Willow River State Park
Little Falls Dam
Final Alternatives Analysis

State of Wisconsin
DEPARTMENT OF NATURAL RESOURCES
February 2016

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I. Executive Summary

Willow River State Park near Hudson, Wisconsin in St. Croix County is the site of Little Falls Lake, a 172-acre impoundment formed by the Little Falls Dam. The dam was originally built circa 1892 on a timber crib structure. With improvements in the 1920's and 1930's, the dam became what it appears today, a concrete structure with four tainter gates, a concrete overflow section and a concrete multiple arch buttress section. In recent years, inspections have identified a series of issues that call to question the structural integrity of the dam. Some of these issues include malfunctioning gates, seepage through and around the dam, and cracks in the concrete. Additionally, it was determined that the dam does not possess the capacity to pass both 100-year and 1000-year flows as required by NR 333 Wisconsin Administrative Code for a high hazard dam.

The Department's engineers in the Dam Safety program and the Facilities and Lands program agreed that the State Park should seek the services of a consulting firm to assist with the State's review of the dam. The consultant was tasked to complete a parallel review of the dam's deficiencies, evaluate potential corrective measures with State engineers, and then provide design calculations, conceptual drawings, and general cost estimates to these options in a feasibility study. This study yielded eight different options that would address the compliance issues related to the public safety concern from the dam's structural deterioration and insufficient flood flow capacity. These options are variations expanding upon three basic alternatives; 1) Remove and Replace the Dam, 2) Permanently Remove the Dam—Stream Restoration, and 3) Dam Repair. During the time the Department considered these alternatives, the Legislature added $5 million to the project through the biennial state budget process. The total amount of state funds now enumerated in the biennial budget for this project stands at approximately $8 million. A portion of these funds will need to be allocated to the project by the State Building Commission prior to June 30, 2017 to avoid lapsing the funds at the end of the biennium.

In spring of 2015 the Department determined that, in the interest of health and safety, the lake should be drained. Drawing down the flowage would reduce the risk of dam failure. The impact of a dam failure at full pool poses a much greater consequence to the risk to life, health, and property with an increased flood wave depth. Since the gate structures did not have the capability to completely drain the lake in July, a wide breach—removal of a large section of the dam—was recommended and implemented. The drawdown began in early June 2015, and required the breach in late September to completely drain the lake to the lowest level of risk for public safety and environmental damage. The drawdown concluded by the middle of October 2015.

Several factors were considered by the Project Team before making a preliminary recommendation regarding the dam structure. The Team reviewed all available information in addition to vetting each option against set guidelines for making a decision. Those guidelines included; the future project had to be safe, code compliant, have little to no environmental impacts, provide for future water-based recreation at the property, take into consideration the majority public opinions, and be of a reasonable and achievable budget.

The Project Team has made a final recommendation to move forward with Alternative 1: Remove and Replace the Dam. Replacing the dam will preserve the main recreational functions of the park as they are currently known by the public today; this includes boating, fishing, swimming, as well as wildlife viewing and bird watching. A newly designed, constructed, and NR 333 Wisconsin Administrative Code compliant dam will provide the best solution possible to address the insufficient flood-flow capacity, provide for a "cold water" discharge to support a trout fishery, and permanently correct the structural instability of the existing dam. Additionally, the public support for a new dam and a restored Little Falls Lake is supported by park users, neighbors, local residents, and elected officials. A dam replacement preference has been reflected in public comments up to this point. The majority of comments received during the public review version of this analysis suggested an accelerated project schedule. Many also requested habitat improvements to the lake to improve the fishery and recreational opportunities.

II. Introduction

A priority of the Wisconsin Department of Natural Resources (Department) and the Wisconsin State Park System is to ensure the safety and security of its visitors and the public. The Little Falls Dam has several issues that call to question the structural integrity of the dam. These issues are serious enough to warrant addressing the situation before the dam fails. The Little Falls Dam was assigned a high hazard rating, such that in the event of dam failure, there is a potential for loss of life as well as negatively affecting existing development downstream of the dam.

A. Purpose

The purpose of this document includes the following:

- Provide a comprehensive written alternative analysis of the project on which the public has had an opportunity to review and comment
- Compile information and supporting documentation regarding the Little Falls Dam issues raised by inspections
- Develop a recommendation by the Project Team to Department leadership in order to make an informed decision regarding the future of the dam structure

The Project Team (Exhibit 1) comprised of Department specialists, managers, and engineers, used the information summarized in this document to make a preliminary recommendation to pursue Alternative 1: Remove and Replace the Dam. This alternative will bring the dam structure into compliance with NR 333 Wisconsin Administrative Code, as well as address the needs of the park recreation and public interests. The Team determined that Alternative 2: Permanently Remove the Dam and Stream Restoration would not be recommended. Also, the Team determined that repairing the existing structure or doing nothing would not adequately address these issues or the challenges with the existing structure.

B. Opportunity for Public Comment

There was a 30-day public comment period from December 15, 2015 to January 15, 2016 for this document. Comments were taken in writing by Cameron Bump, Park and Recreation Specialist. The proper mailing address and email address were provided to submit comments. All but two comments were submitted by email. A summary of comments is provided under VII. Public Participation and Stakeholder Input.

III. Background

A. Willow River State Park

The property now known as Willow River State Park (Exhibit 2) was previously owned by Northern States Power Company (NSP) from 1945 to the mid-1960's. It consisted of three flowages and approximately 1,200 acres of adjacent land. The State of Wisconsin purchased these lands and flowages in 1966-67 in response to NSP's proposal to abandon the Willow River properties. The intense public outcry sought to convert this river valley into a park facility that would preserve the recreation value of the flowages. By 1984, state ownership totaled over 2,750 acres. Today the total area of Willow River State Park encompasses 2,911 acres.

Photo 1: Scenic Willow Falls

1) Recreation Developments

The main park development is located adjacent to Little Falls Lake. Beginning in 1972, the state invested in facilities for a range of recreational activities including; camping, picnicking, hiking, skiing, fishing, swimming, nature education and more.

The 1984 Willow River State Park Master Plan recommends a development plan to fully utilize the available property for recreation purposes. The objectives listed in the master plan include the following:

- To provide recreational facilities to accommodate 270,000 visits for such activities as camping, group camping, picnicking, swimming, boating, fishing, hiking, cross-county skiing, nature study, horseback riding, and special events.
- To manage and enhance the property's scenic and natural qualities by restoring and maintaining a diversity of vegetative cover types for the lifetime of the property.
- To manage and provide for 5,900 angling trips and maintain the Race Branch of the Willow River to produce 1,800 catch-and-release trips.
- To maintain the deer herd in balance with the carrying capacity of the range through the use of a special gun hunting season.

- To accommodate individuals who are handicapped or disadvantaged through the proper design, construction, and management of the property and its facilities.

Photo 2: Sunny day at the beach

Today there are three family campground loops with a combined total of 150 campsites. The newly developed 100's Campground offers 50 sites that can accommodate tents and motor homes alike. The 200's Campground offers 30 sites with some offering electricity and size to allow some moderately sized trailers. The 300's Campground has 70 sites for tents, trailers or motor homes. The family campgrounds offer toilet and shower facilities. There is a group camp area available for larger camping groups.

In addition to the popular campgrounds, other complementary developments play a significant role in the park experience. The nature center provides for nature interpretation through exhibit and classroom experiences. The nature center also provides space for a part-time educator funded by the park's Friends Group. The facilities and trails are used by civic and school groups for education and nature viewing. The beach bath house was recently replaced with a restroom facility and picnic shelter to better serve park visitors using the main picnic area and beach. The park contains over fifteen miles of hiking trails many of which are used for cross-country skiing in the winter. The

park also offers playgrounds, handicap accessible fishing stations, canoe and kayak rental, winter snow-shoe trails, overlooks, and picnic shelters. Visitors can find a variety of recreational opportunities including hiking, biking, fishing, hunting, canoe and kayaking, bird watching, camping, picnicking, skiing, snow-shoeing, geocaching, rock climbing, and sight-seeing.

2) Little Falls Lake Uses

A boat launch on Little Falls Lake accommodates smaller non-motorized boats. There are no motors allowed on the lake except for those who obtain disability permits. The lake sustains a healthy warm water sport fishery that includes large and smallmouth bass, northern pike, and a variety of pan fish. The lake is also used for canoeing, kayaking, sculling, and sailing. The Friends of Willow River and Kinnickinnic River State Parks operates a canoe and kayak rental as a source of revenue. These funds are then reinvested in the park through the naturalist program, additional facilities, and maintenance activities.

