Final Environmental Impact Statement for the Proposed Introduction and Stocking of Landlocked Salmon into Big Green Lake

November 17, 2014

Wisconsin Department of Natural Resources

Proposed by:

The Green Lake Coldwater Fishery Advisory Committee

Members:
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To the reader:

The draft environmental impact statement (dEIS) was made available for public review and comment from August 19, 2004 to September 22, 2014 pursuant to Section NR 150.30 of the Wisconsin Administrative Code.

In addition, a public informational meeting and hearing was held on September 9, 2014 to receive public comments on the proposal and the dEIS. The meeting/hearing was held at 6 PM in Studio A of the Green Lake Town Square located at 492 Hill Street in the City of Green Lake.

The Department considered all public comments received. This final environmental impact statement (fEIS) has been published on the Department's web site, along with a determination of compliance with the Wisconsin Environmental Policy Act and Section 1.11 of the State Statutes.

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1. Description of Proposal

The Wisconsin Department of Natural Resources (DNR) has received a request evaluate the introduction of Landlocked Atlantic Salmon by the Green Lake Coldwater Fishery Advisory Committee (GLCFAC) into Big Green Lake, Green Lake County, on a four year trial basis. A stocking permit (Wisconsin State Statute 29.726) will be applied for by the GLCFAC pending completion of the environmental impact statement process under Section NR 150.30, Wisconsin Administrative Code.

The Green Lake Coldwater Advisory Committee is seeking permits from the State of Wisconsin to import, rear and stock a limited number of landlocked Atlantic salmon to replace domestic brown trout. This experimental stocking would be for a period of four years with the option of continued stocking based on an evaluation of the program through annual progress reports and a more thorough summary at six to eight years into the program. It is proposed to stock spring yearling Atlantic salmon in Green Lake at a density of two fish per acre, totaling 15,000 fish. If available, a small sample stocking of 2,500 fall fingerlings could also be considered to determine if these fall fingerlings would survive and be more cost effective by eliminating the need to rear fish through the winter.

Landlocked Atlantic salmon (*Salmo salar,*) hereafter referred to as salmon or LLAS, are a freshwater fish within the sea-run Atlantic salmon species. In particular, the committee recommends stocking the strain of LLAS available from Grand Lake Stream Fish Hatchery in Grand Lake Stream, Maine. This recommendation is based on positive stocking results from both the Michigan DNR and the Lake Superior State University Aquatic Laboratory, the later successfully stocking Atlantic salmon in the St. Marys River and Torch Lake (State of Michigan). The Grand Lake Stream Fish Hatchery has been contacted by the GLCFAC and has confirmed that they are able to provide certified, disease-free Atlantic salmon eggs. These eggs would need to meet Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) and DNR fish health certifications, and are considered by the committee as the highest priority source for hatching, rearing and stocking LLAS in Big Green Lake.

The GLCFAC has contacted the Grand Lake Stream Fish Hatchery in Grand Lake Stream, Maine to initially supply LLAS for this project. The fish hatchery has acknowledged that it is able to provide certified, disease-free eggs for hatching, rearing and stocking in Big Green Lake. The eggs would be required to be accompanied by a WDNR health certificate indicating that the eggs are free from the following infectious diseases: Infectious Hematopoietic Necrosis (IHN), Viral Hemorrhagic Septicemia (VHS), Whirling Disease, Enteric Redmouth, and Ceratomyxa Shasta.

Eggs obtained from the Grand Lake Stream Hatchery would be hatched and initially reared to fall fingerling size for stocking into Big Green Lake. Complete hatching and rearing plans are not finalized as of yet, as they are contingent upon import and stocking approval.

Based on communication with the Grand Lake Stream Fish Hatchery, Atlantic salmon eggs could be ordered for Green Lake stocking each October and delivered the following February. The eggs could be used for hatching and rearing. Fall fingerlings would be approximately 3.5

inches long and spring yearlings approximately 7+ inches long. Using efforts in Maine and Michigan as a stocking model, the spring yearlings would be scatter-planted in Green Lake along deep water shores over 100 feet deep to minimize predation. If done, any small sample stocking of fall fingerlings would be in spring-fed creeks in Norwegian Bay, as this location would provide reduced predation potential and easy access to the cold, deep waters of the bay during smoltification.

For the experimental stocking program, spring yearling salmon will be scatter-planted over the deep waters of Green Lake. Proposed locations include off of Horner Landing, Sandstone Bluff and Sugar Loaf. Any small sample stocking of fall fingerlings, should they occur, would be in specially selected spring -fed creeks on the Green Lake Conservancy's property, located adjacent to deep Norwegian Bay waters. These stocking techniques and locations should minimize potential predation. However, there are times during the year, including salmon spawning in the fall or periods during the winter when the lake is homothermous, when salmon and potential predators may spatially occupy the same depths or areas.

Depending on available forage, the average size of the salmon are expected to be 17 to 18 inches long and weigh two to four pounds within two to three years. The growth rates and ages of caught salmon would be monitored by fin-clipping, tagging or otherwise marking the stocked fish. These marked fish would then show up in DNR surveys, GLCFAC assessments and reported angler catches. Continued stocking of LLAS would be contingent on DNR surveys showing no negative impacts to the current fish populations on Big Green Lake, particularly the native cisco population. Impacts evaluated could include, decreased catch-per-unit-effort (CPE) in surveys, reduced recruitment for young-of-year, reductions in population numbers, changes in length frequencies, changes in growth rates or age composition of current game fish stocks. The decision for determining negative effects and termination of LLAS stocking would rest solely with the DNR.

It is not the intent of the WDNR to actively manage Big Green Lake for LLAS, but rather to explore the proposal of the GLCFAC to add another species of cold-water sport fish similar to the Seeforellen brown trout that showed the most success but are unfortunately unavailable for stocking under current DNR stocking policies related to VHS. WDNR would continue to monitor the fish community in Big Green Lake using current methods, protocols and schedules, but would not be doing additional surveys specifically for LLAS. Green Lake is a high profile lake and on a five-year rotation for comprehensive surveys. The next comprehensive survey of Big Green Lake is scheduled for 2016. Any additional monitoring specifically for LLAS, including any angler creel surveys, may be conducted by the GLCFAC or their designee.

From 1962 to 2012, Green Lake was stocked with 513,327 brown trout, including 13,899 stocked in 2012. The intense competition between these closely related species, brown trout and Atlantic salmon, may prevent the successful introduction of salmon in Green Lake. Given this intra-species competition and the historically low brown trout return to creel, WDNR would suspend the stocking of domestic brown trout in Big Green Lake should this LLAS proposal move forward with stocking LLAS into Big Green Lake.

During the experimental stocking program in Big Green Lake, the GLCFAC is recommending a 15 inch minimum size limit and a daily bag limit of two (2) LLAS. However, because of the timeframe in implementing rule changes, WDNR and the GLCFAC agree that initially Atlantic salmon would be considered as "other trout" in the current regulations, with a 14 inch minimum size and a bag limit of three. Based upon the evaluation of stocking and monitoring results, adjustments in size, bag limits and/or regulations may be recommended for LLAS. No regulations for existing fish species would be modified to benefit LLAS in response to any negative effects caused by the LLAS. Regulation changes currently being considered for cisco on Big Green Lake are not related to this proposal nor should not be interpreted as a part of this proposal.

Additionally a valid Wisconsin fishing license and inland trout stamp would be required to fish for salmon on Big Green. If and/or when the experimental stocking of landlocked salmon proves to be successful based on a fishable population and healthy growth, the size/bag regulations could be adjusted as appropriate.

2. Purpose and Need

The purpose of stocking Landlocked Atlantic Salmon into Big Green Lake is to promote increased angling opportunities while maintaining the health of the existing fishery. The Seeforellen strain of Brown Trout that was previously stocked in the lake has been discontinued to minimize the risk of spreading viral hemorrhagic septicemia. Salmon would replace Seeforellen Brown Trout (stocked prior to 2007) and domestic Trout (currently being stocked) to provide a unique fishing opportunity in Wisconsin.

3. Authorities

- A Department of Natural Resources Fish Stocking Permit, Wis. Stat. 29.726, will be required.
- A Department of Agriculture, Trade and Consumer Protection Fish Import Permit, Wisconsin Act 207, may be required.

4. Scoping Process

The Green Lake Coldwater Fishery Advisory Committee had meetings with Department staff, the Green Lake Association, Green Lake Sanitary District, and Walleyes for Tomorrow during 2013 and 2014.

5. Affected Environment

5.1. Big Green Lake Physical Description and Water Quality

Situated in Green Lake County, Big Green Lake ("Green Lake") is the deepest natural lake in Wisconsin. Measuring 7.3 miles long by two miles wide with 27.3 miles of shoreline, Green Lake has a surface area of 11.5 square miles. With an average depth of 100 feet that extends to a maximum depth of 237 feet, the lake encompasses a volume of 248.3 *billion* gallons. Green Lake was formed over 10,000 years ago when a deep valley on the west side of the lake was

impounded with a mass of rocks and sediment during the Cary sub-stage of Wisconsin's last glacial period.

The surrounding watershed that drains to the lake covers 107.3 square miles (68,676 acres) and is primarily agricultural landuse (57%), with the remaining area in open water (13%), grassland (10%), forest (9%), wetland (7%), urban (3%) and barren (1%). Eight major streams flow into Green Lake and include Dakin, Hill, Roy, Wuerches, White, Silver, Spring and Assembly Creeks. Silver Creek, the easternmost basin, is the largest of these tributaries and accounts for 54% (58 square miles) of the watershed. The watershed is dominated by agriculture (56%), open water (12%) and grasslands (10%) and is ranked high for nonpoint source issues affecting groundwater.

