and also extends to the opposite (west) side of the Flambeau River from the mine.

Wisconsin DNR Regulatory Decision/Misstep:

In a comprehensive review of historical and modern FMC documents published in 2019, hydrogeologist Robert E. Moran[1] concluded that the DNR had "failed to define viable compliance measures for the FMC operation" (Moran, 2019). Among the deficiencies he noted were the following:

- *"The state-established compliance boundary for enforcement of groundwater quality standards extends to the opposite (west) side of the Flambeau River from the mine. Because there is no groundwater monitoring across the Flambeau River, the boundary ignores possible impacts to the water quality of the river, and to groundwater on the west side of the river"*; and
- *"The compliance wells are inadequate in number and location; only one set of nested wells (MW-1015A/B) is located anywhere near the compliance boundary."*

Background Information:

Wisconsin law has legalized unlimited groundwater pollution within and up to 1200 feet beyond a mine's project boundary (with certain caveats), in effect creating a pollution buffer zone where otherwise-applicable groundwater quality standards cannot be enforced. If, however, sufficiently high concentrations of contaminants are measured in monitoring wells located at or beyond the mine's so-called "1200-foot compliance boundary", citations can be issued by the Wisconsin DNR.

When the Flambeau Mine was permitted in 1991, the operative rule in the *Wisconsin Administrative Code* that specified where the DNR was to draw the Flambeau Mine's compliance boundary was NR 182.075(1)(b), enacted in 1982. The rule has since been amended and renumbered, but here is the wording as it existed in 1990 (at the time of the Flambeau Mine Permit proceedings), as supplied by the Wisconsin Revisor of Statutes Bureau in response to a public records request (WRSB, 2004):

> (b) Compliance boundary. 1. Maximum compliance boundary. The maximum compliance is 1,200 feet from the outer perimeter of the mining waste site or at the boundary of the property owned or leased by the operator, whichever distance is less. For purposes of this section, highways as defined in s. 340.01 (22), Stats., shall not be considered in determining the property boundary. The applicant or operator may seek a variance, modification or exemption to enlarge the maximum compliance boundary pursuant to s. NR 182.19, but in no event shall such a variance, modification or exemption authorize a boundary which exceeds the distance necessary to protect public health, safety and welfare.

In 1989, the DNR notified FMC of the Department's proposed compliance boundary for the Flambeau project (WDNR, 1989), and the specific groundwater quality enforcement standards for any wells located along the compliance boundary were established in the Flambeau Mine Permit (WDHA, 1991; see pp. 90-92).

[1] Citizens retained Dr. Robert E. Moran (hydrogeologist; Michael-Moran Associates, Golden, CO; remwater.org) in early 2017 to conduct a comprehensive review of historical and modern FMC documents and water quality data. He issued a summary of his initial findings in April 2017 (Moran, 2017), and the complete report was issued in 2019, posthumously (Moran, 2019) with the help of Dr. David M. Chambers (geophysicist; Center for Science in Public Participation, Bozeman, MT; csp2.org). Both reports were submitted to the Wisconsin DNR in 2019 in efforts to inform Department decisions on issues of concern.

See Tab-18, Figure 13 for a diagram showing the location of the Flambeau Mine compliance boundary and Tab-18, Figure 14 for a comparable diagram including an overlay of approximate groundwater flow vectors. The FMC compliance boundary, which encircles the entire project site and extends to the opposite (west) side of the Flambeau River from where mining operations took place, is about 3.5 miles in length and encompasses an area of nearly a square mile in size.

Discussion:

As noted above, hydrogeologist Robert E. Moran, who was retained by citizens in early 2017 to review historical and modern FMC documents, concluded that the Wisconsin DNR had "failed to define viable compliance measures for the FMC operation" (Moran, 2019). In particular, he took issue with the following:

1. **The Department's decision to extend the compliance boundary to the opposite (west) side of the Flambeau River from the mine.**

   Dr. Moran not only criticized the DNR's decision as "disregarding possible impacts" to the Flambeau River, but made note of the questionable circumstances surrounding the decision. Here is what he said:

   "The FMC compliance boundary … crosses the Flambeau River southwest of the backfilled pit, disregarding possible impacts to the water quality of this river. This was a notable point of contention prior to the 1990 permit hearing, when the Office of Public Intervenor within the Wisconsin Department of Justice argued that the compliance boundary west of the pit should be the Flambeau River (Falk, 1989). The Office cited, among other things, that Foth[2] itself had characterized the Flambeau River as "the most logical compliance boundary" in its Prediction of Groundwater Quality Downgradient of the Reclaimed Pit for the Kennecott Flambeau Project, dated July 1989. After the Public Intervenor made her argument, however, Foth released a revised version of the groundwater quality report, dated December 1989, that no longer included the above reference to the Flambeau River (Foth, 1989c)."

   As noted by Dr. Moran, the revised (December 1989) FMC report referenced above referred to locating the compliance boundary "beyond the river," where Foth theorized, without firm foundation, that exceedances of applicable groundwater quality standards would not occur[3]. The DNR proceeded to reject the Public Intervenor's request to make the Flambeau River the western perimeter of the compliance zone, ignoring Foth's *original* (July 1989) findings.

   As a result of the DNR's decision, the Flambeau River runs right through the Flambeau Mine's "pollution buffer zone", allowing contaminated groundwater to be discharged into the river. FMC has maintained that contaminants emanating from the backfilled mine pit and entering the river "pose no threat" to the river (Foth, 1989c) and that the river "remains fully protected" (FMC, 2021). As discussed earlier in great detail, however, the company's river-monitoring program is insufficient to substantiate the claim (see Tabs 4, 5 and 6). Dr. Moran summed it up as follows:

   "FMC's surface water monitoring program is inadequate to define potential impacts due to, among other things, inappropriate monitoring locations, an inadequate list of monitored chemical constituents, and unclear reporting of Dissolved versus Total and Field versus Lab test results. This, in combination with FMC's failure to submit any new biomonitoring or river sediment data to the Wisconsin DNR since 2011, especially when earlier studies suggested a possible mining effect, brings into question the company's claim that the river "remains fully protected" (Moran, 2019).

[2] Foth (Green Bay, WI) was FMC's primary environmental consultant for the Flambeau project.

[3] As discussed on page 8-3 of the present report, FMC has drilled no monitoring wells west of the Flambeau River. Therefore, as noted by Dr. Moran, "the company's theory cannot be proven or disproven" (Moran, 2019).

2. The Department's failure to require FMC to drill any monitoring wells west of the Flambeau River.

Even though the DNR had decided to extend the Flambeau Mine compliance boundary across the Flambeau River, and even though FMC's modeling clearly showed groundwater from the backfilled pit moving in that direction (see Tab-18, Figure 14), the Department failed to require FMC to drill any groundwater monitoring wells west of the river to check for compliance with standards.

Dr. Moran offered a possible explanation for the DNR's decision and also leveled a criticism against both the Department and Foth by citing the work of FMC's own technical expert, Vladimir Straskraba[4]. Here is what Dr. Moran stated:

"It appears [the Department] *accepted Foth's assertion that '… all of the groundwater flowing through the Type II waste rock in the reclaimed pit will exit the pit through the Precambrian rock in the river pillar and flow directly into the bed of the Flambeau River' and therefore 'it will not be possible' for exceedances to occur at the compliance boundary (Foth, 1989c). This, however, is inconsistent with* [Vladimir] *Straskraba's findings*."

Dr. Moran went on to explain that, based on Straskraba's work, it was likely that "*significant volumes of pit groundwater may be flowing downgradient below the Flambeau River, in the deeper alluvial sediments and or bedrock"* and added that this was "*especially evident when* [FMC's] *pit cross section maps are modified to show the relative position and depth of the Flambeau River"* (Moran, 2019).

Dr. Moran, who referred to Foth's narrative predictions regarding groundwater impacts at the Flambeau project site as "largely naïve geochemically and hydrogeologically", included a diagram in his report to show how the Flambeau River, which Foth maintained would serve as a barrier to groundwater migration in a westerly direction, is only about 5 feet deep in the vicinity of the 225-foot deep mine pit (see Tab-18, Figure 16).

Dr. Moran went on to conclude the following:

"FMC has failed to provide data to clarify the actual flow pathway(s) of [Flambeau] *groundwaters. By focusing attention on the seepage of degraded-quality pit waters into the Flambeau River but failing to provide data to clarify the probable flow of groundwater below the Flambeau River, in the deeper alluvial sediments and or bedrock, FMC has diverted attention from a potential long-term problem, barely regulated."*

He added:

"FMC has tried to justify its failure to monitor ground water quality west of the Flambeau River by asserting that contaminants like sulfate "will never be able to travel more than 140 feet from the reclaimed pit," i.e., beyond the Flambeau River (Foth, 1989d). But without any monitoring wells west of the river, the company's theory cannot be proven or disproven."

3. The Department's decision to require FMC to drill only one nest of monitoring wells along the entire 3.5-mile-long compliance boundary.

If you go to Tab-18, Figure 13, you will see that the MW 1015A/B is the only compliance well established anywhere near the 3.5-mile-long Flambeau Mine compliance boundary. Here is how the situation was described by Dr. Moran (Moran, 2019):

[4] FMC retained Vladimir Straskraba (hydrogeologist; Hydro-Geo Consultants, Lakewood, CO) in the mid-1990s to review hydrogeologic conditions and bedrock geology at the Flambeau project site. His findings were tucked away as an appendix to a groundwater modeling report prepared by another FMC consultant (Engineering Technologies Associates, Ellicott City, MD) and submitted to the Wisconsin DNR in April 1998(Straskraba, 1997; ETA, 1998).

"Besides its failure to locate any groundwater monitoring wells west of the Flambeau River, FMC established only one nested well (MW-1015A/B) in the vicinity of the compliance boundary east of the river (roughly 750 ft. NW of the backfilled pit), and it was not installed until January 2001 (FMC, 2000). Thus, there is no reliable baseline for this well. Several wells would have been needed to define the actual groundwater plume. In addition, it appears this one compliance boundary well was located inappropriately, outside the main groundwater flow path identified by FMC and their consultants" (see Tab-18, Figure 14 for approximate groundwater flow vectors).

He concluded: *"The location of the single nested well (MW-1015A/B) constructed by FMC for determining compliance with the State's groundwater protection law is largely useless, and is certainly inadequate to provide warning of contaminated seepage from the pit."*

Tab 9

Regulatory Issue:

What to use as the numeric groundwater quality criteria for intervention boundary wells located between the backfilled mine pit and Flambeau River – and what to do if those standards are exceeded.

History of DNR Regulatory Mismanagement of the Flambeau Project

Tab-9

Issue Under Consideration:

What to use as the numeric groundwater quality criteria for intervention boundary wells located between the backfilled mine pit and Flambeau River – and what to do if those standards are exceeded.

NB: The Flambeau Mine open pit was backfilled in 1997-98 with sulfide-containing waste rock and other mining-related wastes (e.g., all of the filter sands and sludges from the mine's waste water treatment plant), some of it amended with limestone.

Wisconsin DNR Regulatory Decision/Misstep:

Instead of relying on DNR scientific staff to determine appropriate groundwater quality criteria for the Flambeau Mine's intervention boundary wells that would be protective of the Flambeau River, Department officials allowed FMC to determine what some of those standards were to be, based on the company's *predictive modeling* of contaminant concentrations expected within the waters of the backfilled pit (WDHA, 1991; see page 92 of the document). Not only did those concentrations have nothing to do with what would be protective of the river, but the FMC predictions turned out to be highly inaccurate.

In addition, some of the FMC-generated standards have been and continue to be exceeded in several intervention boundary wells near the Flambeau River, but the Department has taken no meaningful enforcement action. This prompted hydrogeologist Robert E. Moran[1] to conclude, in a review of historical and modern FMC documents published in 2019, that the contaminated FMC groundwaters represent a "sacrifice zone" (Moran, 2019).

Background Information:

As discussed in the previous section (Tab-8), the *Wisconsin Administrative Code* requires the DNR to establish a "compliance boundary" at mine sites for the purpose of enforcing groundwater quality standards. But the regulations also call on the Department to establish a so-called "intervention boundary" somewhere between the mine's compliance boundary and waste disposal site in order to help identify and manage emerging pollution problems *before* they have a chance to reach the compliance boundary or, in the case of the Flambeau Mine, before they reach the Flambeau River.

When the Flambeau Mine was permitted in 1991, the operative rule in the *Wisconsin Administrative Code* that specified where the DNR was to draw the Flambeau Mine's intervention boundary was NR 182.075(1)(c)3, enacted in 1982. The rule has since been amended and renumbered, but here is the wording as it existed in 1990 (at the time of the Flambeau Mine Permit proceedings), as supplied by the Wisconsin Revisor of Statutes Bureau in response to a public records request (WRSB, 2004):

> 3. Intervention boundary. At the hearing conducted under s. 144.836, Stats. the department shall establish an intervention boundary between the outer perimeter of the mining waste site and the compliance boundary.

In 2003, I contacted the Wisconsin DNR's chief mining regulator to find out where the Department had drawn the Flambeau Mine intervention boundary. Surprisingly, however, the official wrote back to say the following:

"The Flambeau operation was permitted prior to implementation in 1998 of the rule provisions that created the concept of the mandatory intervention boundary. Thus, a mandatory intervention boundary has not been established for the Flambeau Mining site" (Lynch, 2003).

I knew at the time that this could not be true, because Section NR 182.075(1)(c)3 of the *Wisconsin Administrative Code* that created the mandatory intervention boundary concept had been in effect since 1982 (see above). Still, I took the Department official at his word. Imagine my surprise when I learned, at the 2007 contested case hearing

[1] Citizens retained Dr. Robert E. Moran (hydrogeologist; Michael-Moran Associates, Golden, CO; remwater.org) in early 2017 to conduct a comprehensive review of historical and modern FMC documents and water quality data. He issued a summary of his initial findings in April 2017 (Moran, 2017), and the complete report was issued in 2019, posthumously (Moran, 2019) with the help of Dr. David M. Chambers (geophysicist; Center for Science in Public Participation, Bozeman, MT; csp2.org). Both reports were submitted to the Wisconsin DNR in 2019 in efforts to inform Department decisions on issues of concern.

over FMC's first attempt to obtain a COC for its reclamation of the Flambeau project site, that the *Flambeau Mine Permit* had indeed specified a number of FMC's monitoring wells as "intervention boundary wells", including the following (see Tab-18, Figure 13 for monitoring well (MW) locations):

- MW-1000
- MW-1002
- MW-1004
- MW-1005
- MW-1010

This was especially concerning to me because I knew that at least one of the wells, MW-1000PR, was registering high levels of contamination. As I checked into it further, I also learned that the *Flambeau Mine Permit* had established numeric groundwater quality criteria for the intervention wells at the project site and that special attention had been paid to the ones located directly between the backfilled pit and Flambeau River (e.g., MW-1000PR). Here is what the permit said (WDHA, 1991; see pp. 92-93):

"Monitoring well nests, MW- 1000, 1002, 1004, 1005, and 1010 shall constitute the intervention boundary for the project. Should a measured or reasonably extrapolated exceedance of a groundwater standard occur at well nests MW- 1002, 1004 or 1005, or if concentrations of measured parameters at well nests MW-1000 and 1010 are statistically significantly greater than the projected water quality as described in Appendix L of the Mining Permit Application, Flambeau shall notify the Department and propose a method of evaluating the exceedance and the associated facility performance implications. Should this evaluation indicate that a violation at the compliance boundary will occur without intervention, Flambeau must implement the appropriate portions of the approved contingency plan."

A bit more digging revealed that *Appendix L of the Mining Permit Application*, referenced in the above statement, included a table with the following water quality projections that therefore constituted the permit stipulations for MW-1000PR, MW-1000R and MW-1010 (Foth, 1989c; see page L-30):

- Copper: 14 ug/L
- Iron: 320 ug/L
- Manganese: 550 ug/L
- Sulfate: 1,100 mg/L

Discussion:
So how did the DNR-approved strategy of using FMC's groundwater quality projections as enforcement criteria for the Flambeau Mine's intervention boundary pan out? Here is what hydrogeologist Robert Moran concluded after reviewing the situation (Moran, 2019):

"FMC's ground water quality data … demonstrate how unreliable predictive modeling can be. When seeking its permits to mine, the company offered modeling that predicted relatively low concentrations of copper (14 µg/L), iron (320 µg/L) and manganese (550 µg/L) in contact water leaving the backfilled pit. In addition, sulfate concentrations were predicted to reach 1,100 mg/L (Foth, 1989d). … Now that actual concentrations are being measured …, individual FMC wells within the backfilled pit have median dissolved concentrations as high as the following (2014-16):

- *Copper = 503 µg/L* [35 times higher than Foth prediction]
- *Iron = 14,000 µg/L* [43 times higher than Foth prediction]
- *Manganese = 33,500 µg/L* [60 times higher than Foth prediction] (See Tab-18, Figures 17 & 18 for graphs)
- *Sulfate = 1,600 mg/L* [1.5 times higher than Foth prediction] (See Tab-18, Figure 19 for graph)

He continued: *"Unfortunately, several of the Flambeau Mine **permit stipulations** were based on these inaccurate simulation results. For example, secondary to Foth's prediction that manganese concentrations in backfilled pit ground waters would be roughly 550 µg/L for close to 4,000 years, the Flambeau Mine permit incorporated a 550 µg/L compliance limit for manganese in wells located between the mine pit and Flambeau River (WDHA, 1991 – p. 92; Foth, 1989c – pp. 20-29). Now that the pit has been backfilled and samples are being collected for analysis, 7 of the 8 wells within the backfill have median manganese concentrations (2014-16) ranging from 1,200 to 33,500 µg/L, significantly exceeding Foth's prediction. In addition, two of the three wells between the pit and river have reported median manganese concentrations of 2,100 to 9,500 µg/L (See Table 6 – Ground water quality data). It appears, however, that no meaningful enforcement action has been taken by the Wisconsin DNR."*

In light of the above, Dr. Moran summed up the situation as follows:

"Some of the groundwater compliance criteria and standards applicable to the project were generated via largely-useless predictions made by FMC's consultants … Despite numerous exceedances of these and other relevant standards and criteria, the DNR has taken no meaningful enforcement actions. Thus, the contaminated FMC ground waters represent a 'sacrifice zone.'"

Perhaps the best example I can offer of what Dr. Moran was talking about involves MW-1000PR, an intervention boundary well located in the bedrock directly between the backfilled mine pit and Flambeau River. The well is about 125 feet from the river, 57 feet deep, and, according to FMC modeling, in line with the direction of groundwater flow toward the river. See Tab-18, Figure 14 for well location and approximate groundwater flow vectors, and then go to Tab-18, Figure 20 for a graphic representation of the manganese levels reported in MW-1000PR over the past 30 years or so. You will notice that the manganese concentrations in the well increased dramatically after the pit was backfilled in 1997-98 and have remained elevated over the years, significantly exceeding the permit criterion of 550 ug/L. Manganese levels in a second intervention boundary well near the river, MW-1000R, rose even higher for a time, topping off at 15,000 ug/L in 2014 (see Tab-18, Figure 21; DTS, 2020).

The high levels of contamination in MW-1000PR and MW-1000R, both located in the bedrock between the pit and Flambeau River, are particularly noteworthy because, at the time of the Flambeau Mine permit hearing, members of the public voiced concern over the potential for this very type of scenario. FMC responded by saying there was nothing to worry about because the rock between the pit and Flambeau River had "the strength of solid concrete" and provided "a barrier stronger than the Hoover Dam which holds back the Colorado River" (FMC, 1991). FMC even posted a plaque at the mine site with a message to the same effect (see Tab 18, Figure 22). Unfortunately, however, the FMC data shown in the above-referenced graphs and statements made by the company in their permitting documents tell a different story (see Tab-12 for related information).

Other Contaminants of Concern:
Manganese is not the only contaminant of concern at the Flambeau Mine intervention boundary. Arsenic and sulfate concentrations, for example, also increased dramatically in several intervention boundary wells after the mine pit was backfilled in 1997-98 and remain elevated to this day:

- Arsenic in MW-1010P

  MW-1010P (about 140 feet from the Flambeau River) registered a baseline arsenic concentration of 4.3 ug/L in July 1992 (Foth, 1992). But, as noted by Dr. Kendra Zamzow in a 2009 Flambeau Mine report[2], arsenic concentrations in the well exceeded Wisconsin's 5ug/L Preventive Action Limit (PAL) for the toxin in 21 of 28 samples collected between 1999 and 2008, reaching as high as 23 ug/L in June 2008 (Chambers & Zamzow, 2009). Several years after Dr. Zamzow's report was issued, Wisconsin lowered the state's arsenic PAL to 1 ug/L,

[2] Citizens retained *Center for Science in Public Participation* (Bozeman, MT; csp2.org) in 2009 to assess groundwater and surface water contamination at the reclaimed Flambeau Mine. Dr. David M. Chambers (geophysicist) assessed FMC's surface water data, and Dr. Kendra Zamzow (environmental geochemist) focused on groundwater issues. Two separate reports were issued (Chambers & Zamzow, 2009; and Chambers, Zamzow & Parejko, 2009), both of which were submitted to the Wisconsin DNR in 2009 and again in 2019 in efforts to inform Department decisions on issues of concern.

and MW-1010P has continued to exceed the criterion. For example, in June 2020 the well registered an arsenic concentration of 29 ug/L (FMC, 2021), exceeding not only the PAL, but Wisconsin's 10 ug/L Maximum Contaminant Level (MCL) for arsenic. No citations have been issued.

- Arsenic in MW-1000PR

  MW-1000PR (about 125 feet from the Flambeau River) registered a baseline arsenic concentration of < 5 ug/L in September 1988 (Foth, 1989a)[3]. In 2002, however (several years after the pit was backfilled), arsenic levels jumped to 10 ug/L in the well and since that time have fluctuated widely, reaching as high as 26 ug/L in October 2007 and 32 ug/L in April 2019 (FMC, 2021). While these concentrations greatly exceed Wisconsin's 1 ug/L PAL and 10 ug/L MCL for arsenic, no citations have been issued.

- Sulfate in MW-1000PR

  MW-1000PR registered a baseline sulfate concentration of 10 mg/L in July 1991 (FMC, 1992)[3]. After the Flambeau pit was backfilled in 1997-98, however, sulfate concentrations in the well increased rapidly, reaching a high of 680 mg/L in October 1999 (see Tab-18, Figure 23). More recent sulfate concentrations in the well are not as elevated (e.g., 211 mg/L in May 2019) but still exceed baseline by a factor of about 20. While these levels of contamination do not exceed the Flambeau Mine permit stipulation of 1,100 mg/L for sulfate (specific to the intervention boundary wells closest to the Flambeau River), the contaminated groundwaters are, according to FMC's modeling, entering the river undiluted (see Tab-12 for details).

  Sulfate influx to the Flambeau River is of particular interest because of the EPA-established sulfate standard of 10 mg/L for wild rice waters. As noted by Dr. Moran in his Flambeau Mine report cited earlier (Moran, 2019):

  "The south fork of the Flambeau River, upstream of the Flambeau Mine, has been identified by the Great Lakes Indian Fish and Wildlife Commission as a wild rice water. While the section of the river downstream of the mine has not been so-designated, the predictable long-term increase in sulfate concentrations in the river due to Flambeau Mine activities is likely negative. … FMC stopped reporting (publicly) sulfate data in the Flambeau River in 2013, despite elevated sulfate concentrations measured in the backfilled Flambeau pit and wells between the pit and river."

  For additional information regarding sulfate concentrations in the wells at the Flambeau Mine site and how they compare to EPA standards, see Tab-18, Figure 19.

- Miscellaneous.

  A series of instructive graphs examining changes in specific conductivity, sulfate, copper, iron, manganese and zinc concentrations in the Flambeau intervention boundary wells (backfill wells, too) is included in the Moran report (Moran, 2019b). Additional information can be found in a 2015 FMC report in which the company itself acknowledged 45 exceedances of Wisconsin groundwater quality standards and criteria in 17 different wells at the Flambeau site, including all three intervention boundary wells located between the backfilled pit and Flambeau River (FMC, 2015; see electronic page 68).

[3] FMC groundwater quality reports that were issued by the company between 1987 and 1995 include data for MW-1000P, not MW-1000PR, but the two wells are considered to be one and the same in the groundwater data tables included in FMC's annual reports issued since that time (i.e., all data previously attributed to MW-1000P is now labeled by the company as being from MW-1000PR). MW-1000P, constructed in October 1987, reportedly was damaged during snow removal operations in January 1996, and MW-1000PR was constructed as its replacement in February 1996. According to Foth, MW-1000PR was established in the same location and "constructed in the same manner" as MW-1000P.

The whole idea behind the DNR establishing an intervention boundary at the Flambeau Mine site was to identify and address pollution problems *before* they had a chance to reach the Flambeau River. So why has the Department taken no meaningful enforcement action against FMC regarding, for example, the ongoing and significant exceedances of the manganese criterion in MW-1000PR? When I emailed the Department about it several years ago, I was told the following (WDNR, 2015):

"The issue of elevated manganese and iron levels at both the in-pit and intervention boundary wells has been addressed in the past and, based on the subsequent sampling results, we see no evidence that conditions at the site have affected the Flambeau River or require further action by the Mining Company."

In other words, the Department has accepted FMC's claim that, despite the exceedances of several *Flambeau Mine Permit* standards and other relevant water quality criteria in a number of wells very close to the Flambeau River, the river remains fully protected. As noted earlier in my comments, however, it would be difficult to demonstrate degraded conditions in the Flambeau River when the DNR-approved monitoring plan for the river is, as described by Dr. Moran, "totally inadequate" – kind of like a "Don't Ask – Don't Tell" policy (see Tabs 4, 5 and 6 for details). Dr. Moran summed it up as follows, and I would ask you to please take his words to heart and move quickly to impose more stringent monitoring requirements on FMC for the Flambeau River (Moran, 2019):

"At present, it is not possible to demonstrate that Flambeau River chemical constituent concentrations have been degraded by FMC activities. This is partly due to the totally-inadequate surface water monitoring data made public by FMC. … FMC's surface water monitoring program is inadequate to define potential impacts due to, among other things, inappropriate monitoring locations, an inadequate list of monitored chemical constituents, and unclear reporting of Dissolved versus Total and Field versus Lab test results. This, in combination with FMC's failure to submit any new biomonitoring or river sediment data to the Wisconsin DNR since 2011, especially when earlier studies suggested a possible mining effect, brings into question the company's claim that the river 'remains fully protected'."

In addition to the above concerns regarding potential adverse impacts to the Flambeau River from contaminated groundwaters entering the river from the backfilled pit, it bears repeating that some of that groundwater might also be traveling *beneath* the river sediments via fractures and faults to the other side, where no monitoring at all is taking place. In fact, as discussed earlier, a report issued by one of FMC's own technical consultants (Vladmir Straskraba), in combination with the pit cross section maps that appear in FMC's annual reports, indicates that "*significant volumes of pit groundwater may be flowing downgradient below the Flambeau River, in the deeper alluvial sediments and or bedrock"* (see Tab-8 for details).

