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Hayward, WI 54843
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Ms. Ashley Beranek
Water Resources Management Specialist
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VIA e-Mail: Ashley.Beranek@Wisconsin.gov

Dear Ms. Beranek:

I am concerned about the water quality and health of Lac Courte Oreilles, Sawyer County, Wisconsin, but I am opposed to the listing of Lac Courte Oreilles, Sawyer County, Wisconsin as impaired due to oxygen-depletion during the summer months. My opposition is due to the fact that I have seen summer lake whitefish (*Coregonus clupeaformis*) kills on Lac Courte Oreilles frequently over seven decades; this suggests strongly that the fish kills due to summer oxygen depletion are natural and should be exempt from impairment listing. I reiterate, **I oppose listing Lac Courte Oreilles as impaired due to naturally caused oxygen-depletion during the summer months.**

Introduction

With that said, allow me to introduce myself. I am Edmond C. Packee, Sr. I hold a Ph.D. from the University of Minnesota (1976), a M. Forestry from Yale University (1963) and a B.Sc. Forestry from the University of Montana. I am 77 years old and have visited/lived on the shore of Lac Courte Oreilles (Northwoods Beach) from nearly the time I was one year old. I remember my first deer (two) on County K on Mullally Hill with my mother en route to pick up my dad at the railroad station in Stone Lake, Wisconsin. I was/am a voting resident in the Town of Bass Lake, Sawyer County, Wisconsin from 1966 through 1982 and again since 2007. Except for my college years 1959 through 1965, I visited Lac Courte Oreilles annually until I retired to the property of my grandparents and parents which I now own. I was professionally employed by the U.S. Forest Service in northwestern WI on the Hayward District of Chequamegon National Forest, Mac Millan Bloedel Limited, Nanaimo, British Columbia, Canada (the largest forest products company in Canada) on the entire west coast of Canada, and the University of Alaska Fairbanks in interior and southcentral Alaska. I am a Certified Forester and a Certified Professional Soil Scientist. Currently, I am semi-retired but do free-lance consulting (AK, ID, WI).

Naturally occurring environmental events, are not directly human caused. As such they are exempt from being listed as impaired. I quote from the Cleveland State Law Review of 2008 (Balanson 2008), "On June 8, 2007, the Eleventh Circuit Court of Appeals, in *Sierra Club v. Leavitt*, rendered a decision that placed its judicial imprimatur on U.S. Environmental Protection Agency ('EPA') policies providing states with the ability to exclude water bodies from their impaired waters list when their condition fails to meet water quality standards due solely to naturally occurring conditions.¹ For example, in 2002 the Florida Department of Environmental Protection ('FDEP') claimed that several streams had low dissolved oxygen² levels due to 'a natural condition,³ likely stemming from hypoxic waters draining into the streams from surrounding wetland and swamps.⁴" Foot note 4 states, "Extreme examples of the effect of low dissolved oxygen include the 'dead zones' in Lake Erie. off the coast of Cape Perpetua, Oregon and the Gulf of Mexico, as well as fish die-offs in ponds and lakes during summer months."

Summer oxygen-deficiencies have occurred in Lac Courte Oreilles for decades. Lac Courte Oreilles, being on the southwest edge of the range of whitefish in the Great Lakes region, is marginally suitable, climatically, for whitefish and probably cisco. Long term climatic change, both natural and human caused, is most likely the primary cause, in some years, of fish die offs due to the warming of the water. The frequency of such conditions resulting in fish kills is most likely increasing.

If currently in effect, as stated by Balanson (2008), "Wis. ADMIN. CODE NR § 104.01 (2007) ('Surface waters which because of natural conditions are not conducive to the establishment and support of the

complete hierarchy of aquatic organisms shall not be degraded below present levels, but shall be upgraded as necessary to support assigned uses” raises several issues which need to be specifically addressed before listing:

- How does one realistically offset climatic change (warming), i.e., cool the water?
- Other than whitefish and possibly cisco, how significant is the impact on the hierarchy of organisms?
- What effect does intermittent periods of oxygen-deficiency have on Lac Courte Oreilles’ ecosystem processes and functions? How does the lake adjust or recover?
- What and how are assigned uses significantly impacted by oxygen-depletion?
- The extinction of whitefish and/or cisco in Lac Courte Oreilles is not the extinction of the species, so what is the real concern? Will other species substitute for cisco as forage fish?
- Similarly, what is the concern of losing a two-story lake? a) suitable to support whitefish and cisco and b) simply for saving that particular lake environmental setting?—there are many more similar lakes in existence in Wisconsin and elsewhere!
- Can we have a healthy lake without whitefish? Without cisco?