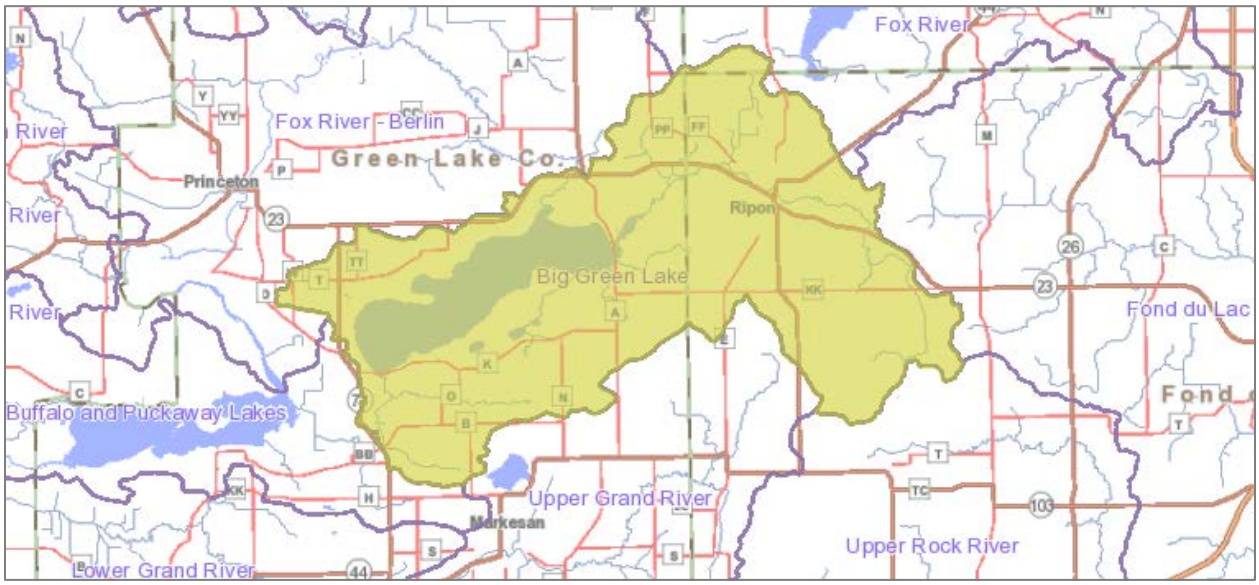

Figure 1. Green Lake's watershed is 107.3 square miles, an area of land that drains to the 11.5 square mile lake

Prior to European settlement, Green Lake was classified as a healthy oligotrophic lake. However, decades of phosphorus and nutrient inputs have increased the lake's productivity, causing it to be more fertile with higher concentrations of phosphorus. Recent phosphorus concentrations (average-summer surface phosphorus concentration of 21 µg/L) classify the lake as a mesotrophic lake, implying the lake has moderate nutrient concentrations and moderate plant biomass production.

Green Lake can experience phenomena known as metalimnetic oxygen minima. This is a decrease in oxygen at and slightly below the thermocline, with adequate oxygen levels above and below. It is be caused by decomposing algae and other organic materials that sink through the water column and concentrate in the denser water of the thermocline. As this material decomposes, it uses oxygen, causing the decrease. This phenomenon has been observed in Big Green Lake in some years primarily during July and August at the thermocline (30-40 feet). The band of low oxygen is narrow being perhaps 3-5 meters wide. Oxygen levels below 1 mg/l have been recorded in Big Green during this time frame (pers. comm. Ted Johnson, WDNR).

The oxygen in this depth range begins to recover in September as the thermocline begins to weaken. This phenomenon has been occurring with more frequency in the last FEW decades. The cause is believed to be from increased organics and nutrients coming into the lake via storm water, urban and agricultural runoff, etc. delivered directly to the lake or via the creeks flowing into it.

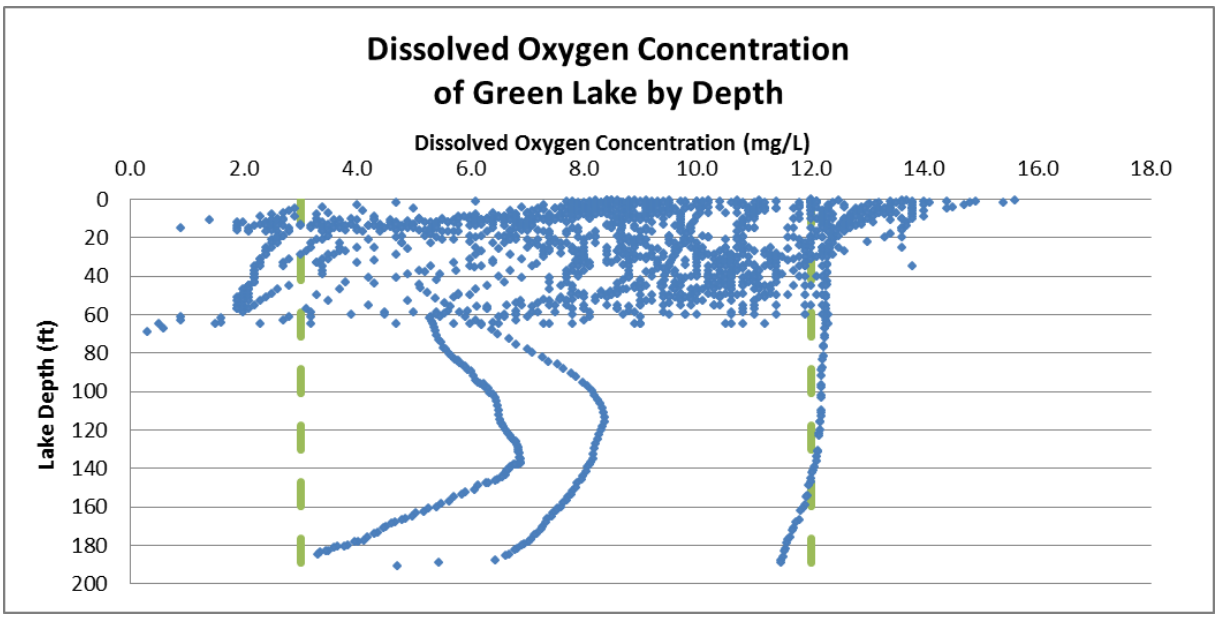

Figure 2. A graph of depth (ft) versus dissolved oxygen (mg/L) of Wisconsin DNR measurements on Big Green Lake (sites 2403021, 243039, and 243046) from 1986 to 2001 shows that 73.5% of dissolved oxygen measurements are within a healthy range of 3-12 mg/L (shown in dashed green), as suggested by Havey and Warner (1970)

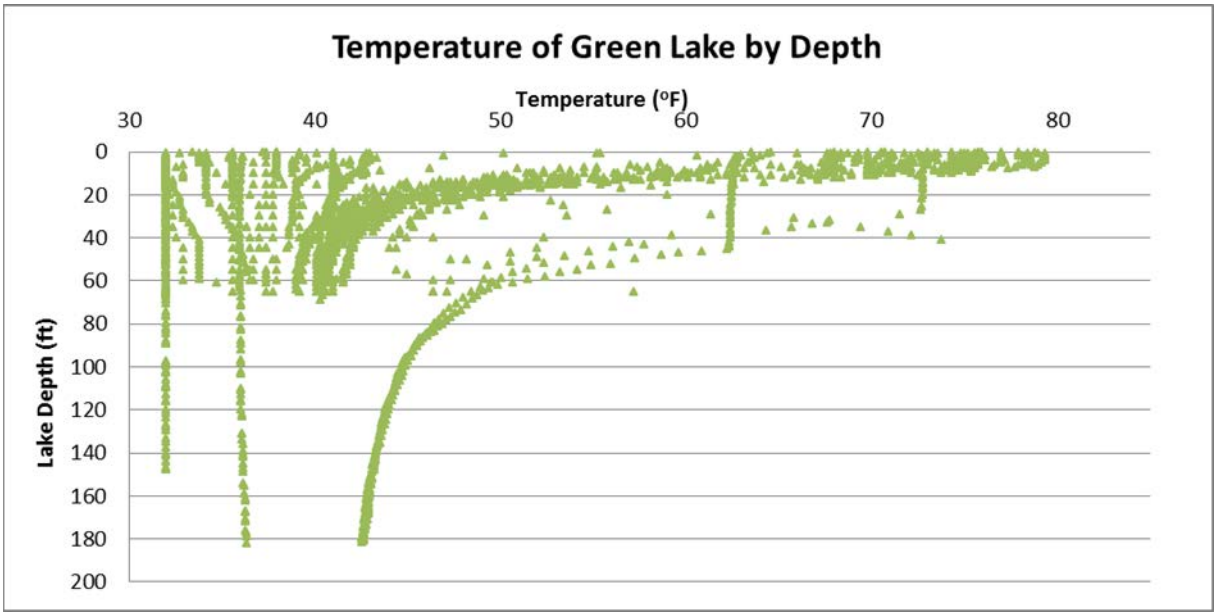

Figure 3. A graph of depth (ft) versus temperature (°F) Wisconsin DNR measurements on Big Green Lake (sites 2403021, 243039, and 243046) from 1986 to 2001