3) Visitation and Revenue

According to the study, Economic Impacts of the Wisconsin State Park System: Connections to Gateway Communities, produced by UW-Extension and the Department, the total annual visitor expenditures into the local tourism economy attributed to Willow River State Park in 2013 totaled $29,730,753. This is the approximate economic value the state park brings to the St. Croix County area.

Willow River State Park is regularly near the top in visitation and revenue generation in the Wisconsin State Park System. Total attendance for the 2014 calendar year was the fourth highest in the System at 721,480. Total revenue generated from camping, day-use, and other sources totaled over $667,000. Park attendance for 2015 was nearly 810,000 and continued the approximate 10% year-to-year increase that has been recorded over recent years. There appeared to be considerable interest in the progress of the drawdown as well as the always-popular waterfalls. Revenue in 2015 kept pace as well with attendance reflecting a 10% year-to-year increase over 2014 revenue. However, looking forward to the 2016 camping season, there appears to be a 50% drop developing in advanced reservations when compared to the same time last year. As of December 31st, 2015 there were 83 reservations for 298 camping days. Last year at this time, there were 157 reservations for 522 camping days.

B. Willow River Watershed

According to the 2010 Water Quality Management Plan Update (Exhibit 3), the watershed lies in a karst geological setting. This means that underlying limestone bedrock can be fissured and represent a threat to groundwater. There are intermittent streams that actually disappear into the ground throughout the region. High capacity wells exist across the watershed that serve as sources for community drinking water, agricultural irrigation and industry.

Figure 1 (below) shows both the Upper and Lower Willow River watersheds. The Upper Willow River watershed is approximately 184 square miles that originates in the southeastern portion of Polk County and extends south into the northeastern portion of St. Croix County. The watershed contains 319 total stream miles, 517 lake acres, and approximately 5,600 total acres of wetland. Streams joining the Willow River in the upper portion include; the South Fork of the Willow River, Dry Run Creek, Carr Creek, Hutton Creek, Black Brook, Wolf Creek, Jack Green Creek and other unnamed creeks. Pine Lake in St. Croix County is the only lake over 100 acres in this watershed.

The Lower Willow River Watershed is situated entirely within St. Croix County. In this watershed, the Willow River main stem flows from the City of New Richmond through Willow River State Park, Lake Mallalieu, and then joins the St. Croix River at Hudson in the lower 25-mile Lake St. Croix reach.

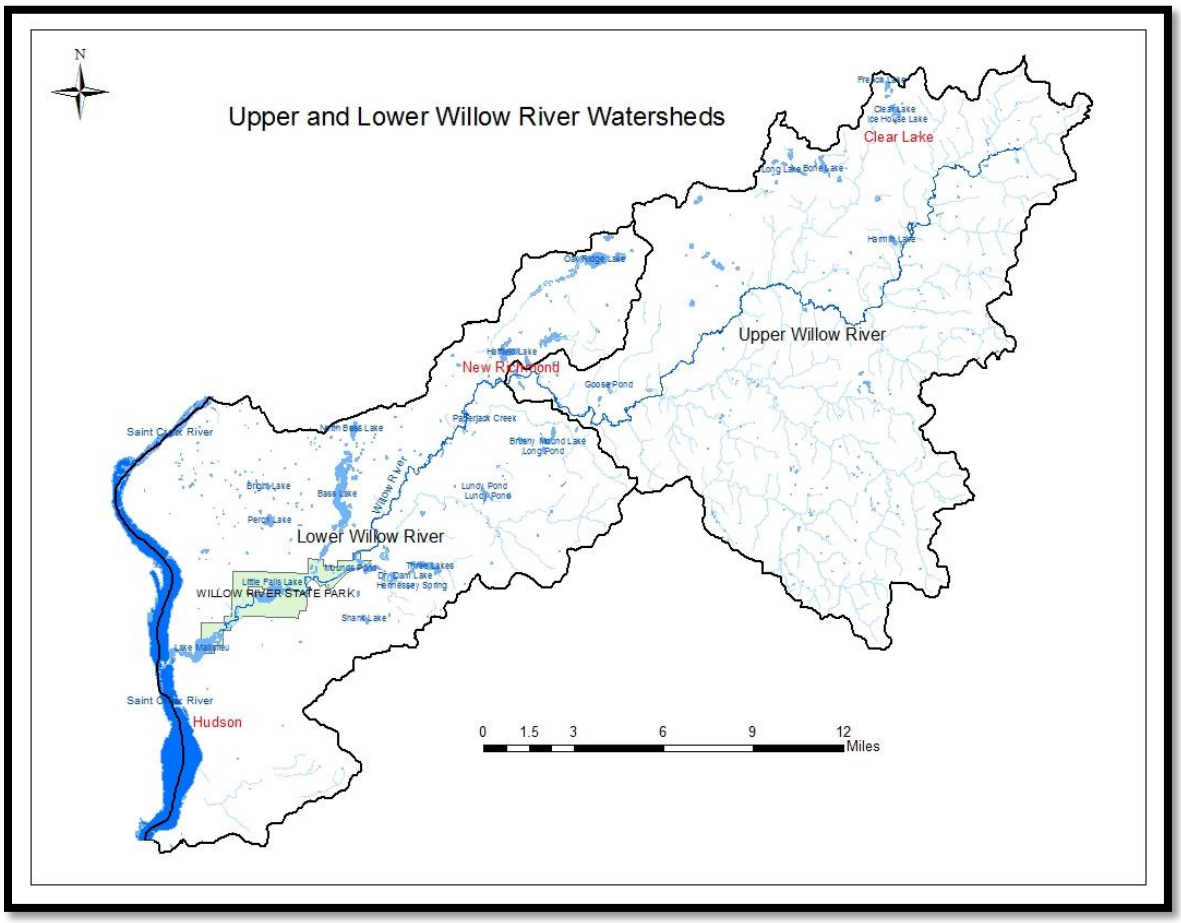

Figure 1: Upper and Lower Willow River Watersheds

The Lower Willow River drains 115 square miles. Tributaries to the Lower Willow River include; Paperjack Creek, Tenmile Creek, the Willow River Race Branch, and other

unnamed creeks. These streams in addition to the Willow River account for 99 stream miles in the Lower Willow River Watershed. There are also 2,139 acres of lakes and 2,482 acres of wetlands. Water bodies over 100 acres in this watershed include; Oakridge and Bass Lakes, and three impoundments on the main stem of the Willow River (New Richmond Flowage, Little Falls Lake, and Lake Mallalieu).

1) Land Use

St. Croix County was one of the most rapidly-developing areas in the state in the 1990s. The increase was likely from new suburban and rural residential and commercial development from the expanding Twin Cities Metro Area in Minnesota.

Both the Lower and Upper Willow River Watersheds are very similar with agriculture being the main use in both basins (56% in the Lower and 66% in the Upper). The Lower Watershed has more open water in streams and impoundments (10%), and more urban and suburban land use (totaling 5%) with the two larger communities of Hudson and New Richmond. The Upper Watershed has more agricultural land, but less urban land cover and open water. Forest and wetland percentages are nearly the same in each watershed.

2) Water Quality

Due to a significant level of non-point source pollution, the Upper Willow River Watershed was established as a priority watershed in 1981 as part of the Wisconsin Nonpoint Source Pollution Abatement Program. Some of the major water quality concerns included sediment deposition, protection of ground water resources from contamination though sink holes, and a reduction in the potential for fish toxicity from ammonia by controlling livestock waste entering the streams. Addressing non-point source runoff from both rural and urban sources remains a high priority in both of these watersheds and throughout the basin.

The effort in progress considering a Willow River and Lake Mallalieu Total Maximum Daily Load (TMDL) would likely include mass limitations for the significant dischargers of phosphorus to the watershed. In the Willow the main dischargers are the two larger municipalities; Clear Lake and New Richmond. Significant reductions will be needed by contributors of non-point source runoff as well.

There are four wastewater treatment plant discharges and one cooling water discharge to surface waters in the Willow. There are also five large farms (Confined Animal Feeding Operations or CAFOs) and nine facilities that discharge via seepage to groundwater.