Other than climatic change (warming) and the reality that Lac Courte Oreilles is in a tension zone between acceptable conditions and unacceptable conditions for whitefish and possibly cisco, there is no clear evidence that there is any other significant cause for the oxygen-depletion. Because there are some correlation does not mean cause and effect. Where is the scientific evidence showing a significant impact? The Courte Oreilles Lake Association (COLA) is convinced that phosphorus is the cause of many of the problems in Lac Courte Oreilles. Science challenges that. Their efforts in 2017 to get Lac Courte Oreilles declared as impaired due to phosphorus (COLA 2017) failed (WisDNR 2018) due, in part, to COLA’s errors in methodology and interpretations as well as supporting science.

Whitefish kills have occurred in Lac Courte Oreilles numerous times in the past. I remember kills from my days in grade school (prior to 1954) and high school and thought the whitefish were suckers because of their mouth characteristics. Becker’s 1983 range map does not show lake whitefish in western Wisconsin and notes the only records in the Mississippi River drainage are from Vilas County.

I have eaten whitefish from Lac Courte Oreilles; I picked them up when they were belly up but still barely moving their tails. I remember one major kill in the early 1980s (prior to my dad’s passing in fall of 1985) when there were more than a hundred floating belly up in the east basin. I picked two of those out of the water and we had them for dinner—knew what they were because of my experience (since 1963) with salmon spawning efforts in British Columbia and Alaska.

Lac Courte Oreilles is two-story lake that supports both lake whitefish and cisco. It is located near the southern limit of two-story lakes in Wisconsin and Minnesota. It is north of Driftless Area. It is in the Couderay River system, a tributary of the West Fork of the Chippewa River. Lakes draining into Lac Courte Oreilles include Grindstone Lake and Whitefish Lake, both two story lakes, and Round Lake; the Lake Sissabagama-Sand Lake system drains into Whitefish Lake. Table 1 provides lake characteristics. Note that in Sawyer County, for lakes supporting lake white fish range in depth from 60 to 105 feet.

In Sawyer County, Lac Courte Oreilles, Grindstone Lake, and Whitefish Lake support both lake whitefish and cisco, three of the five lakes in Wisconsin known to support both species; only four additional Wisconsin lakes are known to support whitefish (Lyons et al. 2015). Many more lakes in Wisconsin support cisco than whitefish (Lyons et al. 2015). This suggests the ecological amplitude of cisco in Wisconsin is greater than for whitefish; cisco are present across southern Wisconsin (Lyons et al 2015, Fuller and Nielson 2018a).

It appears that whitefish within Sawyer County are on the southwestern edge of their Wisconsin range (Lyons et al. 2015) and their native range in the U.S. west of the Lake Michigan drainage (Scott and Crossman 1973, Fuller and Nielson 2018b). Wisconsin is similar to the lake whitefish being near the southwest range limit of the cisco (Scott and Crossman 1973, Fuller and Nielson 2018a).

Table 1. Characteristics of Couderay River headwater lakes (various WisDNR sites)

Lake	Acres	Max. Depth	Clarity	Trophic Status	Fish sp.
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		Feet		(Sum)	W F C M N W
Ashegon	75	56	Mod	Meso	X X X X
Grindstone	3176	60	Very	Oligo	X X X X X
Lac Courte Oreilles*	5279	90	Very	Oligo	X X X X X
Little Round	229	38	Very	---	X X X X
Round	3294	74	Very	Oligo	X X X X
Sand	949	50	Low	Eutro	X X X
Sissabagama	805	48	Low	Eutro	X X X
Whitefish	800	105	Mod	Meso	X X X X X
Windigo	503	51	Low	Eutro	X X

Possible causes for low oxygen (hypoxia) content in the waters of Lac Courte Oreilles

Aquatic hypoxia, although commonly considered to be caused by pollution and eutrophication, has been a common problem on Lac Courte Oreilles (exclusive of Musky Bay) for decades, if not centuries which suggests that the resulting summer whitefish kills are not something new. So, what has changed? Climate is one factor that has been changing and warming since the end of the Ice Age. Two questions concerning climate beg:

- 1) What has been the past aquatic climate been?
- 2) What affect has been the long term (natural) and short term (human) climate change impact been?

The first two sentences in the abstract of Read et al. (2014) state, "Changes in water temperatures resulting from climate warming can alter the structure and function of aquatic ecosystems. Lake-specific physical characteristics may play a role in mediating individual lake responses to climate." Temperature is a controlling factor for many ecosystem processes in the air, in water, in organic and mineral materials. It is a "master" factor for many aquatic ecosystems. Lake temperature affects lake stratification, ice-cover and snow-cover duration, aquatic vegetation growth, senescence, decay which affect aquatic oxygen levels, and fish movement and spawning.