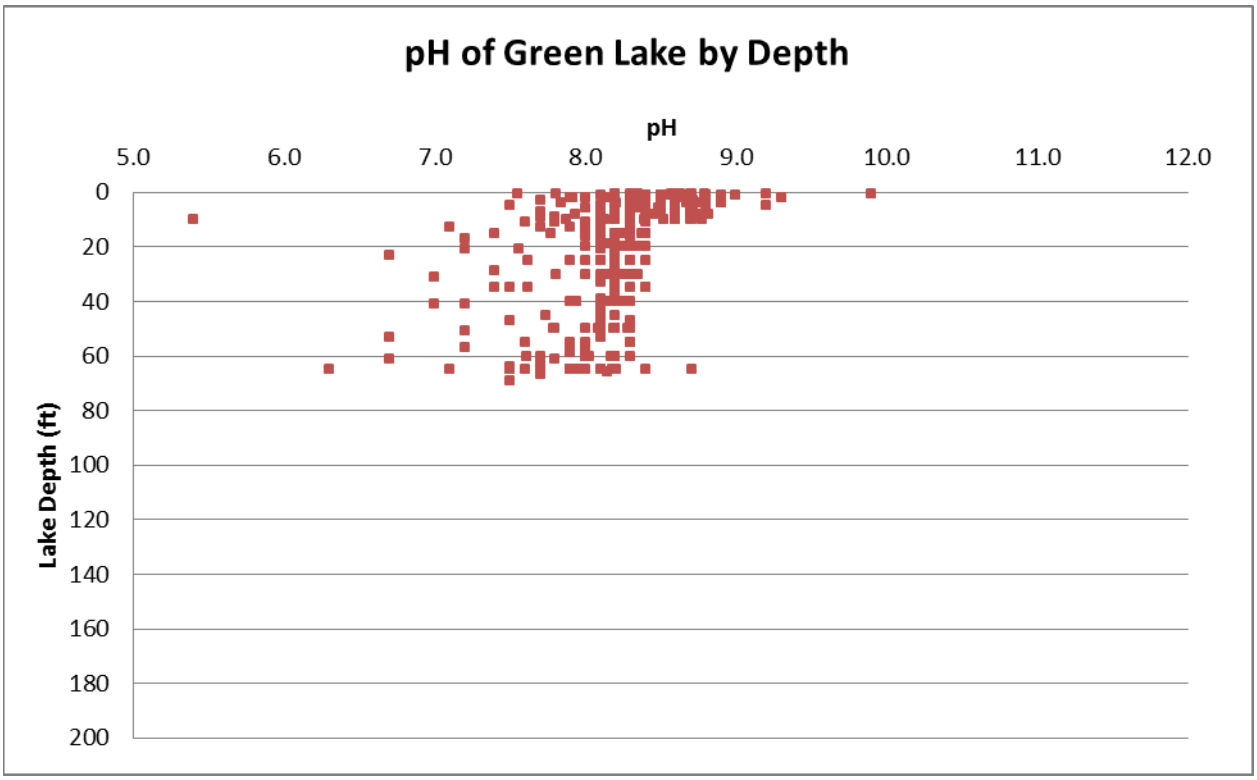

Figure 4. A graph of depth (ft) versus pH of Wisconsin DNR measurements on Big Green Lake (sites 2403021, 243039, and 243046) from 1986 to 2001

5.2. Big Green Lake Fishery and Stocking History

Green Lake's significant depth allows it to support a two-tiered fishery of both warmwater and coldwater fish. Past surveys of warmwater species show "excellent naturally-reproducing populations" (Lake Management Plan Team 2013) of bluegill, black and white crappie, channel catfish, yellow perch, black bullheads, and small-, largemouth-, rock- and white bass. Pumpkinseed, carp and white suckers are also present. A low density, coolwater population of muskellunge ("musky") is currently sustained in the lake through stocking efforts. Walleye populations are self-sustaining at low densities and current efforts have been underway to help bolster the walleye population, through stocking of fry, but success has not been documented. Northern pike also are able to reproduce successfully and their numbers may be on the rise due to habitat improvements.

No endangered fish species are listed for Big Green Lake in the Natural Heritage Inventory.

Green Lake also has a history of stocking coldwater fish species, including lake and brown trout, as well as splake and rainbow trout. Current stocked coldwater fish include brown and lake trout. Green Lake does contain a native population of cisco and is only one of a handful of inland lakes in Wisconsin that has a lake trout fishery. This fishery is sustained through a cooperative agreement between WDNR and the Green Lake Sanitary District.

Lake trout (*Salvelinus namaycush*) were first stocked in the lake in 1886 and stocking continued until 1944 (WDNR stocking data base). During that year, test gill nets demonstrated a healthy

population of lake trout, but fishermen experienced little angling success. Therefore, stocking was stopped.

In 1951 to 1952, a hook-and-line method for catching lake trout during summer months was discovered. Green Lake became famous for excellent lake trout fishing in the Midwest and, in 1953, stocking efforts were restarted with 21,000 lake trout. In the next few years, hundreds of nonresidents began visiting the area to fish for trophy trout, resulting in an impact similar to a "local gold rush."

This demand encouraged an even greater stocking effort, which totaled nearly 100,000 of lake trout, splake, brown trout and rainbow trout annually from 1964 to 1970. Fishing and the related tourism and economy were excellent during most of the 1960s, however, excessive harvest and over stocking of lake trout, along with the stocking of brown trout and splake (lake trout x brook trout hybrid), was not successful. As a result, fishing results declined by the late 1960s to early 1970s.

Only lake trout were stocked from 1975 to 1983, with annual totals ranging from 12,000 to 49,000. Slowly, lake trout fishing returned. In 1983 to 1990, brown trout stocking resulted in reasonably positive fishing results. From 1990 to 1997, the stocking of brown trout was replaced by the stocking of rainbow trout. In both cases, the initial positive returns on both brown and rainbow trout turned negative and stocking was terminated as a result.

From 1997 to 2007, Seeforellen brown trout and lake trout were stocked in Green Lake, averaging stocking totals of 12,000 and 17,000 fish, respectively. The balance of these two species worked well, and the inherently more -hearty, wild-strain of Seeforellen brown trout proved to be successful. However, this success was short-lived due to the discovery of Viral Hemorraghic Septecimia virus (VHS) in Lake Michigan waters.

Viral Hemorrhagic Septicemia is a deadly fish virus and an invasive species that is threatening Wisconsin's fish. VHS was diagnosed for the first time ever in the Great Lakes as the cause of large fish kills in lakes Huron, St. Clair, Erie, Ontario, and the St. Lawrence River in 2005 and 2006. Thousands of muskies, walleye, lake whitefish, freshwater drum, yellow perch, gizzard shad, redhorse and round gobies died. Many Chinook salmon, white bass, emerald shiners, smallmouth bass, bluegill, black crappie, burbot, and northern pike were diseased but did not die in large numbers. It's not a threat to people who handle infected fish or want to eat their catch, but it is threat to the more than 25 fish species it can kill. It has also been found in Lake Winnebago, Little Lake Butte des Morts, Green Bay.

A policy decision was made by the WDNR not to stock fish from a Great Lakes source into inland waters because of the risk of transferring VHS. Thus Seeforellen-strain stocking in Green Lake ended as Lake Michigan was the brood source for the Seeforellen. As a result of this policy decision, domestic brown trout strains were stocked in Green Lake beginning in 2008. Since that time, relatively few brown trout have been caught by anglers in Green Lake. The exact cause of this is unknown, though some type of predation on the stocked brown trout is suspected.

5.3. Other Big Green Lake Fauna

Big Green Lake and its surrounding uplands and wetlands support a variety of wildlife species including common mammals and birds.

Eagles, red shouldered hawks, osprey, pelicans and/or seagulls and other common waterfowl are present in Big Green Lake. There are no reported rare species in the lake or tributary streams.

Invasive aquatic species present in Big Green Lake include Freshwater Jellyfish and Zebra Mussel.

5.4. Big Green Lake Flora

Two of Green Lake's most abundant plant species, Ceratophyllum demersum and Myriophyllum spicatum also known as coontail and Eurasian water milfoil dominate the Lake. Approximately 18 species were noted during a 1990 survey and 22 in a 1992 survey. Maximum rooting depths are 15 to 21 feet below the lake surface.

The base of the food chain is dependent on healthy marsh environments having dense aquatic plant growth. The 1921 Rickett study indicates areas of emerging plants like bulrush were much larger than today. Many functions are supported by healthy shallow water marshes, including water filtration, fish spawning, and wildlife feed. The access to marsh areas for pike, panfish, forage minnows, and waterfowl, for example, is critical to support of these species.

Invasive plant species present in Big Green Lake include Curly-Leaf Pondweed, Eurasian Water-Milfoil, Hybrid Eurasian/Northern Water-Milfoil, and Purple Loosestrife.

5.5. Ecologically critical areas

Ecologically sensitive areas near Big Green Lake included County Park Marsh (CTH K), Silver Creek inlet, Blackbird Point, Beyer's Cove, West Norwegian Bay, Dartford Bay (SE shore), Green Lake Millpond, and Carver Islands channel. These shoreland wetlands generally support prey species for predator fish.

Big Green Lake is unique in that is accommodates a two-story fishery including both warmwater and coldwater fish species. Spawning habitats are available near-shore and in adjacent streams.

5*.6. Socio-Economic Environment*

Big Green Lake is the primary economic engine that drives the prosperity of the City and County of Green Lake. The lake and its adjacent property owners account for 3% of the population of the County, while contributing over 51% of County tax revenue (Jim Hebbe,County Conservationist, County Board presentation, 2012). Maintaining and improving the recreational resources of the County's largest natural resource is important in maintaining and improving the economics of the region.

Sport fishing is a popular year-round activity with several charter fishing/guide businesses in the area.

The existing public boat launch facilities on Big Green Lake currently have adequate capacity. Peak angling and boating activity occurs on summer weekends and holidays.

5.7. Human Health

Mercury and PCBs are the primary contaminants of concern in fish in Wisconsin and all waters of the state have recommendations on how frequently different species may be eaten safely by people. Concentrations of these bioaccumulating contaminants generally increase in most long-lived species as the fish ages. Atlantic salmon spawn and return to deep water in subsequent years and live up to 14 years of age. Contaminant testing of fillets from any newly introduced species will need to be conducted to determine the concentrations of mercury and PCBs that are attained as they grow and age and to determine the consumption advice needed to protect the health of people who may eat that species. In addition, fish are consumed by Green Lake's birds of prey, including herons, eagles, osprey, pelicans and/or seagulls as is the case for most other waters and is not discussed further.

Fish from Green Lake were first tested for contaminants in 1984 and most recently in 2011. Several species (including lake trout, cisco, common carp, walleye, and northern pike) have been tested for a variety of chemicals including PCBs, mercury, and banned pesticides. In 1987, recommendations were issued that people "not eat" Green Lake lake trout over 32". However, due to more recent testing and advisory protocols, the consumption advice that currently applies to Green Lake is the statewide general advisory that applies to most inland waters of the state. Depending on a person's category, this advice ranges from 1 meal per week to 'do not eat' depending on the species and size of fish. Until contaminant testing of LLAS can be completed, it is recommended by the GLCFAC that the same current guidelines for lake trout in Big Green Lake be used for LLAS.

6. Ecology of LLAS

6.1. LLAS Habitat Requirements

Historically, Atlantic salmon were known to survive within a rigid set of environmental conditions. Salmon were proposed to need cold water (less than 70 - 75^{o}F), dissolved oxygen greater than 5 mg/L, and a pH above 6.0 (Cooper 1940). However, later studies concluded that salmon were able to exist in a much broader range of conditions than those previously thought necessary.