3) Outstanding and Exceptional Resource Waters

Wisconsin Administrative Code NR 102 establishes protective classifications for different categories of lakes, rivers, and streams. The Outstanding Resource Water classification is given to our most high quality waters and is one of the highest levels of protection for surface waters under Wisconsin law. Exceptional Resource Waters are the

next tier below Outstanding and have nearly the same level of protection. Exceptional Resource Waters include the Willow River and the Willow River Race Branch between Little Falls Lake dam and the upstream end of Lake Mallalieu. Because of recent thermal degradation to this section of the Willow River and Willow Race Branch, it may no longer meet state standards for Exceptional Resource Waters designation.

4) Trout Water Classification

Class I trout waters support viable populations through natural reproduction, whereas Class II trout waters have some natural reproduction but require supplemental stocking to create a significant fishery. Class III waters have no natural reproduction and rely on stocking legal sized fish to provide a trout fishery. There are several Class II and Class III trout water sections throughout the Willow River watershed. In the area of the Willow River State Park the main stem of the Willow River and the Willow Race Branch are included in this classification. The main stem of the Willow River upstream of Willow Falls is Class III water and dependent on stocking of legal sized brown and rainbow trout to support a fishery.

The Willow River and Willow Race Branch downstream of Little Falls Lake is Class II brown trout water. Some natural reproduction occurs here but the stream is stocked with Timber Coulee wild strain brown trout fingerlings on an annual basis. A small section of the Willow River downstream of Willow Falls (0.4 mile) is also Class II trout water but is not stocked. Trout washed over the falls from the Class III section often reside there. Currently the best trout water found in the park is the Class II portion downstream of Little Falls Lake. The stream currently suffers from elevated water temperatures and nutrients from the top water discharge at the upstream flowage dam.

C. Little Falls Lake and Lake Mallalieu

1) Little Falls Lake

Little Falls Lake (Exhibit 4) is a 172-acre flowage on the Willow River and is located primarily within Willow River State Park. The water level in the flowage is controlled by the Little Falls Dam, a concrete dam, operated by Willow River State Park staff. It has a maximum depth of 18 feet near the dam and approximately 4.86 miles of mostly undeveloped shoreline. Much of the east half of the lake is roughly 1 to 5 feet deep. It is a hard-water, eutrophic lake that suffers periodically from algal blooms.

a. Sedimentation in Little Falls Lake

Little Falls Lake has collected sediment over time. Over one-third of the lake is less than three feet deep. Immediately upstream of the dam is the deepest area of the impoundment. Depths decrease further to the east where the Willow River enters the flowage. This is due to years of sediment transport from the larger watershed collecting in what was a series of impoundments. There was a significant delivery of sediment to Little Falls Lake when the Willow Falls dam flowage was drawn down for emergency

repairs. More sediment moved in as a result of the draw down and ultimate removals of the Willow Falls and Mounds dams. Much of this sediment collected at the headwater of the lake on the east end.

Photo 3: View of Little Falls Lake

A dredging project on Little Falls Lake was planned to take place after the removal of Willow Falls and Mounds dams. The focus was to dredge a channel through the sediment sitting in the head waters of the lake. The thought was that by providing a channel, the colder water would move more quickly through the flowage and be available for cold water fish species below the Little Falls dam. However, this dredging project was never completed due to insufficient funds and technical difficulties dealing with dredge spoils.

b. Fishery Resources in Little Falls Lake

Little Falls Lake offers a warm water sport fishery with bass, northern pike and pan fish. According to the latest lake survey information sheet (Exhibit 5), the most recent fish survey was conducted in 2012 and found the most common game fish was largemouth bass. The size distribution of largemouth bass is considered exceptional. Largemouth bass range in size up to 20 inches with an average length of 13 inches. Northern pike and smallmouth bass are also present in lower densities. Northern pike were found up to 40 inches in length and averaged 24 inches. Smallmouth bass averaged 13 inches in length but were found up to 19 inches. Growth rates in Little Falls Lake are average when compared statewide.

Five pan fish species were found during the 2012 survey. Yellow perch were the most common pan fish sampled. Bluegill and black crappie were the other common pan fish found. Bluegill averaged 5-inches in length and were found up to 9 inches. Black crappies averaged 7 inches and were found up to 11 inches in length. Growth rates of these pan fish are average when compared statewide. Other fish species sampled were pumpkinseed sunfish, rock bass, black bullhead, yellow bullhead, white sucker, common carp, common shiner, golden shiner, hornyhead chub, and central stoneroller.

Past surveys were conducted primarily for baseline inventories and evaluation of dam repairs or removals. The last comprehensive survey was completed in 2000. Generally speaking, largemouth bass have increased slightly while the size range remains similar. Smallmouth bass populations appeared to decline, as have northern pike numbers. Pan fish numbers for all species have shown increases. Changes in these populations are neither dramatic nor unusual. Some of the reasons for fish population changes may be related to natural variation, an artificial inflation of northern pike and smallmouth numbers following the removal of Mounds Flowage in 1997 and/or sediment deposition, and associated changes in macrophyte (aquatic plant) abundance following upstream dam removals.

2) Lake Mallalieu

Lake Mallalieu (Exhibit 6) is a 270 acre flowage near the mouth of the Willow River. The Willow River is the only inlet stream to Lake Mallalieu. The Lower Power Dam, located at the outlet of Lake Mallalieu, was originally constructed in 1848 and was later reconstructed in 1934 after the dam washed out. The dam is approximately 22 ft. in structural height and has a maximum storage of approximately 3000 acre-ft. A maximum water depth of approximately 17 ft. can be observed near the location of the Lower Power Dam. Much of the eastern half of the lake ranges between 1 to 5 feet, resulting in a mean depth of 5 feet. The watershed's primary land use is urban/residential, agriculture and woodlands.

a. Water Quality Challenges

Lake Mallalieu is considered to be a hypereutrophic lake with poor water quality due to high nutrient levels, high algal concentrations, and poor water clarity. There were a total of 24 species of aquatic plants found in Lake Mallalieu during a 1998 field survey. Included were three non-native species: Lythrym salicaria (purple loosestrife), Myriophyllum spicatum (Eurasian water milfoil), and Potamogeton crispus (curly-leaf pondweed). Lake Mallalieu is listed with EPA as an impaired waterbody due to eutrophication and high pH. This is manifested as algae blooms. A TMDL study in progress has determined that nonpoint source pollution from agricultural operations throughout the watershed is a significant contributor of phosphorus which causes the water quality impairment.

A TMDL for reducing phosphorus for the entire St. Croix Basin and all waters tributary to Lake St. Croix in Wisconsin and Minnesota has been adopted and is being

implemented. Completing the Willow River TMDL report and TMDL Implementation Plan are priorities for the entire Willow River watershed. The TMDL will set a goal for phosphorus loading reduction to improve water quality in Lake Mallalieu. Phosphorus reduction goals are expected to be set for both point and non-point sources. Preliminary projections call for a 40% reduction of phosphorus overall to lower the in-lake phosphorus concentration from 65.5 ug/L (2006 measured level) to 45 ug/L. This represents a drop from 24.3 tons per year entering Lake Mallalieu to 12.3 tons/year. This goal and percent reduction are subject to change before the plan is finalized.

b. Shoreline Habitat

Lake Mallalieu has an abundant source of large woody debris along certain parts of the flowage. Residential and shoreline development has eliminated large woody debris and natural vegetative buffers in numerous locations throughout the lake. Many shoreline lots have been converted to limestone rip-rap which has proven to benefit young smallmouth bass but may also fail to provide both juvenile and adult fish cover for most other fish species.

Preservation of large woody debris and natural shoreline buffers consisting of emergent and submergent plant beds, trees, shrubs, grasses, and forbs has shown to be critical for the survival of healthy fish and aquatic life resources. Improving the water quality will reduce the algae levels and allow more rooted aquatic vegetation to become established.

c. Fishery Resources

Despite the challenges listed, Lake Mallalieu currently provides an abundant and diverse sport-fish community. Both largemouth and smallmouth bass fishing is excellent with many trophy bass present. Northern pike densities are low however, the size distribution is well above average. Pan fish populations are good but growth rates and large adult densities are lower than expected for small fertile flowages.

