White River Hydroelectric Project
FERC No. 2444

Exhibit A
Description of Project

Final License Application

Prepared for

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a Wisconsin Corporation

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LIST OF ABBREVIATIONS

A	Amperes
AC	Alternating Current
cfs	cubic feet per second
FERC	Federal Energy Regulatory Commission
FLA	Final License Application
kV	Kilovolt
kW	Kilowatt
NGVD	National Geodetic Vertical Datum
NSPW	Northern States Power Company, a Wisconsin corporation
O&M	Operation and management
Project	White River Hydroelectric Project
PURPA	Public Utility Regulatory Policies Act
USGS	United States Geological Survey
WDNR	Wisconsin Department of Natural Resources

1. Project Description

The White River Hydroelectric Project (Project) is located on the White River, approximately 5 miles south of the City of Ashland, in Ashland County and Bayfield counties, Wisconsin. **Appendix A-1** of this application includes a map showing the general location of the Project. **Appendix A-2** presents an aerial photograph showing the Project facilities.

The Project works consist of (1) a 46-foot high and 775-foot long earthen and concrete dam that includes a left earthen embankment, an intake structure, a gated spillway section and a right earthen embankment; (2) a reservoir with a maximum surface area of 39.9 acres and a maximum gross storage capacity of approximately 297 acre-feet[1] at an elevation of 711.6 feet National Geodetic Vertical Datum 1929 (NGVD)[2]; (3) a 1,346-foot long conveyance system from the intake to the powerhouse consisting of a 7-foot diameter conduit, a 16-foot diameter surge tank, and two 5.5-foot diameter penstocks; (4) a concrete powerhouse that houses two generating units with a total authorized installed capacity of 1,200 kilowatts (kW); (5) a 2.4 kilovolt (kV), 220-foot long underground transmission line from the powerhouse to the non-project substation containing the 1,000 kVA, 69/2.4 kV 3-phase step-up transformer; and (6) appurtenant facilities.

A description of each part of the facility is provided in the following paragraphs.[3] The Project boundary is provided in Exhibit G in Volume 2 of this application.

2. Description of Dam Structures

The dam is 775 feet long[4] and 46 feet high. From left to right looking downstream, the main structures of the dam consist of a left earth embankment dam section, an intake structure, a gated spillway section, and a right earth embankment dam section. The downstream portion of the abutment walls on either ends of the intake structure and gated spillway section are curved to the right approximately 40 feet.[5] The abutments are parallel to the river flows at their downstream ends. The State Highway 112 (non-project structure) runs along the top of the dam structures.

2.1 Intake Structure

The intake structure consists of a mass concrete structure between the left abutment and bridge pier. The length and width of the left (north) abutment is 65 feet and 3.25 feet respectively. The intake structure is composed of the stop log section and the transition section. The overall intake structure is 22 feet wide[6], 123 feet long[7] at its base, and 37 feet high.[8] The elevation of the top of the intake structure is 718.82 feet.[9] The stop log section base extends upstream of the highway bridge. It is 52 feet long, 22 feet wide, and has a maximum height of 37 feet. The trash rack and stop log slots are located on the upstream end

[1] Calculated by interpretation of the updated bathymetric map included as Figure 10 of the Aquatic and Terrestrial Invasive Species Study Report.
[2] NGVD is assumed to be the same datum as mean sea level.
[3] Unless otherwise cited, all facility description attributes are from the Supporting Technical Information Document filed with the FERC in December 2008 (NSPW, 2008).
[4] Spillway and intake length 75 feet, left earthen embankment 400 feet, and right earthen embankment 300 feet.
[5] Measured from Exhibit F-1.
[6] Measured from Exhibit F-1.
[7] Measured from Exhibit F-2 cross section.
[8] Height measured from Exhibit F-2 cross section.
[9] Unless noted otherwise, all elevations provided are given in National Geodetic Vertical Datum, NGVD. Top elevation noted in previous Exhibit F-2.

of the stop log section within the intake structure. The vertical stop log slots are located on the downstream edge of the pier radius and are approximately 20 feet high and accommodate 12-inch wide stop logs. The trash rack has a vertical length of 23.5 feet[10] by 16 feet wide with 1.25 inch clear spacing.[11] The transition section is 42 feet long, 22 feet wide, and has a maximum height of 37 feet.[12] The intake structure directs flow into the 7-foot diameter concrete conduit that extends 1,346 feet downstream to the powerhouse. There is no gate to control flow.