Here is how Dr. Moran summed up the situation (Moran, 2019):

"The overall hydrogeological relationships suggest that the deeper groundwaters may be migrating under the river sediments via fractures and faults. It is unclear whether contaminants have or could migrate to the west side of the river via such a deep path. Over decades, FMC has failed to conduct detailed investigations to evaluate the uncertainties of this basic ground water pathway question. **Neither the actual flow pathways for groundwaters exiting the backfilled pit nor the ground water-surface water interactions have been defined."**

FMC's failure to establish exactly *where* all of the contaminated groundwater from the backfilled pit is headed highlights the importance of the DNR doing *something* about the documented exceedances of *Flambeau Mine Permit* standards in the mine's intervention boundary wells near the Flambeau River. Perhaps a good starting point would be for the Department to follow the recommendations of Dr. Kendra Zamzow (Chambers & Zamzow, 2009):

"Given the movement of contaminants out of the pit towards MW-1000PR, and since it is theoretically possible that contaminated groundwater could move under the Flambeau River toward the compliance boundary located west of the mine site, it would be prudent to provide a nested monitoring well at the compliance boundary to the west of the Flambeau River to ensure that any residential or agricultural well water quality is not being impacted, and to provide a point of measurement for ensuring groundwater meets Wisconsin drinking water standards."

Tab 10

Regulatory Issue:

How to process groundwater samples submitted for testing.

History of DNR Regulatory Mismanagement of the Flambeau Project

Tab-10

Issue Under Consideration:
How to process groundwater samples submitted for testing.

Wisconsin DNR Regulatory Decision/Misstep:
The DNR allowed FMC to *filter* all Flambeau groundwater samples before running them in the lab instead of requiring the company to follow best practices and report both filtered (dissolved) *and* unfiltered (total) concentrations. The latter, of course, undoubtedly would expose higher levels of contamination, as discussed at length in a Flambeau Mine report authored by hydrogeologist Robert E. Moran[1] (Moran, 2019). Reporting totals is also important because, as Dr. Moran noted:

"… most families using private wells or springs and all farms, livestock, wildlife, fish and vegetation, etc. *use and consume unfiltered water."*

This apparent trick of the trade, whereby the company's publicly-available groundwater monitoring data only reflects analyses of filtered samples, from which, as noted by Dr. Moran, *"some, if not most of the chemical components have been removed by the filtering,"* was slipped by DNR regulators in not only the original *Quality Assurance Plan* approved by the Department for the Flambeau project (Foth, 1993), but the updated monitoring plan recently approved (Foth, 2020).

Discussion:
A very thorough discussion of the "filtered" vs. "unfiltered" issue is included by Dr. Moran in his report. Here is what he said: (Moran, 2019):

Sulfide-Rich Waters: Sampling, Sample Handling, and Checks on Data Quality.

The public often assumes that problems in laboratory analyses are the main sources of uncertainty in mine environmental studies, which is incorrect. The main sources of error and data uncertainty occur in the field, resulting from inadequate sampling and sample handling procedures.

Interpretation of such chemically-complex, unstable waters as found at Flambeau requires that numerous checks on data quality be performed (e.g. ion balances; comparisons of dissolved versus total concentrations; ratios of field specific conductance (S.C.) to total dissolved solids (TDS); analyses from statistically-relevant "blind" replicates; determinations of turbidity and suspended solids on ground waters to determine the quality of well development, etc.). ***Such data quality checks require reporting detailed ground water quality data from both filtered and unfiltered samples (appropriately preserved)*** *that include all major, minor and trace constituents, combined with detailed field measurements of water temperature, pH, and specific conductance.*

It is beyond the scope of this paper to discuss detailed aspects of water chemistry and sample handling. More complete discussions of these topics can be found in Hem (1985), Freeze & Cherry (1979), Driscoll (1986) and USGS (2017). In addition, Moran (2011 and 2014) presents detailed descriptions of sampling procedures and analytical details useful for evaluating baseline water quality. The situation at Flambeau, however, warrants discussion of several key concepts.

[1] Citizens retained Dr. Robert E. Moran (hydrogeologist; Michael-Moran Associates, Golden, CO; remwater.org) in early 2017 to conduct a comprehensive review of historical and modern FMC documents and water quality data. He issued a summary of his initial findings in April 2017 (Moran, 2017), and the complete report was issued in 2019, posthumously (Moran, 2019) with the help of Dr. David M. Chambers (geophysicist; Center for Science in Public Participation, Bozeman, MT; csp2.org). Both reports were submitted to the Wisconsin DNR in 2019 in efforts to inform Department decisions on issues of concern.

Filtered vs. Unfiltered Samples: *Ground waters in contact with sulfide-rich rocks are very complex chemically, physically and microbiologically. The chemical compositions of such complex waters change whenever ground water is lifted from depth and exposed to the normal atmosphere. For example, ground waters found at 100 ft. below the land surface are under roughly three times the atmospheric pressure to be found at the surface. Simply lifting such a ground water from a depth of 100 ft. (during sampling) reduces the pressure on the water and its contents, releasing previously-dissolved gases (and introducing others), which then begins a chain of other chemical changes that occur within seconds to minutes---reducing the dissolved concentrations of many of the formerly-dissolved chemical constituents.*

Aluminum, iron and manganese are the metals/metal-like elements (metalloids) most commonly found at the highest concentrations in metal-sulfide waters. As the chemical changes described above commence, these three constituents begin to form compounds that come out of solution forming small particles, which gradually clump together (called precipitates) and begin to fall to the bottom of the sampling container. Because the surfaces of these precipitates all contain mild electrical charges, they attract the other metals and metalloids that are charged (e.g. arsenic, antimony, copper, lead, mercury, selenium, uranium, etc.), trapping them on and/or within the iron, aluminum and manganese precipitates, reducing their concentrations as the precipitates form and fall to the bottom of the sample containers.

When chemically-unstable waters are filtered in the field, this mix of aluminum-iron-manganese particles plus trapped trace constituents is removed from the water sample, prior to being acidified and sent to the lab for analysis. Thus, the concentrations of these metals and metal-like elements originally dissolved in the ground waters are greatly reduced when reported later in the laboratory analyses.

Theoretically, such filtered waters represent the concentrations of the "dissolved" chemical constituents, similar to waters that have been "treated" at a municipal water treatment plant, intended for public consumption. ***In fact, ground waters transport chemicals in both dissolved and tiny particulate forms (colloids), and most families using private wells or springs and all farms, livestock, wildlife, fish and vegetation, etc. use and consume unfiltered water.*** *Obviously, FMC understood the colloidal transport aspect because they directed that samples of leachates from the waste rock piles be filtered first through 0.45-micrometer filters, and later through even finer filters with a 0.2-micrometer pore size. They did the same with samples of untreated runoff being pumped from a detention basin to a gravel pit during site reclamation. When FMC switched from using a 0.45-micrometer filter in March 1998 to a 0.2-micrometer pore size in May 1998, reported iron concentrations in the detention basin water samples dropped from 320 to 180 µg/L (FMC, 1998b).*

Because analytical results are often compared to regulatory standards for drinking water, independent investigators, in addition to collecting unfiltered samples for analysis, also routinely collect water samples that are filtered in the field (through 0.45-micrometer filters), followed immediately by addition of acid in the field, as described above. Thus, scientists routinely have analytical data from ***both filtered and unfiltered (and acidified) samples*** *when conducting a detailed study such as should have been performed at Flambeau. [In the routine language of water quality studies, analytical data from* ***filtered samples*** *are referred to as* ***"Dissolved" (D) concentrations*** *and those from* ***unfiltered samples*** *as* ***"Total" (T) concentrations***.] …

Flambeau Inadequacies. *Unfortunately, among the thousands of pages of Flambeau ground water quality data made public by FMC over decades, the data have generally not been clearly identified as either Dissolved or Total. If one does painfully wade through these thousands of pages or is able to track down some of the original laboratory reports it becomes obvious that* ***few Total analytical data (unfiltered samples) for ground waters have been made public*** *by FMC in the relevant monitoring and permitting documents.*

Instead, almost all of the publicly-available FMC ground water monitoring data reflects analyses of ***filtered samples****, from which some, if not most of the chemical components have been removed by the filtering, thereby lowering the*

original concentrations. This pertains to data beginning in the 1970-71 period through the data submitted for the 1989-90 EIR/EIS, continuing to the present. FMC and their consultants should have been thoroughly aware that all comparable ground water studies and reports were based (and are) on the collection of both filtered and unfiltered samples (Hem, 1970 and 1985). This would have been especially true after the passage of the National Environmental Policy Act (NEPA, 1970) and the Clean Water Act (CWA, 1972).

Because chemical components in mine-impacted ground waters are transported as both dissolved and particulate forms (sediments, colloids, chemical precipitates), interpretation of the FMC data is largely meaningless without having data from both filtered and unfiltered samples.

XXX

Based on the above analysis provided by Dr. Moran, it is clear that the Wisconsin DNR's failure to require FMC to follow best practices and report groundwater quality data from both filtered *and* unfiltered samples at the Flambeau project site can be considered a regulatory misstep. This pertains to not only the original *Quality Assurance Plan* approved by the Department for the Flambeau project (Foth, 1993) but the updated monitoring plan recently approved (Foth, 2020).

I urge the Department to review and take stock of Dr. Moran's findings and formulate a plan to beef up groundwater reporting requirements at the Flambeau project site. Surely a provision requiring FMC to report water quality data from both filtered *and* unfiltered samples would not be overreaching, especially considering how *"most families using private wells or springs and all farms, livestock, wildlife, fish and vegetation, etc. use and consume unfiltered water."*

Tab 11

Regulatory Issue:

What constituents to include in the groundwater test panel for the Flambeau project.

History of DNR Regulatory Mismanagement of the Flambeau Project

Tab-11

Issue Under Consideration:
What constituents to include in the groundwater test panel for the Flambeau project site.

Wisconsin DNR Regulatory Decision/Misstep:
It appears that the Wisconsin DNR fell victim to several tricks of the trade used by the mining industry to limit liability for emergent water pollution problems at project sites. Here, for example, is what hydrogeologist Robert E. Moran[1] observed with regard to the limited scope of constituents included in the DNR-approved groundwater test panel employed by FMC (Moran, 2019):

"Most metal-mine projects with which I have familiarity, both domestically and internationally, begin with company-compiled baseline data that may appear to be extensive, but which inevitably suffer from huge gaps that make ascribing technical and legal responsibility for later impacts extremely difficult. The same is true for the Flambeau baseline data, which was compiled by FMC and their consultants. For example, a comparison of the 1989 EIR baseline data reported by FMC – ground water and surface water – with test panels later adopted for routine monitoring shows that many trace constituents detected and reported in 1989 were lost to follow-up monitoring (e.g., uranium and aluminum) and others were never determined to begin with or at least reported publicly (e.g., antimony)."

Discussion:
Dr. Moran wasn't just spouting off here. During mine operations, the only metals or metalloids that FMC reported in groundwater samples were copper, manganese and iron. That's what FMC said they were going to do in their 1989 *Mining Permit Application* (Foth, 1989b, Volume 1 and Volume 2), and the DNR went along with it. Here is how Dr. Moran described the situation (Moran, 2019) :

"FMC's failure to routinely report most trace metals and metal-like elements (metalloids) other than copper, iron and manganese encouraged the impression that other trace/minor constituents were not present at Flambeau, such as: aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, zinc, natural radioactive constituents (uranium, radium, thorium, potassium-40, gross alpha and beta). For many years, including the years of active mining, ***arsenic*** *was not reported;* ***antimony*** *and* ***uranium****—both reported to be present in Great Lakes regional massive sulfide ores—were not reported, even though FMC's ground water* ***baseline compilation reports that uranium was detected in between 64 to 100% of their samples****, depending upon the well producing zone. Nor was aluminum reported, despite the fact that it was detected in all samples tested for baseline. Additional important chemical constituents were frequently not determined (or not made public) when samples were analyzed. These include for example:* ***sulfide****,* ***total suspended solids (TSS)****,* ***turbidity****.*

The Wisconsin DNR did not require FMC to report what was referred to as "an expanded suite of parameters" until after mining operations were complete and the pit was backfilled. When FMC finally started to report the "expanded suite" in mid-1999 [nearly two years after the mine pit was backfilled]*, the public still would have seen only filtered sample data, collected once per year, and the test panel was limited to the following constituents: chloride, calcium, magnesium, potassium, sodium, barium, cadmium, chromium, lead, mercury, selenium, silver and zinc. Quarterly reporting of the constituents mentioned above also continued, with arsenic added to the test panel in 1999."*

[1] Citizens retained Dr. Robert E. Moran (hydrogeologist; Michael-Moran Associates, Golden, CO; remwater.org) in early 2017 to conduct a comprehensive review of historical and modern FMC documents and water quality data. He issued a summary of his initial findings in April 2017 (Moran, 2017), and the complete report was issued in 2019, posthumously (Moran, 2019) with the help of Dr. David M. Chambers (geophysicist; Center for Science in Public Participation, Bozeman, MT; csp2.org). Both reports were submitted to the Wisconsin DNR in 2019 in efforts to inform Department decisions on issues of concern.

With regard to the DNR's failure to institute a sufficiently-broad groundwater test panel for follow-up studies at the Flambeau project site, a second researcher who reviewed FMC's groundwater monitoring program, environmental geochemist Kendra Zamzow[2], singled out several constituents of particular concern that were missing from the FMC analyses. Here is what she stated in her 2009 report (Chambers & Zamzow, 2009):

"Consideration should also be given to expanding the groundwater monitoring program at the Flambeau mine site to include more parameters. The geology of the area and of ore samples suggests nickel, cobalt, aluminum, and uranium could be elevated. Although testing was conducted for all in 1987-1988, no groundwater analysis for these elements have been conducted since then, with the exception that samples were analyzed for nickel in July 2005. Shallow wells not recovered from groundwater drawdown did not yet have water and were therefore not sampled for nickel [but] *monitoring wells MW-1014B, MW-1014C, and MW-1013C in the pit all had significant levels of nickel for the one reported nickel measurement taken in 2005, with MW-1014B as high as 440 ug/L[3]. …*

Other parameters that should be added to the list include cobalt and aluminum, since both were identified in measurable quantities in pore water obtained from leach extraction tests performed by the company on waste rock samples in 1997 [Foth, 1997]. *It is also recommended that groundwater and stream sediment be tested for radioactivity, since Rusk County has been identified by the United States Department of Energy in 1980 as "favorable for uranium deposits"* [USGS, 2003; USDOE, 1981] *and enforcement standards specific to radioactivity were included in the Flambeau Mine Permit. Adding nickel, cobalt, aluminum, uranium and radioactivity to the list of parameters will not have a significant impact to the collection or analytical monitoring costs."*

In addition to the above-noted omissions in FMC's groundwater test panel, the company also failed to report any turbidity data (baseline or follow-up) for samples collected at the Flambeau project site. As noted in the *Flambeau Mine Permit,* both FMC and the DNR had concluded that "turbidity is not a useful parameter for groundwater monitoring" (WDHA, 1991). Dr. Moran, however, did not agree. Here is what he stated regarding this and several other omissions in the FMC groundwater monitoring program (Moran, 2019):

"You will notice that baseline ground water testing at Flambeau also failed to include sulfide, total suspended solids (TSS), and turbidity. Consultant's reports incorrectly argued these determinations were not useful (Foth, 1987). Sulfide would be expected in waters contacting sulfide ores and in the water treatment plant effluents, and is toxic to aquatic organisms; TSS and turbidity are extremely useful for determining whether wells had been adequately developed, or when chemical precipitates were forming."

I could go on and on with examples of DNR-approved groundwater monitoring protocols for the Flambeau project that Dr. Moran found unacceptable. In the interest of brevity, however, let me leave you with his own summation. As you read it, please bear in mind that these are the words of a seasoned hydrogeologist with more than 45 years of domestic and international experience in conducting and managing water quality, geochemical and hydrogeologic work for private investors, industrial clients, tribal and citizens groups, NGO's, law firms, and governmental agencies at all levels (Moran, 2017a). Here then is an excerpt from Dr. Moran's summation of the situation at Flambeau (Moran, 2019):

"For decades, some of the most relevant data and the most significant water-related impacts [at Flambeau] *have been withheld from public view. Parameter concentrations from most FMC wells are not quantitatively-reliable due to: failure to collect unfiltered samples; inadequate well construction, well development and purging, and, unacceptable sampling procedures. Frequently, important chemical constituents were missing from analyses,*

[2] Citizens retained *Center for Science in Public Participation* (Bozeman, MT; csp2.org) in 2009 to assess groundwater and surface water contamination at the reclaimed Flambeau Mine. Dr. David M. Chambers (geophysicist) assessed FMC's surface water data, and Dr. Kendra Zamzow (environmental geochemist) focused on groundwater issues. Two separate reports were issued (Chambers & Zamzow, 2009; and Chambers, Zamzow & Parejko, 2009), both of which were submitted to the Wisconsin DNR in 2009 and again in 2019 in efforts to inform Department decisions on issues of concern.

[3] Wisconsin's Maximum Contaminant Level (MCL) for nickel in drinking water is 100 ug/L and the Preventive Action Limit (PAL) is 20 ug/L (Chapter NR 140, *Wisconsin Administrative Code*).

inappropriate analytical detection limits were employed, and crucial data were not reported. Most importantly, the DNR allowed FMC to inappropriately restrict the list of chemical constituents monitored in waters from wells, waste rock, pit leachates, and the influent waters to the waste water treatment plant. FMC permit reports and subsequent public documents were based on these inadequate data. …

Obviously the mining and remediation practices employed at Flambeau do not represent a sustainable, long-term solution. While FMC may have satisfied the State oversight and disclosure requirements, the site ground waters are contaminated, and ***these waters would require expensive, active water treatment to be made suitable for most foreseeable uses****. The operating and maintenance costs for such plants are extremely high. I have worked on several projects where the present water treatment costs have been hundreds of millions of dollars, and in some cases the costs must be paid by the taxpayers.*

FMC and their contractors supplied all of the data and interpretations used to compile the permit-related reports and subsequent Annual Reports. Such an approach obviously reflects FMC's interests, but is likely quite different from financially-independent, public-interest science. In short, the Flambeau Mine is the poster child for a severely-flawed permitting and oversight process that has likely generated long-term public liabilities.

As a minimum, a program of water quality monitoring totally independent from any financial or political control by FMC (or the DNR) should be instituted. This program would include independent sampling, sample handling, analysis and data interpretation.

Flambeau ground and surface water quality is being and has been degraded—despite years of industry public relations statements touting the success of the FMC operation. Rio Tinto said in a 2013 public relations (PR) release regarding the Flambeau Mine: "Testing shows conclusively that ground water quality surrounding the site is as good as it was before mining." In efforts to encourage development of the other metal-sulfide deposits in northern Wisconsin and the Great Lakes region, the industry approach has been to simply repeat this false statement over and over, assuming that repetition will make it believed[4]*. Unfortunately, the FMC data show otherwise."*

[4] A collection of *Mining Industry Promotional Materials Featuring the Flambeau Mine* has been compiled by Deer Tail Scientific for educational purposes (DTS, 2019c).

Tab 12

Regulatory Issue (1989):

Whether to grant FMC an exemption to NR 132.18(1)(c) of the *Wisconsin Administrative Code*, the Department rule that stated a mine shall not be constructed “within 300 feet of a navigable river or stream”.

History of DNR Regulatory Mismanagement of the Flambeau Project

Tab-12

Issue Under Consideration:
The DNR's 1989 decision to grant FMC an exemption to NR 132.18(1)(c) of the *Wisconsin Administrative Code*, the Department rule that stated a mine shall not be constructed "within 300 feet of a navigable river or stream." The exemption allowed FMC to construct the Flambeau Mine pit 140 feet from the Flambeau River.

NB: NR 132.18(1)(c) has since been amended and renumbered to NR 132.110(1)(c). The current setback requirement specified in the rule is 500 feet, which further brings into question the DNR's 1991 decision to allow FMC to construct the Flambeau pit just 140 feet from the Flambeau River.

Wisconsin DNR Regulatory Decision/Misstep:
The DNR recommended granting FMC a variance to the Department's 300-foot setback rule, and it was written into the *Flambeau Mine Permit* approved by Hearing Examiner David Schwarz (State of Wisconsin Division of Hearings and Appeals) in January 1991 (WDHA, 1991), this despite the fact that FMC's 1989 *Mining Permit Application* had stated the following with regard to the company's predictive modeling (Foth, 1989c):

"… all of the groundwater flowing through the Type II [high-sulfur] *waste rock in the reclaimed pit will exit the pit through the Precambrian rock in the river pillar and flow directly into the bed of the Flambeau River. Since this flow path is very short and occurs entirely within fractured crystalline rock, there will be little if any dispersion or retardation of the dissolved constituents in the groundwater. … Since there will be no dispersion, dilution, or retardation, in the river pillar, the concentrations of these constituents in the groundwater leaving the pit will be the same as the concentrations entering the river bed."*

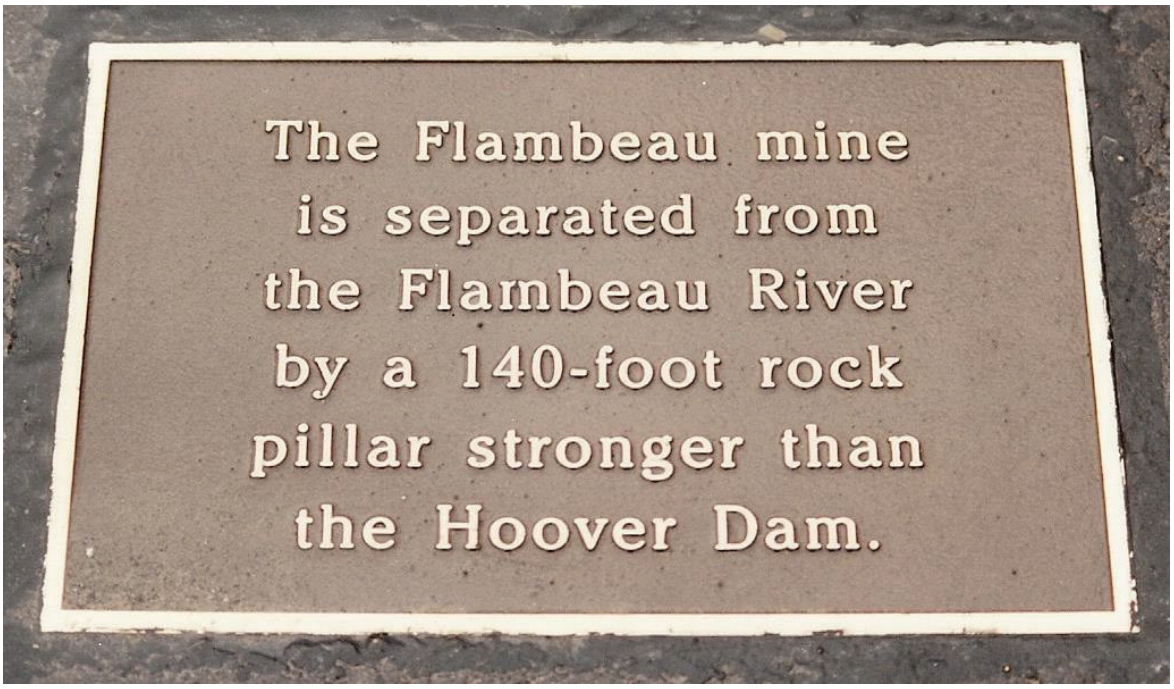
Background Information:
FMC needed a variance to the DNR's 300-foot setback rule because it wanted to dig its mine pit 140 feet from the Flambeau River to capture additional ore. To put it into perspective, consider this: There are 12 city blocks in a mile, so granting the variance meant the pit would be less than 1/3 of a block from the river.

Discussion:
While FMC was certainly aware of the findings generated by their own consultant in 1989 regarding the fractured nature of the bedrock between the mine pit and Flambeau River and the certainty of contaminants entering the river from the pit (see above), here is what the company communicated to the local people in a brochure disseminated in 1991 (FMC, 1991):

"The [mine pit] will be located near the Flambeau River and will be separated, at its nearest point, by a 140-foot-wide rock pillar that has the strength of solid concrete and provides a barrier stronger than the Hoover Dam which holds back the Colorado River." FMC even displayed a plaque with similar messaging at the project site during mine operations (see next page).

Now that the Flambeau Mine pit has been backfilled with sulfide-containing waste rock and other mining-related wastes (e.g., all of the filter sands and sludges from the mine's waste water treatment plant), monitoring wells *within* the backfilled pit and *between the pit and river* are showing high concentrations of several different contaminants, greatly exceeding baseline concentrations and relevant water quality standards and criteria. In a comprehensive review of historical and modern FMC documents published in 2019, hydrogeologist Robert E. Moran[1]

[1] Citizens retained Dr. Robert E. Moran (hydrogeologist; Michael-Moran Associates, Golden, CO; remwater.org) in early 2017 to conduct a comprehensive review of historical and modern FMC documents and water quality data. He issued a summary of his initial findings in April 2017 (Moran, 2017), and the complete report was issued in 2019, posthumously (Moran, 2019) with the help of Dr. David M. Chambers (geophysicist; Center for Science in Public Participation, Bozeman, MT; csp2.org). Both reports were submitted to the Wisconsin DNR in 2019 in efforts to inform Department decisions on issues of concern.



In FMC's 1989 *Mining Permit Application* for the Flambeau project, the rock between the Flambeau Mine pit and Flambeau River was described as "fractured", and the company predicted that contaminated groundwater leaving the mine pit would "flow directly into the bed of the Flambeau River." But that's not what FMC told the public. Shown here is a plaque displayed at the project site during mine operations (Photo by Kira Henschel, circa 1995).

described the situation as follows and also included a series of graphs in his report to demonstrate the extent of the groundwater contamination problem (Moran, 2019; Moran, 2019b):

"Roughly 20 years after the cessation of active mining, Flambeau Mine ground waters are contaminated by past Flambeau Mining Company (FMC) activities. … FMC wells within the backfilled pit have median dissolved concentrations as high as the following (2014-16): Copper = 503 µg/L; Iron = 14,000 µg/L; Manganese = 33,500 µg/L; Zinc = 1,200 µg/L; Arsenic = 23 µg/L; Sulfate = 1,600 mg/L; Alkalinity = 610 mg/L; Hardness = 2,150 mg/L; Total Dissolved Solids = 3,110 mg/L; Specific Conductance = 3,180 µS/cm. These values greatly exceed baseline data and relevant water quality standards and aquatic life criteria. FMC's "baseline" ground water data report that uranium was detected in between 64% to 100% of their samples, depending upon the well producing zone, yet uranium was not included in the routine monitoring."