D. Little Falls Dam

1) History of Dams in the Park

At one time, there were three dams in the park (Mounds, Willow Falls, and Little Falls dams), all of which were used for hydroelectric power generation. The power generation at these dams was discontinued by NSP in 1963. During the 1970's a renewed interest in domestic energy sources began to emerge, there were federal incentives available that caused nation-wide interest in new hydropower development and redevelopment of closed generation facilities. There were also several energy producers that approached the Department with plans for the dams on the Willow River. These energy producers eventually became less interested due to uncertainty with how the Department would proceed with the issues of dam repair or removal. Also, global energy trends resulted in a decline in value for domestically produced power making investment in hydropower less lucrative.

Prior to the state's acquisition of the property, NSP had made repairs to the three dams that made them structurally adequate well into the 1960's. By the 1970's and 1980's deficiencies had become evident in all three dams. To become compliant and restore structural integrity the dams needed to be repaired, reconstructed, or otherwise removed. Due to cost of repairs and uncertainty with long-term structural stability the Department removed the Mounds and Willow Falls dams and restored the Willow River to pre-dam conditions in that reach of the river. The Department determined it was feasible to repair the Little Falls dam into the 1980's and 1990's.

2) Little Falls Dam History

The existing dam was constructed in 1920 for hydroelectric power generation. It creates a 172 acre flowage named Little Falls Lake. The base flow for the Willow River at the Little Falls Dam is between 100 and 200 cubic feet per second. As it existed prior to the breach completed in October 2015, looking upstream (from right to left) the dam includes a 117 ft. concrete multiple arch buttress section, a 22 ft. wide by 12 ft. tall tainter gate, 43 ft. wide powerhouse, three 12 ft. wide by 9 ft. tall tainter gates, a gated 3 ft. diameter low water draw (sluice gate), and a 72 ft. concrete overflow spillway. The Gate 1 bay and piers, arch 4 and 5, and the right buttress were all removed during the breach in October 2015.

Figure 2: Downstream view of Little Falls Dam. Note that Gates 2 and 4 are inoperable and Gate 3 is in poor condition.

The original Little Falls dam, built circa 1892 on a timber crib structure, was used in the logging industry and later as a grist mill. In 1920, the Burkhardt Milling and Power Company replaced part of the timber crib structure with a concrete overflow spillway and three 12-foot tainter gates (Gates 2, 3 and 4) and at that time began using the dam for

power generation. A large flood in 1934 washed out the earthen embankment section of the Little Falls dam which was then replaced with the concrete multiple arch buttress section and a 22 ft. tainter gate (Gate 1) in 1935. In 1938, a concrete apron was installed to minimize the erosion below the spillway. Between 1930's-1960's several repairs were made to different parts of the dam structure in response to inspections. After purchasing the dam from Burkhardt in 1945, NSP operated the dam until it was eventually retired from power production in 1963. In 1967, the State of Wisconsin purchased the dam and developed Willow River State Park.

A major rehabilitation of the dam was undertaken in 1980. This repair was originally estimated at $500,000. The costs, however, nearly doubled to almost $1 million as more repairs became evident during repair work. The work included the following:

- Addition of an apron
- Sluice gate replacement
- Concrete rehabilitation near the tainter gates and powerhouse
- Refurbishing of tainter gates
- Installation of motor operators
- Rock bolts were drilled through the dam and into bedrock to anchor and provide greater stability

The dam was once again repaired in 1990 with work completed on the right abutment wall and other surface concrete. A drawing of the dam can be viewed in Exhibit 7.

3) Dam Operation and Thermal Regimes of Lower Willow River

The Lower Willow River downstream of Little Falls Lake had historically been an outstanding inland trout fishery. The cold water fishery in the river has steadily declined over the past 35 years partly due to limitations with dam operations and partly to the sedimentation of Little Falls Lake. Sedimentation of the river channel and upper portion of Little Falls Lake has been identified as a significant "heat sink" problem preventing cold water from reaching the deep water areas of Little Falls Lake. The previous dam removals upstream exacerbated the sedimentation problem in the upper reaches of the lake. A dredging operation was originally proposed after the two dam removals, however that dredging was never completed resulting in significant loss of lake water levels in the upper portions of Little Falls Lake.

File records indicate past dam construction failed to incorporate a year round functional bottom discharge. The dam's sluice gate was not designed as a bottom draw system to provide a cold water source to the river and continuous operation is currently prohibited for safety reasons. Past operations of the existing dam used a tainter gate to allow a mid-water column withdrawal of cooler water to help sustain the downstream cold water fishery. However, a mid-water draw from a tainter gate also pulls warmer surface water and does not produce the effective lower water temperature desired. The surface water discharge that currently exists is very damaging to the cold water temperature regime of the Lower Willow River resulting in a subpar trout fishery.

4) Little Falls Dam Deficiencies

a. Recent Inspection Reports

The Department has two recent inspection reports outlining concerns with the Little Falls dam. An October 17, 2011 inspection (Exhibit 8) conducted by the Department's Dam Safety Engineer noted cracking of the concrete at the pinions of the tainter gate piers, as well as cracking and weeping of moisture through the arches. There was also evidence of seepage through the sandstone abutting the dam. Included in the recommendations for the next inspection of the dam was to draw down the flowage for the purpose of conducting a more thorough inspection by exposing the tainter gate components, the face of the concrete dam, and the concrete making up the spillway. The drawdown would also provide for a dry inspection of the inoperable tainter gates.

In lieu of a drawdown at that time in August 2013, the Department hired a consultant to furnish specialized equipment and conduct a detailed inspection (Exhibit 9) of the areas of the dam not readily accessible by Department personnel. The extent of the inspection was limited because the flowage was not drawn down to expose the face of the dam and gate mechanisms. Therefore some of the inspection was conducted underwater by certified divers. Some of the findings and confirmations from these inspections are as follows:

- Several voids were found on the downstream portion of the dam.
- Gates 2 and 4 were inoperable at the time of inspection. Several areas of corrosion and wear on the support steel as well as damaged bracing and missing fasteners were identified and recommended for repair. The loss of operational gates significantly reduces the dam's ability to pass high flows and ease the hydrostatic pressure on the dam during flooding.
- The Little Falls dam does not have sufficient spillway capacity to pass the flows required by state regulations. Additional analysis is needed to determine alternatives to increase spillway capacity to safely pass the flows required for a large, high hazard dam under NR 333 Wisconsin Administrative Code.
- Back-up power is needed to run the gates during a power outage.

In the fall of 2014 upon review of the history and inspection findings by the state's engineers, the Department retained the inspection consultant to continue forward with the planning process and develop alternatives (Exhibit 10) to correct operational and structural deficiencies and bring the Little Falls dam into compliance with NR 333 Wis. Admin. Code. The criteria that were used to develop this study included ways to address spillway capacity and structural integrity, maintaining the current lake water elevation, providing for a cold water discharge to address water temperature concerns, and have minimal need for staff operation. This study produced eight different potential options centered around three basic alternatives—replace the dam, repair the dam, or remove the dam.

b. Little Falls Dam Hazard Rating

The Little Falls Dam was formally assigned a high hazard rating based on the Dam Failure Analysis (excerpts in Exhibit 11) that was approved in January 2014. NR 333.06, Wis. Admin. Code describes that "high hazard rating shall be assigned to those dams that have existing development in the hydraulic shadow that will be inundated to a depth greater than 2 feet or do not have land use controls in place to restrict future development in the hydraulic shadow."

A dam failure analysis is required for all large dams under NR 333 Wis. Admin. Code. It is used for the following purposes:

- Identify the inundation area or the extent of the dam failure floodplain (hydraulic shadow) for the dam if it were to fail.
- Determine the dam's hazard potential.
- Determine the design capacity requirements for the structure.
- Utilize the information to determine downstream land use controls that must be implemented to protect the public and to incorporate the information into the Emergency Action Plan.

c. Non-Compliance with NR 333 Wis. Admin. Code

The inspection reports from 2011 and 2013 highlighted significant structural deficiencies which were summarized in a February 5, 2015 letter to Willow River State Park (Exhibit 12). This letter, requiring an eventual drawdown of the flowage, would serve to clearly establish the fact that the dam is not in compliance with NR 333 Wis. Admin. Code for a high hazard dam. Deficiencies outlined in this letter were; flood flow capacity, gate inoperability, concerns with the concrete-sandstone interface on the right abutment and the timber crib structure beneath the concrete, water seepage and cracking in the concrete, and the sediment build up against the dam.

d. Drawdown of Little Falls Lake

Inability to pass the required flows for a large, high hazard dam, structural deficiencies and gate inoperability, the Department decided to commence a drawdown of the flowage impounded by Little Falls dam after Memorial Day 2015. An injunction was filed by the Lake Mallalieu Association that delayed the commencement of the drawdown to June 15th. The gates were opened to achieve the result of a 6-inch per day lowering of the water level. In July the flowage was drawn down to the bottom sill of the largest tainter gate but could not be lowered any further. Rain events caused the water level of the flowage to "bounce" up and down. This water level rebound caused sediment in the flowage to be re-suspended in the water, working against the strategy to manage sediment behind the dam.