Harvey and Warner (1970) note that Atlantic salmon prefer deep, oligotrophic lakes, low in organic matter and containing plenty of cold, well-oxygenated water, though they can tolerate marginal water conditions very well. Of these environmental constraints, the most important environmental parameter for healthy development is dissolved oxygen content. Harvey and Warner (1970) documented salmon living in lakes with dissolved oxygen concentrations ranging from 3-12 mg/L. As an active fish species, Andrews et al. (1988) documented salmon needing oxygen concentrations of 5 mg/L, though there is evidence that landlocked Atlantic salmon can tolerate oxygen levels below 3 mg/L for a short period of time (Warner and Havey 1985).

Temperature is another important parameter for this fish species. Warner et al. (1968) have shown that salmon are capable of surviving waters reaching temperatures in the upper 70 ^{o}F and oxygen deficiencies present in the deeper areas of lakes at certain times of the year. Atlantic salmon generally feed and grow at warmer temperatures than steelhead, for example. Optimal growth and lethal temperatures are approximately 66.2 ^{o}F and 87.8 ^{o}F (19 ^{o}C and 31 ^{o}C), respectively.

Of less importance to the resilience of Atlantic salmon is pH. Harvey and Warner (1970) documented preferable pH values ranging from 5.8-7.6, though researchers seem to agree that salmon are "capable of inhabiting a variety of lake types with no distinct preference for certain exact conditions" (Scheirer and Soldo 1990). Furthermore, too *low* pH is of greater concern than too *high* pH (personal communication, 2014, West Grand Lake). Big Green Lake is slightly alkaline. In Maine, the pH in waters where salmon exist is not a limiting factor to their survival or reproduction (Warner and Havey 1985).

6.2. LLAS Behavior and Feeding Habits

Atlantic salmon undergo smoltification, a physiological process that adapts them to the transition to an oceanic, salt water environment. Some Atlantic salmon, known as landlocked salmon, remain in freshwater their entire life cycle, whose smolts migrate to cold, freshwater lakes rather than the ocean (Thorstad, et al. 2011). Smolting also stimulates a change in behavior from a territorial, benthic stream dweller to that of a pelagic[1], shoaling[2] lake or ocean fish (Thorstad, et al. 2011). Unlike brown trout, which do not smolt or move offshore, Atlantic salmon smolts migrate to offshore waters where predation rates are lower.

While monitoring the seasonal depth distribution of Atlantic salmon in Maine, Lackey (1970) found the fish to be wide-ranging, not normally found in particularly shallow or deep water. He did note that salmon preferred open water away from the lake bottom and moved to deeper water as summer progressed. Cooper and Fuller (1945) also found salmon to be more abundant at mid-depths than near the bottom, between 4.6 m and 22.9 m (15 and 75 feet), with the majority of depths shallower than 18.3 m (60 feet).

Compared to Pacific salmon, like Chinook and Coho, Atlantic salmon do not have a limited life-cycle and do not die after spawning. Rather, Atlantic salmon spawn and return to deep water in subsequent years, living up to 14 years of age. As is common with other fish populations on the lake, any small population of dead fish would be consumed by Green Lake's birds of prey.

Atlantic salmon are opportunistic generalists in their feeding behavior, meaning they are able to modify their feeding behavior to consume readily available prey. In Maine, landlocked Atlantic salmon prefer rainbow smelt as prey (Boucher and Warner 2006). Despite a lack of rainbow smelt in Gull Lake, Michigan, stocking efforts were successful and the Atlantic salmon diet was mainly a combination of mayfly nymphs, small bluegills, perch and minnows.

[1] *Pelagic:* Of or relating to the open sea.
[2] *Shoaling*: A shallow place in a body of water.

Havey and Warner (1970) noted that salmon and lake trout directly compete for food and space, though trout inhabit deeper waters than those normally occupied by salmon. However, thriving Atlantic salmon populations were shown to commonly coexist with lake trout and other warmwater fish species throughout Maine (Warner and Havey 1985).

Competition for food and space has been documented to occur both within salmon populations themselves and between salmon and other fish species cohabitating the same lake. Researchers have documented slowed growth and low yields of salmonoids due to excessive competition (Foerster, 1968; Fraser, 1978), which occurs to some extent between landlocked salmon and warmwater species such as yellow perch and smallmouth bass. Both these fish species occasionally descend into the colder, deeper waters of the lake to feed (Warner and Havey 1985). However, Warner et al. (1968) found that salmon were capable of withstanding relatively heavy competition from warmwater fish.

In Maine, lake trout and salmon segregate to some extent during summer stratification of its deep lakes, though there is some habitat overlap. In the spring, fall and winter when the deep lakes are well-mixed (homothermous), the lake trout still tend to live in deeper waters, though both species can occur at any depth.

The literature contains references alluding to food base suppression by Atlantic salmon if stocking levels are too high. In Gull Lake, Michigan, yearling Atlantics were stocked from 1986-1990 at a rate of 10.6 fish per acre. Initially, the stocking was successful, and in 1987, the return to creel was nearly 10% of the 25,356 fish stocked in 1986. These extremely high stocking rates established an adult salmon population estimated at 6-8 adult salmon per acre. Eventually, the perception that salmon had negatively impacted the prey base led to the abandonment of the stocking program.

Atlantic salmon can also be impacted by intense competition with other species, including brown trout.

Landlocked salmon are vulnerable to predation by other fish, birds and mammals at times when the salmon are concentrated, particularly in hatcheries or following lake stocking. In Maine, examination of stomach contents of potential predators revealed that chain pickerel, lake trout, burbot, smallmouth bass and largemouth bass accounted for most predation by other fish on juvenile and adult salmon (Warner and Havey 1985). In particular, Warner and Havey considered chain pickerel as the most serious threat to newly stocked salmon. Although Big Green Lake does not contain chain pickerel, it does contain northern pike and musky, which are closely related to chain pickerel and share similar food habits. Warner (1792) suggested that the survival of stocked salmon could be increased by scatter-stocking salmon in deep, open water areas. Furthermore, Warner found that scatter-stocking significantly reduced the post-stocking predation by chain pickerel.

6.3. Potential LLAS Diseases

The Wisconsin Fish Health Lab has concerns that imported fish or eggs could carry Infectious Salmon Anemia virus (which is endemic in the cage culture industry of Atlantic salmon in

Maine), Infectious Pancreatic Necrosis (IPN), Bacterial Kidney Disease and Bacterial Furunculosis. There have been recent detections of furunculosis in cultured Atlantic salmon that were obtained as fingerlings (not eggs) in a non-DNR fish rearing facility. This underscores the importance of importing only eyed eggs which can be surface disinfected. Surface disinfection of eggs after importation significantly reduces the risk of future furunculosis infections. Within the past two years, a herpesvirus of Atlantic salmon has been discovered for the first time and it is very similar to, but not the same as the herpesvirus that infects lake trout, based on genetic comparisons. We know the lake trout stocked in Green Lake in the mid 1980's were likely infected with the lake trout herpesvirus, and the population has survived and provide a fishery over time. The potential of introducing a second herpesvirus to the Green Lake ecosystem is possible, depending on the source of the Atlantic salmon chosen for the project.

Specific to the fish species, Atlantic salmon are vulnerable to thiamine deficiency, fungal infections and bacterial gill diseases. Based on experience in the Platte River Hatchery in Michigan, Atlantic salmon are ***very*** UV sensitive (sensitive to sunlight) and require UV protection (shade) during hatching and rearing. Typically, most parasites and diseases associated with Atlantic salmon occur in hatchery situations, where fish are crowded in ponds or raceways and where water quality can change quickly. Many diseases appear to be linked to stress, overcrowding, elevated water temperatures and low dissolved oxygen levels.

The diseases listed above are all specific to fish and are not transferable to humans.

6.4. LLAS Stocking

Maine supports one of the largest sport fisheries for landlocked Atlantic salmon, providing the primary fishery in 176 lakes and incidental fisheries in an additional 127 waters. The average return to creel[3] for stocked yearlings of Atlantic salmon averaged 23% in 13 Maine lakes from 1988-1996 (Johnson 2012).

Landlocked Atlantic salmon have also been successfully stocked in inland lakes in Michigan and New Hampshire for several years with stocking levels ranging from 1.5 to 2 fish per acre (personal communication,2013, John Viar, Fisheries Biologist, New Hampshire Fish and Game Department; personal communication, 2013, Heather Hettinger, Fisheries Biologist, Michigan DNR). One, Torch Lake, in Michigan, is similar to Big Green Lake. It is the longest inland lake in Michigan at 19 miles (Green Lake 7.3 miles) and 2 miles wide (same as Green Lake). The surface area of Torch Lake is 29.3^2 miles (Green Lake 11.5^2 miles). Torch Lake has a max depth of 285ft with an average depth of 256ft (Green Lake is 237ft deep with an average of 100ft). The volume of Torch Lake is 858.9 billion gallons of water (Green Lake 248.3 billion gallons). Torch Lake has been intermittently stocked with fall fingerling and spring yearlings of Atlantic salmon since 1986. The spring yearlings have ranged from 6 to 8+ inches (average 7 inches) with fall fingerlings ranging from 3 to 4+ inches (average 3.64") (personal communication, 2013, Heather Hettinger, Fisheries Biologist, Michigan DNR).

[3] *Return to creel*: Defined as the number of fish caught per number of fish stocked.

In St. Marys River in Michigan, stocking is timed such that fish are released when the river reaches 46.4 ^{o}F (8 ^{o}C) in late May or early June. This is the ideal temperature and time of year for smoltification[4] to occur in yearling LLAS (Hosmer 1979, Zydlewski 2005).

Atlantic salmon stocked in Michigan have consistently provided a better return to creel than any other salmonid stocked in Lake Huron (Johnson, Gonder and Schaeffer In press). Return to creel averaged 5.5% after 2004, which is nearly 10 times the return to creel for steelhead during the same period. In Maine, returns to creel averaged 23% from 1988 to 1996 for yearling Atlantic salmon stocked in 13 lakes. Based on this performance, the Green Lake Coldwater Advisory Committee estimates an average return to creel of 15%, resulting in a first-year return of 2,250 fish and a three-year angler catch of 6,750 based on 15,000 fish stocked annually.