The trash rack is raked manually, and the material cleaned from the trash rack (except for large woody debris) is collected, garbage removed, and flushed downstream. When a sizable amount of large woody debris has been stockpiled on the shoreline near the intake deck, it is loaded into a truck and disposed of in the landfill. Raking occurs at least weekly during the spring season, after storms during the summer season, and at least weekly during the fall season. Raking is not normally required during the winter season.

At the upstream side of the transition section, a 4.5-foot long, 12-inch diameter steel pipe penetrates the concrete wall of the intake and extends downstream penetrating the left abutment wall in order to pass the required minimum flow of 16 cfs. The invert of the intake for the pipe is at an elevation of approximately 684.8 feet NGVD and the flow can be controlled with a flapper valve. During each visit to the facility, the minimum flow release is confirmed by the operator by visual observation.

2.2 Gated Spillway

The gated spillway section is 55-feet-long, approximately 60-feet wide at the base, and 35-feet-high. It is a mass concrete structure with a downstream concrete apron and a right (south) concrete abutment that has a length and width of 59 feet and 5.25 feet respectively. The spillway is comprised of 2 gate bays each 25-feet wide separated by a concrete pier that has a length and width of 54'-5 3/8" feet and 4 feet respectively. The elevation of the gate sill is 685.17 feet. Concrete piers are located on both ends of each of the gated spillways and support the steel radial-type gate, the steel walkway, and gate opening equipment. The radial-type gates are 25-feet-wide and have a top of gate elevation of 711.7 feet. The left gate is comprised of two sections stacked on top of each other. The top section is 6-feet-tall and can be operated independently from the lower section. The bottom section is 19-feet tall. The gates are lifted by hydraulic cylinders connected to the hoist chains. The power unit for the hydraulic cylinders is located above the intake structure.

When the maximum hydraulic capacity of the powerhouse is exceeded, the reservoir will continue to increase until it reaches an elevation of 711.10 feet NGVD at which the top portion of Gate 1 (north gate) begins to open. Note that Gate 1 is a split or hinged gate where the upper portion can operate independently of the lower portion. The top portion of the north gate continues to adjust as needed to approximate inflows and maintain a relatively constant reservoir elevation. If the top portion of the Gate 1

[10] Height measured along the incline.
[11] The top of the trash racks is angled downstream 22 degrees from vertical, with a bar thickness of 0.375 inches. The top five feet of the rack is supported by the dam structure on the top, in the middle by one 0.25 foot-high I-beam support, and at the base by a 0.25 foot-high notch in the foundation. There are no other vertical frame supports on the sides of the trash racks. The spacing of the bars is held in place by seven horizontal, 0.375-inch high rows of spacers between the bars. However, only six of the horizontal rows of spacers restrict flow beyond the restrictions provided by the other supports. The effective vertical length of the trash rack is 23.5 feet minus 5.0 feet for the top support, 0.25 feet for the I-beam support, 2.25 inches for the six rows of spacers and 0.25 feet for the bottom support or 17.8125 feet. The effective width is 16.0 feet minus 117 bars, 0.375 inches wide or 12.34 feet. This results in an effective opening of approximately 220 square feet.
[12] These length measurements do not include the toe wall because it extends downstream of the beginning of the concrete conduit.

is fully open and the reservoir elevation continues to increase, Gate 2 (south gate) begins to open and continues to automatically adjust as needed to maintain a relatively constant reservoir elevation. If the reservoir elevation continues to increase with Gate 2 fully opened, the lower portion of Gate 1 is opened to match inflows and maintain a relatively constant reservoir elevation.

As inflows to the Project subside, the gates are closed in the reserve order from which they were opened, with the bottom of the north gate closing first and the top of the north gate closing last.