Department staff determined that the best method to continue the drawdown while managing sediment would be to breach the dam by demolishing and removing of a section of dam. The size and location of the opening was calibrated to the hydraulic model in the dam failure analysis in order to limit the dam from filling during a flood.

Working with the expertise of several large construction companies capable of demolition at this scale under these dangerous conditions, Lands and Facilities Engineering proposed the most efficient plan to meet the breach criteria.

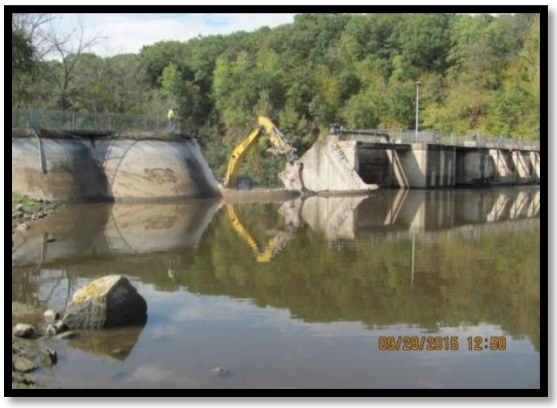

Photo 4: Initial breach placement.

The breach had to lower the impoundment as safely, quickly and cost-effectively as possible given the project delays to-date. Dam Safety Engineering staff provided the plan approval for the breach on September 8, 2015 (Exhibit 13). The breach began September 28th and was completed by October 6th, allowing the Willow River to flow unencumbered by the dam. Additional photos of the drawdown process can be found in Exhibit 14.

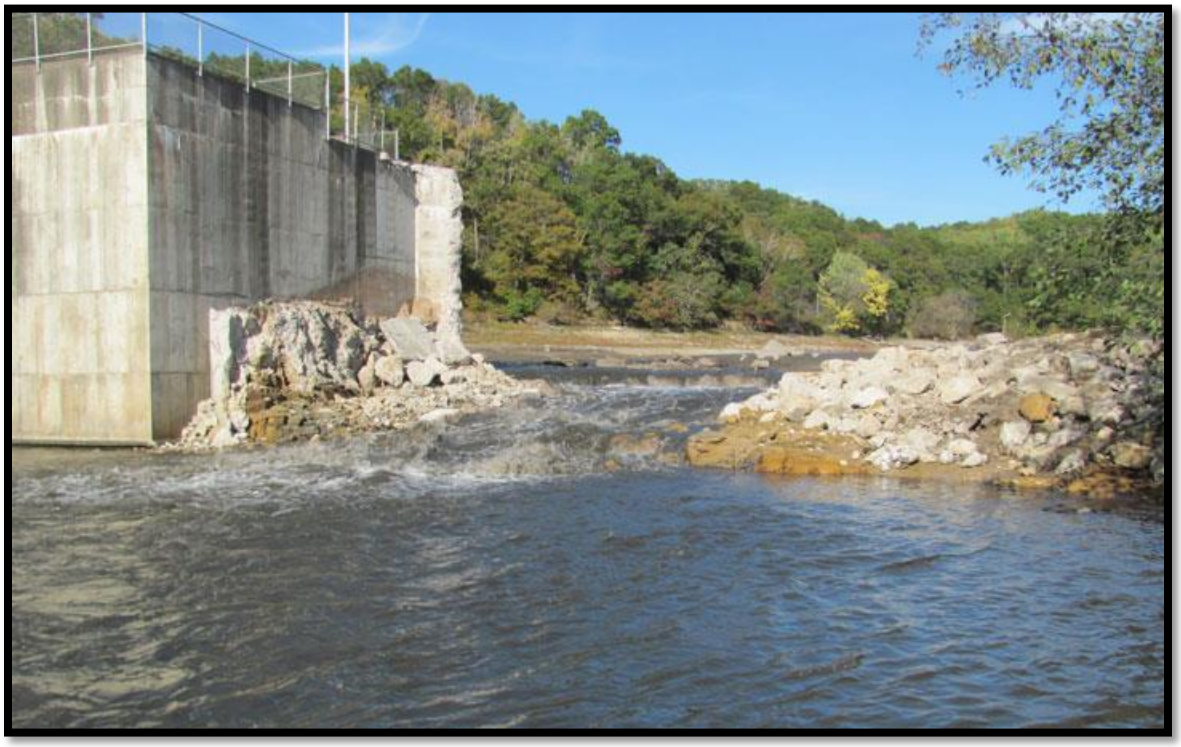

Photo 5: Breach completed October 6, 2015.

5) Effects of the Drawdown

a. Wildlife

The initial drawdown exposed open mudflat habitat that was used temporarily by migratory shorebirds. As the drawdown progressed, the reduced amount of surface water

concentrated aquatic invertebrates and fish creating excellent foraging opportunities for wading birds including; waterfowl, kingfisher, grebes, and herons. Once the lake bed dries out, these mudflats will quickly vegetate by various types of plants.

Photo 6: Looking west toward dam

The temporary loss of surface water will have an impact on the number of waterfowl using the area especially during fall migration. Geese and ducks will still use the remaining stream corridor however; much of the waterfowl activity will likely go elsewhere.

No long term impacts to reptiles or amphibians during the drawn down conditions are expected. The initial exposed mudflat will provide additional habitat for reptiles and amphibians until the ground begins to dry out.

Once the ground is dried out, and for the remainder of the drawdown, reptiles and amphibians will likely go to other habitats nearby including the stream channel and other ponds/wetlands until the flowage is filled. Wetlands near the lake will dry out and no longer have the hydrology to support hydric plant species. The long term drawdown may temporarily reduce the amount of habitat available for common species found in the area including; common snapping turtles, spiny soft shelled turtles, painted turtles, mudpuppy, green frogs, leopard frogs, American toads, and bull frogs.

Photo 7: Looking east of Little Falls Dam. Note the contrast between areas exposed after initial drawdown compared to areas more recently exposed after breach.

The majority of mammals in the park will not be affected by the drawdown. Over the time that the lake is drawn down the habitat changes from mudflat to early successional plant growth will affect aquatic furbearers; mink, river otter, beaver, and muskrat. As habitat develops other early successional species will benefit. These common species include; voles, mice, rabbits, deer, turkeys, fox, and other early successional species.

Many aquatic invasive species can be eliminated by drawdowns, but many wetland invasive species such as purple loosestrife, reed canary grass, and phragmites can quickly colonize the exposed mudflats during and after a drawdown. Even if these invasive species are not known to be present they often show up and quickly gain dominance after a drawdown. If allowed to establish, invasive plants can create monotypic stands that reduce biodiversity, alter nutrient cycling and modify food webs.

There are no known rare mussels in the section of the Willow River between Little Falls Flowage and Lake Mallalieu, however there were mussels in Little Falls Flowage. While the drawdown was occurring there was an effort to assess and salvage mussels. They were relocated to other locations where there was sufficient water for their survival.

The Natural Heritage Inventory identified the presence of a state-threatened turtle and two communities (Spring Pond, Springs and Spring Runs) within the immediate area of Little Falls Lake. There are 13 state-listed freshwater mussel species that are known to occur downstream of Lake Mallalieu. There are no known state-listed mussel species that occur in the section of the Willow River between Little Falls Flowage and Lake Mallalieu. Given the timing of the drawdown, no incidental take of reptiles or amphibians will occur. The water was gone prior to movement to winter hibernation areas.

b. Fisheries

The Lower Willow River and Lake Mallalieu are found a short distance downstream of the Little Falls Lake. Prior to 1980, the Lower Willow River was an outstanding Class II trout stream with heavy fishing pressure (*A Successful Application of Catch and Release Regulations on a Wisconsin Trout Stream by Robert L. Hunt., Tech. Bulletin No. 119 WDNR, 1981*). This section of stream has since degraded from sedimentation of the flowage and changes in dam operation from a mid-water draw to a surface water discharge because of dam safety issues. A drawdown of Little Falls Flowage will temporarily eliminate thermal issues and trout populations may experience a temporary improvement. Long term improvement in the trout fishery will depend on the project alternative chosen.