The above quote from Dr. Moran primarily deals with monitoring wells located *within* the backfilled pit, but he also examined pollution data from several wells located directly between the backfilled pit and Flambeau River (MW-1000R, MW-1000PR and MW-1004). Here is what he reported:

" … the increased and sustained or fluctuating levels of manganese, sulfate and S.C. [Specific Conductance] *in the downgradient replacement wells (MW-1000R and MW-1000PR) indicate pit-influenced water is slowly migrating to the southwest of the pit* [i.e., toward the Flambeau River]. *Slowly increasing trends in manganese and iron since 2007 in a well located to the northwest of the backfilled pit (MW-1004P; 76 ft. deep) suggest some slow, deeper migration of pit water in that direction as well (see trend graphs in FMC annual reports). MW-1003/P, located along the north wall of the backfilled pit, is also of interest, but no water quality data for this particular nested well has been included in any of FMC's annual reports."*

In addition to the graphs from Dr. Moran's report referenced above, a number of Flambeau Mine groundwater pollution graphs generated by *Deer Tail Scientific* show how contaminant levels in several of the so-called "intervention boundary" wells in the mine's 140-foot-wide "Hoover Dam" shot upward after the mine pit was backfilled (DTS, 2020). This has already been discussed earlier (see Tab-9), but please take the time to look once more at the manganese and sulfate graphs for MW-1000PR (Tab-18, Figures 20 and 23) and the manganese graph for MW-1000R (Tab-18, Figure 21).

The above-cited graphs demonstrate how FMC's "Hoover Dam" analogy for the bedrock between the backfilled mine pit and Flambeau River was a farce and a sham. Even more inexcusable, however, was that the DNR *knew* it was a farce (by virtue of admissions made by the company in their 1989 *Mining Permit Application* regarding the fractured nature of the bedrock between the pit and river and the likelihood of contaminants exiting the pit and flowing "directly into the bed of the Flambeau River") and still proceeded to grant FMC a variance to the 300-foot setback rule.

Tab 13

Regulatory Issue (1989):

Whether to grant FMC an exemption to NR 132.18(1)(d) of the *Wisconsin Administrative Code,* the Department rule that states a mine shall not be constructed “within a floodplain”.

History of DNR Regulatory Mismanagement of the Flambeau Project

Tab-13

Issue Under Consideration:
The DNR's 1989 decision to grant FMC an exemption to NR 132.18(1)(d) of the *Wisconsin Administrative Code*, the Department rule that states a mine shall not be constructed "within a floodplain".[1]

Wisconsin DNR Regulatory Decision/Misstep:
The DNR granted FMC an exemption to the Department's floodplain rule, allowing the Flambeau Mine and all its features (pit, waste rock stockpiles, wastewater detention ponds, etc.) to be constructed within the floodplain of the Flambeau River (WDHA, 1991). Apparently neither FMC nor the Department thought there was any substantial risk of flooding at the project site. Unfortunately, though, Ladysmith experienced a "hundred-year flood" while the mine was in operation, resulting in the Flambeau River coming to within 20 horizontal and 4 vertical feet of spilling into the mine pit, a near-catastrophe.

Discussion:
The below aerials of the Flambeau Mine pit, taken on September 17, 1994 during flood stage conditions in the Flambeau River, say it all: The DNR's granting of FMC's request for an exemption to the Department's floodplain rule was a regulatory misstep that nearly resulted in environmental disaster.

The Flambeau River came within 20 horizontal feet and 4 vertical feet of spilling into the Flambeau Mine pit in September 1994 during heavy rains, as Rusk County experienced a flood of such magnitude that it exceeded a hundred-year event. This photo was taken the day after *the river crested (Photo by Bob Olsgard of Sarona, WI, September 17, 1994).*

[1] The rule has since been renumbered to NR 132.110(1)(d).

FMC's water treatment plant couldn't keep up with all the rainwater and groundwater that poured into the mine pit. Four feet of water accumulated in the bottom, totaling about four million gallons according to FMC estimates (Photo by Bob Olsgard of Sarona, WI, September 17, 1994).

Aerial view of the Flambeau Mine shows the pit with accumulated precipitation and groundwater in the bottom and its close proximity to the Flambeau River. To the left is the high-sulfur waste rock stockpile, ore crushing area, rail spur, and an engineered runoff pond (Photo by Bob Olsgard of Sarona, WI, September 17, 1994).

Tab 14

Regulatory Issue (2007):

Whether to object to FMC's stated position that groundwater and Flambeau River environmental monitoring results should not be allowed into evidence at the hearing over the company's initial (2007) request for a Certificate of Completion of reclamation for the Flambeau Mine project site.

History of DNR Regulatory Mismanagement of the Flambeau Project

Tab-14

Issue Under Consideration:
The DNR's failure to object to FMC's demand that groundwater and Flambeau River environmental monitoring results not be allowed into evidence at the contested case hearing over the company's initial (2007) request for a Certificate of Completion (COC) of reclamation for the Flambeau Mine project site.

Wisconsin DNR Regulatory Decision/Misstep:
The DNR's failure to object to FMC's position that the scope of the hearing should be limited to those issues deemed appropriate by the company doomed the hearing, for the most part, to a discussion of issues that were topical rather than substantive in nature, as reflected in the *Ruling on Statement of Issues* handed down by the Administrative Law Judge (WDHA, 2007a). In effect, the Department's acquiescence on this matter allowed FMC to set most of the terms for what defined successful reclamation. Luckily, the Administrative Law Judge still ruled that issues related to the failed *Surface Water Management Plan* implemented by FMC in the Industrial Outlot were properly part of the proceedings, but this was not done at the DNR's insistence, but rather the insistence of the objecting parties.

Discussion:
FMC's position leading up to 2007 contested case hearing was that the issues to be considered at the hearing were *"simple"* and should be *"limited to essentially 'checking off' whether FMC has or has not completed certain specified reclamation tasks and met specified revegetation performance standards"* (FMC, 2007b). Any discussion of performance standards related to groundwater quality at the project site or the protection of fish and other aquatic species in the Flambeau River was considered off limits by FMC.

The above approach to defining successful reclamation and the DNR's failure to object had serious ramifications at the 2007 contested case hearing. Here's just one example: In an effort to help minimize groundwater contamination within the backfilled pit, FMC's reclamation plan had called for the company to add limestone to the high-sulfur waste rock during backfill operations. FMC maintained that, in order to get the COC, they only had to prove to the state that, yes, they had added the limestone just like they said they would. The fact that their own monitoring data showed significant groundwater contamination within the backfilled pit despite the limestone amendment (and that the levels of contamination greatly exceeded predictions offered by FMC during the permitting process) was something FMC felt should be off limits for discussion, and, remarkably, the DNR did not object.

As a result of the DNR allowing FMC to set most of the terms for the 2007 contested case hearing, the following issues related to site reclamation were among those disallowed from consideration: (a) groundwater contamination within the reclaimed mine pit that significantly exceeded levels predicted by FMC in their *Mining Permit Application* (see Tab 9 for details); (b) exceedances of *Flambeau Mine Permit* standards in monitoring wells located between the reclaimed pit and Flambeau River (see Tab 9 for details); and (c) data regarding potential adverse impacts of the mine on fish and other aquatic life in the Flambeau River, including endangered and threatened species found near the project site prior to mine construction (see Tabs 5 and 6 for details). Instead, the COC awarded to FMC in 2007 for its reclamation of the pit area was based solely on the company's completion of backfill operations according to plan and successful revegetation of the surface.

The only issue where FMC did *not* get its way at the 2007 hearing was consideration of surface water pollution issues in the Industrial Outlot, where FMC had implemented a *Surface Water Management Plan* as part of site reclamation. As discussed in great detail earlier (see Tab-3), the pollution data was so compelling that FMC had no choice but to enter into a *Stipulation and Order* that denied the company a COC for the outlot (WDHA, 2007b). Yet, even though: (1) the DNR was a signatory to the *Stipulation and Order;* (2) the most recent *Surface Water Management Plan* implemented by FMC in 2016 has failed to clean up the problem (the Flambeau River tributary at issue remains impaired; see Tab-18, Figures 8 and 9); and (3) the *Stipulation and Order* specified that, in order for the outlot to obtain a COC in the future, issues related to FMC's *Surface Water Management Plan* would once again need to be considered, Department officials failed to even *mention* the ongoing surface water pollution problem in their "Findings of Fact" when evaluating FMC's most recent (2022) attempt to obtain the COC and appear poised to grant the COC at the present time (WDNR, 2022b). See Tab-16 for details.

The first time around (2007), FMC took the initiative to eliminate a number of important issues from consideration during the COC process, and the DNR acquiesced. This time (2022), it appears the DNR has taken the initiative itself. This cannot stand!

Tab 15

Regulatory Issue (2018 and 2022):

Whether to grant FMC's 2018 petition to scale back environmental monitoring requirements at the reclaimed Flambeau Mine site, how to address public comment submitted on the matter, and whether to incorporate the same scaled-back monitoring plan into the *Revised FMC Mining Permit* under consideration in 2022.

History of DNR Regulatory Mismanagement of the Flambeau Project

Tab-15

Issue Under Consideration:
Whether to grant FMC's 2018 petition to scale back environmental monitoring requirements at the reclaimed Flambeau Mine site, how to address public comment submitted on the matter, and whether to incorporate the same scaled-back monitoring plan into the *Revised FMC Mining Permit* under consideration in 2022.

Wisconsin DNR Regulatory Decision/Misstep:
Despite the precarious groundwater situation at the reclaimed Flambeau Mine project site (see Tab-9 for details) and the ongoing impairment of Stream C in the mine's industrial outlot (see Tab-3 for details), the DNR approved FMC's scaled-back monitoring plan in late 2019 with little modification, and it went into effect the next year. When questioned as to its rationale for rejecting science-based recommendations and expert reports submitted in opposition to the plan during the public hearing process, the Department could provide no explanation. In addition, the DNR now proposes to incorporate the same scaled-back monitoring plan (known as the *2020 Updated Monitoring Plan*) into the *Revised FMC Mining Permit* currently under consideration even though the above-noted surface and groundwater contamination problems persist.

Discussion:
FMC petitioned the Wisconsin DNR in late 2018 to scale back environmental monitoring requirements at the Flambeau project site (FMC, 2018b). They sought, among other things, permission to: (1) decrease the number of constituents tested in groundwater samples and the frequency of testing; (2) abandon 18 of their 49 monitoring wells and piezometers; and (3) eliminate all earlier requirements for monitoring Flambeau River surface water quality, sediments, macroinvertebrates and fish. In addition, the proposed monitoring plan included no provisions whatsoever for monitoring Stream C.

The DNR issued a Notice of Public Hearing on the FMC proposal, and Deer Tail Scientific (DTS) submitted detailed and fully-referenced comments in opposition (DTS, 2019a), including two volumes of expert reports upon which the comments were based (DTS, 2019b, Vol I and Vol-II). One issue that DTS raised, for example, was the fact that FMC continues to filter all groundwater samples before running them in the lab instead of following best practices and reporting both filtered *and* unfiltered concentrations. As noted in one of the expert reports submitted in tandem with the comments, not only does filtering *artificially lower the levels of contamination reported to the State,* but it's critical for regulators to have access to *unfiltered* data because most families using private wells or springs and all farms, livestock, wildlife, fish and vegetation, etc. use and consume *unfiltered* water. Yet, no such information has ever been provided by FMC to the State of Wisconsin, this despite the fact that even the *filtered* groundwater samples from many of the company's monitoring wells at the reclaimed site routinely register levels of contamination that, as described in the cited expert report, "greatly exceed baseline data and relevant [drinking water] standards and aquatic life criteria" (Moran, 2019). See Tab-10 for details.

In its comments, DTS also raised concerns over the fact that the scaled-back monitoring plan proposed by FMC included no provisions for monitoring Stream C surface water quality. Here is an excerpt from the DTS submittal (DTS, 2019a):

> Since Stream C contamination was one of the main reasons the state denied FMC a full Certificate of Completion for reclamation of the mine site in 2007, and since Stream C remains on Wisconsin's 303(d) list, continued monitoring of Stream C should be required in the monitoring plan currently under consideration by the Department, rather than the current piece-meal approach, whereby monitoring requirements are tied to specific work plans and subject to potential premature termination.
>
> The Department's original oversight (i.e., the failure to require Stream C monitoring in the 1991 monitoring plan) needs to be corrected so that Stream C does not fall between the cracks, as seems to be the case right now (Fall 2018 concluded the required monitoring period specified in the latest work plan, even though ATCs for copper continue to be exceeded at SW-C1).
>
> If Stream C were given its rightful place in the approved monitoring plan, as it should have been from the very beginning, continued monitoring would be assured until the Department has made the determination that the stream has recovered.

DTS raised many other concerns regarding FMC's scaled-back monitoring plan as well. Rather than repeating all of the details here, I refer you to our original submittal:

- Comments/Requests regarding a proposal from Flambeau Mining Company to scale back monitoring requirements at the Flambeau Mine, Deer Tail Scientific, 2019 (DTS, 2019a); and
- *Outside Reviews of Flambeau Mine Environmental Monitoring Data,* , as compiled by Deer Tail Scientific for educational purposes, 2019 (DTS, 2019b, Vol I and Vol-II).

When the DNR issued their final decision on the FMC petition in 2019, ***none*** of the concerns raised by DTS or its experts were addressed (WDNR, 2019). Instead, the Department opted to approve the new FMC monitoring plan with little modification, and it went into effect in 2020 (Foth, 2020).

While the DNR certainly was not obligated to adopt the recommendations made by DTS and its experts, **surely Department officials were obligated to do their due diligence when reviewing the submitted materials and, if deciding to reject science-based recommendations, be able to explain their reasoning.**

That is why DTS proceeded to do a Public Records Request (PRR) of the DNR in October 2019 – to find out on what basis all of the recommendations submitted to the Department had been rejected. Following is an excerpt:

> As you are aware, [DTS] submitted extensive comments to the Wisconsin DNR this past July regarding a request from Flambeau Mining Company (FMC) to scale back monitoring requirements at the Flambeau Mine site. The comments were based on the findings of several expert reports submitted in tandem with the comments, including reports authored by Dr. Robert E. Moran, Dr. David M. Chambers, Dr. Kendra Zamzow, Dr. Ken Parjeko and the Department's Craig Roesler.
>
> Also submitted was a letter signed by 59 individuals and organizations (including Secretary of State Doug La Follette …), specifically asking Department staff to "thoroughly review Dr. Moran's report and take its findings into account before approving any changes to the Flambeau Mine monitoring plan."
>
> It appears that none of the concerns raised in the comments (or by the experts in the submitted reports) were addressed in the Department's final decision. [We are] trying to better understand what transpired and on what basis the comments and suggestions were rejected.

The Department produced 61 items in response to the PRR, but not a single one addressed the science behind the Department's decision to reject the concerns raised. Instead, many of the produced records consisted of email correspondence involving the Department's legal staff, and many of those emails were highly redacted. Based on the records produced (which, by the way, only included email correspondence even though DTS had requested all letters, emails, meeting notes, appointment records, phone logs, memoranda or other records related to this matter), it appears that Department officials in Madison, when processing the DTS submittal, had not sought input from any of the Department's technical experts in the field (i.e., the water resource management specialists and hydrogeologists at the DNR's Park Falls, Hayward, Rhinelander and Tomahawk field offices who had been following the water quality data at the reclaimed Flambeau Mine project site all along). All that DTS could conclude was that either: (a) there was no proper scientific review of the submission; or (b) if there was, the Department did not want DTS to know what was said.

After receiving the unsatisfactory response to its records request, DTS did not let the issue drop. The need for transparency was too important, so they sent a letter to the DNR's Natural Resources (NR) Program Manager asking for some sort of ***documentation*** of how the DTS submission had been processed and handled (DTS, 2020a). The only thing the official offered in response, though, was this generic statement: "The decision making process included a thorough review and due consideration of all materials received during the written comment period, including yours, by department resource managers, mining technical staff and experts, including regional staff."

The DNR's response did not sit well with DTS, so they sent a second letter pushing the issue. Here's an excerpt (DTS, 2020b) :

> You state: "The decision making process included a thorough review and due consideration of all materials received during the written comment period, including yours, by department resource managers, mining technical staff and experts, including regional staff."
>
> That's great and what I would expect the Department to do. But again, as I am sure you know:
>
> 1. 14 of the last 15 samplings of Stream C surface water showed significant exceedances of the ATC for copper immediately downstream of the mine's passive water treatment system, confirming the system has failed to clean up the contamination caused by mining activities. This is no throw-away stream (see enclosed photos); and
> 2. Manganese concentrations in an intervention boundary well located directly between the backfilled pit and Flambeau River have exceeded and continue to exceed the enforcement standard established in the Flambeau Mine Permit (most recently, by a factor of 4; see enclosed graph for historical data). As might be suspected, concentrations within the backfilled pit are even worse (despite limestone amendment of the waste rock).
>
> The above are just two examples of the kinds of issues raised in my comments. Yet, the new Flambeau Mining Company (FMC) monitoring plan, as approved by the Department:
>
> 1. Requires no further monitoring of Stream C surface water quality (or that of the Flambeau River);
> 2. Allows for a decrease in the monitoring frequency of the above-cited contaminated well (and all other contaminated wells at the mine site), even though said well is within 150 feet of the Flambeau River; and
> 3. Allows FMC to get away with the commonly-used industry trick of filtering all groundwater samples before running them in the lab instead of following best practices and reporting both filtered (dissolved) *and* unfiltered (total) concentrations. The latter, of course, undoubtedly would expose additional contamination, as discussed at length in the report authored by Dr. Robert Moran that I submitted to the Department in tandem with my comments.
>
> These are the kinds of issues that prompted my PRR and why I wrote the follow-up letter to you last month. I would like to understand the Department's reasoning in all this, especially since my comments were submitted in response to your own call for public input and were backed by the findings of professional consultants: hydrogeologist Robert Moran, geophysicist David Chambers, environmental chemist Kendra Zamzow, and aquatic ecologist Ken Parejko.
>
> While I was pleased to learn in your email that my comments were thoroughly reviewed and duly considered by "department resource managers, mining technical staff and experts," surely you can understand it is not enough to just *say* that, especially when things do not appear to add up.

When the official failed to respond to the above letter, DTS sent a follow-up email seeking clarification and received a response from the Director of the DNR's Bureau of Environmental Analysis & Sustainability. Unfortunately, the director simply repeated the same generic claim about how the submission had been given "due consideration" by the Department and, like the NR Program Manager, failed to provide any documentation to substantiate the claim.

None of this adds up. In particular, the Department's own response to the original PRR (if indeed all relevant documents were produced), *belies* the claim made by Department officials that the comments and expert reports submitted by DTS were given "a thorough review and due consideration." If what they said is true, where then is the documentation?

An even more important question to answer is this: **Was the DNR's handling and processing of the DTS submittal *typical* of how comments and expert reports submitted by the public pursuant to a Notice of Public Hearing are processed by the Department?** If so, how can the DNR be held accountable for its actions when Department officials provide no documentation to justify their rejection of recommendations made by bona fide experts in the relevant areas of study (e.g., hydrogeology, geophysics, geochemistry, aquatic ecology)?

Frustrated by the lack of transparency on the part of Department officials regarding this matter, DTS contacted the State of Wisconsin Department of Justice (DOJ) in early 2021 for help in securing the requested records from the DNR. Copies of all correspondence between DTS and the DNR regarding the matter were provided to the DOJ, including all of the above-cited letters and email correspondence (DTS, 2021). Unfortunately, though, the DOJ was unable to help. Here's what they stated: "DOJ cannot offer you legal advice or counsel concerning your public records request as DOJ may be called upon to represent DNR" (WDOJ, 2021).

It appears the system is broken, and that's why the above issues are raised here, hoping that *someone* at the DNR or EPA who is concerned that citizen comments be properly reviewed as part of the public hearing process will take notice of the malfeasance and try to remedy the situation. Otherwise, one can only conclude that good faith efforts on the part of the public to respond to government agency requests for public comment on critical issues are no more than an exercise in futility.

Another problem that needs to be addressed is the fact that the same scaled-back monitoring plan approved by the DNR for the Flambeau project site in late 2019 (Foth, 2020) is what the Department now proposes to incorporate into the *Revised FMC Mining Permit* currently under consideration. Since none of the concerns raised by DTS or its experts were addressed by the Department when the plan was originally approved, we would now like to resubmit those same comments and expert reports to the Department, this time in opposition to the DNR's proposal to use the *2020 Updated Monitoring Plan,* unaltered, as the basis for future monitoring at the Flambeau project site. For a copy of the earlier DTS submittal, hereby resubmitted to the Department for review, please go to the DVD inside the back cover and click on the following files:

- DTS_2019a.pdf
- DTS_2019b_Vol-I.pdf
- DTS_2019b_Vol-II.pdf

Tab 16

Regulatory Issue (2022):

What to include as central “Findings of Fact” in the evaluation of FMC’s 2022 request for a Certificate of Completion (COC) of reclamation of the 32-acre industrial outlot at the Flambeau Mine site.

History of DNR Regulatory Mismanagement of the Flambeau Project

Tab-16

Issue Under Consideration:

What to include as central "Findings of Fact" in the evaluation of FMC's 2022 request for a certificate of completion (COC) of reclamation of the 32-acre industrial outlot at the Flambeau Mine site.

NB: Flambeau Mining Company sought a COC for successful reclamation of the *entire* 181-acre Flambeau Mine site in 2007, resulting in a contested case hearing. The company ultimately was awarded a COC, but only for the 149-acre section of the mine site encompassing the backfilled pit[1] and *not* for mine's 32-acre industrial outlot. At issue was ongoing surface water contamination in Stream C (a tributary of the Flambeau River that crosses a portion of the industrial outlot). As part of the 2007 proceedings, a legally-binding *Stipulation and Order* was handed down that, among other things, identified issues to be considered if/when FMC reapplied for a COC covering the industrial outlot.

Wisconsin DNR Regulatory Decision/Misstep:

When presenting its "Findings of Fact" in support of the Department's decision to grant the COC sought by FMC in 2022, the DNR failed to incorporate a key provision of the above-cited 2007 *Stipulation and Order* (to which the Department was a signatory) that identified issues to be considered in any future hearing over the COC. As a result of the omission, critical issues impacting the advisability of granting the COC were not addressed or even acknowledged by the Department when rendering its decision to grant the COC.

Discussion:

At a 2007 contested case hearing over FMC's initial (2007) attempt to gain a COC of reclamation for the Flambeau Mine project site, representatives of FMC, the DNR and the objecting parties entered into a *Stipulation and Order* that included the following provision (WDHA, 2007b; emphasis added):

> 7. In order for the Industrial Outlot to obtain a COC in the future, the Outlot will need to meet the Administrative Law Judge's interpretation as set forth in the May 14th, 2007 Ruling on the Statement of Issues and any modifications thereto on the record at the contested case hearing on May 30,2007. This interpretation is that the definition of reclamation, which is found in section 293.01(23), Stats. applies as to whether FMC has achieved its reclamation plan, and that FMC will not be required to prove there will not be groundwater or surface water pollution that arises after the COC is issued in order to obtain the COC for the Industrial Outlot.

The "Ruling on the Statement of Issues" referenced in the above excerpt included, among other things, the Administrative Law Judge's determination that "any on-site soil or sediment contamination issues, as well as those related to the erosion control and surface water management plan and the creation of wetlands or placement of biofilters required by the Reclamation Plan" were to be considered as part of the COC hearing process (WDHA, 2007a).

The above ruling is what allowed surface water contamination issues in Stream C to play a central role in the 2007 contested case hearing, ultimately resulting in a denial of the COC for the outlot (see Tabs 3 and 14 for details). Yet, when the DNR issued its "Findings of Fact" for the 2022 COC proceedings, the Department failed to acknowledge the full extent of the ALJ's ruling. Instead, below you will find what the Department stated with regard to the 2007 *Stipulation and Order* (WDNR, 2022b). When you read the passage, please note there is no mention of the ALJ's *Ruling on the Statement of Issues:*

[1] The COC awarded to FMC in 2007 for the 149-acre portion of the mine site where the open pit and several other mine features were located during operations was based solely on FMC's completion of backfill operations according to plan and successful revegetation of the surface. Through legal maneuvering, the company succeeded in securing a ruling from the State of Wisconsin Division of Hearings and Appeals that eliminated consideration of the following factors in the certification process: (a) groundwater contamination within the mine's backfilled pit that significantly exceeded levels predicted by FMC's consultants; (b) documented violations of Flambeau Mine Permit standards in monitoring wells located between the backfilled pit and Flambeau River; and (c) data regarding potential adverse impacts of the mine on fish and other aquatic life in the Flambeau River (WDHA, 2007a). See Tab-14 for more details.

> 13. The Stipulation and Order provides that in order for Flambeau Mining Company to obtain a Certificate of Completion of Reclamation for the Industrial Outlot in the future, Flambeau Mining Company will need to demonstrate the Industrial Outlot has been reclaimed in accordance with the Reclamation Plan, and that Flambeau Mining Company will not be required to prove there will not be groundwater or surface water pollution that arises after the Certificate of Completion of Reclamation is issued for the Industrial Outlot.

The above statement from the DNR represents a *partial* reporting of the facts, not a complete reporting. Surely this can be considered a regulatory misstep on the part of the Department in that legally-binding elements of the 2007 *Stipulation and Order* were not considered by the DNR when handing down the decision to approve the 2022 COC for the industrial outlot. Specifically, issues related to FMC's *Surface Water Management Plan* in the outlot should have been considered in the 2022 proceedings, just like the ALJ deemed such issues appropriate for consideration in the 2007 proceedings. And, just like the failure of FMC to effectively deal with surface water contamination issues in the industrial outlot led to a denial of the COC in 2007, so should their *ongoing failure* to effectively deal with the problem have resulted in a denial of the COC in 2022 (see Tab-18, Figures 8 and 9 for documentation of said failure).

I also ask that the Department please refrain from pointing to Wis. Stats. 107.32 and 289.41(1m)(c) in an effort to assure interested parties that, regardless of what happens at the present hearing, FMC will indeed be responsible, in perpetuity, for any environmental problems that may arise at the Flambeau Mine site *in the future*.

I've heard that argument from the Department in the past, and, even if one could interpret said statutes to require this type of perpetual responsibility (which, upon close review of the statutes and related natural resource rules is debatable), the present hearing is supposed to deal with what FMC has *already* done to the water at the Flambeau Mine site and the *current* situation (not some hypothetical that may arise down the line) and whether or not the company's reclamation efforts should therefore be considered "complete". Any attempt to try to shift the focus of the hearing to potential *future* liabilities when problems already exist in the *present* is a red herring that worked once before for FMC. Please, do not let it happen again.

Tab 17

References.

NB: *Live links* to all listed references are included in an *electronic* version of these comments that can be found on a DVD inside the back cover.
The DVD also includes copies of all the references.

REFERENCES:

Austin, Brenda, 2014 (Oct). Great Lakes woman struggles to educate people about pollution from Flambeau Mine *in:* Win Awenen Nisitotung, October 17, 2014, p. 15

Chambers, Dr. David M, 2010 (Dec). Compilation of FMC Stream C and Biofilter Monitoring Data (1999-2010) [NB: This data table was compiled by Dr. Chambers and submitted to the Wisconsin DNR as part of a citizen petition requesting the Department to add Stream C to Wisconsin's Section 303(d) list of impaired waters. To prepare the table, Dr. Chambers drew on historical FMC environmental monitoring reports on file with the Wisconsin DNR].