2.3 Earth Embankment

2.3.1 Left Embankment

The left earthen dam is 400 feet long, 86 feet wide[13] at its base, and has a maximum height of 37-feet above bedrock. It extends north from the intake structure. It has a minimum crest elevation of approximately 720.4 feet. Rip-rap has been placed on the upstream face to protect against wave action.

2.3.2 Right Embankment

The right earthen dam is 300 feet long, 112 feet wide[14] at its base, and has a maximum height of 37-feet above bedrock. It extends south from the gated spillway. It has a minimum crest elevation of approximately 720.4 feet. Rip-rap has been placed on the upstream face to protect against wave action.

3. Description of Reservoir

The reservoir encompasses approximately 39.9 acres with a storage capacity of approximately 297 acre-feet at the maximum reservoir operating elevation of 711.6 feet.

4. Description of Conveyance Systems

Conveyance systems at the Project consist of a reinforced concrete conduit, a steel surge tank, and two steel penstocks.

4.1 Conduit

The conduit is a reinforced concrete pipe with an inside diameter of 78 inches. It extends approximately 1,296 feet downstream from the intake structure to the surge tank. The conduit is covered by approximately 3 feet of soil.

4.2 Surge Tank

The steel surge tank is situated between the conduit and the steel penstocks which connect to the powerhouse. It is a steel-walled tank that is 16 feet in diameter and extends 60 feet above the flange on the conveyance pipeline. The steel surge tank is supported by a reinforced concrete base.

[13] Width varies.
[14] Width varies.

4.3 Penstock

The two steel penstocks, which are bifurcated immediately downstream of the surge tank, extend 30 feet downstream above ground from the surge tank to the powerhouse. Each pipe is 66 inches in diameter. Each penstock has a gate valve located in the powerhouse.

5. Description of Powerhouse

The single-story powerhouse structure is comprised of reinforced concrete and brick masonry with a wooden roof covered with steel. The powerhouse is 69 feet long by 39 feet wide and is 25 feet high from the ground surface to the peak of the roof and 45 feet high from the bottom of the tailrace to the peak of the roof. The combined maximum hydraulic discharge of the powerhouse is 350 cfs. The minimum discharge of the powerhouse is 50 cfs (Unit #2 minimum discharge). The average head of the Project is 49 feet.

5.1 Turbines

The powerhouse contains one Kiser Hydro double Francis-type runner (15 blades), horizontal-type turbine unit (Unit #1) and one S. Morgan Smith double Francis-type runner (16 blades), horizontal-type turbine unit (Unit #2). The rated horsepower of Unit #1 is 940 and the calculated horsepower of Unit #2 is 667.[15]

The rated hydraulic discharge of Unit #1 is 200 cfs and the rated hydraulic discharge of Unit #2 is 150 cfs.

5.2 Generators

The Project features one General Electric 2,300-Volt, 700 kW generator unit (Unit #1) and one Westinghouse 2,300-Volt, 500 kW generator unit. Each unit is operated on a 2,400 Volt system at 450 revolutions per minute. Unit #1 was installed in 2017 and Unit #2 was installed in 1954. The combined plant capacity is 1,200 kW.

6. Tailrace

Water is released from the powerhouse directly to the White River through a short tailrace that was excavated along with the footprint of the powerhouse. The area originally excavated for the tailrace has a maximum bottom width of 40 feet and extends approximately 120 feet downstream from the downstream edge of the powerhouse to the bottom of the original stream channel. The bottom of the tailrace is at an approximate elevation of 658 feet and the normal tail water elevation at the powerhouse is 662.1 feet.

7. Transmission Equipment

The power generated by the project is transferred to a non-project substation through underground 2.4 kV cables. The 3-phase underground cables are approximately 220 feet long and include a main set and a spare set, each composed of three 4/0 conductors. The cables are connected to a 1,000 kVA, 69/2.4 kV step-up transformer within the non-project substation that serves as the point of interconnect with the Licensee's non-project distribution system and the 69 kV grid. As shown in Appendix A-4, the substation is not used exclusively for the Project. The substation is also part of the 69 kV grid that also supports

[15] Both units were originally installed in 1954. The turbine for unit #1 was replaced in 2017.

three 12.5 kV distribution feeders. The 1,000 kVA, 69/2.4 kV step-up transformer only serves the hydropower Project and is the point of interconnect with the 69 kV grid.