The drawdown of Little Falls Lake has most likely passed the entire fish community of Little Falls Lake downstream to the Lower Willow River and Lake Mallalieu and perhaps partly to the St. Croix River. This increase in fish populations would be temporary in these receiving waters. Lake oriented species most likely will continue and settle in downstream lake environments. Fish populations in the short term would surge in downstream receiving waters which over time would return to normal both in Lake Mallalieu and the Lower Willow River.

c. Sediment Transport

Little Falls Lake has accumulated sediment from the two other dam removals upstream. Considering that sediment transport has been a concern throughout, the Department developed a drawdown strategy and sediment management report (Exhibit 15). Downstream sediment transport has and will continue to happen, however the amount and type of sediment that will be transported for the duration of the drawdown remains undetermined. Currently, only fine sediment has transported downstream while coarse sediment appears to be collecting just below the existing dam structure with little to no long distance transport.

The Willow River has cut a channel through the flowage and is carrying some sediment with it. Whether a significant amount of sediment enters the Lower Willow River and Lake Mallalieu will depend on how active the river channel cuts through the flowage after the drawdown. To date, the channel appears to be fairly stable and head-cutting of the channel is slowing. In an effort to manage sediment, the Department implemented aerial seeding of winter wheat on the exposed lake bed. In addition, the department hired a contractor to periodically remove coarse bed load sediment from a sediment trap which is located immediately below the dam.

In mid-October 2015 after the dam breach was completed, Department water sampling specialists collected sediment cores at fourteen sites in the delta and far eastern portion of Lake Mallalieu. The depth of newly deposited fine sediment was measured using a marked transparency tube. The sites in the delta received up to 24 inches of new fine sediment represented below as the darkest-shaded circles on the aerial photo (Figure 3) of Lake Mallalieu.

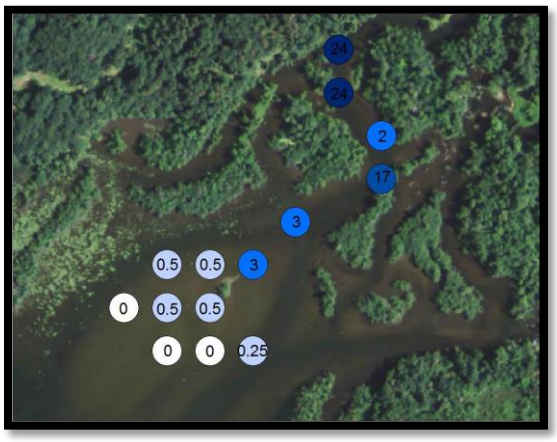

Figure 3: Location of sediment samples and approximate depth change (inches). Sediment depth and location will change as water flows continue to transport this soft sediment.

The samples collected further into the lake basin appeared to have significantly less new deposition of fine silt. New sediment depth measured about three inches just past the delta area and then eventually to undetectable levels about 400 feet into the flowage.

New fine sediment is very mobile. It is expected that this sediment will either move through the flowage into the St. Croix River over the course of a few storm events or settle out on the lake bed. It is difficult to predict the actual depth and location of this sediment as it settles out in the flowage.

Sediment transport from the Little Falls Lake bed will be episodic directly related to high flow events in the Willow River, such as from spring melt or heavy rains. Sediment particles will be mobilized when water velocities exceed settling velocities of any given sediment particle size. In other words, small particles require lower water velocities to move, whereas larger particles require higher water velocities. Coarser sediment will transport typically within the main channel area with deposition most likely across the delta face in Lake Mallalieu. Fine sediment deposition will likely be more variable as flow characteristics change in backwater areas above and within Lake Mallalieu. The flow characteristics within Lake Mallalieu will determine where fine sediment will be deposited within the reservoir. This phenomenon may result in localized areas within Lake Mallalieu where noticeable amounts of fine sediment will be deposited.

As the Willow River flows unencumbered by the Little Falls dam, sediment occurring in the river will continue to move. Some larger sediment often called "bed load" sediment will be caught in the sediment trap just below the Little Falls dam. Park staff will continue to monitor the sediment trap and have sediment removed as necessary throughout the duration of the temporary drawdown to maintain the trap's effectiveness. Much of the finer suspended sediment will continue to travel through the system. Over the 2016 sampling season, Department specialists will continue to track additional deposition, consolidation and movement of fines.

d. Social/Economic Considerations

Visitation for the summer use season of 2015 did not drop off. There was a fair amount of interest in the drawdown of the flowage that kept visitation at normal levels for the 2015 summer season. The waterfalls continued to be a big attraction at the property and will remain unchanged in the future regardless of the status of the dam structure. However, with no ice fishing available, a decrease in park visitation over the winter season is expected. Cross-country ski and snowshoe trails will still be open and generate park attendance as it would any other year. As the drawn-down status continues into next summer use and subsequent seasons, visitation is expected to decrease with the reduced water-based recreation at the property. Income generated at the park would decrease a certain amount as visitation decreases. Correspondingly, total generated expenditures to the local economy could decrease if fewer people are drawn to the area due to the lake being drained.

With no open water at the park, it is likely that other nearby lakes and local parks could see an increase in use by the public. For example, ice fishermen that would have normally used Little Falls Lake as their destination would likely use Bass Lake or other nearby water bodies on which to fish. The local economies of those communities may benefit from increased use of their public recreation and natural resources.

IV. Alternative 1: Remove and Replace the Dam

A. Scope of Work

The primary components of this alternative include; demolition of the existing structure, construction of a new dam, park road replacement, and habitat improvements on and around Little Falls Lake. This alternative would result in a full impoundment (lake water body restoration) with new main road infrastructure and improved lake and shoreline habitat.

There are many possible options for a new dam in approximately the same location on the Willow River. The most appropriate structure will be determined through the design process. There are several aspects of a new dam that will be considered, including the following:

1. Safely pass the 100 and 1000 year flood flows.
2. Account for the safety of park visitors, lake users near and on the dam, and downstream property owners.
3. Public accessibility.
4. Cold-water bottom draw to best address water temperature impacts on the trout fishery downstream of the structure.
5. Minimize maintenance costs and time for park staff to operate the dam.
6. Minimize the construction footprint and impacts on the rest of the park and its enjoyment by visitors.
7. Construction cost effectiveness.

The park road was not built to handle heavy construction vehicles. Therefore the road is expected to be significantly damaged as a result of the construction. Addressing the road will include fixing any subgrade deficiencies and drainage problems, pulverizing and repaving of approximately two miles of roadway.

Habitat improvements to Little Falls Lake can be completed through a combination of mechanical dredging, tree drops, shoreline manipulation, and other activities. Habitat improvements on Little Falls Lake could range in costs between $1 – 4 million depending upon the extent of the work.

B. Budget

There is a relatively wide range of costs for a new dam. Those costs will become more representative once a preliminary design is completed and the full extent of the necessary structure is determined. The cost of a new dam alone (including all fees and contingency) could range from $6.0 million to over $12.0 million.

C. Outcomes

A newly constructed dam would address the flood flow capacity issues and structural stability issues identified through observation, inspection, and analysis by park staff and

engineers in previous years. Initial construction costs would be high when compared to other alternatives. However, this alternative is the long term solution that will be in place for decades to come to meet the expectations of the various user groups and the property master plan. There will be some cost to maintain and operate the dam along with the potential for certification of park staff in order to operate the dam.

It is expected that visitor use of Little Falls Lake and the park developments surrounding it will be similar to previous seasons prior to when the impoundment was drawn down, and may increase depending on the scope of habitat improvement to the impoundment. With the addition of a new restroom facility and picnic shelter (completed in fall 2015) combined with possible improvements to the impoundment basin and beach area on a refilled impoundment, it is expected that visitation to the property will increase. Based on other major development projects in the Wisconsin State Park System, increases in visitation 1%-5% per year can be seen after the completion of major recreation development.

