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Prairie du Sac:
Good or Bad?

Part 1: The Intro

Wisconsin has been at the forefront since the beginning of the dam building movement. People have poked, prodded, and experimented Wisconsin's streams and rivers for over 100 years. The first hydroelectric project ever was built in Appleton, on the Fox River around the turn of the century (River Alliance, 2000). Since that first project, Wisconsin has been host to thousands of dam building projects from small to very large. The Wisconsin Department of Natural Resources "WDNR" reports over 3,800 registered dams. Some unofficial estimates predict 10,000 dams may exist in the state if small, unregulated dams are included. The largest dam in the state with regards to volume and generating power is the Prairie du Sac "PDS" dam on the Lower Wisconsin River. PDS is one of the most controversial dams in Wisconsin. With issues ranging from toxic sedimentation up stream to threatened fish species being adversely affected by the dam. Do the good affects of hydropower really outweigh the environmental destruction?

In the early 1900's the entire world was on a constant search for white coal, energy produced by taking the white out of the water. Hydropower dams were going up everywhere. The dam just upstream of PDS, at Kilburn, had just been finished. It turned out to be a major failure financially and otherwise. Magnus Swenson, the investor who paid for the Kilburn dam, decided to fund construction of a dam at PDS. This dam was to be built on a broad sandy section of river with sloping sandstone bluffs on either shore. The sandstone base was not a suitable material to build the dam on. Thus, the final project was to include 11,000 wooden piles driven into the sandstone to form a foundation for the dam. Concrete and stone were filled into the forest of piles creating a foundation for the massive dam. At a total cost of 4.5 million, the dam was completed in 1913.

1913 construction
11,000 piles driven into the sandstone riverbed to anchor the dam's foundation.
F. S. Eberhart, Photographer

From the time of its construction, the dam was the largest energy producer on the Wisconsin power grid until World War II (Burnstein, 2000). Its large generating capacity is due to the dam's high head, almost 40 feet, and the sheer volume of water flowing through its turbines.

The generating station at PDS can swallow the entire river from five thousand to fourteen thousand cubic feet per second (cfs). Above fourteen thousand cfs the dam becomes flood control. It is the final flood deterrent before the Mississippi, 92 miles down stream. The stretch of river between Prairie du Sac and the Mississippi is the longest free flowing river of its size in the Midwest; it is also one of the most protected (River Alliance, 1999). The Lower Wisconsin River is home to a wide variety of fish and wildlife. The dam is a barrier to fish living in the Mississippi and Lower Wisconsin. It prevents them from going any further upstream. This has not been proven quantitatively to be a problem, but it has never been looked at as a good thing to limit habitat.

The PDS dam has many effects on the river and habitat therein. Reaching from the upper most portions of Lake Wisconsin, near the dells, all the way to the Mississippi, well over 100 miles of river has been altered by the dam. Upstream the lake has been clogged with polluted sediment, greatly altering the water's chemistry. Downstream the lack of sediment in the water has scoured the muddy riverbed clean and eroded mass quantities of sand. At the dam the amount of material washed away represents a six to eight foot decline in river level. This has left the locks for navigating up or downstream useless. The locks functioned and the whitewater below the dam was underwater when the dam was built in 1914; however, over the years the dam has had a much greater effect than Magnus Swenson ever imagined.

Prairie du Sac Dam

The powerhouse is on the left, the locks are in the middle and the flood gates can be seen to the right. This picture was taken at roughly 17 thousand cubic feet per second.

Photo by the author.

Part 2: The Good

Hydro power has been looked at as an inexpensive clean source of energy with few bounds compared to alternatives for over a century. In many of terms hydro power is all its talked up to be. The PDS dam has a capacity of 29 megawatts and an average annual production of 150,000-megawatt hours at a cost of about $3,350,000. The most likely replacement for this energy would be a high efficiency combined cycle gas turbine generating station at a cost of about $3,700,000 annually. This represents a $350,000 or 10% difference (FERC, 2002). Emissions of the fossil fuel alternative are the obvious downfall. Fossil fuels have an environmental impact that is not yet fully understood, and a global impact that we are witnessing in the Middle East and elsewhere in the form of trade disputes and all the issues along with them. Hydropower uses no fossil fuels, thus not contributing to air pollution or the global oil market, but can be very damaging to the local ecosystems and river systems.