Chambers, Dr. David M., 2011 (Aug). Public Hearing Comments RE: File IP-NO-2011-55-03344 and 03345 – Flambeau Mining Company application to convert a detention basin (referred to as a biofilter) to an infiltration basin, and to construct two new infiltration basins, 5 pg.

Chambers, Dr. David M. and Dr. Kendra Zamzow, 2009 (June). Report on Groundwater and Surface Water Contamination at the Flambeau Mine, 29 pg.

Chambers, Dr. David M., Dr. Kendra Zamzow and Dr. Ken Parejko, 2009 (June). Recommendations for Changes to Groundwater, Surface Water and Biomonitoring Specified in the Stipulation Monitoring Plan at the Flambeau Mine, 15 pg.

Churchill, Roscoe and Laura Furtman (Gauger), 2007. The Buzzards Have Landed! – The *Real* Story of the Flambeau Mine, 1285 pg.; To download a free copy of the book from the Deer Tail Scientific website, go to: https://deertailscientific.wordpress.com/book/

Cooper Engineering Company, 1997 (Jul). Letter regarding liner maintenance repairs at Flambeau project site.

Deer Tail Scientific, 2019a. Comments/Requests regarding a proposal from Flambeau Mining Company to scale back monitoring requirements at the Flambeau Mine, 32 pg.

Deer Tail Scientific, 2019b. Outside Reviews of Flambeau Mine Environmental Monitoring Data, Vol-I and Vol-II, as compiled by Deer Tail Scientific for educational purposes; https://deertailscientific.wordpress.com/flambeau-2-volume-set/

Deer Tail Scientific, 2019c. Mining Industry Promotional Materials Featuring the Flambeau Mine, as compiled by Deer Tail Scientific for educational purposes, 26 pg.

Deer Tails Scientific, 2020 (Sep). Graphs of Flambeau Mine Surface and Groundwater Quality Data (Time Period 1987-2020), created by Deer Tail Scientific (Duluth, MN) for educational purposes using data submitted by Flambeau Mining Company to the Wisconsin Department of Natural Resources, 15 pg.

Deer Tail Scientific, 2020a. Letter to Wisconsin DNR regarding a problem with the Department's handling of a Public Records Request.

Deer Tail Scientific, 2020b. Follow-up letter to Wisconsin DNR regarding a problem with the Department's handling of a Public Records Request.

Deer Tail Scientific, 2021. Letter to Wisconsin Department of Justice seeking help in resolving a problem with the Wisconsin DNR's handling of a Public Records Request.

Engineering Technologies Associates, 1998. Addendum to Flambeau Mine Groundwater Model, 75 pg.

Falk, Kathleen, 1989 (Nov). Letter to Wisconsin DNR regarding Flambeau Mine compliance boundary, 2 pg.

Flambeau Mining Company, 1991. A Look at the Flambeau Mine, 4 pg.

Flambeau Mining Company, 1992 (Jan). 1991 Annual Report, 375 pg.

Flambeau Mining Company, 1995 (Jan). 1994 Annual Report, 256 pg.

Flambeau Mining Company, 1996 (Jan). 1995 Annual Report, 185 pg.

Flambeau Mining Company, 1997 (Jan). 1996 Annual Report, 247 pg.

Flambeau Mining Company, 1998 (Jan). 1997 Annual Report, 176 pg.

Flambeau Mining Company, 1999 (Dec). Wetland and Biofilter Monitoring – Fall 1999, 7 pg.

Flambeau Mining Company, 2000 (Dec). Letter to Wisconsin DNR regarding groundwater monitoring well nest installation at compliance boundary, 4 pg.

Flambeau Mining Company, 2001a. Wetland and Biofilter Monitoring – Fall 2000, 6 pg.

Flambeau Mining Company, 2001b. 2000 Annual Report, 250 pg.

Flambeau Mining Company, 2002 (Jan). Wetland and Biofilter Monitoring – Spring 2001, 8 pg.

Flambeau Mining Company, 2003 (Jan). Wetland and Biofilter Monitoring – Spring 2002, 11 pg.

Flambeau Mining Company, 2004 (Aug). Proposed Monitoring Plan for Intermittent Stream C, 11 pg.

Flambeau Mining Company, 2005 (Oct). Stream C – 2005 Analysis of Collected Data, 56 pg.

Flambeau Mining Company, 2007a. 2006 Annual Report, 425 pg.

Flambeau Mining Company (DeWitt, Ross and Stevens), 2007b. Memorandum Regarding Identification of Issues Applicable to Certificate of Completion of Reclamation Hearing, 38 pg.

Flambeau Mining Company, 2008 (Jan). 2007 Annual Report, 319 pg.

Flambeau Mining Company, 2009 (Jan). 2008 Annual Report, 326 pg.

Flambeau Mining Company, 2010 (Feb). 2009 Annual Report, 312 pg.

Flambeau Mining Company, 2011 (Jan). 2010 Annual Report, 260 pg.

Flambeau Mining Company, 2012 (Jan). 2011 Annual Report, 277 pg.

Flambeau Mining Company, 2013 (Jan). 2012 Annual Report, 286 pg.

Flambeau Mining Company, 2015 (Dec). Flambeau Mining Company Environmental Monitoring (Fourth Quarter, 2015), 73 pg.

Flambeau Mining Company, 2018a. 2017 Annual Report, 320 pg (see Appendix B, Attachment 3 for historical Flambeau River surface water quality test results reported by FMC).

Flambeau Mining Company, 2018b. Request to Modify the Updated Monitoring Plan, 197 pg.

Flambeau Mining Company, 2019 (Jan). Environmental Surface Water Monitoring (Second Half of 2018) – Revised, 84 pg.

Flambeau Mining Company (Foth), 2021 (Feb). 2020 Annual Summary Memorandum – Reclaimed Flambeau Mine, 101 pg.

Foth, 1987 (Oct). Scope of Study for the Kennecott Flambeau Project, 161 pg.

Foth, 1989a. Environmental Impact Report for the Kennecott Flambeau Project, Volume 5, Appendix 3.6-H (Groundwater Quality Data), 127 pg.

Foth, 1989b. Mining Permit Application for the Flambeau Project, Volume 1 and Volume 2.

Foth, 1989c. Prediction of Groundwater Quality Downgradient of the Reclaimed Pit for the Flambeau Project, 51 pg. *in:* Mining Permit Application for the Flambeau Project, Foth & Van Dyke, 1989, Volume 2, Appendix L.

Foth, 1991 (July). Updated Monitoring Plan for the Flambeau Project, 51 pg.

Foth, 1992 (Sep). Environmental Monitoring – Groundwater Quality Results (July 1992), 22 pg.

Foth, 1993 (Nov). Operational Phase and Long Term Care Quality Assurance Plan, 359 pg.

Foth, 1997 (Mar). 1997 Backfilling Plan for Stockpiled Type II Material, 403 pg; and Apr 1997 Addendum No. 1, 125 pg.

Foth, 2004 (June). Memo to FMC regarding MW-1015B – Analysis and Talking Points for Fe/Mn Trends [and Sulfate Signature], 4 pg.

Foth, 2007 (Dec). Flambeau Certificate of Completion Stipulation Monitoring Plan, 15 pg.

Foth, 2011 (May). Copper Park Business and Recreation Area Work Plan, 269 pg.

Foth, 2015 (May). Copper Park Business and Recreation Area Work Plan Supplement, 212 pg.

Foth, 2020 (Aug). 2020 Updated Monitoring Plan – Reclaimed Flambeau Mine, 421 pg.

Lac Courte Oreilles Ojibwe, 1991 (Aug). LCO, Sierra Club and Gregg Moore (plaintiffs) vs. Wisconsin Department of Natural Resources and Flambeau Mining Company (defendants), Dane County Circuit Court (Wisconsin), Case No. 91CV2972, Order from Judge George Northrup, filed 08/30/1991.

Lynch, Larry, 2003 (Dec). Response to Public Records Request from Laura Furtman (Gauger).

Moran, Dr. Robert E., 2017 (Apr). Summary – Flambeau Mine: Water Contamination and Selective "Alternative Facts", 4 pg.

Moran, Dr. Robert E., 2017a. Full resume, 22 pg.

Moran, Dr. Robert E., 2019 (posthumous). Flambeau Mine: Water Contamination and Selective "Alternative Facts", 116 pg.; For additional information, go to: https://deertailscientific.wordpress.com/moran-report/.

Moran, Dr. Robert E., 2019a (posthumous). *Excerpt from:* Flambeau Mine: Water Contamination and Selective "Alternative Facts": Appendix: Inadequacies in FMC's Water Quality Monitoring Programs.

Moran, Dr. Robert E., 2019b (posthumous). *Excerpt from:* Flambeau Mine: Water Contamination and Selective "Alternative Facts": Figures 7, 8, and 9a-9f (Figures showing Flambeau Mine monitoring well locations; and Graphs showing groundwater quality data *(measured* vs. *baseline* vs. *predictive modeling* vs. *water quality standards)* for the following groundwater constituents at Flambeau: (a) Specific Conductivity; (b) Sulfate; (c) Copper; (d) Iron; (e) Manganese; and (f) Zinc).

Moran, Dr. Robert E., 2019c (posthumous). *Excerpt from:* Flambeau Mine: Water Contamination and Selective "Alternative Facts": p. 45 and Figure 10 (Summary Table: Work Plans Implemented by Flambeau Mining Company to Address Soil and Water Contamination Issues in the Industrial Outlot at the Flambeau Mine Site – plus follow-up water quality monitoring data and figure with sampling site locations).

Parejko, K., 2009a. Flambeau River Monitoring at the Flambeau Mine, Rusk County, Wisconsin: 1. Flambeau River Sediments – Analysis, Comments and Recommendations, 27 pg.

Parejko, K., 2009b. Flambeau River Monitoring at the Flambeau Mine, Rusk County, Wisconsin: 2. Macroinvertebrates – Analysis, Comments and Recommendations, 29 pg.

Parejko, K., 2009c. Flambeau River Monitoring at the Flambeau Mine, Rusk County, Wisconsin: 3. Crayfish – Analysis, Comments and Recommendations, 14 pg.

Parejko, K., 2009d. Flambeau River Monitoring at the Flambeau Mine, Rusk County, Wisconsin: 4. Walleye Tissue Monitoring – Analysis, Comments and Recommendations, 18 pg.

Straskraba, Vladimir (Hydro-Geo Consultants, Inc.), 1997 (Aug). Review of Hydrogeologic Conditions and Bedrock Geology at Flambeau Mine near Ladysmith, Wisconsin, 21 pg. *in:* Addendum to Flambeau Mine Groundwater Model, Engineering Technologies Associates, 1998, Appendix A.

United States Department of Energy, 1981 (Jan). National Uranium Resource Evaluation, Rice Lake Quadrangle, Wisconsin: Derry, Michener & Booth (R.E. Routledge, I.S. Parish, and O.E. Leigh), GJQ-006(81), 71 pg. See USGS website for additional information: https://pubs.usgs.gov/of/1997/ofr-97-0492/quad/q_ricelk.htm#GJBX-95(78).

United States Environmental Protection Agency, 2014 (Jun). Decision Document for the Approval of Wisconsin's 2012 List with Respect to Section 303(d) of the Clean Water Act, 126 pg. See electronic page 93 of the document for Stream C information.

United States Geological Survey, 2003. The Geochemical Landscape of Northwestern Wisconsin and adjacent parts of Northern Michigan and Minnesota (Geochemical Data Files): W.F. Cannon and L.G. Woodruff, Open File Report 03-259.

Wisconsin Department of Justice, 2021 (Mar). Response to request from Deer Tail Scientific for help in resolving a problem with the Wisconsin DNR's handling of a Public Records Request.

Wisconsin Department of Natural Resources, 1989 (Nov). Flambeau Mine Compliance Boundary Memo, 5 pg.

Wisconsin Department of Natural Resources, 1990 (Mar). Final Environmental Impact Statement: Flambeau Mining Co. – Copper Mine, Ladysmith, Wisconsin, 246 pg.

Wisconsin Department of Natural Resources, 1992a. An Evaluation of Endangered Resources in the Flambeau River - and - A Supplement to the Environmental Impact Statement for the Flambeau Mine Project, 114 pg.

Wisconsin Department of Natural Resources, 1992b. Permit to Discharge Under the Wisconsin Pollution Discharge Elimination System, 30 pg.

Wisconsin Department of Natural Resources, 1996 (Mar). Permit to Discharge Under the Wisconsin Pollution Discharge Elimination System, 21 pg.

Wisconsin Department of Natural Resources (Tom Portle), 2006 (Apr). Internal email correspondence characterizing sampling station SW-C8 in Stream C as "suspect in terms of its value as an upstream or background sample site".

Wisconsin Department of Natural Resources, 2011 (Jul). Lab and Field Results for Surface Water Samples Collected by WDNR at the Flambeau Mine Site (plus calculated ATC's for Copper and Zinc).

Wisconsin Department of Natural Resources, 2012a. Public Data Submittals for First Public Comment Period on Wisconsin's 2012 Section 303(d) List, 39 pg. See electronic pages 3 and 22-34 of the report for Stream C monitoring data. In addition, please see an auxiliary table and map appended to the report in 2022 by DTS for educational purposes (showing Stream C/SWIMS monitoring locations).

Wisconsin Department of Natural Resources, 2012b. Surface Water Quality Assessment of the Flambeau Mine Site, 40 pg.

Wisconsin Department of Natural Resources, 2013 (Apr). Internal email correspondence and photos regarding malfunction of infiltration basins in Flambeau Mine industrial outlot.

Wisconsin Department of Natural Resources (Philip Fauble), 2014 (Oct). Email correspondence with Laura Gauger (Duluth, MN).

Wisconsin Department of Natural Resources (Philip Fauble), 2015 (Feb). Email correspondence with Laura Gauger (Duluth, MN).

Wisconsin Department of Natural Resources, 2019 (Oct). Decision *in:* The Matter of Modifying the Updated Monitoring Plan of Flambeau Mining Company (FMC) for the Reclaimed Flambeau Mining Site, 12 pg.

Wisconsin Department of Natural Resources (Benjamin Callan), 2020 (July). Email correspondence with Laura Gauger (Duluth, MN).

Wisconsin Department of Natural Resources, 2021a. 2022 Water Quality Assessment for Stream C (WBIC 4000013), 2 pg.

Wisconsin Department of Natural Resources, 2021b. DRAFT 2022 Impaired Waters and Restoration Waters Lists [XLS], Wisconsin DNR, as posted to Wisconsin DNR website (Copy Made 12/24/2021). (Go to "Listing Additions" tab, lines 109-110 and "Impaired Waters List" tab, lines 1373-1374 for proposed listing of the portion of Stream C located within the Flambeau Mine Industrial Outlot for both copper and zinc toxicity; Go to "Impaired Waters List" tab, line 1375 for the Department's recommendation to maintain the current listing of the portion of Stream C downstream of the Industrial Outlot for copper toxicity).

Wisconsin Department of Natural Resources (Benjamin Callan), 2022a. Response to Public Records Request from Laura Gauger (Duluth, MN).

Wisconsin Department of Natural Resources, 2022b. Preliminary Determination RE: Findings of Fact, Conclusions of Law and Decision on FMC Petition for Issuance of Final Certificate of Completion of Reclamation and Mining Permit, 16 pg.

Wisconsin Division of Hearings and Appeals, 1991 (Jan). Decision, Findings of Fact, Conclusions of Law and Permits: Application of Flambeau Mining Company for Permits to Build and Operate a Surface Mine in Rusk County, Wisconsin, 199 pg.; Docket No. IH-89-14.

Wisconsin Division of Hearings and Appeals, 2007a. Ruling on Statement of Issues in the Matter of the Application of Flambeau Mining Company for Issuance of a Certificate of Completion of Reclamation, 7 pg.; Case No. IH-07-05.

Wisconsin Division of Hearings and Appeals, 2007b. Stipulation and Order in the Matter of the Application of FMC for Issuance of a Certificate of Completion of Reclamation, 4 pg.; Case No. IH-07-05.

Wisconsin Resources Protection Council, 2011a. WRPC, Center for Biological Diversity and Laura Gauger (plaintiffs) vs. Flambeau Mining Company (defendant), U.S. District Court for the Western District of Wisconsin, Case No. 11-cv-45, Document # 1 (Complaint), filed 01/18/2011.

Wisconsin Resources Protection Council, 2011b. WRPC, Center for Biological Diversity and Laura Gauger (plaintiffs) vs. Flambeau Mining Company (defendant), U.S. District Court for the Western District of Wisconsin, Case No. 11-cv-45, Document # 103 (Declaration of James Saul), filed 12/19/2011.

Wisconsin Resources Protection Council, 2012a. WRPC, Center for Biological Diversity and Laura Gauger (plaintiffs) vs. Flambeau Mining Company (defendant), U.S. District Court for the Western District of Wisconsin, Case No. 11-cv-45, Document # 137 (Opinion and Order on Motions for Summary Judgement), filed 04/13/2012.

Wisconsin Resources Protection Council, 2012b. WRPC, Center for Biological Diversity and Laura Gauger (plaintiffs) vs. Flambeau Mining Company (defendant), U.S. District Court for the Western District of Wisconsin, Case No. 11-cv-45, Document # 256 (Opinion and Order), filed 07/24/2012.

Wisconsin Resources Protection Council, 2013. WRPC, et al. (Plaintiff-Appellees, Cross-Appellants) versus Flambeau Mining Company (Defendant-Appellant, Cross-Appellee), U.S. Court of Appeals for the 7th Circuit, Case Nos. 12-2969 & 12-3434, Document # 52 (Decision), filed 08/15/2013.

Wisconsin Revisor of Statutes Bureau, 2004 (Feb). Response to Public Records Request from Laura Furtman (Gauger).

Tab 18

Figures.

NB: Included are maps and diagrams establishing the layout (historical and current) of the Flambeau Mine project site, including the industrial outlot and its hydric connection to the Flambeau River via Stream C. Graphs and tables showing the extent of groundwater and surface water pollution at the project site are also provided, as are several photos of interest.

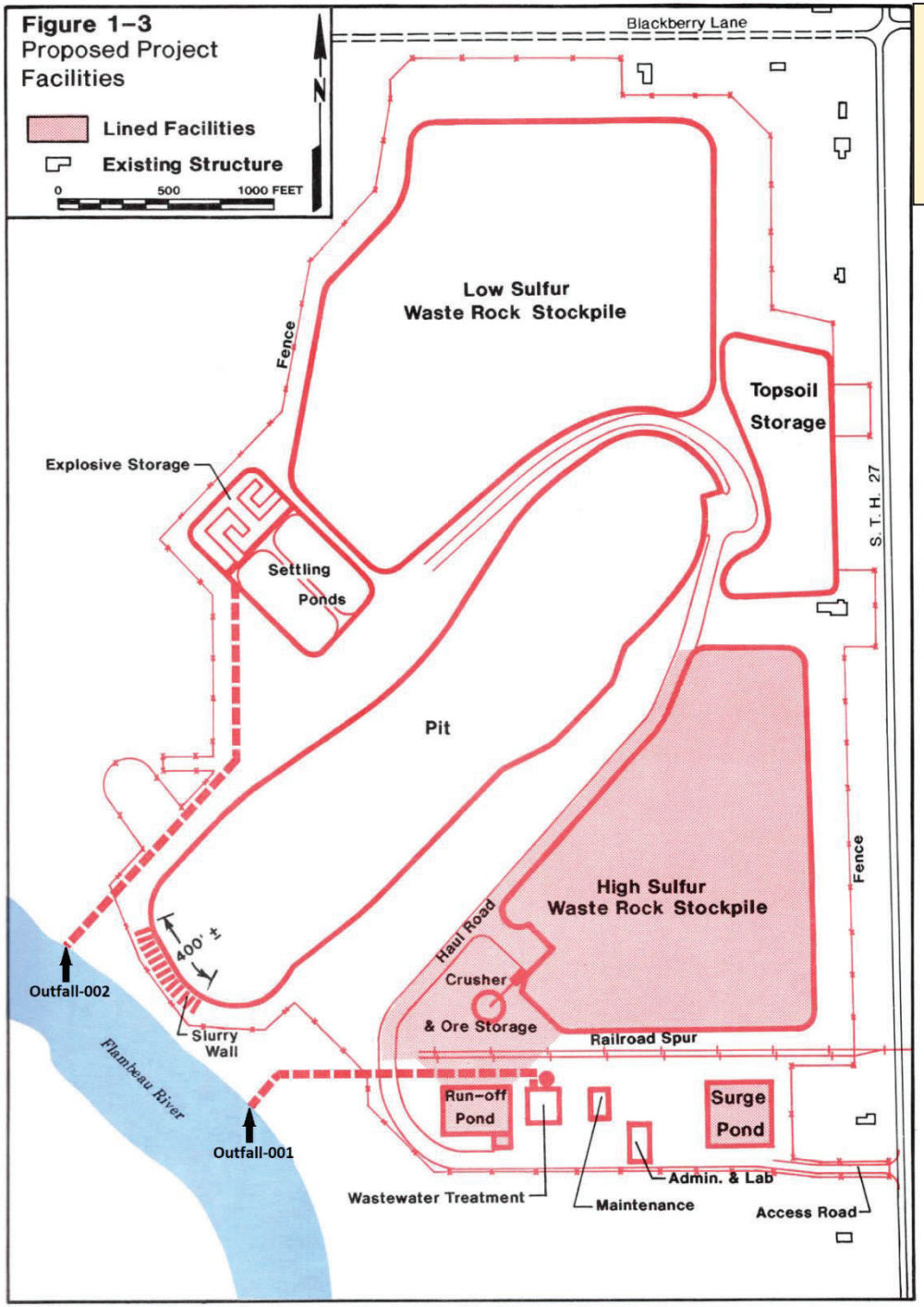


Figure-1. Location of Flambeau Mine features during mine operations in the mid-1990s (Adapted from Figure 1-3 *in:* Final Environmental Impact Statement for Flambeau Mining Co. Copper Mine, Wisconsin DNR, 1990). [Source: Moran, Dr. Robert E., May 2019 (posthumous). Flambeau Mine: Water Contamination and Selective "Alternative Facts", Figure 2]

NB: When the Flambeau Mine project site was reclaimed in 1998, the south-eastern corner became known as the "Industrial Outlot" (see Figure 2). This is where the following facilities were located during mine operations in the mid-1990s:

- Ore crusher
- Crushed ore stockpile
- Waste water treatment plant (WWTP)
- Surge pond and runoff pond (for holding contaminated runoff prior to treatment)
- Railroad spur and rail car loading area
- A portion of the mine's mammoth high-sulfur waste rock stockpile
- Several small buildings that housed a maintenance shop, administrative offices and laboratory

Today, none of the above facilities remain at the project site, except for the buildings that once housed the WWTP, maintenance shop and offices/lab. In addition, the area now known as the "Industrial Outlot" has a passive water treatment system that encompasses the area where the surge pond and runoff pond were located during mining operations (See Figure 5).

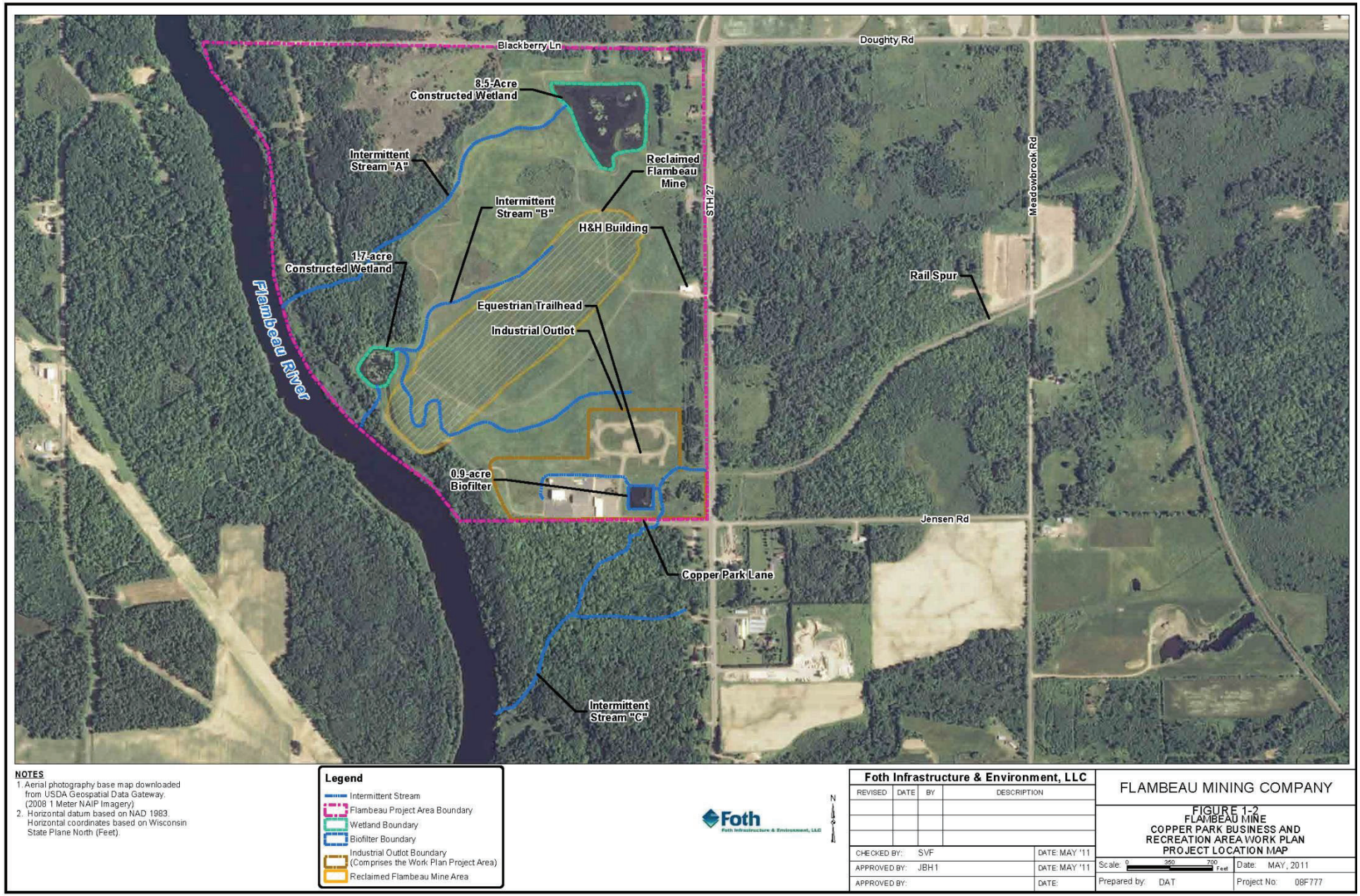


Figure-2. Location of the industrial outlot at the reclaimed Flambeau Mine project site relative to other mine features as they existed in 2011 [NB: See Figure 3 for enlarged view of the industrial outlot; see Figures 4 and 5 for changes made to the outlot in later years [Source: Foth, 2011 (May). Copper Park Business and Recreation Area Work Plan, Figure 1-2].