As mentioned earlier, a dam replacement presents an opportunity to enhance in-lake and downstream habitat while the flowage is in a drawn-down state. Deep water habitat is extremely limited in Little Falls Lake by poor water clarity and the lack of aquatic plants. Aquatic plants provide preferred habitat for sport fish food sources. Near shore habitat is considered excellent in Little Falls Lake and additional enhancements through tree drops and boulder clusters would improve the existing habitat. With sufficient funding, the Department will be able to contour the lake bed and beach area, therefore enhancing in-lake habitat by adding a variety of fish habitat in the lake. Contouring the lake bed to reestablish the deep water channel that existed years ago—as well as adding the cold water draw on the new dam—would help to address water temperatures downstream.

Once the dam is replaced and the impoundment is refilled, Little Falls Lake may be restocked with sport fish to assist in reestablishing water-based recreation. The new dam and enhancements to the lake basin may provide improved fishing opportunities. The Department will develop stocking quotas to best restore the fishery. After three years of restocking the Department will reevaluate the fishery and if necessary revise the stocking plan. This process is a rehabilitation of the fishery and is considered a high priority by the Department. A stocking plan would include field transfer of mixed aged fish from other nearby waterbodies, stocking of large fingerlings over three consecutive years, and natural re-colonization from upstream segments of the Willow River. Species included in this stocking plan include largemouth bass, smallmouth bass, northern pike, bluegill, black crappie, and yellow perch.

V. Alternative 2: Permanently Remove the Dam—Stream Restoration

A. Scope of Work

This alternative includes: demolition of the existing dam, site restoration of the demolition area, restoration of the stream channel throughout the existing impoundment area, park road replacement, and minor habitat improvements on and around the existing impoundment. This alternative would result in a restored flowage (river channel and immediate overbank vicinity only, no lake), vegetated impoundment, new main park road infrastructure, and minor basin and shoreline habitat improvements.

A restoration plan would be developed to include stream bank creation, any additional recreation infrastructure, and wildlife habitat development that would benefit the park user experience.

The park road was not built to handle heavy construction vehicles; therefore the road is expected to be significantly damaged as a result of the construction. Addressing the road will include fixing any subgrade deficiencies and drainage problems, pulverizing, and repaving of approximately two miles of roadway.

B. Budget

Removing the dam is estimated to cost $600,000. This cost only accounts for the immediate direct costs of the structural removal of the dam. Additional costs would be incurred for sediment control, stream bank restoration, grade controls, and any additional recreational development. Costs vary for restoration, recreation development, and habitat improvement; but could range from $1.0 - $4.0 million (including all fees and contingency) in addition to the dam removal costs.

C. Outcomes

This alternative will cause an ecological shift from a lake community to a stream community and all the associated terrestrial and aquatic life. Wetlands that are near Little Falls Lake will dry out due to lack of water impounded within the former lake basin. Avian insectivores would eventually change from species known for lake habitats to those known for stream habitats. A potential decrease may occur in the amount of available habitat for reptiles and amphibians. There will be a likely increase in deer habitat. Common species would shift over time from those needing ponds, lakes, and slow moving water to those that prefer riverine and riparian habitat.

Depending upon the resulting water temperatures of a restored stream, the Willow River will most likely return to a Class II trout fishery. There may be springs that emerge that have been submerged by the lake that may contribute to cooler water temperatures. Some natural trout reproduction may occur. However, in the event that temperatures remain

higher than what can support a trout fishery, a healthy small mouth bass fishery most likely would develop.

There would also be an immediate increase in sediment movement downstream into Lake Mallalieu. Currently, Little Falls Lake acts as a primary sediment trap for Lake Mallalieu, capturing much of the bed load sediment in the Willow River. Lastly, there is some uncertainty with the long-term stability of the restored river way. Addressing erosion and stream movement could become a long-term maintenance item for park staff.

It is expected that the open basin exposed by dam removal will vegetate with a variety of pioneer species of plants, including buckthorn, cottonwood tree seedlings and any number of plants found throughout the watershed. Left alone, this could limit the amount of quality habitat for wildlife. A restoration plan would be developed that could include strategies to create suitable habitat for wildlife or an appropriate recreational use.

This alternative will significantly change many recreational uses at the park. Little Falls Lake is used for a wide range of water based recreation including ice and open-water fishing, canoeing, kayaking, and swimming in the beach area. Removing the lake would alter those uses to more of a riverine park experience. Fishing opportunity would be converted to a trout and/or small mouth bass pursuit. The swimming beach area could be reestablished along the river but probably not near the newly constructed restroom-picnic shelter. Total canoe and kayak use may decline due to it being focused only in the river channel. It is believed that these changes would affect overall park visitation numbers. However, it is possible that recreation activity on the Willow River would begin to resemble that of the nearby Apple River with canoe/kayak/tubing use. It is possible that the Friends group could modify their income model or that guide services may develop to accommodate this different recreation use. There would be no notable changes to hunting opportunity or the use of trails for hiking or skiing. The waterfall area will continue to remain an attraction.

Removing the third and final dam within the park would provide visitors with a riverine experience with the potential for additional scenic waterfalls and/or rapids, potential for additional trout fishing opportunities, and other river-based recreation. There would be added acreage within the park to potentially develop additional recreation areas or restore wildlife habitat. A revised flood study and mapping would be required to determine new floodplain limits if there is to be consideration for development beyond open space use. Little if any of the former lake bed could be utilized for additional campground area.

Without a dam on the Willow River, there would be no long-term dam maintenance or inspections required; no cost to certify park staff for dam operation and a reduced need to manage sediment that inevitably settles out in flowages.

VI. Other Alternatives Considered

A. Alternative 3: Dam Repair

This alternative was considered early on since some amount of work was required to address the structural integrity of the dam and to comply with NR 333 flood flow requirements. As different options were brought forward, they were based assuming that the underlying, century-old dam foundation was still structurally sound and the repairs could be made without jeopardizing the stability of the dam. As more information became available none of the state or consulting engineers would warranty new construction on top of older unknown conditions. This would have left a wide margin for potential contingency and carried a high risk of project failure. In addition, a repair would, at best, allow only a 10-15 year added life to the existing dam structure. Lastly, the estimated costs of repairs are similar to those of a complete structure replacement. With that information, it was determined that the Dam Repair alternative would not solve the underlying safety and flood flow issues and would not be cost effective.

Note: The Dam Repair alternative was removed as viable option prior to the decision to breach the existing dam structure. In light of that status, it opened up several alternatives, means and methods for the breach procedure that would have otherwise been quite limited and prescriptive. This in turn facilitated an accelerated breach demolition time with five to ten fold reduction in breach cost. The implementation of the breach made it further evident that dam repair would not have been a viable alternative for this project.

B. Alternative 4: Do Nothing

In January 2014, a Dam Failure Analysis was approved by the Department for the Little Falls Dam. The analysis confirmed the dam is to be formally assigned a high hazard rating and does not have the spillway capacity to pass the required flow rates per NR 333, Wisconsin Administrative Code. According to NR 333.07, a large, high hazard dam is required to pass the 100-year storm event through the principal spillway and have a total spillway capacity to pass the 1000-year event. As currently configured, the Little Falls Dam cannot pass the 100 or 1000-year storm events through the spillways.

Furthermore, inspections were completed in 2011 and 2013, which listed issues with inoperable tainter gates, potential foundational movement, seepage and other structural concerns.

In this state of deterioration and design deficiency, the dam was egregiously out of compliance with state code as well as posing a hazard to life and property.

As a result, “do nothing” is no longer a viable option. The existing dam structure must be reconstructed to pass the required flows or must be removed with proper site restoration, as it is a risk for downstream population and development.

VII. Public Participation and Stakeholder Input

Throughout 2015, the Project Team implemented differing techniques to effectively engage public input. The methods incorporated included; verbal and written comments, web site inquiries, public meetings, meetings with elected officials, Township and City Governments, and a nearby Lake Association. The following are some specific examples of methods utilized to gain public feedback on the project.

A. Public Informational Meetings

The Project Team hosted three public informational meetings in 2015. Each of these meetings where held at the Hudson Town Hall near Willow River State Park. The meetings were publicized through the park website and through news releases delivered to local media outlets. At those meetings, the Project Team presented the issues of concern, status updates, and potential ways to address the problems. The Team also collected comments from those in attendance. Exhibit 16 includes meeting summaries and question/answers from the following public meetings.