The energy from the Project is routed locally to the Licensee's rural distribution system through the interconnected transmission system. In both situations, NSPW is the entity receiving the power generation.

8. Appurtenant Equipment

Appurtenant equipment includes, but is not limited to, bearing lubrication systems, generator ventilation systems, switchboards, additional gate raising equipment, switchgear, protective devices, and metering devices.

9. Project Operation

Under the proposed operation, NSPW will continue to operate the Project as a run-of-river facility for the purpose of generating hydroelectric power where the discharge measured immediately downstream of the Project approximates inflows into the Project reservoir. NSPW will continue to operate the reservoir between reservoir elevations 710.4 and 711.6 feet NGVD.[16]

NSPW also will continue to release a minimum flow of 16 cfs, or inflow, whichever is less, into the approximately ¼ mile-long bypass reach at all times to protect aquatic resources. The hydroelectric generating and spillway radial-type gate equipment are set up for automatic operation based on the headwater elevation.

Just prior to spring runoff, the Applicant may need to deviate from the maximum reservoir elevation (by no more than an increase of 0.5 feet) to remove ice from the downstream side of the dam for dam safety purposes. The duration of the deviation shall be no longer than necessary (normally less than a few days) to remove the ice and will be conducted as a planned deviation under the requirements outlined in Section 5.8 of Exhibit E.[17]

An operator is assigned to oversee the daily operation and routine maintenance of the Project. The operator visits the project site daily on weekdays and conducts a visual inspection once a week. The Project is set up for automatic operations, but the gates can also be operated locally when needed. Whenever a malfunction occurs, an alarm is sent to the operator and the owner's off-site control center.

For emergency operation of the facility, the operator is available 24 hours a day and can also be supported by two operators from the licensee's nearby hydroelectric projects as well as personnel from NSPW's Hydro Maintenance Department in Chippewa Falls, Wisconsin.

[16] In the Pre-Application Document, NSPW proposed to operate under the subsequent license with a maximum reservoir elevation of 712.6 feet NGVD. NSPW has adjusted its operation and no longer believes a maximum elevation up to 712.6 feet NGVD is necessary.

[17] Due to the short duration of the ice removal events, and their timing during high inflow periods (which matches the natural hydrologic cycle), the proposed planned deviations for ice removal purposes are not expected to have an adverse impact upon geology and soil resources, water resources, fish and aquatic resources, terrestrial resources, threatened and endangered resources recreation resources, aesthetic resources, cultural resources, socioeconomic resources, tribal resources, land use, or environmental justice. Therefore, the planned deviations for ice removal are not considered a material change to operations.

10. Safe Management, Operation, and Maintenance

NSPW has a robust Owners Dam Safety Program that incorporates all inspection, monitoring, and reporting requirements for a dam with this hazard classification. It also ensures that adequate resources are allocated for fulfillment of FERC dam safety requirements. The current Owners Dam Safety Program was revised and submitted to FERC on January 12, 2022.

NSPW developed a public safety plan in consultation with the FERC. The plan is reviewed on an annual basis to determine if changes are necessary. The plan was last updated in 2015.

11. Average Annual Generation

Average annual generation for the Project averaged approximately 4,927 Megawatt-hours (MWh) for the five-year period ending in 2022.

12. River Flow Characteristics

The river basin drainage area upstream of the Project powerhouse is approximately 301 square miles[18] as calculated at the United States Geological Survey (USGS) Gaging Station No. 04027500, located in the tailrace of the Project. The gage was used to develop flow duration curves for the White River. Based on the data for the period of May 1948 to December 2021, the average annual calendar year flow at the Project was 279 cfs; the maximum annual calendar year flow at the Project was 457 cfs in 2018; and the minimum annual calendar year flow was 156 cfs in 1948 (US Geological Survey, n.d.). Streamflow duration data show the percentage of time a given flow is equaled or exceeded. Monthly flow duration curves and the annual exceedance table are based on data collected for the period of record from May 1948 to December 2021 and are included in **Appendix A-3** and shown in **Table A-1**.