Figure-3. Enlarged view of Flambeau Mine industrial outlot as it existed between 1998 and 2011. Please note that the "0.9-acre Biofilter" is in the same location as the "Surge Pond" shown in Figure 1 and that it drains to Stream C. The biofilter was constructed in 1998 as part of site reclamation to passively treat contaminated stormwater runoff from the industrial outlot [Source: FMC, 2009 (Jan). 2008 Annual Report, Figure 4-3].

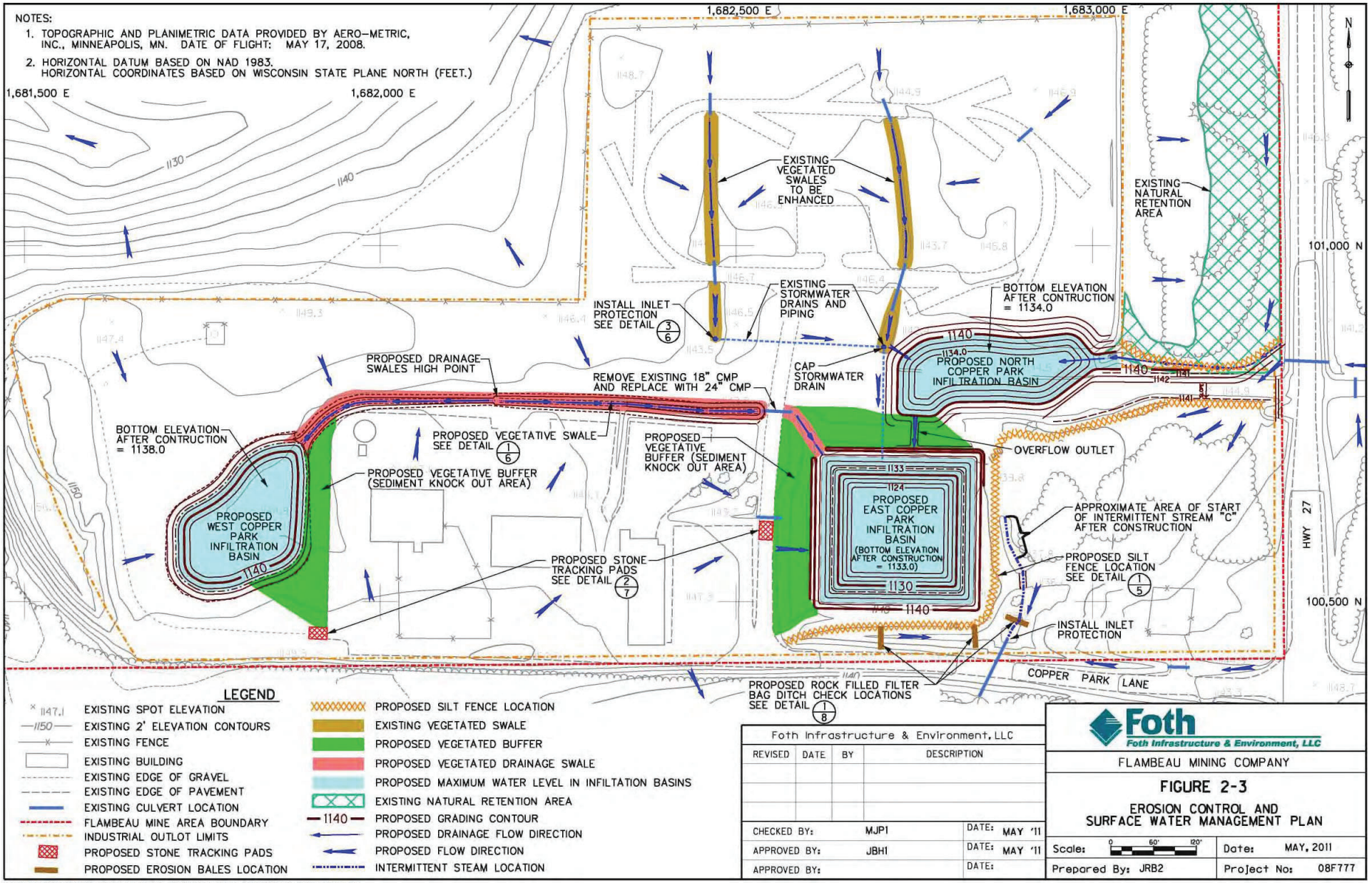
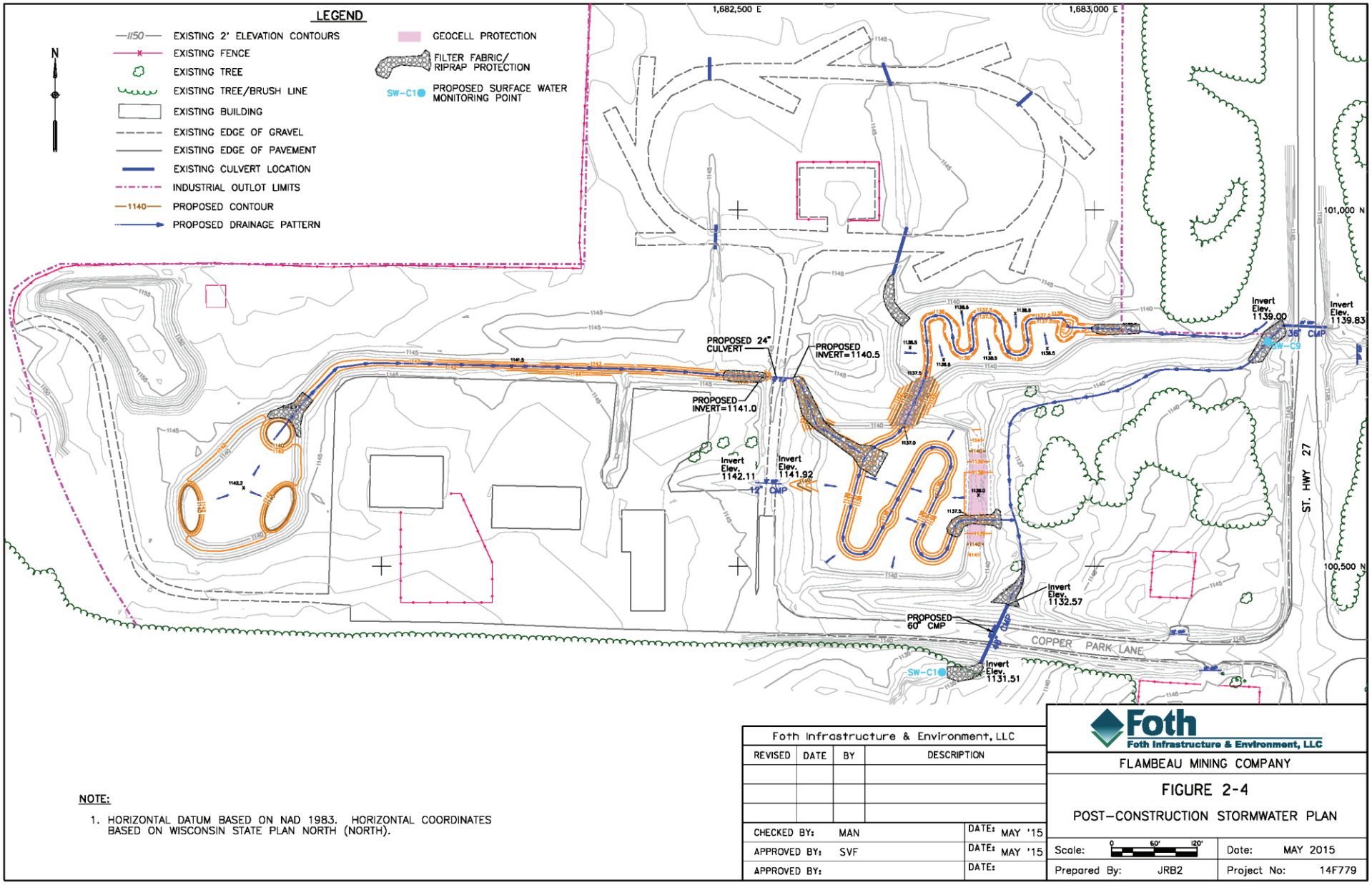


Figure 4. Reconfiguration of Flambeau Mine industrial outlot as proposed by FMC in May 2011 as part of site reclamation. The plan was implemented later the same year to convert the outlot's 0.9-acre biofilter (which had a liner and drained into Stream C) to an unlined infiltration basin with no outlet to Stream C. At the time, Stream C was registering toxic concentrations of copper and zinc, and a Clean Water Act lawsuit had been filed against FMC earlier in the year regarding the same. The idea behind FMC's new plan was that the contaminated runoff from the industrial outlot would now seep into the earth instead of discharging to Stream C [Source: Foth, 2011 (May). Copper Park Business and Recreation Area Work Plan, Figure 2-3].



NOTE:

1. HORIZONTAL DATUM BASED ON NAD 1983. HORIZONTAL COORDINATES BASED ON WISCONSIN STATE PLAN NORTH (NORTH).

Foth Infrastructure & Environment, LLC			
REVISED	DATE	BY	DESCRIPTION

CHECKED BY: MAN	DATE: MAY '15	
APPROVED BY: SVF	DATE: MAY '15	
APPROVED BY:	DATE:	

Foth
Foth Infrastructure & Environment, LLC

FLAMBEAU MINING COMPANY

FIGURE 2-4

POST–CONSTRUCTION STORMWATER PLAN

Scale: 0 60' 120'		Date:	MAY 2015
Prepared By:	JRB2	Project No:	14F779

Figure-5. Configuration of Flambeau Mine industrial outlot after implementation of FMC's most recent (2015) reclamation work plan. The plan called for converting the industrial outlot's "East Infiltration Basin" back into a biofilter with an outlet to Stream C. This was necessary due to the inability of the infiltration basin to handle Spring melts and large rainfall events. As before, Stream C, which was added to the EPA's 303(d) list of impaired waters in 2012 for copper toxicity, remains impaired [Source: Foth, 2015 (May). Copper Park Business & Recreation Area Work Plan Supplement, Figure 2-4].

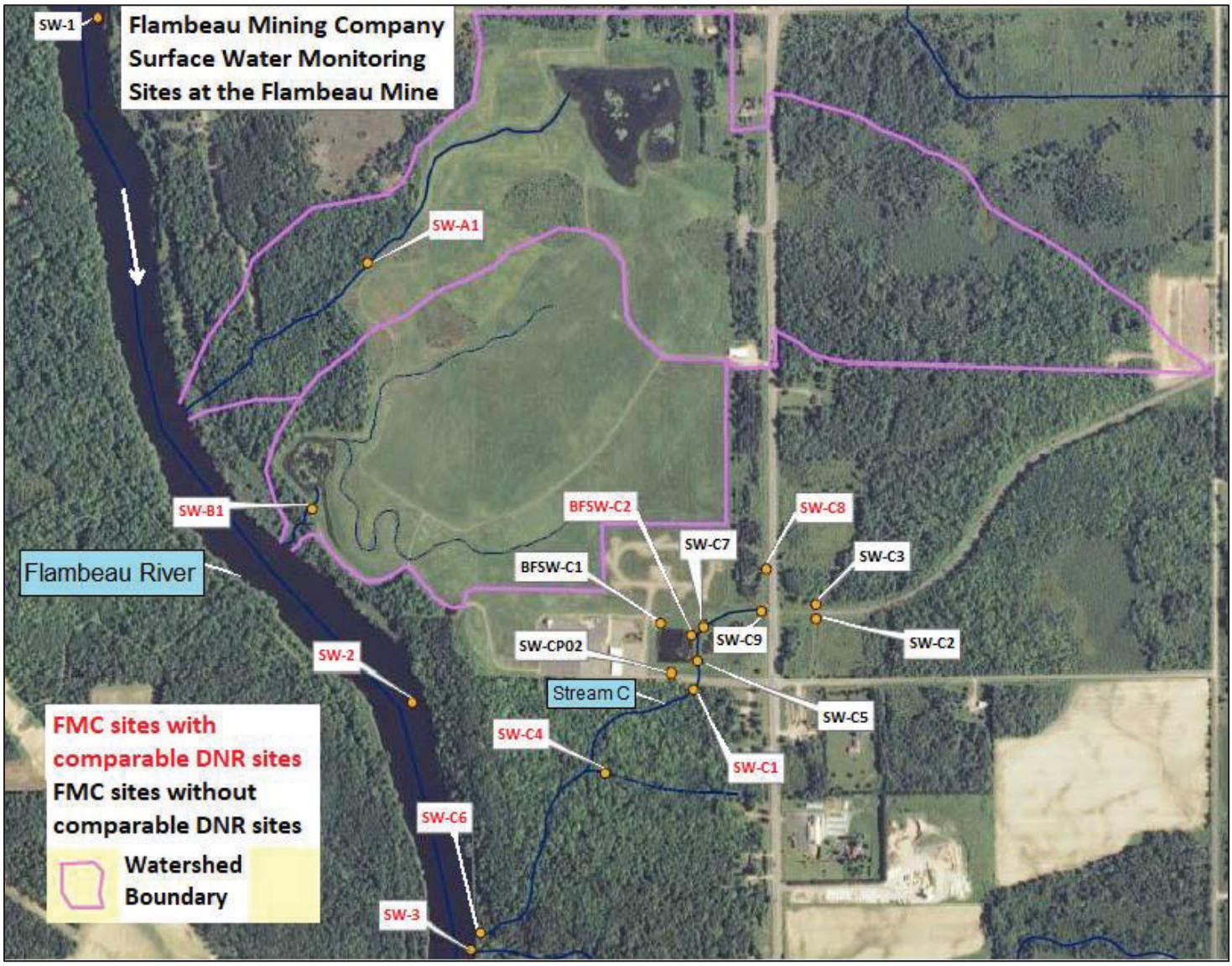


Figure 6. Location of various historical and current surface water monitoring stations at the reclaimed Flambeau Mine site, some of which were sampled by the Wisconsin DNR in 2010-2011 when evaluating Stream C for inclusion on the EPA's 303(d) list of impaired waters (Adapted from Figure 3 *in:* Surface Water Quality Assessment of the Flambeau Mine Site, Wisconsin DNR, April 2012). [Source: Moran, Dr. Robert E., May 2019 (posthumous). Flambeau Mine: Water Contamination and Selective "Alternative Facts", Figure 10]

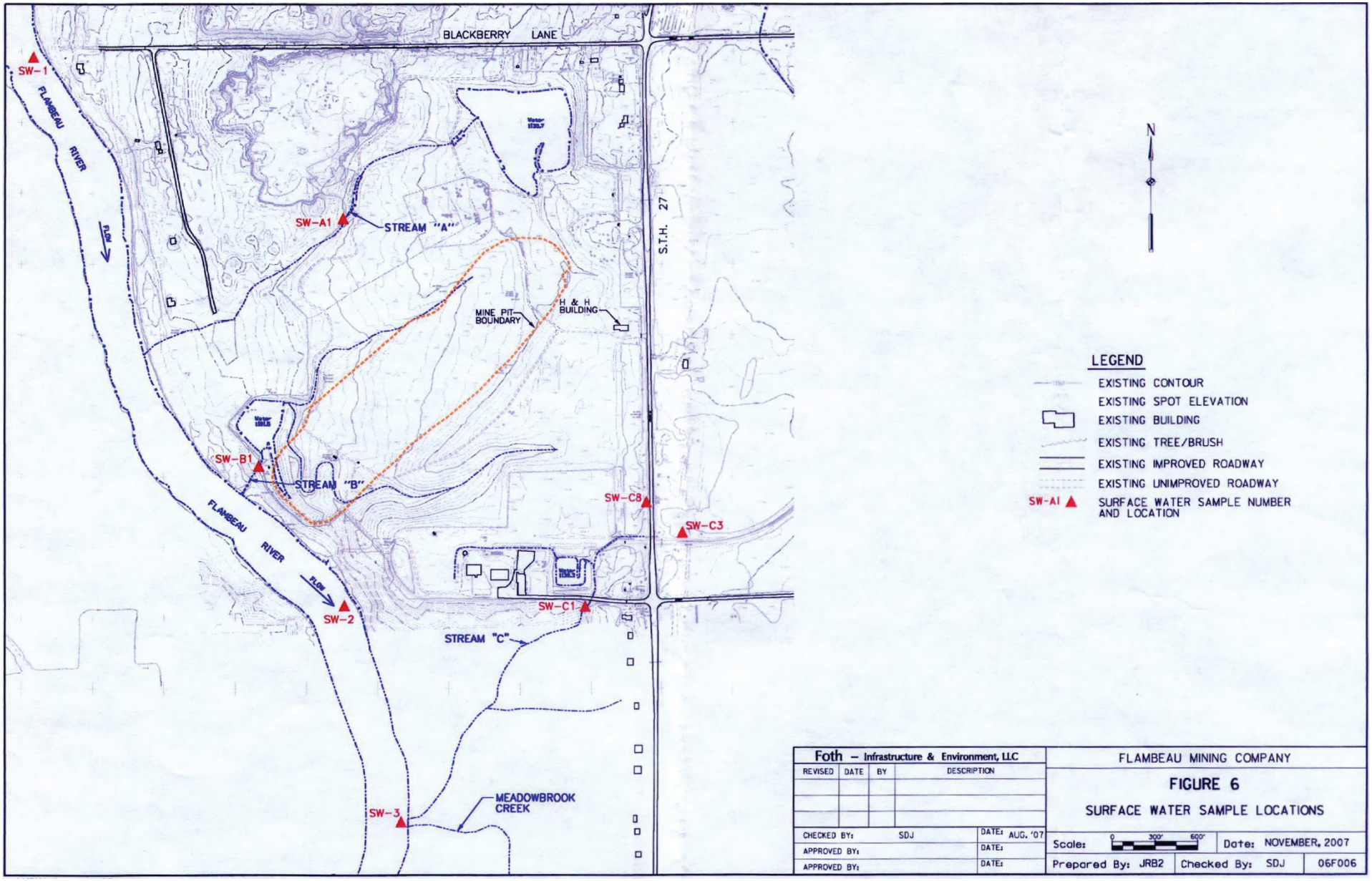
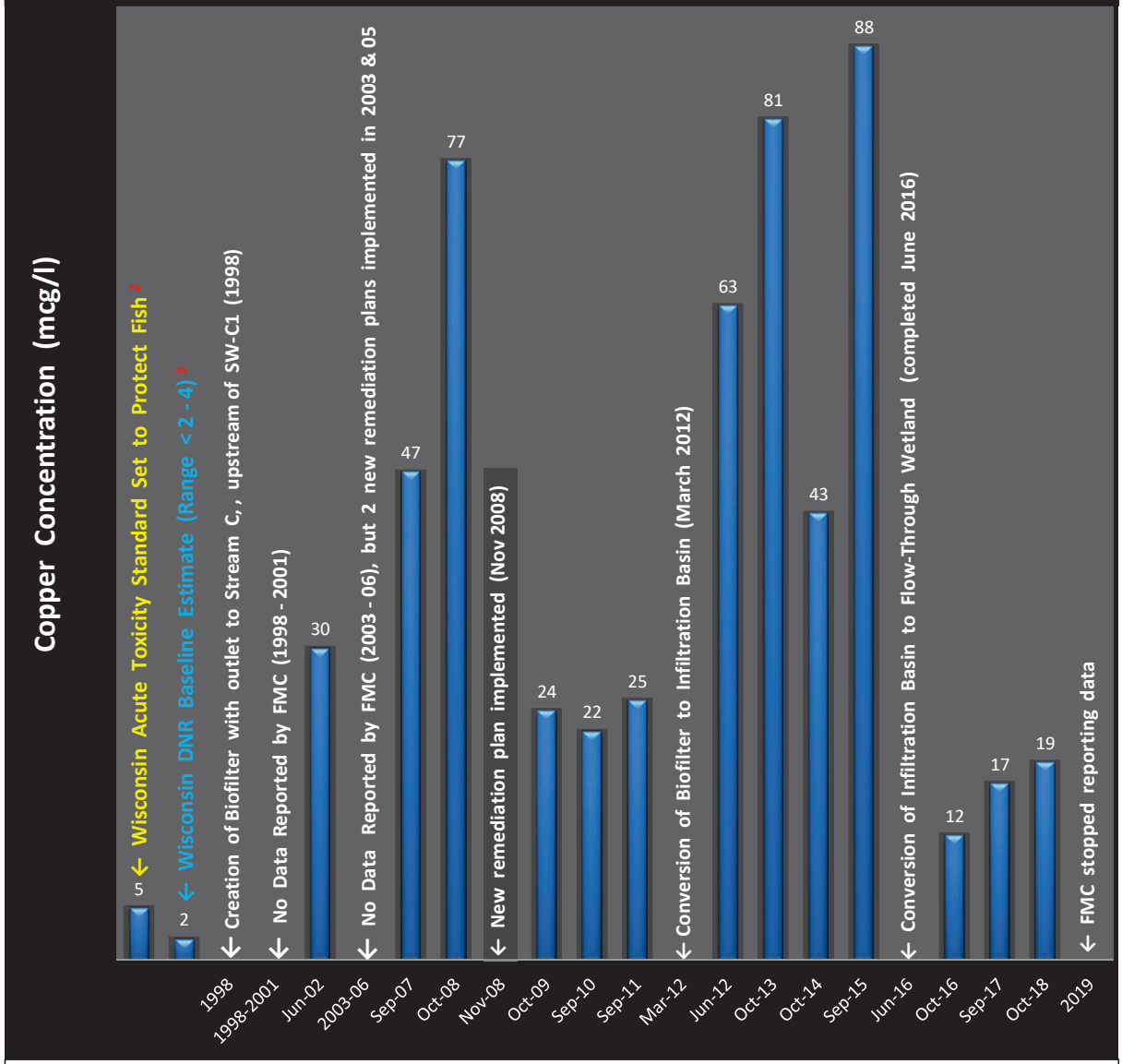


Figure-7. Surface Water Sample Locations required per the terms of a *Stipulation and Order* handed down at a 2007 contested case hearing over FMC's original application for a Certificate of Completion of reclamation for the Flambeau Mine project site. Some of the sampling stations were part of earlier monitoring programs (e.g., SW-1 and SW-2) and others (e.g., SW-3) were new. The addition of the SW-3 sampling station in 2007 marked the first time FMC was required to report Flambeau River water quality data anywhere near the Stream C discharge point [Source: Foth, 2007 (Dec). Flambeau Certificate of Completion Stipulation Monitoring Plan, Figure 6].

Copper Concentrations (total recoverable) in Stream C at the Flambeau Mine Site

Stream C is a tributary of the Flambeau River that crosses the SE corner of the Flambeau Mine site, where the mine's ore crusher, rail spur, water detention ponds and high-sulfur waste rock stockpile were located during operations. [1]

Data shown below was reported by Flambeau Mining Company for Stream C sampling site SW-C1 which is located downstream of where passively treated stormwater runoff from the mine site enters the stream.



1. Historically, Stream C has been used by Flambeau Mining Company (FMC) as a conduit for conveying contaminated stormwater runoff from the mine site to the Flambeau River. In 2012, the stream was added to the Environmental Protection Agency's list of "impaired waters" for copper toxicity linked to the mine operation. Over the years, FMC has instituted 6 different work plans to try to control contamination in the stream (as marked on the above diagram), but the stream remains impaired.

2. *Wisconsin Administrative Code*, NR 105.06 (Nov 2008); Hardness-dependent toxicity; Reported value of 5 mcg/L (Total Recoverable) was calculated for a hardness of 40 mg/l.

3. FMC failed to report baseline surface water quality data for Stream C. In 2010, however, the Wisconsin Department of Natural Resources (DNR) identified a nearby stream deemed appropriate to use for estimating Stream C baseline conditions. A mean copper concentration of 2.2 mcg/L was measured in the stream (range = <2-4; n = 5), as reported *in:* (1) Surface Water Quality Assessment of the Flambeau Mine Site, Wisconsin DNR, Apr 2012; and (2) Flambeau Mine Field and Surface Water Results, Wisconsin DNR, July 2011.

Data Sources: Stream C SWIMS Data Submittal Package to WDNR, Dr. David Chambers (Center for Science in Public Participation, Bozeman, MT), 2010; Stipulation Monitoring Reports, FMC (2010-2012); 2012 Impaired Waters List Submittal Package to EPA, WDNR (2012); 2018 Impairment Assessment for Stream C, WDNR (2017); 2020 Impairment Assessment for Stream C, WDNR (2020); and 2022 Water Quality Assessment for Stream C, WDNR (2021).
Graph created by: Deer Tail Scientific, Duluth, MN (2021). For more information go to: https://deertailscientific.wordpress.com/flambeau-pollution-graphs/.

Figure-8. Copper Concentrations (total recoverable) in Stream C, Immediately Downstream of the Flambeau Mine Industrial Outlot [Source: Deer Tail Scientific, 2020 (Sep). Graphs of Flambeau Mine Surface and Groundwater Quality Data (Time Period 1987-2020), Figure 13 (updated Nov 2021)]. NB: Graphs were created by Deer Tail Scientific for educational purposes using data submitted by Flambeau Mining Company to the Wisconsin DNR.

FMC Work Plan	Selected Copper Concentrations Reported in Stream C after Implementation of Work Plan[14]
1998: Construction of a 0.9-acre biofilter in the industrial outlot to passively treat contaminated storm water runoff from the mine site "before it flows to Stream C" (AES, 1997)	**Jun 2002** [15] (FMC, 2003) • SW-C1: Cu = 30 µg/L (T/D not specified); Hardness-adjusted ATC = 3.7 µg/L (T) • SW-C6: Cu = 22 µg/L (T/D not specified); Hardness-adjusted ATC = 6.4 µg/L (T)
Nov 2003: Removal of rail spur in the industrial outlot and excavation of contaminated soils beneath it (Foth, 2003)	**Jun 2005** (FMC, 2005) • SW-C1: Not Reported • SW-C6: Cu = 36 µg/L (T); Hardness-adjusted ATC = 5.1 µg/L (T)
Jun 2006: Excavation of drainage ditch leading to biofilter; replacement of drainageway with limestone cobbles; removal of 4-10 inches of soils in 2.2-acre area within outlot, covering with crushed limestone gravel and paving with asphalt (Foth, 2005 and 2006)	**Oct 2008** (Foth, 2008b) • SW-C1: Cu = 77 µg/L (T); Hardness-adjusted ATC = 4.4 µg/L (T) • SW-C6: Not Reported
Nov 2008: Excavation and removal of soils in a drainage ditch along a roadway in the outlot (Copper Park Lane) considered a potential source of copper to Stream C (Foth, 2008a)	**Jun 2011** (WDNR, 2012b) • SW-C1: Cu = 23 µg/L (T/D not specified); Hardness-adjusted ATC = 5.6 µg/L (T) • SW-C6: Cu = 22 µg/L (T/D not specified) Hardness-adjusted ATC = 6.6 µg/L (T)
Mar 2012: Replacement of the 0.9-acre biofilter with an infiltration basin (Foth, 2011)	**Oct 2013** (FMC, 2014) • SW-C1: Cu = 81 µg/L (T); Hardness-adjusted ATC = 6.2 µg/L (T) • SW-C6: Not Reported
Jun 2016: Conversion of the infiltration basin to a flow-through wetland area, apparently due to the infiltration basin's inability to handle spring melt volumes and its need to be pumped in order to avoid overtopping[16] (Foth, 2015; WDNR, 2013)	**Oct 2016** [17] (FMC, 2017b) • SW-C1: Cu = 12 µg/L (T/D not designated); Hardness-adjusted ATC = 3.2 µg/L (T) • SW-C6: Not Reported

[14] Between implementation of successive work plans, all copper concentrations reported by FMC at SW-C1 and SW-C6 exceeded the hardness-adjusted ATC. Examples shown here are among the highest reported concentrations.