The dam at PDS has a large capacity for flood control. As the last dam before the Mississippi, the amount of water coming out of the dam effects hundreds of land owners and cities down stream. At high water events, the dam is a torrent with plumes of white water exploding from the floodgates. In winter, the lake level is drawn down in anticipation of the coming spring floods. When snow melts in the north, the Wisconsin

River surges from below five thousand cfs all the way to fifty thousand or more (USGS, 2004). If all this water were allowed to flow out all at once, the flood plains would fill above and beyond what they have for years. The dam, by holding back these floodwaters, has allowed people to feel more comfortable putting homes and businesses much closer to the water, expanding and improving the river bottom for further development. This tendency of people to want to live as close to the river as possible has its ups and downs. Being close to water raises property values and gives opportunities to enjoy a beautiful scenic river, but can put people in the path of flooding.

In one instance, the dam has had a great effect on a species that we, in the US, hold to be almost sacred. Many bald eagles call PDS home throughout the winter, and spend summers nearby. The protection of the Southern Wisconsin Riverway has helped to increase habitat and protect the birds themselves, but the dam has been the major cause of great increases in eagle populations. For many miles downstream the outflow of the dam causes there to be no ice throughout the winter. Eagles would have a much harder time in the winter or would have to go south if the dam wasn't there. The owners of the dam have been required to test river water and the surrounding area for chemicals that could endanger the eagles, and provide signage to inform visitors of the dam to respect the eagles space and habitat (FERC, 2003a). Prairie du Sac is known as one of the best places in the Midwest to view bald eagles (Ritt, 1997).

Eagle watching is only one of many recreational opportunities made available to the public by the PDS dam. Lake Wisconsin upstream, is a world-class sport fishery with over 9,000 acres of navigable surface (FERC, 2002). Motorboats, canoes, and kayaks are common on every part of Lake Wisconsin. Below the dam, the whitewater created in the

outflow is bigger and more powerful than anything in the state. Whitewater paddling enthusiasts frequent the boiling outflow to hone their skills and enjoy the power of the river. The outflow is also a very popular fishing spot. The calm eddies and fast moving water are a magnet for all kinds of fish. Motorboats will come right up to the rapids and drop anchor to fish the eddy-lines. In article 413 of the license issued to the PDS dam in 2003, the owners of the dam were required to assess all recreational opportunities and provide those that were deemed in the public interest. A handicapped accessible fishing platform and a new ramp for launching boats were the only things required. Several letters were received regarding Canoe and Kayak access and improvements, but nothing was required (FERC, 2003b).

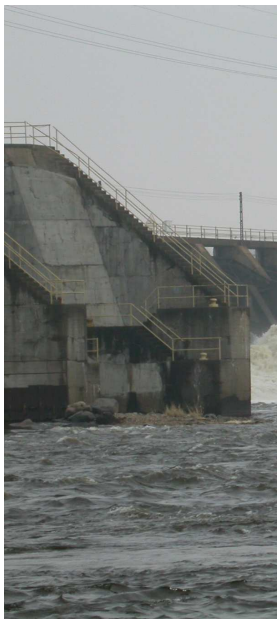
Part 3: The Bad

By backing up the water, the dam has created a lake, a large stagnant pool that grows algae and allows sediment to separate and accumulate on the lake bottom. Nutrient loading occurs causing algae to grow in force and affecting dissolved oxygen levels in the lake and downstream. This is a huge threat to the natural state of the river. By changing something as fundamental as the amount of oxygen in the water, every plant and animal living in the river is at risk. Fluctuations in the amount of nutrients and oxygen are large and quite frequent depending on a countless number of variables. The science behind what causes these things to change is amazingly inexact. The owners of the dam have been required to monitor levels of nutrients and dissolved oxygen, and to do all they can to keep them within normal levels. However, any method to control these is purely experimental (FERC 2002).

One of the major problems with the damming of rivers in general, is the interruption of the natural flow of the water. The normal meander of a river serves to slow water down and let sediment deposit or be swept away depending on nature's random orded. This natural deposit of silt tends to quickly spread and dilute any pollution

that is in the water and mix all the sediments together. This process cleans river water very well. When a river is dammed, it makes sediment drop to the bottom of the lake in one constant location. This creates hotspots of polluted sediment. A major example of this on Lake Wisconsin was when the Badger Ammunition plant lost millions of gallons of untreated wastewater into the lake leaving Grubers Grove Bay a major toxic mess. In 2001, an aggressive project to clean the bay was started and the Badger Ammunition Plant is still cleaning up the mess it created (WDNR, 2002). Sooner or later, the sedimentation, polluted or not, will become a major problem. The shallows will fill up and the lake will have to be dredged. This has happened in thousands of shallow impoundments all over the world. When the dredged material is full of heavy metals and other toxic substances, those in charge of clean up have a very stinky toxic pile, that's very hard to get rid of.