Landlocked Atlantic salmon regulations in Maine, New Hampshire and Michigan vary to a degree. In Maine, the minimum size is 14 inches with a daily bag limit of two (2), in New Hampshire, the minimum size is 15 inches with a daily bag limit of two (2), and the Michigan minimum is 15 inches with a daily limit of three (3) fish.

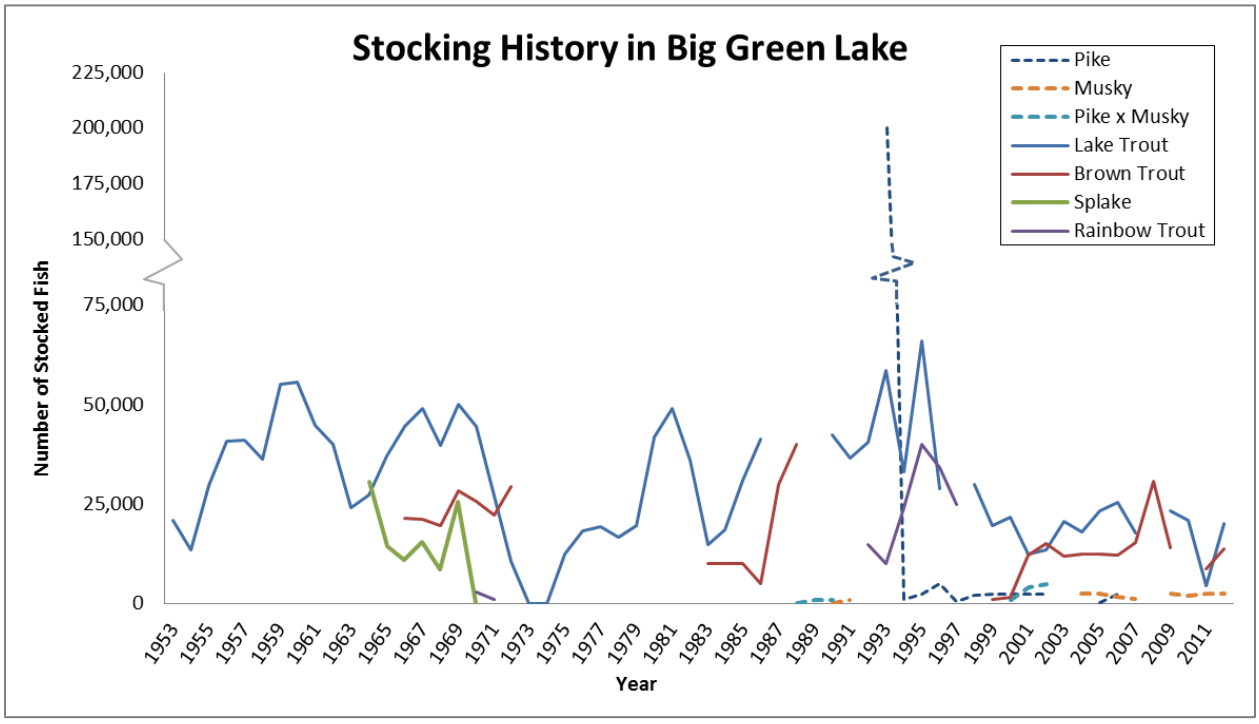

Figure 5. DNR fish stocking records of warmwater (dashed line) and coldwater (solid line) fish species in Big Green Lake. Note the vertical axis break from 75,000 to 150,000 stocked fish (WDNR public stocking database website)

[4] *Smoltification*: Defined as the physiological changes anadromous salmonids and trout undergo in freshwater while migrating toward saltwater that allow them to live in the ocean.

7. Environmental Effects

7.1. Physical and Water Quality Effects

No physical or water quality effects are anticipated. Stocked Salmon and Trout have similar diets, behavior, and life cycles utilizing similar habitat. Salmon would be stocked at a lower rate per acre as compared to the domestic brown trout.

7.2. Likelihood of Stocking Success

Given the unsuccessful stocking of domestic brown trout in Big Green Lake, the GLCFAC began looking for other options to establish a second coldwater species available for anglers. One species of coldwater salmon that has successfully been stocked in lakes in Maine and Michigan is landlocked Atlantic Salmon.

Based on extensive data collected by the USGS from 1986-2001, the physical and chemical characteristics of Big Green Lake appear to be adequate to meet the environmental requirements of Atlantic salmon. Approximately 74% of all dissolved oxygen concentrations are within the recommended range of 3-12 mg/L with an average of 8.4 mg/L (Figure 1). Furthermore, an extensive feasibility study by Scheirer and Soldo (1990) found that:

> *"We examined dissolved oxygen, temperature, and pH profiles collected by WI DNR personnel in April and June, 1989, and August 1988 (personal communication, 1990, Mark Sesing, Area Water Resources Management Specialist, Wisconsin DNR, Horicon, WI , unpublished file data). In April the lake was homothermous, having the same temperature from surface to bottom, and the oxygen was 12 mg/L throughout the water column. By the third week of June, Green Lake became stratified into distinct temperature zones with a surface temperature of 21 ^{o}C and a thermocline starting at 5 meters; however, the dissolved oxygen remained above 8.5 mg/L at all depths."*

There have been no significant changes to the physical and chemical characteristics in Big Green Lake since that time (pers. comm., Ted Johnson, WDNR.Given the fact that LLAS are believed to tolerate lower oxygen levels for short periods of time and the narrow band of depth where the lower dissolved oxygen is found relative to the entire water column in Green Lake, GLCFAC believes that this phenomena will negligibly, if at all, affect survival or growth of LLAS.

Depending on available forage, the average size of the salmon are expected by the GLCFAC to be 17 to 18 inches long and weigh two to four pounds within two to three years. The growth rates and ages of caught salmon would be monitored by fin-clipping, tagging or otherwise marking the stocked fish. These marked fish would then show up in DNR surveys, GLCFAC assessments and reported angler catches.

Landlocked Atlantic salmon stocked in Green Lake will likely be hatchery-reared, as spawning and nursery habitats that support a naturally-reproducing population are limited in Green Lake. There are a number of smaller creeks that flow into Big Green Lake that could possibly provide the needed spawning habitat, including Silver, White, Dakin and a number of small, unnamed

spring fed creeks. LLAS begin to move out of the deeper areas of lakes and into the shallows and the creeks in summer, coinciding with peak angling times (Johnson 2012). Although sustainable reproduction is not anticipated, it *is* possible that limited successful spawning could be achieved based on behavior seen in Torch Lake and Gull Lake, Michigan. However, some past stocking of brown and rainbow trout were done into these creeks specifically in the hope that they would imprint and return to these areas to establish some natural spawning, but none were seen over the years. There has not been documentation of any natural reproduction for any cold-water species in Big Green Lake for at least the last 50 years (Dave Bartz, pers. comm.)

Stocked fish will be of an adequate age and size to maximize their chance of survival, and thus the benefit to cost ratio. In general, fish stocked at larger sizes have a better survival rate due to decreased competition and predation, but this benefit must be weighed with the additional cost required to raise a larger fish size.

7.3. Effects on Other Fish Species

Competition for food and space may arise between lake trout and salmon in Green Lake and is a point of concern. Lake trout have had a historic presence in Big Green Lake since they were first stocked in 1886. Both species are considered to be a open water (pelagic) fish that are very opportunistic feeders. Lake trout feeding habits are governed by the availability of prey and they will eat whatever prey item is abundant.

Thriving Atlantic salmon populations were shown to commonly coexist with lake trout and other warmwater fish species throughout Maine (Warner and Havey 1985). It should be noted however that some of these lakes have smelt present as forage. Smelt are not present in Green Lake.

The LLAS in Green Lake would likely forage broadly on a variety of insects and small fish, such as minnows, perch, bluegill and white bass. They will also likely prey on Cisco, also known as lake herring (*Coregonus artedii*), as both Atlantic salmon and Cisco are pelagic in nature (Scott and Crossman 1973). The extent of this possible predation is unknown at this time and could be of concern. The cisco population in Big Green Lake is currently stable. However, elsewhere in Wisconsin native cisco populations are in decline (John Lyons, Wis. DNR pers. Comm). Hacker (1962) noted that the growth of young lake trout in Green Lake appeared to be related to the abundance of freshwater shrimp (*Mysis relicta*). In view of their opportunistic feeding behavior, one would expect juvenile salmon to feed on *Mysis* as well.

The proposed low-density experimental stocking of LLAS in Green Lake is believed unlikely to contribute any long-term negative impact on lake trout. While competition for food and space may arise between lake trout and salmon in Green Lake, lake trout inhabit deeper water than normally occupied by salmon. Negative effects to the current lake trout population will be monitored via current ongoing lake surveys. Lake trout are not considered to be a serious threat to newly-stocked, juvenile Atlantic salmon (Warner, AuClair, et al. 1968).

No endangered fish species are listed for Big Green Lake in the Natural Heritage Inventory, thus no conflicts with endangered fish species are anticipated.

Stocked salmon are not anticipated to have any significant benefit or impact on other fish populations and health.

7.4. Effects on Other Fauna and Flora

Stocked salmon are not expected to have any significant benefit or impact on Green Lake fauna and flora, including rare species.

7.5. Effects on Ecologically Critical Areas

Stocked salmon are not expected to have any significant impact on existing spawning habitat in ecologically critical areas.

7.6. Socioeconomic Effects

The GLCFAC's goal is to "reestablish Big Green Lake as the premiere inland coldwater fishery destination in the Midwest." Furthermore, the GLCFAC hopes to strongly encourage and support Big Green as a unique two-story lake with both excellent warmwater and coldwater fisheries. Therefore, the Committee recommends the experimental stocking of landlocked Atlantic salmon, which has the potential of being positive by providing an additional component to the lake's sport fishery. This added fishery would potentially increase tourism, resulting in a positive financial impact on Green Lake's economy.