The most likely causes of summer hypoxia are climate-related and include:

- Pre-existing climate conditions: Current environmental and hence ecological conditions, including summer hypoxia.
- Climatic warming (natural): Current Lac Courte Oreilles conditions relict of the past; there is a lag time for lake temperature changes, especially deep-water.
- Storm and normal wind wave action disturbs sediments (mineral and organic) placing them in suspension, reducing water clarity and in the case of organic sediments increasing organic decay and release of nutrients,
- Natural highwater level (seasonal [spring high and decreasing thereafter except after heavy, short term rainfall which results in an increase in water level] increases wave related erosion.
- Terrestrial vegetation litter (pollen, flowers, leaves, fruits/ seeds) that fall directly into the water, are blown into the water, or picked up from the shore during periods of high water transfer organic and mineral components from the land to the water. Within a species, different parts have different quantities of nutrients, Different species have different amounts of nutrients, for example, in the laboratory, percent soluble phosphorus leached from the leaves of poplar is more than double that of oak (Cowen and Lee 1973).

Human caused high water (long term) can exacerbate (increase and duration) summer hypoxia

- ✓ Increased water column height prolonged through the growing season provides more growing space for increased biomass production,
- ✓ Increased bank erosion resulting in increased organic and mineral soil particles and soluble and insoluble nutrients to enter the lake,
- ✓ Increased leaching of nutrients from the soil (pit toilets, NPK fertilizer from the past, current NK fertilizer to compliment available/surplus P in the lake),
- ✓ Wave action exacerbates bank erosion
- ✓ Allows boat access where not possible in the past especially in shallow water which increases area available for propeller disturbance of the sediments

Boat traffic (human) (see Asplund 2000 for detailed analysis and summary of potential effects)

- ✓ Wave action of boats especially near shore and disturbance of sediments and shoreline erosion; this is particularly a problem near shore with sudden reduction in boat speed or sudden acceleration in boat speed and sharp turns create larger than normal waves;
- ✓ Prop disturbance of sediments down to depth of 20 or more feet;
- ✓ Phosphorus and other elements from outboard and inboard motor exhaust (as in vehicle exhaust) impacts aquatic plant growth;
- ✓ Breaking up aquatic vegetation (weeds and algae) unnaturally adds to the organic sediments.

Recommendations

- Since there is little or no scientific evidence to demonstrate a specific pollutant or human activity is creating or increasing summer hypoxic conditions in Lac Courte Oreilles (exclusive of Musky Bay),
- Since Wisconsin DNR denied the Impairment Listing of Lac Courte Oreilles Due to Phosphorus levels not being a threat,
- Since there is evidence to suggest that whitefish kills, are the results of natural hypoxic events have been occurring for decades and probably centuries,

I encourage/recommend that Wisconsin DNR not list Lac Courte Oreilles as impaired to the U.S. EPA.

- The following questions, previously raised, need to be addressed:
 - ✓ How does one realistically offset climatic change (warming), i.e., cool the water?
 - ✓ Other than whitefish and possibly cisco, how significant is the impact on the hierarchy of organisms?
 - ✓ What effect does intermittent periods of oxygen-deficiency have on Lac Courte Oreilles' ecosystem processes and functions? How does the lake adjust or recover?
 - ✓ What and how are assigned uses significantly impacted by oxygen-depletion?
 - ✓ The extinction of whitefish and/or cisco in Lac Courte Oreilles is not the extinction of the species, so what is the real concern? Will other species substitute for cisco as forage fish?
 - ✓ Similarly, what is the concern of losing a two-story lake? a) suitable to support whitefish and cisco and b) simply for saving that particular lake environmental setting?—there are many more similar lakes in existence in Wisconsin and elsewhere!
 - ✓ Can we have a healthy lake without whitefish? Without cisco?

I encourage/recommend that Wisconsin DNR not list Lac Courte Oreilles as impaired to the U.S. EPA until these questions are answered.

- Since there is no monthly climatic (atmospheric or aquatic) summary of climatic conditions over the past decades (century?) and no anecdotal information (e.g., ice out, drought years, flooding), is readily available for the headwater lakes of the Couderay River,
- Since there is no historic annual or monthly water level summary for Lac Courte Oreilles, Lake Grindstone, and Whitefish Lake,

I encourage/recommend that the Wisconsin DNR summarize monthly climatic and water level data (both measured and anecdotal) because such data are critical for understanding current and past biotic processes/changes/causations and for predicting future biotic change. See Read et al. (2014) for lake ecosystem modeling.

- Since the published record of the presence of whitefish and whitefish kills in Lac Courte Oreilles is incomplete,

I encourage/recommend that the Wisconsin DNR develop and conduct a survey asking current and former long term residents (seasonal and full time) and regular visitors of the past about historic fish kills that they remember.

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