The pile of sludge sitting at the bottom of lake Wisconsin should have gone somewhere, right? It should have made its way to the river downstream to the Mississippi then eventually to the Gulf of Mexico. The direct effect of the sediment piling up behind dams upstream is the scouring of all sediment directly below the dam. The riverbed below the dam has been washed away to a depth of 40 feet or more. For miles downstream, so much sediment has been washed away that the river has dropped over 6 feet since the dam was put in place. The locks at the dam sit above water, completely impassable as you can see in the picture to the right. All that is left of the riverbed is very fine hard packed sand that was laid in place hundreds if not thousands of years ago. Rivers are supposed to flow and gradually lay down sediment, changing path slowly and not carrying a silt load very far. The water below PDS has no silt to lay down so it picks up the river bottom and pushes it into the Mississippi, which has a similar



PDS Locks
Picture taken at high water. Notice bare ground at entrance and boat tie up platforms well above water level.
Photo taken by author

problem with all its dams.

Of all things affected by the dam, the most endangered are the fish. The big issue recently has been fish passage, some way to get fish from upstream to downstream or vice versa. The idea is discussed in depth in the dam's new license. The DNR filed two formal requests for fish passage. One possibility would be a standard fish ladder costing about $500,000. Most fish of the area would not use it because of its large length and height. The species that need passage most are the sturgeon and paddlefish, and these would almost certainly not use a fish ladder.

The other option for fish passage would be to rehabilitate the locks at the dam. The concrete floor of the locks currently sits three to four feet above normal summer tail water levels. A functional rehab would require around three million dollars of work. Even after this complete rebuild, the fish may not be attracted to the very small amount of water coming out of the locks compared to the tailrace of the hydropower facility. The wide variety of fish and the large dimensions of the dam caused fish passage to be deemed not in the public interest (FERC, 2002). In the public interest or not, fish like lake sturgeon and paddlefish are threatened and need help more then ever.

The paddlefish, one of the most endangered fish species on the Lower Wisconsin, congregate at the tail water of the Prairie du Sac Dam. The Paddlefish is an ancient species resembling a shark or a catfish, but are most closely related to the sturgeon. They grow to great size, sometimes over 100 pounds. With natural uninhibited habitat, they thrive. In other parts of the country, luckily, the

Paddlefish
A rare pre-historic species most closely related to the sturgeon. Paddlefish have been known to grow in excess of 100 pounds.
Photo by Joseph Tomelleri Taken from (lyons, 1998)

paddlefish are doing well. However, in all areas where dams have been introduced and the paddlefish can't make their upstream passage, their numbers decline dramatically. The paddlefish feed off plankton and other tiny animals, and depend on a healthy thriving river (Lyons, 1998).

Part 4: The Verdict

In environmental terms, this dam has been a disaster. It has caused sediment to accumulate to dangerous levels in the lake up stream. The nutrient levels, oxygen levels, and amounts of algae have gone in unnatural directions. The river downstream has been scoured clean leaving an unnatural riverbed and causing massive erosion. Fish have been blocked from moving up or down stream greatly limiting their habitat and access to smaller upstream tributaries. This dam has been a major nuisance to the environment. How much this matters depends on how much you value and respect the natural world. Or how greatly you value other things the dam has to offer.

In economic terms, the dam is a success. It is about ten percent cheaper than operating a gas turbine plant of similar output. It is much cleaner to the air than an equivalent fossil-fueled source. Another great advantage is that it doesn't depend on imported oil or mined coal; the water is there and flowing by. The fuel source is endless in terms of the life of the dam. As power sources go, it is not too bad. Hydropower does have major downfalls and there are other options, like wind or solar power. Unfortunately these have not become popular or feasible in our current market place.

Hydropower has been a major source of energy for the world from the beginning of the industrial revolution. From waterwheels to immense hydropower projects, they are all an extension of Mankind's ability to harness and alter nature with implications we don't fully understand. The damage done to nature by covering over 9,000 acres of land

with a lake will never be fully understood and will take countless hundreds of years to reverse after the lake fills with toxic sediment and the dam must be removed. The Prairie du Sac dam is a product of an age of building the amazing no matter what the cost or implication; it is a menace and should be removed for the good of southern Wisconsin's and the river's environmental health.

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