Landlocked Atlantic salmon have had a positive impact on sport fishing, tourism and regional economics in Maine, New York, New Hampshire and, most recently, Michigan. In West Grand Lake, Maine, "The salmon fishery, which is [of a] statewide significance, attracts numerous non-residents from the Eastern seaboard every spring" (Maine Department of Inland Fisheries and Wildlife 1995). In New Hampshire, regional biologists monitor landlocked salmon and trout, which "provide fishing opportunities that bring significant economic benefits to area businesses, including hotels, restaurants, and tackle shops" (New Hamphsire Fish and Game n.d.). In Michigan on the St. Marys River at the Lake Superior State University Aquatic Research Lab, Lab Manager Roger Grail said, "It seems to be a good fishery…the fish are exciting [and] the fishery created a stir. We get people coming from all over to fish for them" (Lake Superior State University 2012).

Based on the information presented, it is believed that the introduction of Atlantic salmon in Big Green Lake is unlikely to have foreseeable adverse effects, while potentially having a substantial positive impact on the lake's fishery and economy. A small increase of only 2,000 anglers a year could have an impact of $316,000 per year based on $ 158 per trip per fisherman based on the nearby Winnebago system (Cook and Neiswender, 2007).

Stocking salmon in Big Green Lake may enhance sport fishing and contribute to existing local businesses.

Some benefit to ice fishing may occur.

7.7. Summary of Adverse Effects

There may be increased competition between stocked coldwater fish for forage and habitat.

Stocked LLAS may negatively impact native fish populations including Cisco.

7.8. Consistency with Plans and Policies

The discontinuation of stocking Seeforellen Brown Trout is consistent with Department's current aquatic invasive species and viral hemorrhagic septicemia (VHS) control plans. Land Locked Atlantic Salmon are also susceptible to VHS as are the Seeforellen strain of brown trout. However, eggs of LLAS that will be obtained will have to be from a certified disease free source per DNR and DATCP rules. Once these eggs and the resulting juvenile salmon are reared they will need to be tested and receive a DATCP Fish Health Certificate before any may be stocked into Big Green Lake. This is consistent with DNR and DATCP policy and law.

Stocking select species of fish is consistent with *A Lake Management Plan for Green Lake* http://dnr.wi.gov/lakes/lakepages/LakeDetail.aspx?wbic=146100&page=more

7.9. Longevity of Effects

Land Locked Atlantic Salmon stocking, monitoring, and management is proposed for four years.

Land Locked Atlantic Salmon are not expected to be able to establish a naturally reproducing population in Green Lake. Self-sustaining populations have not been established in Michigan lakes.

No permanent impacts are anticipated.

8. Alternatives

8.1. Department Alternatives

Do not approve the introduction of LLAS to Big Green Lake - This alternative would maintain the current fishery. The Department and Green Lake Sanitary District would continue to stock domestic Brown and Lake Trout. Landlocked Atlantic Salmon would not be introduced.

Approve introduction of LLAS to Big Green Lake – This alternative would introduce salmon into the current fishery. The Department and Green Lake Sanitary District would continue to stock Lake Trout and the Green Lake Coldwater Fishery Advisory Committee would stock Land Locked Atlantic Salmon. This alternative requires Department of Natural Resources Fish Stocking and Department of Agriculture, Trade and Consumer Protection Fish Import permit approvals.

Revise the DNR stocking policy related to VHSv – Wait to see if, or actively work to change, DNR and DATCP stocking policies to allow eggs taken from Lake Michigan brood stock to be used for stocking in inland waters. This would again allow the Seeforellen strain of brown trout to be stocked into Big Green Lake at some unknown time in the future. Currently there is no discussion of this or is any being proposed at this time. This would delay the establishment of an alternate cold water sport species in the lake for an undetermined amount of time. While waiting for a policy change, domestic brown trout would likely continue to be stocked.

8.2. Stocking Source Alternatives

GLCFAC has explored three options for rearing. The committee has been in contact with the UW Stevens Point Northern Aquaculture Demonstration Facility (NADF) in Bayfield, WI about hatching and rearing the eggs for Green Lake. They are interested, but waiting to see if stocking approvals are granted and the project moves forward. If stocking approval is granted, the GLCFAC will have more in-depth discussions with the NADF about rearing the imported eggs.

Another option for hatching and rearing LLAS eggs include contracting with a private hatchery to hatch/rear the eggs. All DNR and DATCP protocols, permits and health requirements relating to importation and stocking would need to be met. The GLCFAC will continue to search for interested private aquaculture facilities to rear the LLAS eggs.

A third option would be for the GLCFAC, or some other entity such as Green Lake Sanitary District, to lease the currently unused DNR coldwater hatchery located at Westfield and hire staff to rear the fish to stocking size. A number of upgrades, modifications and issues would need to be addressed at this facility. The costs associated with these would be the responsibility of the GLCFAC and/or its partners. Any improvements to the facility would become property of the State of Wisconsin with no reimbursement of repairs, maintenance or upgrades to the GLCFAC or its partners beyond what is outlined in any future lease agreement. (The availability/lease of an unused WDNR hatchery is a separate issue and should not be considered as WDNR's position being supportive or against Atlantic Salmon in Big Green Lake. WDNR's primary role with this EA is to function as a neutral, objective evaluator of the LLAS stocking proposal.)

The GLCFAC would also consider purchasing spring yearling and/or fall fingerling LLAS for stocking if a suitable source were found. At this time however, no available source for purchase of fingerlings and/or yearlings has been found.

9. Degree of Risk or Uncertainty

Currently, the Green Lake coldwater and warmwater fisheries are healthy and productive. The GLCFAC does not want to do anything to compromise the current status of these populations. However, the addition of LLAS could provide increased recreational opportunities in Green Lake and a benefit to the local economy. Experimental stocking of LLAS would be monitored and evaluated through regularly scheduled surveys to ensure a healthy lake ecosystem.

There have been several discussions between the Department of Natural Resources and the GLCFAC about competition with lake trout, cisco and white bass. There is agreement between the Committee and WDNR that LLAS and brown trout are intense competitors and both should not be stocked in Big Green Lake at the same time. Therefore, if all necessary permits from WDNR to stock LLAS are issued, no brown trout will be stocked while LLAS are being stocked. At any time during the course of this stocking project, if WDNR believes LLAS are negatively affecting the Green Lake ecosystem, WDNR has the authority to order a halt to the stocking of LLAS; and, should this occur, the State of Wisconsin shall incur no liability with costs related to or incurred from the project.

Continued stocking of LLAS would be contingent on DNR surveys showing no negative impacts to the current fish populations on Big Green Lake, particularly the native cisco population. Impacts evaluated could include, decreased catch-per-unit-effort (CPE) in surveys, reduced recruitment for young-of-year, reductions in population numbers, changes in length frequencies, changes in growth rates or age composition of current game fish stocks. The decision for determining negative effects and termination of LLAS stocking would rest solely with the DNR.

The LLAS in Green Lake would likely forage broadly on a variety of insects and small fish, such as minnows, perch, bluegill and white bass. They will also likely prey on Cisco, also known as lake herring (Coregonus artedii), as both Atlantic salmon and Cisco are pelagic in nature (Scott and Crossman 1973). The extent of this possible predation is unknown at this time and could be of concern. The cisco population in Big Green Lake is currently stable. However, elsewhere in Wisconsin native cisco populations are in decline (John Lyons, Wis. DNR pers. Comm). Hacker (1962) noted that the growth of young lake trout in Green Lake appeared to be related to the abundance of freshwater shrimp (Mysis relicta). In view of their opportunistic feeding behavior, one would expect juvenile salmon to feed on Mysis as well.

The proposed low-density experimental stocking of LLAS in Green Lake is believed unlikely to contribute any long-term negative impact on lake trout. While competition for food and space may arise between lake trout and salmon in Green Lake, lake trout inhabit deeper water than normally occupied by salmon. Negative effects to the current lake trout population will be monitored via current ongoing lake surveys. Lake trout are not considered to be a serious threat to newly-stocked, juvenile Atlantic salmon (Warner, AuClair, et al. 1968).

10. Precedence

Each fish stocking permit is evaluated on a case-by-case basis. Issuance of this fish stocking permit does not require the Department to issue other fish stocking permits.

11. Controversy

There may be limited controversy as fish have been stocked at Big Green Lake since 1886.

Angling is a popular recreational activity and important to the economic activity in the area. Any perceived or actual disruption may be viewed as controversial.

Some may not support stocking non-native species although non-native species are already in the system.

Some may be concerned that the presence of Land Locked Atlantic Salmon may decrease other fish populations and affect angling. Native Cisco populations are of particular interest.

Some residents may be concerned about the potential for increased angling activity and traffic from visitors coming to the area due to the novelty of the newly introduced fish.

12. Need for Additional Information

Information about foraging and spawning habits of LLAS during this 4-year stocking trial.

13. Contacts

Date	Contact	Comment Summary
January – May 2013	**John Viar**, Fisheries Biologist, New Hampshire Fish and Game Department	Positive experience with landlocked Atlantic salmon (and lake trout) in New Hampshire.
March – May 2013	**Roger Greil**, Aquatic Research Manager, Lake Superior State University	"Fish is exciting" but tough to rear, and all excess eggs/fry/fingerlings are for a Lake Huron project.
April – June 2013	**Heather Hettinger**, Fisheries Biologist, Michigan DNR	Landlocked Atlantic salmon and lake trout do well in Torch Lake.
April – August 2013	**Dr. Matthew Rogge**, Co-Director of Northern Aquaculture Demonstration Facility, University of Wisconsin-Stevens Point	They are "interested in collaborating with you to develop an [Atlantic salmon] stocking program from Green Lake."
May 2013 – Present	**Randy Schumacher**, NR Region Program Manager, Fisheries East District, Wisconsin DNR	Provided input, comments and DNR oversight throughout the process. Worked in revising and finalizing the environmental analysis and assisted with public meeting and collecting public comments.
May – June 2013	**David Marsanskis**, Fish Culture Supervisor, Grand Lake Stream Fish Hatchery, Maine Department of Inland Fisheries and Wildlife	Disease-free landlocked Atlantic salmon eggs are available for Wisconsin hatching/rearing/stocking.
May 2013 – Present	**Kendall Kamke**, NR Region Team Supervisor, Oshkosh Field Unit, Wisconsin DNR	Provided input and comments throughout the process as a DNR resource manager. Worked in revising and finalizing the environmental analysis and assisted with public meeting and collecting public comments.
May 2013 – Present	**David Bartz**, Fisheries Biologist, Oshkosh Field Unit, Wisconsin DNR	Provided input and comments throughout the process as the DNR resource manager responsible for Big Green Lake. Worked in revising and finalizing the environmental analysis and assisted with public meeting and collecting public comments.