[15] No water quality data for Stream C prior to June 2002 could be located in the public record. It is also unclear if the copper concentrations reported for SW-C1 and SW-C6 in June 2002 were Total or Dissolved. Between 2003 and 2006, no additional SW-C1 data and only limited SW-C6 data could be located in the public record. See Table 7 – Stream C water quality data, for more details.

[16] An April 2013 email string between the Wisconsin DNR and FMC regarding the near over-topping of infiltration basins at the Flambeau Mine site included photo documentation and the following statement from the DNR: "On a broader issue, we clearly cannot continue responding frantically every spring when the North and East Basins fill up to capacity. That is not a viable management strategy. The basin waters may infiltrate eventually, but they are clearly having difficulty handling the spring melt volumes. With shifting global weather patterns accentuating extreme weather events, I don't see this situation getting much better in the future. I think it is time to discuss the installation of some sort of engineered emergency overflow system. Whether it is a simple rip-rapped apron or some sort of culvert, we need something in place to prevent overtopping of the sidewalls in these intense events" (WDNR, 2013).

[17] **Editor's Note:** Copper concentrations at SW-C1 in Stream C continue to exceed Wisconsin's hardness-adjusted ATC for copper. Among the highest reported concentrations are the following:

06/2017 (FMC, 2017c): Cu = 14.6 µg/L (T/D not designated); Hardness-adjusted ATC = 3.7 µg/L (T);
09/2017 (FMC, 2017d): Cu = 17.1 µg/L (T/D not designated); Hardness-adjusted ATC = 7.9 µg/L (T);
07/2018 (FMC, 2018b): Cu = 14.7 µg/L (T/D not designated); Hardness-adjusted ATC = 5.3 µg/L (T);
09/2018 (FMC, 2018e): Cu = 22.0 µg/L (T/D not designated); Hardness-adjusted ATC = 7.1 µg/L (T).

It is unclear if FMC will continue to monitor Stream C water quality in the future. A recently proposed plan from the company to scale back environmental monitoring at the Flambeau site makes no mention of the stream (FMC, 2018d).

Figure 9. As summarized in this table, FMC has implemented six different work plans in the Flambeau Mine industrial outlot over the years in efforts to clean up Stream C as part of site reclamation. Copper concentrations in the stream, however, continue to come back at levels exceeding applicable water quality standards. [Source: Moran, Dr. Robert E., May 2019 (posthumous). Flambeau Mine: Water Contamination and Selective "Alternative Facts", p. 45].

NB: FMC stopped reporting Stream C water quality data in late 2018. The data reported in footnote 17 of the present table is among the most recent on file with the DNR.

Flambeau River Water Quality Data

	Date												
	9-21-07	4-25-08	10-27-08	4-25-09	10-3-09	4-16-10	9-17-10	10-26-10	4-27-11	4-29-11	9-27-11	6-19-11	6-23-12
SW-2 (Flambeau River below backfill pit)								(WDNR)[a]	(WDNR)[a]			(WDNR)[a]	
Copper (Cu) (µg/L)	<1.3	2.8	1.8	1.6	0.32	<1.3	0.89	3	<2	2.7	0.86	4	1.4
Hardness (mg/L)	60	27	57	48	60	43	43	41.8	26.7	25	56	41.4	46
pH, Lab (s.u.)	7.94	7.54	8.26	7.82	7.67	7.89	7.26	-	-	6.63	7.61	-	6.95
Chronic WQ Standard for Copper based on Hardness (µg/L)[b]	6.7	3.4	6.4	5.5	6.7	5.0	5.0	4.9	3.3	3.2	6.3	4.9	5.3
Acute WQ Standard for Copper based on Hardness (µg/L)[b]	9.6	4.5	9.1	7.8	9.6	7.0	7.0	6.8	4.5	4.2	9.0	6.8	7.5
SW-3 (Flambeau River below Stream C)													
Copper (Cu) (µg/L)	4.2	5.6	2.7	2.4	1.8	<1.3	1.6	5	<2	2.2	0.87	-	1.5
Hardness (mg/L)	53	25	56	49	61	42	44	38.7	25.7	25	57	-	45
pH, Lab (s.u.)	7.83	7.46	8.25	7.49	6.54	7.67	7.16	-	-	6.55	7.53	-	6.55
Chronic WQ Standard for Copper based on Hardness (µg/L)[b]	6.0	3.2	6.3	5.6	6.8	4.9	5.1	4.6	3.2	3.2	6.4	-	5.2
Acute WQ Standard for Copper based on Hardness (µg/L)[b]	8.5	4.2	9.0	7.9	9.7	6.8	7.2	6.3	4.3	4.2	9.1	-	7.3

[a] In a Flambeau Mine surface water quality assessment conducted by WDNR in 2010-11, the Department established two sampling stations in the Flambeau River (FA-8 and FA-9) comparable to FMC's SW-2 and SW-3 sampling stations, and the Department also established a sampling station in Stream C (SC-7) comparable to FMC's SW-C6 sampling station. In its summary report, WDNR stated the following: *"The Flambeau River below the mouth of Stream C (SW-3 / FB-9) had a slightly higher mean copper concentration (2.7 ug/l) than the Flambeau River above the mouth of Stream C (SW-2 / FA-8) (1.5 ug/l copper). The difference may not be statistically significant, but mixing Stream C water with a mean copper concentration of 19.1 ug/l* [SW-C6 / SC-7] *and Flambeau River water with a mean copper concentration of 1.5 ug/l* [SW-2 / FA-8] *would be expected to produce a somewhat elevated copper concentration in a very small area of the Flambeau River"* (WDNR, 2012). Please note, however, that while WDNR equated sampling stations FA-8 and SW-2 for purposes of calculating mean contaminant concentrations in the Flambeau River upstream of the Stream C discharge point, the two stations were not co-located. FA-8 was *"shortly above the mouth of Stream C"*, while FMC's SW-2 sampling station was much further upstream (although still downstream of the backfilled mine pit). The WDNR data reported in the present table and labeled as "SW-2" is from the FA-8 sampling station.

[b] Calculated from Wisconsin Administrative Code, NR 105 (Jul10).

Figure 10. Select Flambeau River Water Quality Data, as compiled by Dr. David M. Chambers (Center for Science in Public Participation, Bozeman, MT; csp2.org) from reports submitted by Flambeau Mining Company to the Wisconsin DNR between 2007 and 2012 and independent studies conducted by the DNR between 2010 and 2011[1]. Applicable water quality standards for copper were calculated by Dr. Chambers using formulas specified in *Wisconsin Administrative Code,* Chapter NR 105.

[1.] Flambeau Mining Company, 2007 Annual Report; Flambeau Mining Company, 2008 Annual Report; Flambeau Mining Company, 2009 Annual Report; Flambeau Mining Company, 2010 Annual Report; Flambeau Mining Company, 2011 Annual Report; Flambeau Mining Company, 2012 Annual Report; Wisconsin DNR, 2011 (Jul). Lab and Field Results for Surface Water Samples Collected by WDNR at the Flambeau Mine Site (plus Calculated ATC's for Copper and Zinc); Wisconsin DNR, 2012. Surface Water Quality Assessment of the Flambeau Mine Site.

Flambeau Mining Company
SW-3 Data Table

	Analyte	Conductivity	Dissolved Oxygen	pH	Redox Potential	Copper	Hardness	Iron	Manganese	Total Suspended Solids	Zinc
	Units	umhos/cm	mg/l	s.u.	mV	ug/l	mg/l	mg/l	ug/l	mg/l	ug/l
Date	Location	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3
09/15/07		NA	NA	NA	NA	4.2	53	0.6	100	NA	8.6
12/15/07		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
04/15/08		NA	NA	NA	NA	5.6	25	0.77	82	NA	11
10/15/08		NA	NA	NA	NA	2.7	56	0.21	45	NA	8.4
04/15/09		NA	NA	NA	NA	2.4	49	0.44	55	NA	7.4
10/15/09		NA	NA	NA	NA	1.6	61	1	200	NA	8.1
04/15/10		161	NA	7.11	NA	1.3	42	0.51	54	NA	5
09/15/10		82.1	NA	7.33	NA	1.6	44	1.8	170	NA	7.7
04/15/11		61.5	NA	7.02	NA	2.2	25	0.73	35	NA	5
09/15/11		117.7	NA	7.66	NA	0.87	57	0.54	61	NA	5
06/15/12		NA	NA	NA	NA	1.6	45	0.59	110	NA	5
11/15/13		100.8	9.63	7.21	72	0.73	45	NA	NA	1	5.1
04/15/14		53	18.48	7.17	137.4	1.7	22	NA	NA	3.3	6
10/15/14		78	9.48	6.08	180.1	1.9	39	NA	NA	3.5	9.5
04/15/15		89	10.74	7.55	264.2	1.3	37	0.63	NA	2.5	5
09/15/15		117	7.79	7.55	125.9	0.88	50.2	0.391	NA	2	3.1
05/15/16		69	9.75	7.19	170.5	1	31.3	0.563	NA	2.8	3.1
10/15/16		91	9.51	7.34	165.7	0.85	42.1	NA	NA	3	4.1
05/15/17		59	8.27	5.9	166.9	1.1	28.9	0.571	52.5	2.4	NA
10/15/17		105	8.12	7.4	168.1	1.1	45.8	0.696	97.7	3	NA
05/15/18		107	NA	NA	NA	1.1	32.6	0.8	142	3.2	4.6
10/15/18		NA	NA	NA	NA	1.1	27.4	0.67	35.2	1.4	15.3
04/15/19		NA	NA	NA	NA	1.1	32.9	0.728	46.7	4.3	4.6
10/15/19		50.8	NA	8.3	36.9	1.1	31	0.809	43.5	2	10.3
06/15/20		73.1	7.54	7.08	148.9	1.9	33.1	0.577	70	3.6	10.3
11/15/20		86.0	11.62	7.63	952	1.9	42	0.8	36.3	1.4	10.3
05/17/21		72.0	9.63	7.79	-50.4	1.9	32.7	0.44	38	1.8	10.3
11/17/21		101.8	12.04	7.94	44.5	1.9	46.8	0.412	44.6	2.2	10.3

pw:\Flambeau Mining\0017F777\4000 Regulatory Agency Correspondence\2022 SW3 Data Table\T-Flambeau SW-3 Data.xlsx

mg/l - milligrams per liter
s.u. = standard units
ug/l = micrograms per liter
umhos/com - micromohs per centimeter
NA = Not Analyzed

Prepared by: NMG1
Checked by: SVF

Figure 11. Flambeau River Surface Water Monitoring Results for Sampling Station SW-3 (immediately downstream of the Stream C discharge point), Flambeau Mining Company, 2022 [NB: This data table was emailed by FMC/Foth to WDNR in March 2022 and forwarded by WDNR to Laura Gauger in April 2022 pursuant to a Public Records Request (WDNR, 2022a)].

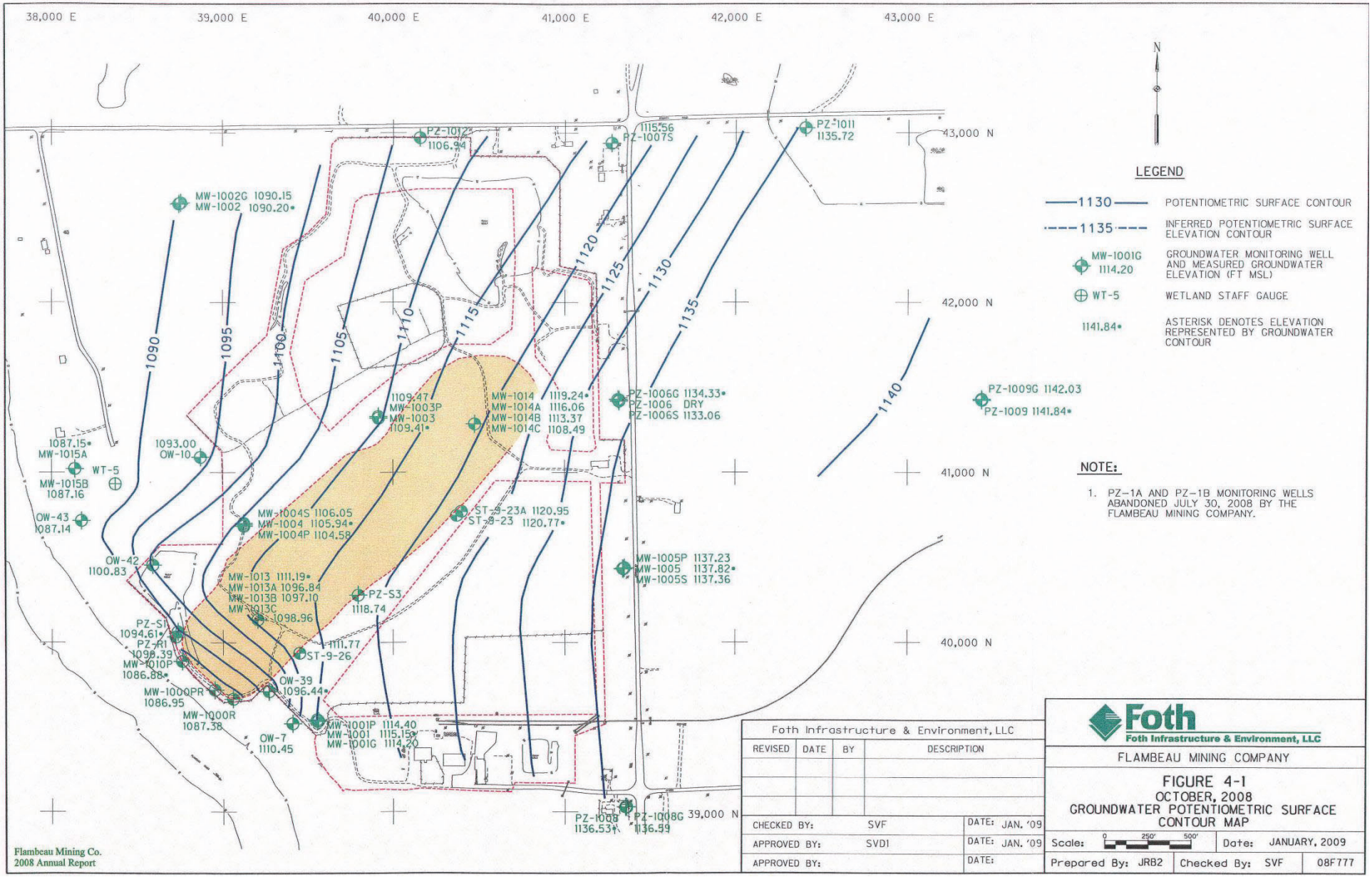


Figure-12. Flambeau Mine monitoring well locations (2008) [NB: Some of the wells shown on the figure were abandoned by FMC in 2020; see *FMC 2020 Annual Summary Memorandum* for details]. [Source: FMC, 2009 (Jan). 2008 Annual Report, Figure 4-1].

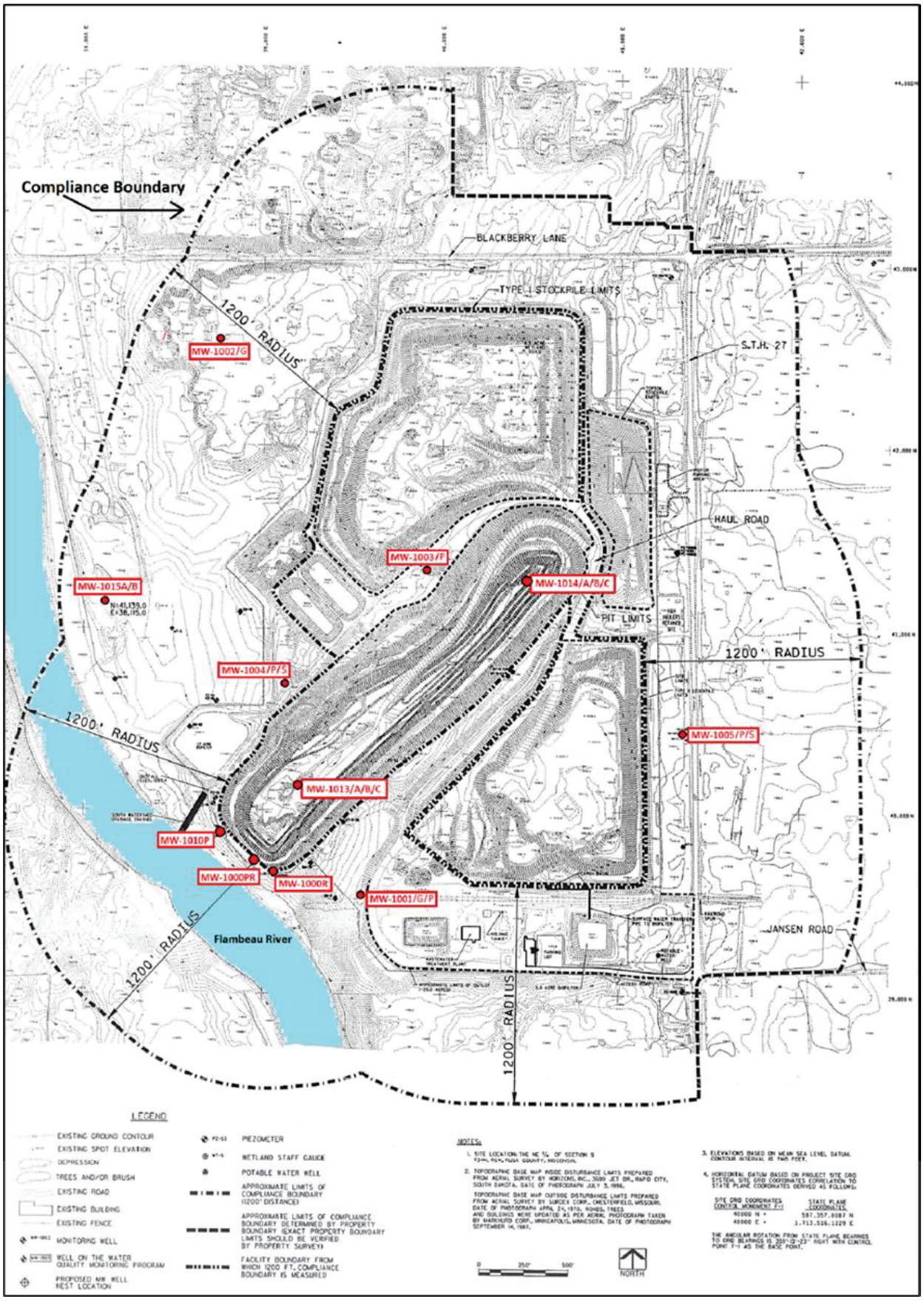


Figure 13. State of Wisconsin-established compliance boundary for enforcement of groundwater quality standards at Flambeau Mine. Diagram also shows monitoring well (MW) locations (Adapted from Figure 1 *in:* Groundwater Monitoring Well Nest Installation at Compliance Boundary, FMC, 2000). [Source: Moran, Dr. Robert E., May 2019 (posthumous). Flambeau Mine: Water Contamination and Selective "Alternative Facts", Figure 7]

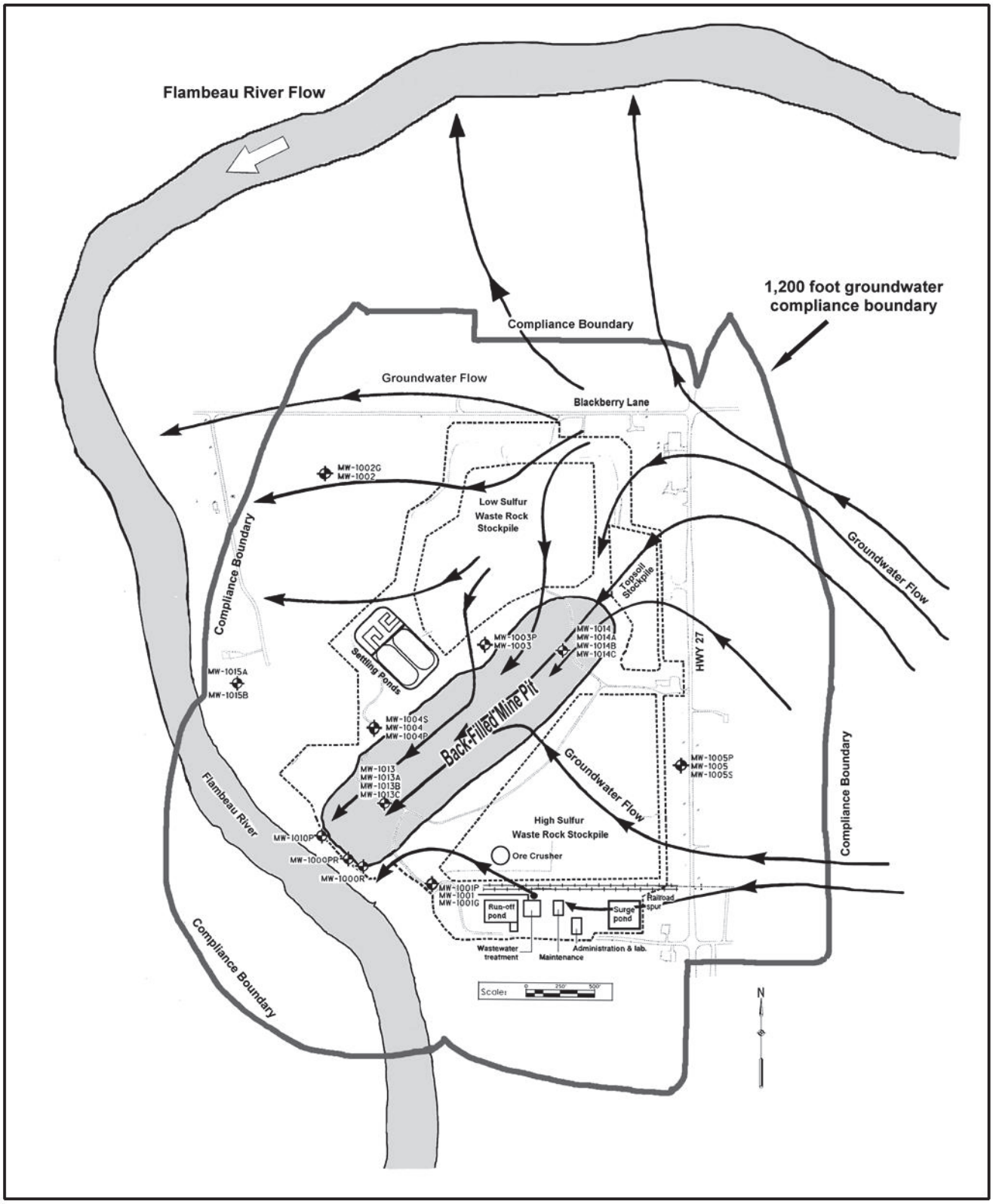


Figure-14. State of Wisconsin-established compliance boundary for enforcement of groundwater quality standards at Flambeau Mine. Diagram also shows monitoring well (MW) locations and includes an overlay of approximate groundwater flow vectors per FMC modeling (Adapted from Figure 1 *in:* Compliance Boundary Memo, Wisconsin DNR, Nov 1989; Figure 4-1 *in:* 2003 Annual Report, FMC, Jan 2004; and Figure 3-5 *in:* Final Environmental Impact Statement for FMC Copper Mine, Wisconsin DNR, 1990) [Source: Chambers, David M. and Kendra Zamzow, 2009 (June). Report on Groundwater and Surface Water Contamination at the Flambeau Mine, Figure A].