1) February 24th Meeting

Information presented included concerns over the Little Falls Dam and discussion of possible future actions. Discussion included issues related to information about the dam's deficiencies, necessary repairs, and the potential for a drawdown of Little Falls Flowage. Department engineers and biologists discussed how a draw-down might proceed and what might be the effect. There were 44 attendees from the public. Comments and questions were taken from the public.

2) May 6th Meeting

After it was announced the drawdown would begin in the spring of 2015, the Project Team met with the public to present information regarding planned drawdown of Little Falls Lake to address public safety. Specific detail about phasing the drawdown and other options available to manage sediment to minimize delivery downstream was discussed. Information was presented about the condition of recreational opportunities for the public expected over the summer during the drawdown. Presenters introduced the decision-making process, project funding constraints, and the state capital development process through the State Building Commission and the Department of Administration. There were 57 attendees from the public, of which many in the audience voiced concern about transport of sediment into Lake Mallalieu. Others expressed concern over the uncertainty with the funding, while a few questioned the reasoning to remove the pool behind the dam. The general interest from the public was to see the dam replaced to keep Little Falls Lake a fixture in the park.

3) October 20th Meeting

After the breech to open up the dam and drain the lake had been completed, the Project Team discussed the drawdown status, strategies considered to manage the sediment transport, decisions needed to move forward with a project, and a potential project schedule. Presenters relayed the message that the lake bed was remarkably stable when compared to other drawdowns and there was no immediate need to install measures to better manage sediment. There were 38 attendees from the public, most commenting in support of replacing the dam while a few offered a preference to removing the dam and restoring the stream channel. The attendee's questions were discussed at the meeting.

B. Comments Received by Park Manager

Over the course of the past six months, the public (mainly park visitors and neighbors) offered thousands of comments about the situation with the dam. Willow River State Park Superintendent, Aaron Mason, received this input through direct conversation with the public and from park staff who received public comments. The large majority of comments reflected strong support of the dam being replaced and the lake being restored. Many visitors using the park were unaware of the drawdown and were shocked to see the lake gone. Refunds have been issued weekly to those that have paid to use the park and upon seeing the lake was drawn down, decided to go elsewhere. Many expressed disappointment to lose that recreational opportunity and felt that the lake was an important part of the park's aesthetic value. Some comments received also indicated concern for the river. While still in support of the dam, they want to see the lower Willow protected and preferred a structure that improves the cool water trout regime through a bottom draw. A few visitors have commented that they would prefer to see the river restored to its natural state.

C. Park Website and GovDelivery Listserve

The Willow River State Park webpage can be found at this link:
http://dnr.wi.gov/topic/parks/name/willowriver/

This webpage contains information about the park and specific details surrounding the issues with the dam. As information became available and pertinent over the past year, it was posted on the site. The Little Falls Dam page includes links to frequently asked questions, inspection reports, the feasibility study, news releases, public meeting information, and photos. As new information was added or if there was new information to share with the public, a notification was sent out through the GovDelivery Listserve for Willow River State Park. The latest figure of subscribers to the Listserve includes over 5000 email addresses.

D. Department Staff Contacts with the Public

Over the past year, many interested citizens, park users, and community leaders have interacted with Department leaders and staff, as well as park staff concerning the Little Falls dam. These interested parties provided email or phone contact information for the purpose of being kept up-to-date with the dam project. As questions were asked and as updates became available, communication was handled through emails or telephone conversations. Generally, all of the comments and questions that were received by Department personnel reflected a preference to replace the dam and preserve Little Falls Lake.

E. Summary of Public Comments Received to Alternatives Analysis

The public comment period for this alternatives analysis was from December 15, 2015 to January 15, 2016. There were a total of 50 individual respondents with a variety of comments and suggestions. Some included their spouse and other family members. All respondents reflected their preference of alternatives and many provided background as to the "why" of their position.

Respondents identified themselves as one or more of the following in relation to this issue (in no particular order): park user, park volunteer, Friends Group member, local government official, Lake Mallalieu resident, Trout Unlimited member, fisherman, life-long resident, local business owner, neighbor, and interested party.

There were 35 respondents who favored Alternative 1: Remove and Replace the Dam. The general theme from this group included a desire to have the project completed more quickly than the project schedule reflects. There was also a strong correlation with recreation at the park largely involving Little Falls Lake. Self-identified park users saw loss of Little Falls Lake as detrimental to their ability to enjoy Willow River State Park. Sediment transport and Lake Mallalieu water quality continues to be a concern identified by Lake Mallalieu residents. In connection with these comments was a desire to control sediment by replacing the dam. There was also a sense by some that surrounding property values would be negatively affected if there was no impoundment.

There were 15 respondents who favored Alternative 2: Permanently Remove the Dam—Stream Restoration. The two general themes that came across from this group were the relatively high cost of dam replacement, and/or the benefit to restore the stream back to the way it was before the dam. Most of these identified restoring the trout fishery as their desire. The Kiap-TU-Wish Chapter of Trout Unlimited submitted support of Alternative 2 on behalf of its membership. There were several who suggested that other conservation or land purchase activities would be a better use of the allotted dollars instead of dam replacement.

A common theme between supporters of either alternative was that of preserving cold water regimes for the trout fishery downstream of the dam. This was captured in statements describing sediment removal from eastern portions of Little Falls Lake,

preference of a cold-water draw on the structure or by not having impounded water altogether.

In response to substantive comments received, the following changes/edits were made to this alternatives analysis document:

1. Clarified in I. Executive Summary the funding timeline in relation to obligating allocated funding for the project so dollars are not lost.
2. Edited text in chapters I, IV, V and VIII to be more consistent with terminology in the rest of the document.
3. Clarified park uses in III. Background, A. Willow River State Park, 1) Recreation Developments.
4. Updated Willow River State Park visitation numbers in III. Background, A. Willow River State Park, 3) Visitation and Revenue.
5. Added presence of ground water use in Willow River watershed in III. Background, B Willow River Watershed.
6. Clarified flowage characteristics in III. Background, C. Little Falls Lake and Lake Mallalieu, 1) Little Falls Lake, and 2) Lake Mallalieu.
7. Added seeding activities and bed load removal to III. Background, D. Little Falls Dam, 5) Effects of the Drawdown, c. Sediment Transport.
8. Corrected the characteristics of sediment deposition of Lake Mallalieu in III. Background, D. Little Falls Dam, 5) Effects of Drawdown, c. Sediment Transport.
9. Clarified the consideration of power generation in VIII. Project Recommendations.

VIII. Project Recommendations

The Project Team has made a final recommendation to the Department to move forward with Alternative 1: Remove and Replace the Dam. This alternative best meets the guiding principles the team established while evaluating all four of the main alternatives.

A newly designed and constructed dam will provide the best solution possible to address the insufficient flood flow capacity, provide for a "cold water" discharge to support a trout fishery, and permanently correct the structural stability and short-comings of the existing dam resulting in compliance with NR 333 Wisconsin Administrative Code.

Replacing the existing dam structure will preserve the main recreational functions of the park as they are currently known by the public today; this includes boating, fishing, swimming, wildlife viewing, and bird watching.

Power generation is not recommended for consideration as a criterion at this time. When a dam is fitted to generate hydropower, the process involves licensing through the Federal Energy Regulatory Commission. The licensing process can be long, expensive, and requires the dam and it's components to be designed according to Federal standards. In the past the Little Falls dam did generate hydro power, however before selling the property to the State of Wisconsin, Northern States Power determined the economic return was not sufficient enough to continue generation. In addition, operating the flowage for power could be detrimental to recreational uses. Lastly, a dam that generates electricity may require more maintenance and staff, which would likely increase the cost of operation.

The public support for a new dam and the reinstatement of a full impoundment is supported by park users, neighbors, local residents, and elected officials, as was reflected in public comments.

The total budget for any of the alternatives cannot be accurately determined until design and specifications are determined. There is currently just over $8.0 million allotted to address the existing dam structure. While this budget may not be enough to complete the chosen alternative, at this time it is reasonable and achievable.

The Project Team has developed an anticipated project schedule (Exhibit 17). This schedule anticipates that the project could be completed and Little Falls Lake refilled by spring of 2020.

IX. Exhibits