May 2013 Present	**Bobbi Jo Fischer,** Environmental Analysis and Review Specialist	Provided guidance and comments related to format, content and drafting of this document, the environmental analysis process and assisted with the public hearing and meeting arrangements.
May 2013 – Present	**Steve Fajfer**, NR Operations Supervisor, Wild Rose Hatchery, Wisconsin DNR	Provided comments relative to the regulations for importation and potential issues and needs for the rearing of LLAS.
May 2013 – Present	Tom Van Effen, Coldwater Technician at Wild Rose State Fish Hatchery and Advisor to Green Lake's Cooperative Lake Trout Rearing Facility, Wisconsin DNR	Provided comments and advice for the potential rearing of LLAS and likely upgrades needed at a DNR hatchery facility that may potentially be used for rearing.
August 2013 - Present	**Green Lake Association Board of Directors**	Membership on the GLCFAC and association staff helped draft and edit the initial environmental analysis.
September 2013 – Present	**Alfred Kaas**, Section Chief, Fisheries Culture Section, Wisconsin DNR	Provided comments and direction to the GLCFAC related to the possible lease of a currently unused DNR hatchery facility to be used for hatching and rearing LLAS prior to stocking.
September 2013 – Present	**David Giehtbrock**, NR Staff Specialist, Fisheries Culture Section, Wisconsin DNR	Provided comments and direction to the GLCFAC related to the possible lease of a currently unused DNR hatchery facility to be used for hatching and rearing LLAS prior to stocking.
September 2013 – Present	**John I. Komassa**, Hatchery Group Leader, Southeast Hatchery Group, Wisconsin DNR	Provided comments and direction to the GLCFAC related to the possible lease of a currently unused DNR hatchery facility to be used for hatching and rearing LLAS prior to stocking.

September 2013 - Present	**Green Lake Sanitary District Board of Directors**	Involved in meetings on the stocking proposal and their possible assistance/involvement with a fish rearing facility.
October 2013 - Present	**Bobbi Jo Fischer,** Environmental Analysis and Review Specialist, Wisconsin DNR	Provided comments and guidance throughout the process on format, content and layout for the environmental analysis.
May 2014	**Sue Marcquenski,** Fish Health Specialist with the Wisconsin DNR	Provided comments related to any potential disease and health issues to native fisheries that could be brought in with the importation of LLAS to Wisconsin.
May 2014	**Candy Schrank,** Environmental Toxicologist with the Wisconsin DNR	Provided comments relative to any public health issues that could be related to the importation and stocking of LLAS.
July 2014	**Ron Bruch,** Director, Bureau of Fisheries with the Wisconsin DNR	Attended environmental analysis meeting between GLCFAC and DNR for background project information and provided comments to the group regarding the environmental analysis and approval process.
July 2014	**Ted Johnson,** Water Resources Management Specialist, Wisconsin DNR	Provided data and comments relative to water quality, temperature, dissolved oxygen, and pH for Green Lake.

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Big Green Lake proposed for landlocked Atlantic salmon stocking

Published: August 19, 2014 by the Central Office

GREEN LAKE, Wis. -- A freshwater salmon sought by some anglers for its fight and "catchability" is being considered for possible introduction into Wisconsin waters through an effort involving Green Lake area stakeholders and the Wisconsin Department of Natural Resources.

The landlocked Atlantic salmon has previously been introduced to inland lakes in Maine and Michigan and a four-year initiative to stock the fish in Big Green Lake is being proposed by the Green Lake Coldwater Fish Advisory Committee. The proposal has been reviewed by DNR's Fish Management Board and will now move forward for public comment with an information meeting and hearing set for Sept. 9 in Green Lake.

David Bartz, the local DNR fisheries biologist assisting with the evaluation efforts, said the Green Lake group's proposal to stock the fish holds strong appeal for some anglers, but the initiative requires careful consideration to ensure no harm would come to the area's already healthy fishery, including the lake's native cisco population. To that end, DNR has prepared a draft environmental impact statement and is inviting public comment on the proposed introduction.

"We appreciate the ideas and leadership of the Green Lake Coldwater Fishery Advisory Committee on this initiative and DNR will now seek additional citizen input," Bartz said. "Interested citizens are encouraged to attend the public information meeting and hearing scheduled for September" and also may submit written comments.

Steve Siders, a member of the Green Lake Coldwater Fisheries Advisory Committee, said his group has been looking at the landlocked Atlantic salmon as a way to add another dimension to the area's sport fishery.

"The landlocked Atlantic salmon has a reputation as an exciting catch, frequently breaking the surface when hooked," Siders said. "With its cold, deeper waters and population of forage fish, Big Green Lake is a destination fishery that could provide a good habitat match."

Under the proposed stocking project, juvenile landlocked Atlantic salmon would be scatter planted in several locations on Big Green Lake. The stocked fish, which would be certified as disease-free under DNR and Wisconsin Department of Agriculture, Trade and Consumer Protection rules, would not be expected to reproduce at sustainable levels although some natural reproduction has been seen in Michigan.

Unlike coho and chinook salmon that die after spawning, the landlocked Atlantic salmon survive, with some living up to 14 years. The fish readily eat mayfly nymphs, small bluegills, perch and minnows as well as cisco. Depending on the availability of forage, they typically reach 17 to 18 inches and weigh 2 to 4 pounds within two to three years. The current world record fish, a 26-pound, 12-ounce female, was caught and released about three years ago in Torch Lake near Traverse City, Mich.

Bartz said the salmon could compete with brown trout, so current brown trout stocking efforts would be suspended during the four year trial. Under current fishing regulations, the landlocked Atlantic salmon would be treated as "other trout," with a 14 inch minimum size and a daily bag limit of three.

If the project goes forward, adjustments in size, bag limits and other regulations could be recommended in the future based on stocking and monitoring results. The proposed introduction would not affect fishing regulations for existing fish.

"We look forward to the public's feedback on the proposal and anticipate we'll see a full range of comments from citizens, anglers, small business owners, community leaders and other stakeholders, both positive and negative" Bartz said. "We will be reviewing these comments and making a decision in October."

Following completion of the environmental impact statement review, the Green Lake committee would apply for a stocking permit and any other necessary approvals. All permits and approvals would be obtained prior to stocking.

A copy of DNR's draft environmental impact statement for introduction of the landlocked Atlantic salmon [PDF] can be found on the DNR website dnr.wi.gov by searching for "Current environmental impact analysis documents." Copies also may be obtained from DNR's Wautoma office by calling 920-787-4686.

A public information meeting immediately followed by a hearing will be held for the proposal and draft environmental impact statement on Tuesday, Sept. 9 starting at 6 p.m. in Studio A of the Green Lake Town Square, 492 Hill St., Green Lake.

Public comments on the draft environmental impact statement, both oral and written, are welcome at the public information meeting or may be submitted to David Bartz by mail or e-mail no later than 4:30 p.m. on September 22, 2014. Send email to David.Bartz@wisconsin.gov or mail to 427 E. Tower Drive, Suite 100, Wautoma, WI, 54982-6927.

FOR MORE INFORMATION CONTACT: David Bartz, fisheries biologist, 920-787-3016, david.bartz@Wisconsin.gov; Kendall Kamke, (920) 424-7880, kendall.kamke@wisconsin.gov; Jennifer Sereno, communications, 608-770-8084, Jennifer.Sereno@wisconsin.gov

DNR Response to Public Comments on LLAS Introduction to Big Green Lake

In preparing this Environmental Impact Statement, the Department considered fifty-one public comments received at the Public Informational Meeting & Public Hearing. This meeting/hearing was held at Green Lake Town Square, City of Green Lake, on September 9, 2014 during the draft EIS public comment period (August 18, 2014 – September 22, 2014).

Department staff compiled questions and statements from the written and verbal comments received and summarized below. Public comments that expressed personal opinion without addressing the draft EIS were read and acknowledged but not included in this summary. Department staff responded to each of the questions or statements and believe that the questions and statements covered in the following summary section are representative of the major issues that the public wanted to be addressed in the final EIS.

A copy of this comment response summary is being sent to all commenters. The Department appreciates the time, effort, and carful thought of the commenters. A new press release will inform the public how to obtain a copy of the final EIS.

Summary of Public Comments

1. *Green Lake is in great shape with a diverse fishery already. Why risk possibly ruining that? Leave it alone.*

Green Lake does currently provide diverse fishing opportunities for walleye, large and smallmouth bass, northern pike, musky, panfish and lake trout. Additionally, native cisco provide angling opportunities in the lake. All of these are native species. Walleye, musky and lake trout are sustained or augmented through stocking. The addition of an additional non-native species, particularly a predator species, does carry some inherent risk of unknown consequences. However after researching the proposal, it appears that landlocked Atlantic salmon (LLAS) are very similar to brown trout in their behavior and habitat requirements. The department has been stocking brown trout (domestic and Seeforellen strains) in Big Green Lake for years. Due to these similarities the department agreed to consider the proposal.

2. *There is a potential to harm the existing fishery.*

The department felt that the low stocking rate proposed for the LLAS introduction would not result in a population of fish that could significantly affect most game and panfish species in the lake based on the lack of effects from the stocking of brown trout. Department staff did express concern over possible negative effects on the lake's native cisco population, since young cisco would likely be preyed upon by the LLAS. Limited sampling shows Big Green's cisco population to appear stable. However statewide, their populations in various lakes are in decline.

3. *Can the forage base handle adding another predator species?*

The forage base in Green Lake is currently healthy and supports the current populations of various fish species. Coldwater species like lake trout and brown trout are likely preying on common forage species in the lake, including freshwater shrimp (Mysis sp.) and young cisco which would inhabit the colder waters. The department's biologists' professional opinion was that the low stocking numbers of the proposed LLAS stocking combined with the halting of brown trout stocking would not likely over stress the forage base, but there is still an unknown amount of risk.