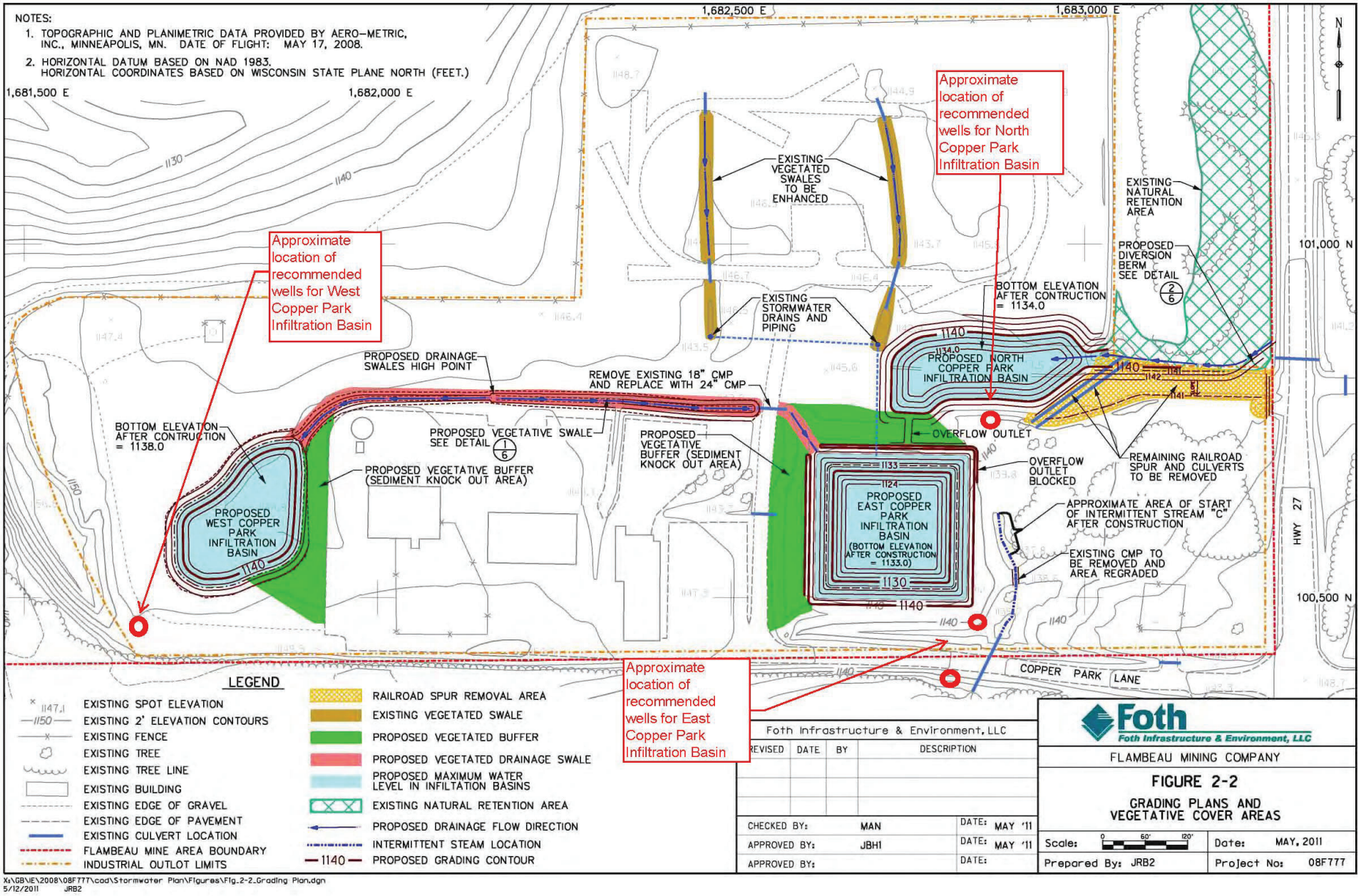


Figure 15. Recommended location of monitoring wells in the Flambeau Mine industrial outlot (Adapted from Figure 2-2 *in:* Copper Park Business and Recreation Area Work Plan, Foth, May 2011). [Source: Chambers, Dr. David M., 2011 (Aug). Comments RE: Public Hearing for File IP-NO-2011-55-03344 and 03345 - Flambeau Mining Company application to convert a detention basin (referred to as a biofilter) to an infiltration basin, and to construct two new infiltration basins]

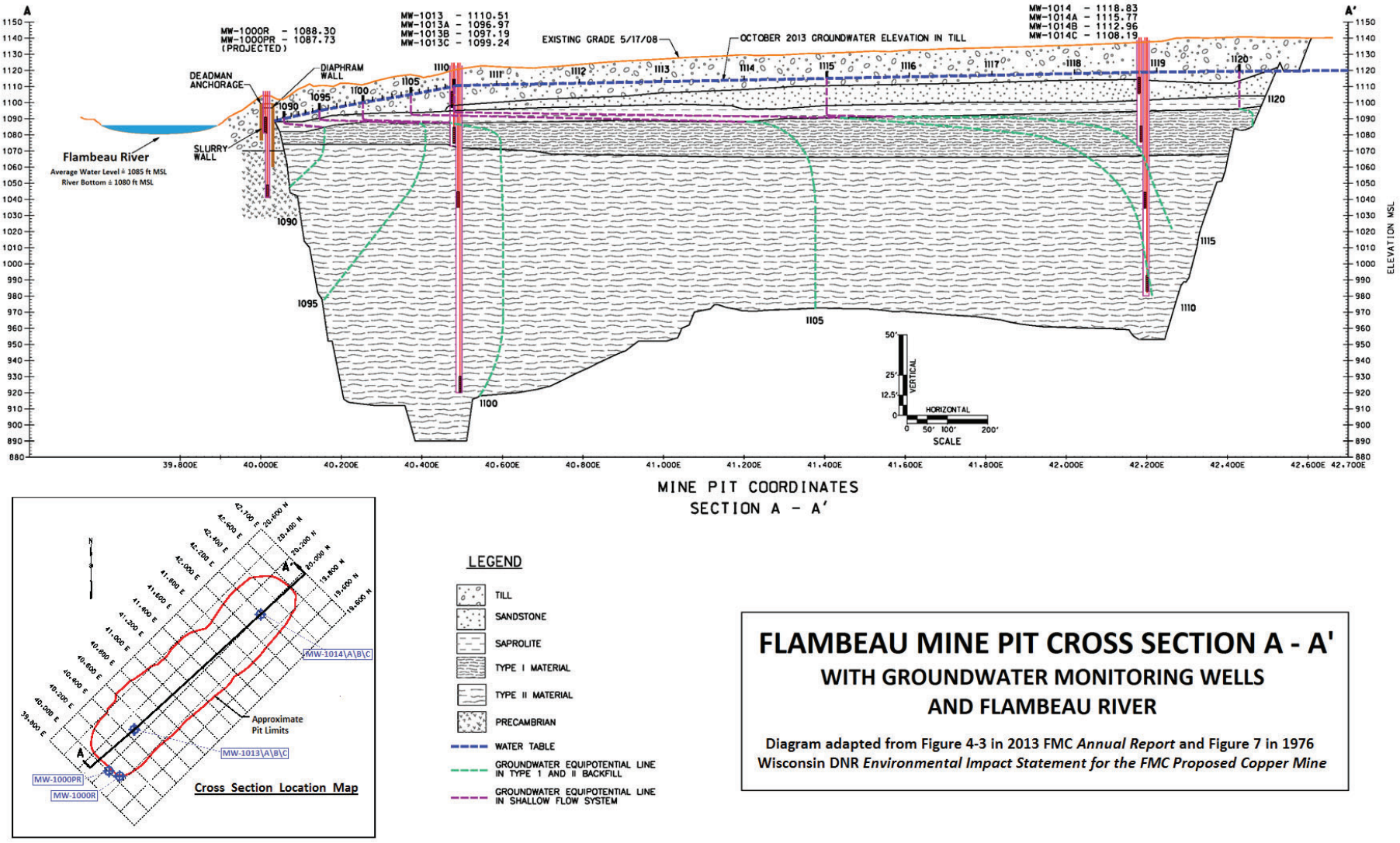
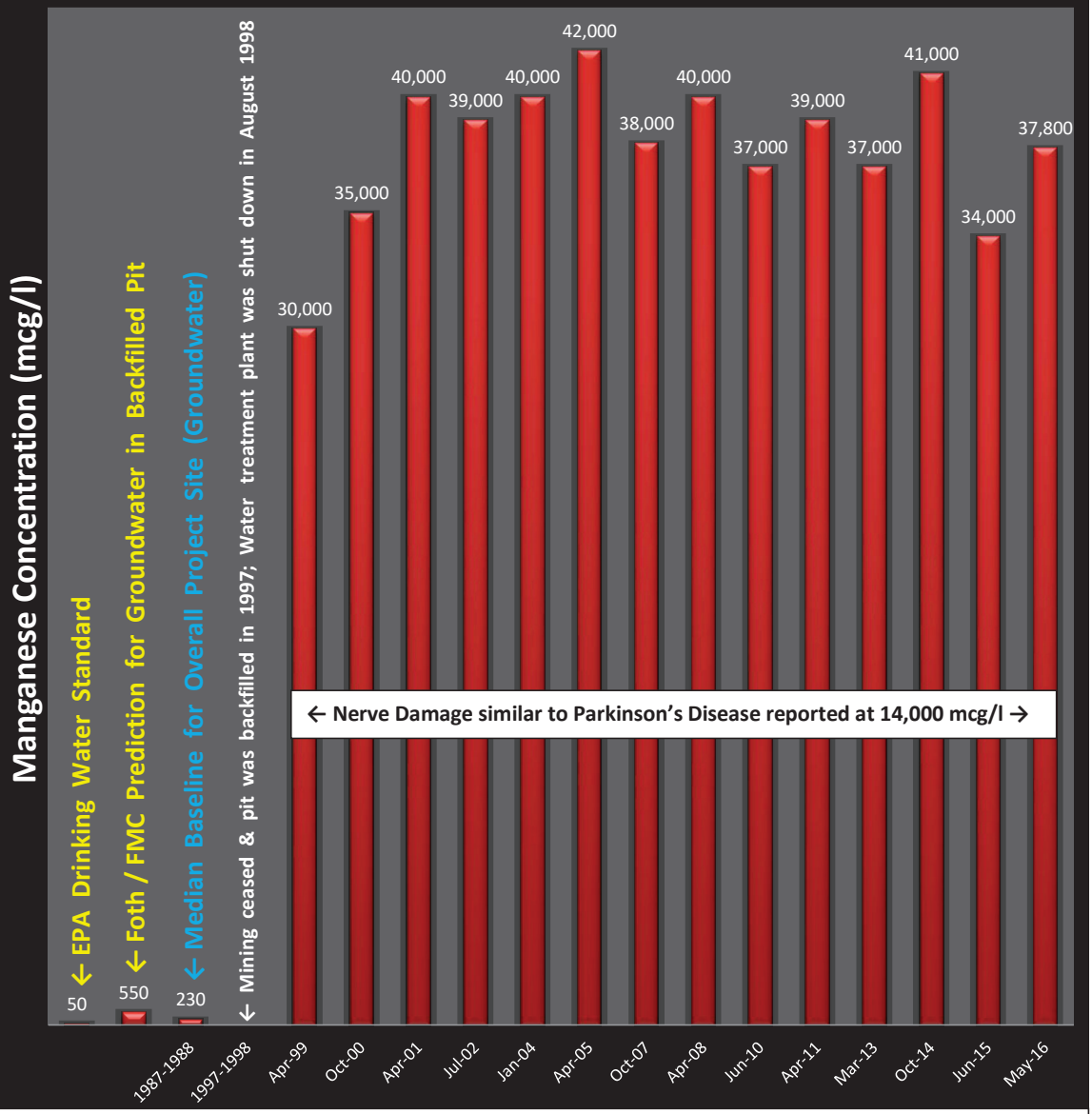


Figure 16. Flambeau Mine backfilled pit cross section with groundwater monitoring wells. Relative position and depth of Flambeau River is also shown (140 ft. from pit; approximately 5 ft. deep in vicinity of the 225-ft. deep backfilled pit) (Adapted from Figure 4-3 *in:* 2013 Annual Report, FMC, Jan 2014 and Figure 7 *in:* Environmental Impact Statement for the FMC Proposed Copper Mine, Wisconsin DNR, 1976). [Source: Moran, Dr. Robert E., May 2019 (posthumous). Flambeau Mine: Water Contamination and Selective "Alternative Facts", Figure 6].

NB: Despite the extreme differences in depth between the river and pit and the fact that FMC modeling shows the direction of groundwater flow to be from the pit toward the river, FMC consultant Foth has asserted that contaminants *"will never be able to travel more than 140 feet from the reclaimed pit,"* i.e., beyond the river to the other side (Foth, 1989c), and that has been FMC's justification for drilling no monitoring wells west of the river. Hydrogeologist Robert E. Moran, on the other hand, has referred to Foth's narrative predictions regarding groundwater impacts at the Flambeau project site as "largely naïve geochemically and hydrogeologically" (Moran, 2019).

Manganese Concentrations (filtered/dissolved)[1] in Monitoring Well-1013B at the Flambeau Mine Site (Backfill Well)[2]

MW-1013B is located within the backfilled mine pit. It is about 600' from the Flambeau River, 86' deep and in line with the direction of groundwater flow toward the river.



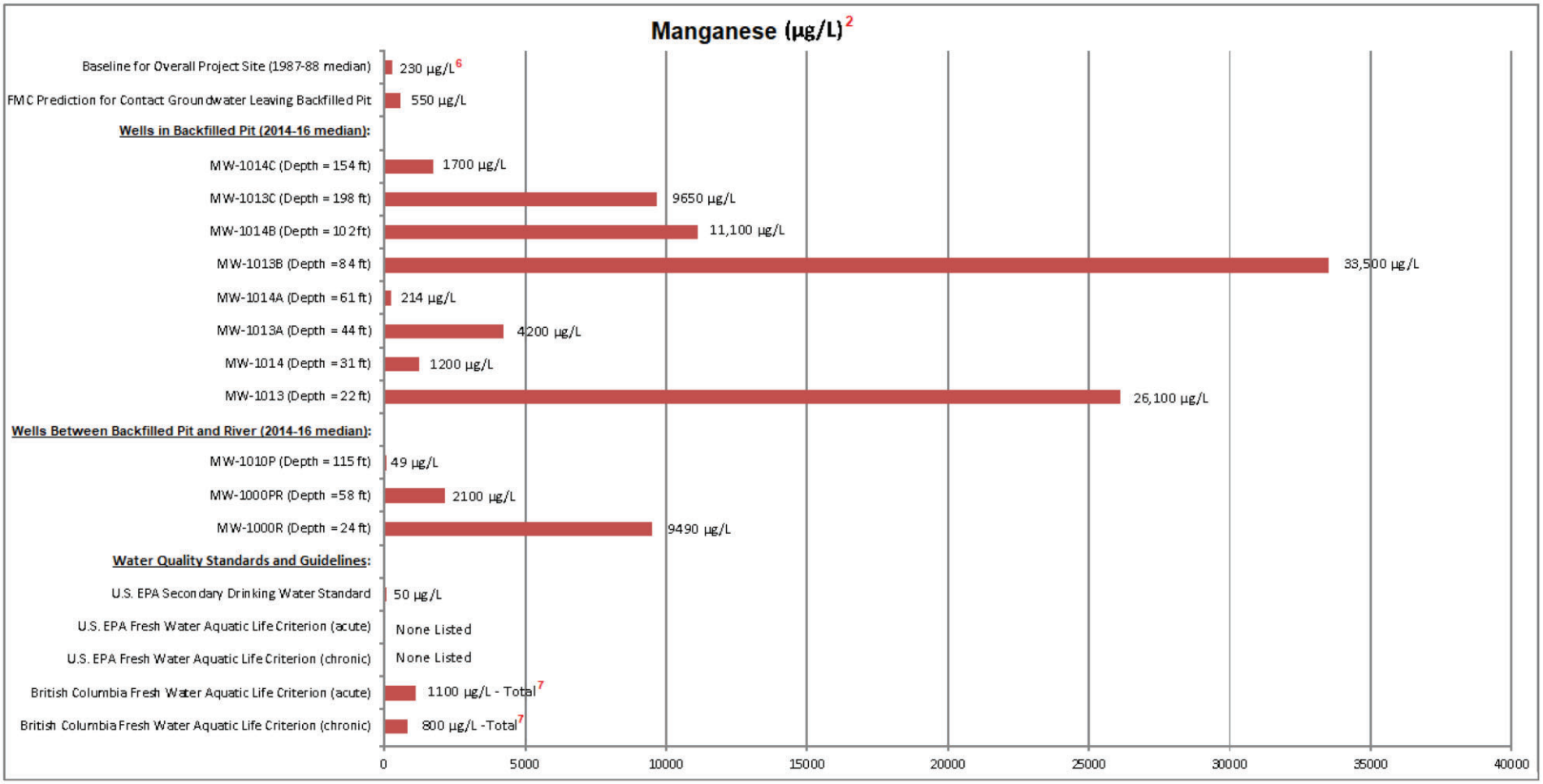
1. Flambeau Mining Company (FMC) only reports data from ***filtered*** groundwater samples instead of following best practices, which would also entail reporting unfiltered ***totals*** (most families using private wells or springs and all farms, livestock, wildlife, fish and vegetation, etc. use and consume unfiltered water).

2. The Flambeau Mine pit was backfilled in 1997 with stockpiled waste rock (some of it amended with limestone due to sulfide content) and sludge from the mine's wastewater treatment plant (the plant was decommissioned in August 1998). Monitoring wells were installed in the backfill in September 1998. Please note the significant increase in groundwater contamination after the pit was backfilled, this despite FMC's limestone amendment program.

Data Sources: Flambeau Mine Permit Application (1989) & Environmental Impact Statement (1990); and Flambeau Mining Company Annual Report (2015) & Quarterly Groundwater Reports.
Graph created by: Deer Tail Scientific, Duluth, MN (2017). For more information go to: https://deertailscientific.wordpress.com/flambeau-pollution-graphs/.

Figure-17. Manganese Concentrations (filtered/dissolved) in Monitoring Well-1013B at the Flambeau Mine Site (Backfill Well) [Source: Deer Tail Scientific, 2020 (Sep). Graphs of Flambeau Mine Surface and Ground-water Quality Data (Time Period 1987-2020), Figure 9].
NB: Graphs were created by Deer Tail Scientific for educational purposes using data submitted by Flambeau Mining Company to the Wisconsin DNR.

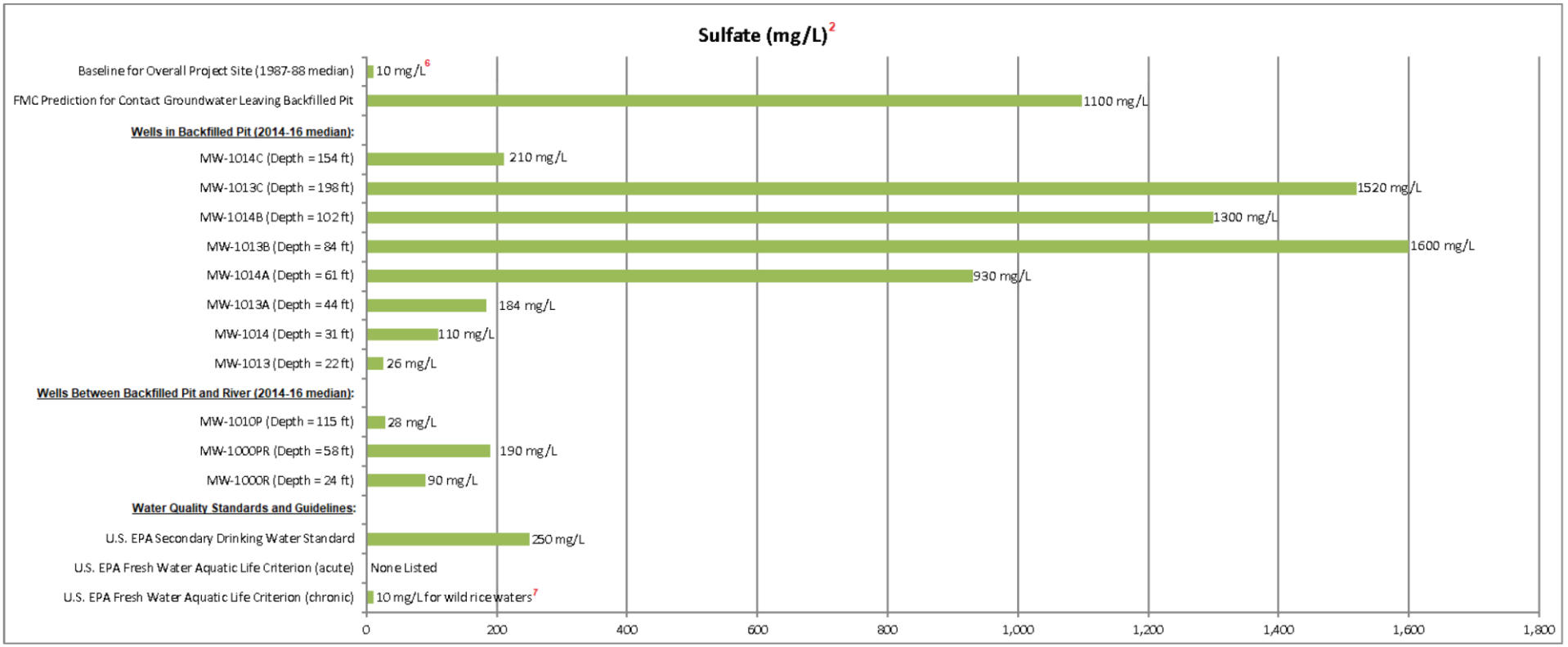
Figure 9e. MEDIAN (2014-16)[1] Flambeau Mine ground water MANGANESE concentrations[2] compared to baseline (1987-88)[3], predictive modeling (1989)[4], and relevant water quality standards[5]



1. Manganese concentrations are measured in ground water by FMC on a quarterly basis. Reported concentration for each individual well is a 2014-16 median value (n = 12) determined by author using historical data presented *in:* 2016 Annual Report, FMC, Jan 2017. For details, see Table 6 - Ground water quality data.
2. There was no "Total" or "Dissolved" designation for baseline (1987-88) concentrations of manganese reported by FMC in their 1989 Environmental Impact Report. Nor is there any such designation for later values reported in the summary tables of "Historical Groundwater Results" found in the company's annual reports. Perusal of other FMC documents suggests reported values are Dissolved. Any concentrations clearly designated as "Total" or "Dissolved" by U.S. EPA or other government authorities in regulatory documents have been so indicated.
3. Baseline median determined by author using data presented *in:* Environmental Impact Report for the Kennecott Flambeau Project, Foth & Van Dyke, 1989. For details, see Table 6 – Ground water quality data.
4. Figures for projected ground water quality of contact water leaving the Flambeau backfilled pit were provided by Foth *in:* Mining Permit Application for the Flambeau Project, Volume 2, Appendix L, Dec 1989. Also see Table 8 – Projected ground water quality.
5. For details, see Table 2 – Water quality standards.
6. Baseline Median = 230 µg/L; Range = < 50 - 1400 µg/L; n = 193; 72% detects.
7. Hardness-dependent toxicity; reported value is for a hardness of 50 mg/l.

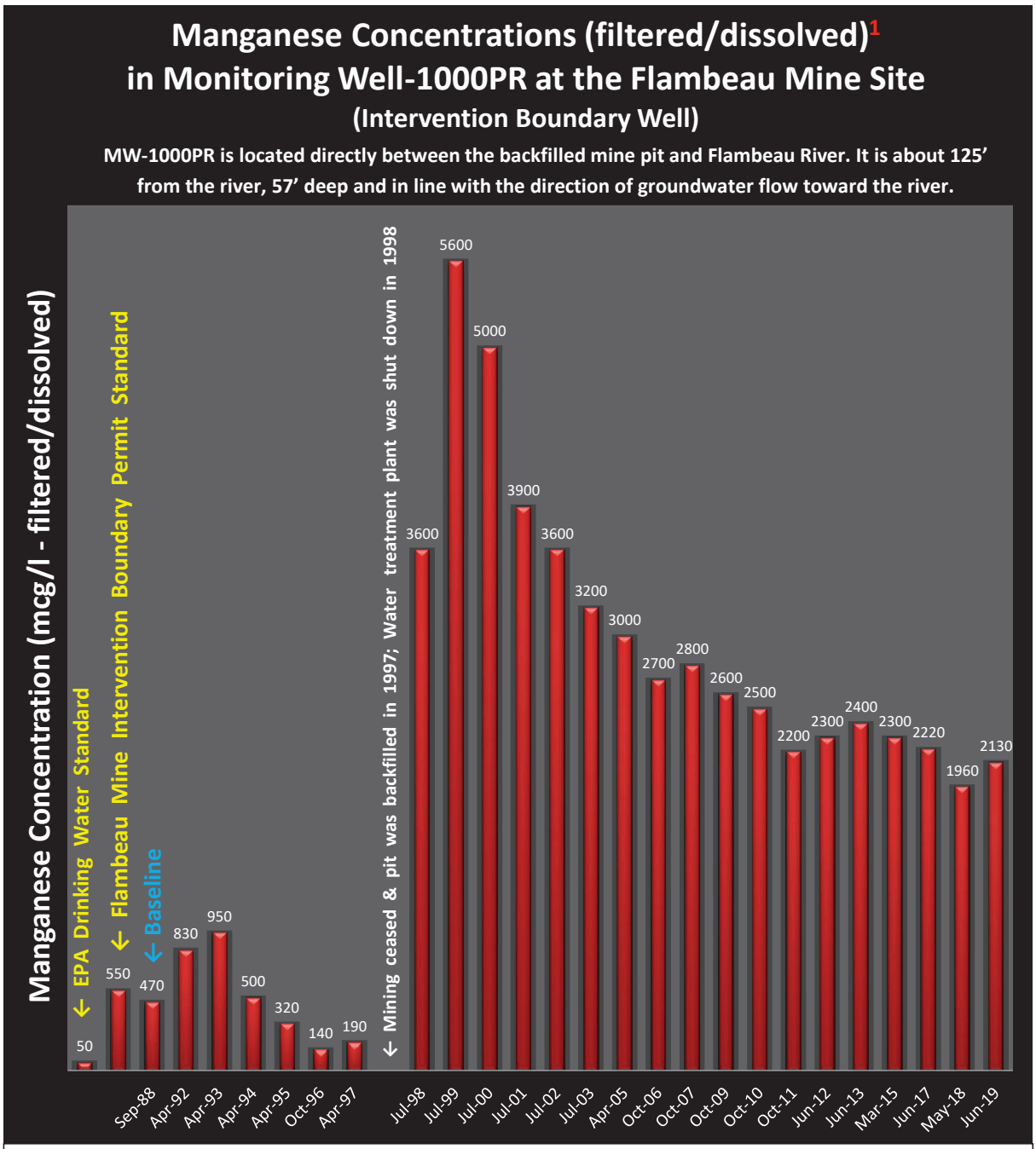
Figure 18. MEDIAN (2014-16) Flambeau Mine groundwater MANGANESE concentrations compared to baseline (1987-88), predictive modeling (1989), and relevant water quality standards. [Source: Moran, Dr. Robert E., May 2019 (posthumous). Flambeau Mine: Water Contamination and Selective "Alternative Facts", Figure 9e]

Figure 9b. MEDIAN (2014-16)[1] Flambeau Mine ground water SULFATE concentrations[2] compared to baseline (1987-88)[3], predictive modeling (1989)[4], and relevant water quality standards[5]



1. Sulfate concentrations are measured in ground water by FMC on a quarterly basis. Reported concentration for each individual well is a 2014-16 median value (n = 12) determined by author using historical data presented *in:* 2016 Annual Report, FMC, Jan 2017. For details, see Table 6 - Ground water quality data.
2. There was no "Total" or "Dissolved" designation for baseline (1987-88) concentrations of sulfate reported by FMC in their 1989 Environmental Impact Report. Nor is there any such designation for later values reported in the summary tables of "Historical Groundwater Results" found in the company's annual reports. Perusal of other FMC documents suggests reported values are Dissolved. Any concentrations clearly designated as "Total" or "Dissolved" by U.S. EPA or other government authorities in regulatory documents have been so indicated.
3. Baseline median determined by author using data presented *in:* Environmental Impact Report for the Kennecott Flambeau Project, Foth & Van Dyke, 1989. For details, see Table 6 – Ground water quality data.
4. Figures for projected ground water quality of contact water leaving the Flambeau backfilled pit were provided by Foth *in:* Mining Permit Application for the Flambeau Project, Volume 2, Appendix L, Dec 1989. Also see Table 8 – Projected ground water quality.
5. For details, see Table 2 – Water quality standards.
6. Baseline Median = 10 mg/L; Range = < 5 - 48 mg/L; n = 193; 75% detects.
7. This criterion is specific for wild rice waters and was approved by U.S. EPA for the Fond du Lac Band of Lake Superior Chippewa, Grand Portage Band of Lake Superior Chippewa, and State of Minnesota. See Table 2 – Water quality standards, for more details.

Figure 19. MEDIAN (2014-16) Flambeau Mine groundwater SULFATE concentrations compared to baseline (1987-88), predictive modeling (1989), and relevant water quality standards. [Source: Moran, Dr. Robert E., May 2019 (posthumous). Flambeau Mine: Water Contamination and Selective "Alternative Facts", Figure 9b]



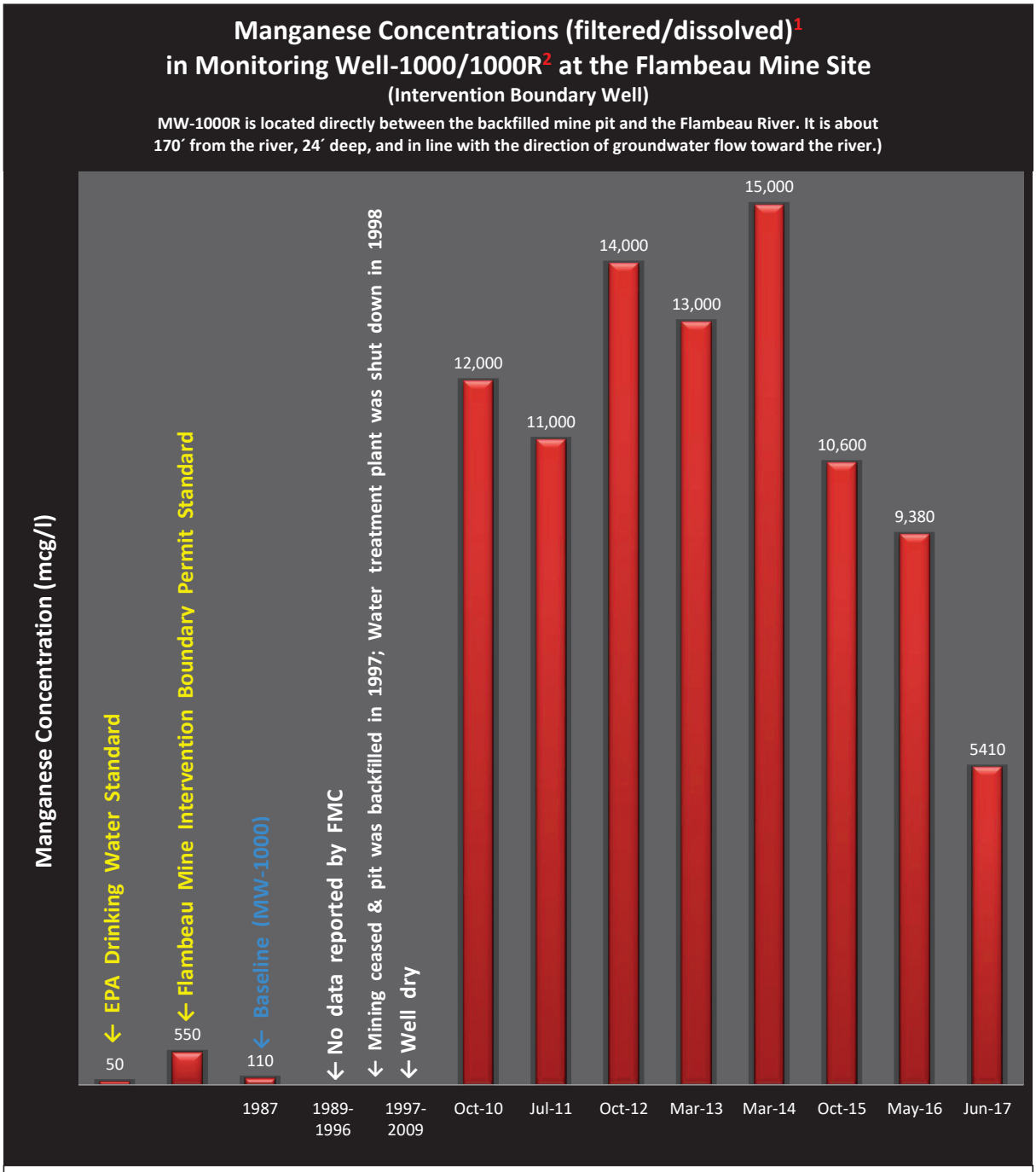
1. Flambeau Mining Company (FMC) only reports data from ***filtered*** groundwater samples instead of following best practices, which would also entail reporting unfiltered ***totals*** (most families using private wells or springs and all farms, livestock, wildlife, fish and vegetation, etc. use and consume unfiltered water). In addition, please note the significant increase in groundwater contamination after the pit was backfilled, this despite FMC's addition of limestone to the sulfide-containing waste rock in an attempt to minimize impacts. While permit standards in this particular well clearly have been exceeded, contamination *within* the backfilled pit is even higher, where manganese concentrations as high as 42,000 mcg/l (filtered/dissolved) have been reported. No citations have been issued.

Data Sources: Flambeau Mine Permit Application (1989) & Permit (1991); FMC Annual Report (2015) & Quarterly Groundwater Reports (2016-2018); and Wisconsin Department of Natural Resources split sample data (2019).

Graph Created by: Deer Tail Scientific, Duluth, MN (2019). For more information go to: https://deertailscientific.wordpress.com/flambeau-pollution-graphs/.

Figure-20. Manganese Concentrations (filtered/dissolved) in Monitoring Well-1000PR at the Flambeau Mine Site (Intervention Boundary Well) [Source: Deer Tail Scientific, 2020 (Sep). Graphs of Flambeau Mine Surface and Groundwater Quality Data (Time Period 1987-2020), Figure 4].

NB: Graphs were created by Deer Tail Scientific for educational purposes using data submitted by Flambeau Mining Company to the Wisconsin DNR.



1. Flambeau Mining Company (FMC) only reports data from ***filtered*** groundwater samples instead of following best practices, which would also entail reporting unfiltered ***totals*** (most families using private wells or springs and all farms, livestock, wildlife, fish and vegetation, etc. *use and consume unfiltered water).* In addition, please note the significant increase in groundwater contamination after the pit was backfilled, this despite FMC's addition of limestone to the sulfide-containing waste rock in an attempt to minimize impacts. While permit standards in this particular well clearly have been exceeded, no citations have been issued.

2. MW-1000R (24 ft deep) was drilled as a replacement for MW-1000 (22 feet deep) which was abandoned in 1992 as the result of the construction of a Slurry Cutoff Wall System between the mine pit and Flambeau River. As described in FMC's *1992 Annual Report*, MW-1000R is "located approximately 100 feet east of the original location of MW-1000. MW-1000 needed to be moved since its original location was downgradient of the Slurry Cutoff Wall System, negating the ability of the well to monitor the shallow till downgradient of the backfilled pit. MW-1000R is positioned to accomplish this intent."

Data Sources: Flambeau Mine Permit Application (1989) & Permit (1991); and FMC Annual Report (2015) & Quarterly Groundwater Reports.
Graph created by: Deer Tail Scientific, Duluth, MN (2017). For more information go to: https://deertailscientific.wordpress.com/flambeau-pollution-graphs/.

Figure-21. Manganese Concentrations (filtered/dissolved) in Monitoring Well-1000/1000R at the Flambeau Mine Site (Intervention Boundary Well) [Source: Deer Tail Scientific, 2020 (Sep). Graphs of Flambeau Mine Surface and Groundwater Quality Data (Time Period 1987-2020), Figure 7].

NB: Graphs were created by Deer Tail Scientific for educational purposes using data submitted by Flambeau Mining Company to the Wisconsin DNR.

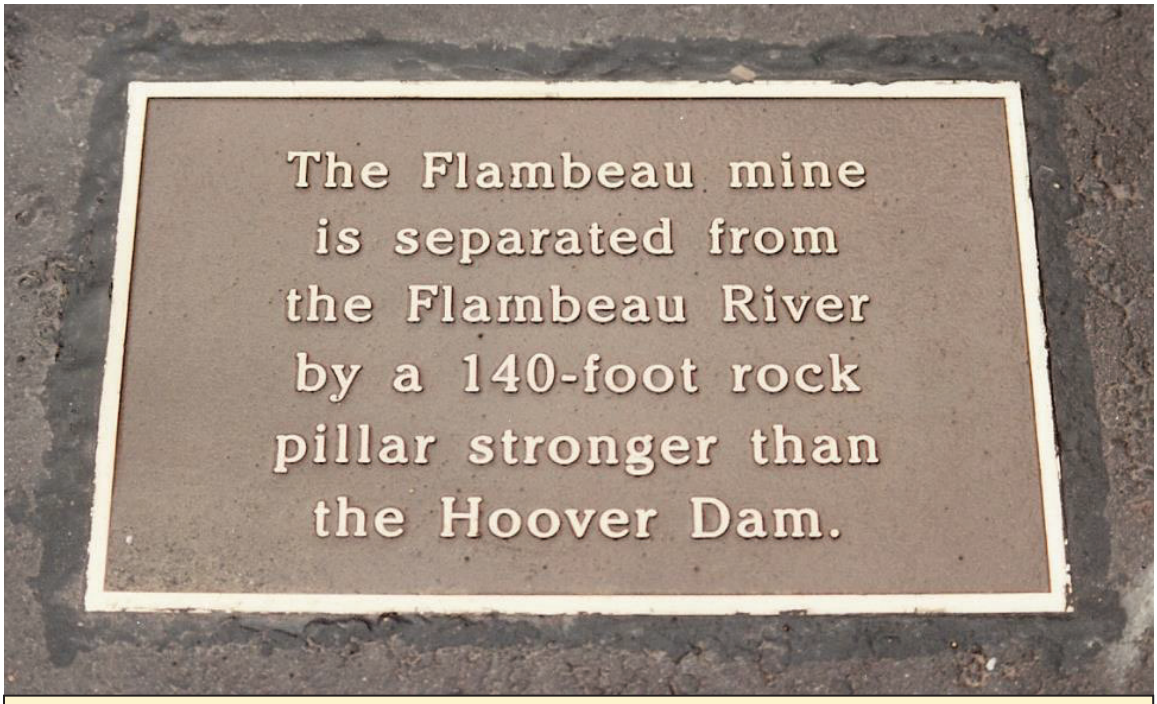
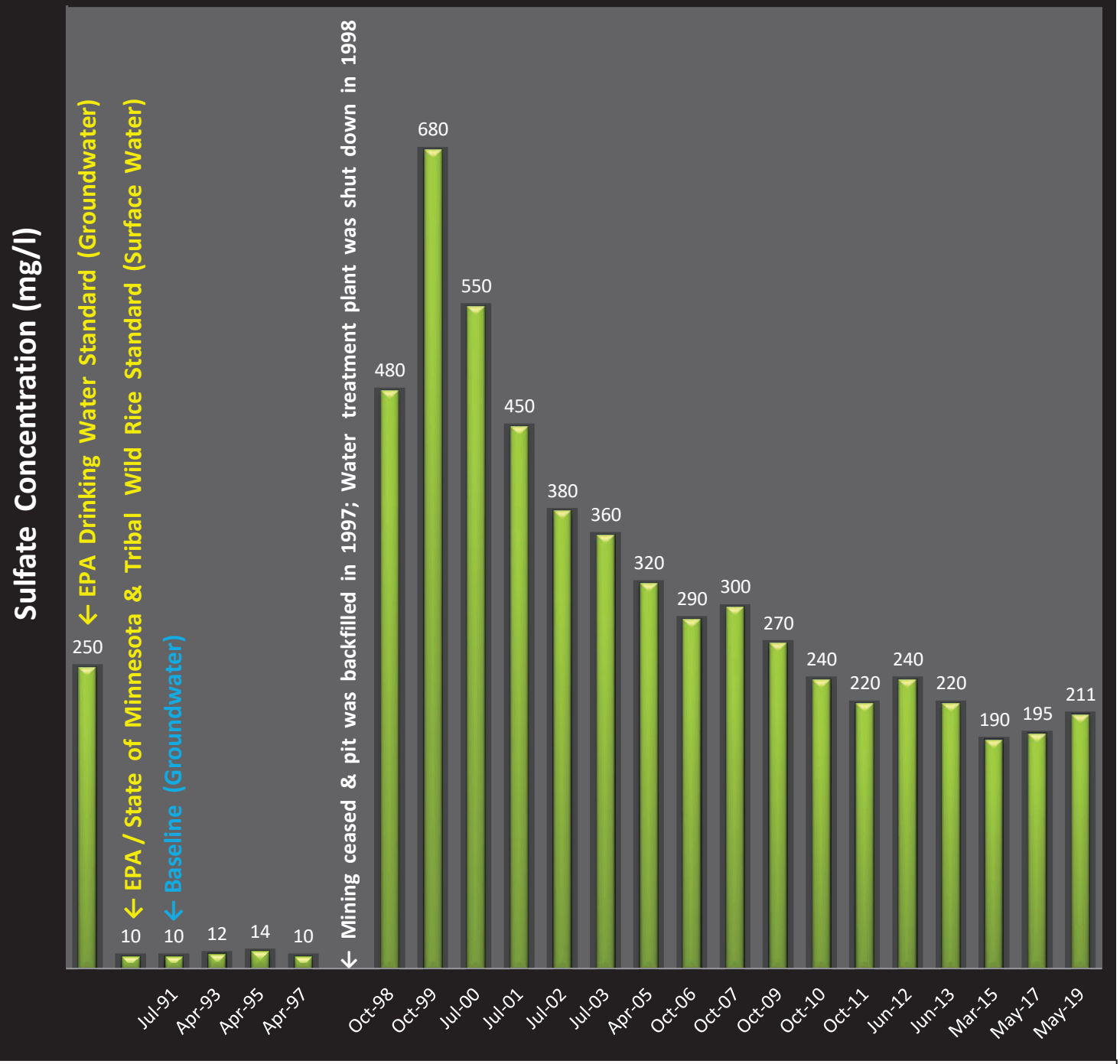


Figure 22. In FMC's 1989 *Mining Permit Application* for the Flambeau project, the rock between the Flambeau Mine pit and Flambeau River was described as "fractured", and the company predicted that contaminated groundwater leaving the mine pit would "flow directly into the bed of the Flambeau River." But that's not what they told the public. Shown here is a plaque displayed by FMC at the project site during mine operations (Photo by Kira Henschel, circa 1995).

Sulfate Concentrations (dissolved/filtered)[1] in Monitoring Well-1000PR at the Flambeau Mine Site (Intervention Boundary Well)

MW-1000PR is located directly between the backfilled mine pit and the Flambeau River. It is about 125' from the river, 57' deep and in line with the direction of groundwater flow toward the river.



1. Flambeau Mining Company (FMC) only reports data from ***filtered*** groundwater samples instead of following best practices, which would also entail reporting unfiltered ***totals*** (most families using private wells or springs and all farms, livestock, wildlife, fish and vegetation, etc. use and consume unfiltered water). In addition, please note the significant increase in groundwater contamination after the pit was back-filled, this despite FMC's addition of limestone to the sulfide-containing waste rock in an attempt to minimize impacts.

Data Sources: Flambeau Mine Permit Application (1989) & Permit (1991); and Flambeau Mining Company Annual Report (2015) & Quarterly Groundwater Reports.
Graph created by: Deer Tail Scientific, Duluth, MN (2019; updated 2022). For more info go to: https://deertailscientific.wordpress.com/flambeau-pollution-graphs/.

Figure-23. Sulfate Concentrations (filtered/dissolved) in Monitoring Well-1000PR at the Flambeau Mine Site (Intervention Boundary Well) [Source: Deer Tail Scientific, 2020 (Sep). Graphs of Flambeau Mine Surface and Groundwater Quality Data (Time Period 1987-2020), Fig. 6 (updated June 2022)]. NB: Graphs were created by Deer Tail Scientific for educational purposes using data submitted by Flambeau Mining Company to the Wisconsin DNR.

The Flambeau River came within 20 horizontal feet and 4 vertical feet of spilling into the Flambeau Mine pit in September 1994 during heavy rains, as Rusk County experienced a flood of such magnitude that it exceeded a hundred-year event. This photo was taken the day after *the river crested (Photo by Bob Olsgard of Sarona, WI, September 17, 1994).*

FMC's water treatment plant couldn't keep up with all the rainwater and groundwater that poured into the mine pit. Four feet of water accumulated in the bottom, totaling about four million gallons according to FMC estimates (Photo by Bob Olsgard of Sarona, WI, September 17, 1994).

Aerial view of the Flambeau Mine shows the pit with accumulated precipitation and groundwater in the bottom and its close proximity to the Flambeau River. To the left is the high-sulfur waste rock stockpile, ore crushing area, rail spur, and an engineered runoff pond (Photo by Bob Olsgard of Sarona, WI, September 17, 1994).

Figure 24. Flambeau Mine pit during flood stages in Flambeau River (September 17, 1994).

Tab 19

Credentials.

David M. Chambers, Ph.D., P. Geop.
Center for Science in Public Participation
Bozeman, MT
csp2.org

Dr. Chambers is the founder and president of the Center for Science in Public Participation, a non-profit corporation formed to provide technical assistance on mining and water quality to public interest groups and tribal governments.

David Chambers has 40 years of experience in mineral exploration and development – 15 years of technical and management experience in the mineral exploration industry, and for the past 25+ years he has served as an advisor on the environmental effects of mining projects both nationally and internationally. He has a Professional Engineering Degree in Physics from the Colorado School of Mines, a Master of Science Degree in Engineering from the University of California at Berkeley, and is a registered professional geophysicist in California (# GP 972). Dr. Chambers received his Ph.D. in Environmental Planning from Berkeley where his doctoral dissertation analyzed the U.S. Forest Service's efforts to plan for and manage minerals on the National Forests.

He has provided technical assistance to public interest groups and tribal governments on proposed, operating, and abandoned mines in Alaska, Arizona, California, Colorado, Idaho, Michigan, Minnesota, Missouri, Montana, Nevada, Oregon, South Carolina, South Dakota, Utah, Washington, Wisconsin, Canada (British Columbia, Ontario, Labrador, Yukon), Kyrgyzstan, and Northern Ireland. This assistance has included review of underground and open pit mine design, seismic stability for tailings dams, waste rock facilities design, water quality monitoring, water treatment facility design, reclamation planning, and financial assurance for mine closure. This has included the review of dozens of environmental impact studies and included analyzing the potential adverse effects on surface and groundwater quality of acid mine drainage and metals leaching from mine point discharges and seepage from mine waste storage facilities, and on proposing alternative methodologies to avoid these impacts.

Dr. Chambers has also provided technical assistance to tribal governments and public interest groups in negotiating with mine owners, mine developers, and federal and state regulators, to assist these parties in understanding the major technical implications of specific mining projects, and in providing alternatives that would lead to more environmentally responsible development. He has played a key role in negotiating complex agreements, including alternative development plans for several mine proposals in Alaska, technical studies related to EPA placer mining regulation, efforts by the mining industry and NGOs to research and regulate marine mine waste disposal, and a joint industry-NGO international effort to develop a process to define and measure performance for responsible mining practices.

Dr. Chambers has worked with the State of Alaska Departments of Natural Resources and Environmental Conservation on mining, reclamation, cyanide and solid waste regulations. He has been a member of the University of Alaska-Fairbanks School of Mineral Engineering Advisory Board; a member of the Western Governors' Association Abandoned Mine Waste Working Group; and, a member of the EPA's RCRA Policy Dialogue Committee, a group of industry, environmental and government representatives who worked to develop regulations for mining wastes under the authority of RCRA Subtitle D.

EDUCATION

Doctor of Philosophy, Environmental Planning
University of California, Berkeley, May, 1985

Master of Science, Geophysics
University of California, Berkeley, June, 1976

Professional Engineer, Physics
Colorado School of Mines, Golden, May, 1969

PROFESSIONAL AFFILIATIONS

Professional Geophysicist (Certificate # GP 972) -
California Board for Professional Engineers, Land Surveyors, and Geologists

Robert E. Moran, Ph.D.
Michael-Moran Assoc., LLC
Water Quality/Hydrogeology/Geochemistry
Golden, Colorado, U.S.A.
remwater.org

Dr. Robert Moran has more than 45 years of domestic and international experience in conducting and managing water quality, geochemical and hydrogeologic work for private investors, industrial clients, tribal and citizens groups, NGO's, law firms, and governmental agencies at all levels. Much of his technical expertise involves the quality and geochemistry of natural and contaminated waters and sediments as related to mining, nuclear fuel cycle sites, industrial development, geothermal resources, hazardous wastes, and water supply development. In addition, Dr. Moran has significant experience in the application of remote sensing to natural resource issues, development of resource policy, and litigation support. He has often taught courses to technical and general audiences, and has given expert testimony on numerous occasions. Countries worked in include: Australia, Greece, Bulgaria, Mali, Senegal, Guinea, Gambia, Ghana, South Africa, Iraqi Kurdistan, Oman, Pakistan, Kazakhstan, Kyrgyzstan, Mongolia, Romania, Russia, Papua New Guinea, Argentina, Bolivia, Chile, Colombia, Guatemala, Haiti, Honduras, Mexico, Peru, El Salvador, Belgium, France, Canada, Germany, Great Britain, Netherlands, Spain, United States.

EDUCATION

University of Texas, Austin: Ph.D., Geological Sciences, 1974
San Francisco State College: B.A., Zoology, 1966

PROFESSIONAL HISTORY

Michael-Moran Assoc., LLC, Partner, 2003 to present
Moran and Associates, President, 1983 to 1992; 1996 to 2003
Woodward-Clyde Consultants, Senior Consulting Geochemist, 1992 to 1996
Gibbs and Hill, Inc., Senior Hydrogeologist, 1981 to 1983
Envirologic Systems, Inc., Senior Hydrogeologist/Geochemist, 1980 to 1981
Tetra Tech Int'l. / Sultanate of Oman, Senior Hydrogeologist, 1979 to 1980
Science Applications, Inc., Geochemist/Hydrologist, 1978 to 1979
U.S. Geological Survey, Water Resources Division, Hydrologist/Geochemist, 1972 to 1978
Texas Bureau of Economic Geology, Research Scientist Assistant, 1970 to 1971

LANGUAGES

English, Spanish

CITIZENSHIP: United States of America, Ireland

NB: To view Dr. Moran's full resume, including representative experience, publications, reports and presentations, please visit his website *at:* https://remwater.org/.

Ken Parejko, Ph.D.
Menomonie, Wisconsin
ParejkoK@uwstout.edu

Dr. Ken Parejko is an emeritus professor of Biology at the University of Wisconsin-Stout. He moved to Rusk County, Wisconsin from Chicago when he was five years old, graduated from Flambeau High and then the University of Wisconsin-Madison, with a degree in Molecular Biology. He has also attended Purdue University and Indiana University. His Ph.D. is from the University of Wisconsin-Madison Zoology Department, with a specialty in aquatic ecology. His research has included work at the University of Alaska, Fairbanks and Stanford University. He has taught at Lake Holcombe High School, Mt. Senario College, Saginaw Valley State University, Winona State University and UW-Stout. His primary research and professional experience includes various aspects of aquatic ecology, the dynamics of phosphorus in watersheds, and lake classification. He extends his understanding of natural ecosystems beyond the professional through hiking, fishing, and kayaking.

Kendra Zamzow, Ph.D.
Center for Science in Public Participation
Chickaloon, Alaska
csp2.org

Dr. Zamzow is an environmental geochemist and is the Alaska representative for the Center for Science in Public Participation. She has a Ph.D. in Environmental Chemistry from the University of Nevada, Reno and a B.A. in Molecular and Cellular Biology from Humboldt State University, California. At UNR she operated a sulfate-reducing field bioreactor treating mine water discharge at an abandoned copper mine Superfund site, and provided the laboratory water chemistry analysis for sulfate, metals, and alkalinity. Bioreactor research examined utilization of industrial waste as feed for bacteria, sulfide toxicity in bacteria, and biological removal of sulfate and metals to MCL guidelines. Molecular techniques were utilized to track microbial populations and identify phylogenies in the bioreactor under optimal and stress conditions.

Dr. Zamzow completed a Science and Policy fellowship with the American Association for the Advancement of Science working with the EPA, Office of Research and Development, Office of Science Policy, in Washington, D.C. from August 15, 2012, through December 31, 2013. Dr. Zamzow has lectured in graduate level classes on Environmental Toxicology and Analysis of Contaminants, and taught community college classes in Microbiology, Chemistry, and Biology. She has 5 years experience as a contract fisheries biologist with Alaska Department of Fish and Game, the Forest Service, and the National Marine Fisheries Service, and was the Field Coordinator for marine mammal biologists in False Pass and Prince William Sound, Alaska for 2 years. Kendra has 7 years experience in laboratories and in contaminant research in Alaska, California, and Nevada.

Education

Ph.D. Environmental Chemistry
University of Nevada, Reno 2007

B.A. Cellular and Molecular Biology
Humboldt State University, California 1986

Laura J. Gauger
Deer Tail Scientific
Duluth, Minnesota, U.S.A.
deertailscientific@gmail.com
deertailscientific.wordpress.com

Laura Gauger is the founder and chair of Deer Tail Scientific, a nonprofit corporation that provides factual information about the Flambeau Mine to interested parties. The open-pit copper mine, located near Ladysmith, Wisconsin, was owned and operated by Rio Tinto/Kennecott and their subsidiary, Flambeau Mining Company. It produced ore during the 1990s and to a large extent has been reclaimed. As stated in the Deer Tail Scientific bylaws:

The mission of Deer Tail Scientific is to educate the public, government officials and tribal sovereign nations with fact-based information on: (1) the permitting, development, reclamation, environmental performance and economics of Wisconsin's Flambeau Mine; and (2) how the Flambeau Mine compares to other mines (closed, currently operating or proposed) in the Great Lakes region and beyond.

Why place such a focus on a single and quite small copper-sulfide mine that has come and gone?

Those supporting the development of new metal-sulfide mines in the Great Lakes region of the Midwest and Alaska's Bristol Bay have drawn on the example of the Flambeau Mine in efforts to convince the public and government officials that metal-sulfide mining can be done without polluting local waters. In effect, the Flambeau Mine has become the industry's calling card, vaulting it into a position of great importance in the ongoing debate over the advisability of developing new metal-sulfide mines in water-rich Minnesota, Michigan, Wisconsin and Alaska.

Over the years Gauger has collected and archived numerous technical reports issued by Flambeau Mining Company, their consultants and government agencies regarding various aspects of the Flambeau Mine operation and has made those documents available to the public on several websites she manages. She also coauthored, with Roscoe Churchill of Ladysmith, a 2007 book about the history and politics of the Flambeau Mine[1] and was a party to several legal proceedings involving the mine's environmental performance, including a Clean Water Act lawsuit filed in federal court in 2011.

Laura, who is a pharmacist by training, resides in Duluth, Minnesota.

EDUCATION

University of Wisconsin School of Pharmacy, Madison: B.S., Pharmacy, 1979

INFORMATIONAL WEBSITES

Deer Tail Scientific *at* https://deertailscientific.wordpress.com/
Flambeau Mine Archive *at* https://flambeauminearchive.wordpress.com/
Deer Tail Press *at* https://deertailpress.wordpress.com/
Flambeau Mine Exposed-I *at* https://flambeaumineexposed.wordpress.com/
Flambeau Mine Exposed-II *at* https://flambeaumineexposed2.wordpress.com/
Flambeau Mine Exposed-III *at* https://flambeaumineexposed3.wordpress.com/

HONORS

Grassroots Citizen Advocate Award, Freshwater Future, 2013.
Hospital Pharmacist of the Year Award, Wisconsin Society of Hospital Pharmacists, 1984.
Merck Sharp and Dohme Pharmacy Award, 1979.

---

[1] *The Buzzards Have Landed! – The* Real *Story of the Flambeau Mine*, Roscoe Churchill and Laura Furtman (Gauger), Deer Tail Press, 2007, 1285 pg.; the book is available online as a free download *at:* https://deertailscientific.wordpress.com/book/.