4. *There is concern that the cisco population may be impacted by the introduction of LLAS.*

Current monitoring efforts show that the cisco population in Big Green Lake is stable. Cisco may be one species that LLAS would utilize as primary forage and put additional stress on the population.

5. *Potential to harm the lake trout population*

This concern is addressed in section 7.3 of the document.

6. *Concern over increased chance of AIS/Exotic introduction due to increased angler participation.*

Educating the user public on AIS/Exotics identification and methods to minimize their spread are constantly being updated in an attempt to prevent introduction.

7. *This is just a small group of people trying to push this idea on everyone.*

The Green Lake Cold Water Fishery Advisory Committee was formed as a component of the old fish committee of the Green Lake Sanitary District, though they are not officially associated with that district. The group has proposed the introduction of the LLAS to add another cold water fish species to the lake to increase angling opportunities and promote Green Lake. (See section 2 in the EIS).

8. *We should be promoting the great fishing that is already available in Big Green Lake.*

The quality of fishing in Big Green Lake is currently being promoted by the local Chamber of Commerce and other Tourist avenues.

9. *Salmon are already available in Lake Michigan*

It is true that there are currently several species of trout and salmon in Lake Michigan. This proposal would add an additional cold water species to Big Green Lake, which lies 65 miles to the west of Lake Michigan.

10. *The current proposal does not contain a plan to adequately monitor the fishery after the introduction of LLAS.*

DNR sampling of Big Green Lake currently takes place every 5 years and there is not additional money or manpower to increase this sampling effort. Additional sampling may be conducted by private consultants and/or with additional funding from outside sources.

11. *Big Green Lake has algae and dissolved oxygen problems*

This concern is discussed under section 5.1 in the EIS.

12. *The lake is not suited for the introduction of LLAS.*

Other lakes in Michigan and Maine have been stocked with LLAS. Although there are differences some of these lakes have characteristics similar to Big Green.

13. *There are too many unknowns to this proposal*

There are a number of unknown consequences that could occur from the introduction of LLAS to Big Green Lake. Department staff have critically reviewed the proposal and weighed the potential risks and benefits. The public's opinion has also been considered by the Department prior to making a decision.

14. *There will be conflicts with other lake users?*

Lake use is on the rise across the state and user conflicts will continue to increase.

15. *Stock more walleye instead*

The walleye in Big Green Lake historically was a low-density population sustained by natural reproduction. Since the late 1990's, Walleyes' for Tomorrow, a sportsman's club, has augmented the walleye population by collecting walleye spawn, hatching the eggs and stocking approximately 3 million fry annually back into the lake.

16. *Tourism benefits, due to the introduction of LLAS, are overestimated.*

Some "rough" numbers have been calculated to estimate increases in tourism dollars due to the introduction of LLAS. LLAS have had positive impacts on tourism and regional economics in other States where they have been introduced. Additional revenue could be generated due to increases in angling following the introduction of LLAS.

17. *Musky will decimate the LLAS*

Musky are a major predator species and opportunistic by nature. If LLAS were introduced into Big Green, some would more than likely fall prey to musky and other predator species such as northern pike, walleye, small and largemouth bass and lake trout.

18. *LLAS are an exciting fish to catch.*

LLAS have the potential to provide a unique addition to the fishery of Big Green. In lakes where they have been introduced; they are often known for their fight and catch ability.

19. *Introduction of LLAS will help tourism.*

The successful introduction of LLAS could contribute additional revenue to the local tourism industry.

20. *LLAS are a great tasting fish*

Although some people may prefer the flavor of LLAS to other species of fish, some may not care for taste of LLAS or any other fish for that matter. Palatability is not relevant to the decision of whether or not to allow their introduction.

21. *Introduction of LLAS will add to the existing fishery.*

In addition to Lake Trout, there have been a number of additional cold water species stocked into Big Green Lake. All have made some contribution to the fishery. Successful introduction of LLAS could make similar or additional contributions.

22. *The introduction of LLAS has small risks versus the benefits that would be gained.*

There are a number of unknown outcomes to this proposal and it is difficult to compare the risk versus benefits.

23. *Stock more panfish*

The panfish population of Big Green Lake is healthy. There is no need to stock panfish to supplement their populations.

FINDINGS OF FACT, CONCLUSIONS OF LAW, AND DETERMINATION OF WEPA COMPLIANCE FOR PROPOSED INTRODUCTION AND STOCKING OF LANDLOCKED SALMON INTO BIG GREEN LAKE

FINDINGS OF FACT

1. The Department received a proposal from the Green Lake Coldwater Fishery Advisory Committee (GLCFAC) to introduce and stock Landlocked Salmon into Big Green Lake, Green Lake County, for a four year trial.
2. No stocking permit application was submitted. However, the GLCFAC did submit an Environmental Impact Report (EIR) that detailed the proposal.
3. Under NR 150.20 (4) (a), Wis. Adm. Code, the Department initiated the environmental impact statement (EIS) process following NR 150.30.
4. The Department prepared a draft EIS in compliance with NR 150.30 (2).
5. The Department announced the availability of the draft EIS for public review on August 18, 2014, and made the draft EIS available on the Department's web site at the following address: http://dnr.wi.gov/topic/EIA/Current.html.
6. The public comment period closed on September 22, 2014.
7. A public informational meeting and hearing were held at Green Lake Town Square, City of Green Lake, on September 9, 2014.
8. Fifty-one public comments were received on the Department's draft EIS.
9. A petition signed by 112 individuals against the proposal was received at the hearing.
10. The Department prepared a response to comments document to address the public comments received.
11. In compliance with NR 150.35, and 150.50, the Department prepared and published a final EIS on the Department's web page on November 18, 2014 at the following address: http://dnr.wi.gov/topic/EIA/ArchiveTitle.html

CONCLUSIONS OF LAW AND DETERMINATION

1. The Department has complied with ch. NR 150, Wis. Adm. Code, and with s. 1.11, Stats., for the Proposed Introduction and Stocking of Landlocked Salmon into Big Green Lake.
2. The Department recommends not introducing or stocking Landlocked Salmon to Big Green Lake at this time. This decision was based on a lack of strong public support, concerns over monitoring frequency of native fish populations and the effects of the introduction of LLAS on them, and concerns of the public to maintain the status quo and/or focus on other lake management priorities. If this proposal is re-introduced at a future date, higher frequency sampling would be necessary to determine if any impacts to native fish populations occur; so timely management decisions can be made to preserve the fishery of Big Green Lake.

Additionally, stronger public support, particularly among the Lake Association and Sanitary District, would need to be garnered.

3. If this proposal is re-introduced at a future date, no further environmental analysis would be necessary unless the scope of the project changed significantly.

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Dave Bartz, Fisheries Biologist Date
Bureau of Fisheries and Habitat

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Bobbi Jo Fischer, Environmental Analysis & Review Specialist Date
Office of Business Support, Science, and Sustainability—Energy, Transportation and Environmental Analysis

Wisconsin Department of Natural Resources

Need for additional community support, long-term monitoring identified as DNR sets aside proposal to stock Big Green Lake with landlocked Atlantic salmon

Weekly News Article Published: December 16, 2014 by the Central Office

GREEN LAKE, Wis. - After reviewing more than 50 submitted comments on a draft environmental impact statement, studying testimony presented at a public hearing and considering a wide variety of fisheries data, the Wisconsin Department of Natural Resources has tabled a proposal to stock Big Green Lake with landlocked Atlantic salmon until additional data on the fish community, specifically cisco, can be gathered.

Cisco are part of the salmon family and provide food for many of Green Lake's game fish, including the outstanding population of lake trout. Atlantic salmon could potentially compete with lake trout for cisco as a common prey item but little is currently known about the status of the lake's cisco population.

The proposal to stock the landlocked Atlantic salmon -- a freshwater salmon species sought by some anglers for its fight, flavor and "catchability" -- was developed by the Green Lake Coldwater Fishery Advisory Committee, a group of anglers and community leaders interested in adding a new dimension to the area's sport fishery.

Dave Bartz, the local DNR fisheries biologist assisting with the evaluation, said the proposal contained a number of exciting elements and presented an important opportunity for DNR to work in partnership with the Green Lake group and other stakeholders throughout the review process.

"The innovative ideas and leadership demonstrated by the Green Lake Coldwater Fishery Advisory Committee brought a variety of stakeholders together for an important discussion about the future of the fishery," Bartz said. "We appreciated the excellent attendance at our community meeting and the thoughtful comments we received both for and against the proposal. Clearly, we have an extremely well-educated community of anglers and we appreciate everyone's thoughtful contributions to the process."

Bartz noted many of those stating opposition to the project were concerned about Atlantic salmon having a negative impact on the lake's forage fish population, particularly the native cisco; and the lack of a monitoring program to tell if the cisco population was to decline.

Steve Siders, a representative of the Green Lake Coldwater Fishery Advisory Committee, said the group appreciated the opportunity to hear what the public had to say about the proposal.

"We discussed their comments within the committee and with the DNR, Siders said. "We now would like to take some time and see if we can help develop a meaningful cisco monitoring program; and, at the same time, more thoroughly discuss this project with those who expressed concerns."

Siders added his group is excited about getting involved in a cisco monitoring project because "it is important for the Lake we care so much about -- Atlantic salmon or not."

Those in favor of the group's proposal noted it would strengthen sport fishing opportunities and draw anglers interested in a new challenge - benefits that have been seen in other states where the landlocked

Atlantic salmon have been stocked. The low initial proposed stocking rate of 15,000 and the fact that the fish most likely would not naturally reproduce would allow fisheries biologists to study the results and avoid adverse impacts, supporters said.

To learn more about the Green Lake group's proposal, read the public comments and review the final environmental impact statement, search the DNR website, dnr.wi.gov for "landlocked Atlantic salmon [PDF]."

FOR MORE INFORMATION CONTACT: David Bartz, fisheries biologist, 920-787-3016, david.bartz@Wisconsin.gov; Jennifer Sereno, communications, 608-770-8084, Jennifer.Sereno@wisconsin.gov