Table A-1 Average, Minimum, and Maximum Monthly Flow at the Project

Month	Monthly Minimum Flow (cfs)	Monthly Mean Flow (cfs)	Monthly Maximum Flow (cfs)
January	89	188	551
February	94	194	883
March	76	318	3,110
April	103	567	3,590
May	120	375	3,050
June	96	298	6,390
July	100	262	3,940
August	71	229	4,100
September	61	232	2,800
October	134	247	2,500
November	65	244	1,710
December	70	204	954
Calculated using USGS mean daily flow data			

[18] The 2008 STID states a drainage area of 279 square miles. Since there is no source given for the 279 square mile figure, the 301-square mile figure provided by USGS is believed to be a more-accurate value and has been incorporated in this document.

NSPW is not proposing any material changes in Project operations.[19]

13. Purpose of the Project

The purpose of the Project is to generate renewable hydroelectric energy. NSPW is a public utility that produces, purchases, transmits, and distributes power to retail customers.

14. Estimated Project Cost

The Project is an existing, FERC licensed facility. As of December 31, 2022, the net book value or net investment was calculated at ($169,768) and the gross book value was calculated at $2,232,503. These figures include the land and land rights, structures and improvements, waterway improvements, generating equipment, accessories, and miscellaneous equipment.

15. Estimated Costs of Proposed Environmental Measures

Based upon the environmental review of the Project NSPW has proposed several mitigation and enhancement measures. The measures proposed and their estimated costs are provided in **Table A-2**.

Table A-2 Estimated Costs of Proposed Environmental Measures

Proposed Measure	Capital Cost	O & M Cost
Conduct shoreline erosion surveys every 10 years.	$0	N/A[20]
Develop Rapid Response Invasive Species Monitoring Plan and conduct biennial surveys.	$35,000	$35,000 every other year
Woody Debris Passage	$0	$10,000
Develop a Compliance Monitoring Plan including deviation reporting and agency consultation requirements.	$30,000	$50,000
Develop Historic Properties Management Plan in consultation with SHPO, Bad River Tribe, and other interested Native American Nations to follow requirements outlined in the Programmatic Agreement.	$20,000	$3,000 per year and $25,000 every 10 years
Review and update or replace Part 8 Sign at Boat Landing and Canoe Portage Take-Out site.	$2.000	N/A[21]
Review and update or replace Part 8 sign at Canoe Portage Trail and Put-in site.	$2,000	N/A[22]
Conduct routine maintenance of NSPW's FERC-approved recreation sites.	$0	N/A[23]
Implement the cave Bat BITP/A for any routine vegetation maintenance at NSPW's FERC-Approved recreation sites	$0	$1,000
Implement the Wood Turtle BITP/A for routine maintenance work at NSPW's FERC-approved	$0	$1,000

[19] Due to the short duration of the planned deviations for ice removal events, and their timing during high inflow periods (which matches the natural hydrologic cycle) they are not considered a material change to operations.
[20] Cost for the shoreline erosion survey is listed with the cost for the HPMP survey every 10 years.
[21] O&M cost figures for 2022 already include the costs of routine recreation site maintenance (including replacement of signs).
[22] O&M cost figures for 2022 already include the costs of routine recreation site maintenance (including replacement of signs).
[23] O&M cost figures for 2022 already include the costs of routine recreation site maintenance (including replacement of signs).

Proposed Measure	Capital Cost	O & M Cost
recreation sites, as long as the turtle remains a state threatened or endangered species.		
Total Costs	**$89,000**	**N/A[24]**

16. License Application Development Costs

The cost for NSPW to relicense under the Traditional Licensing Process through the filing of the FLA is $387,000.

17. Estimated Value of On-Peak and Off-Peak Power

The Project operates in a run-of-river mode of operation; therefore, this section is not applicable.

18. Average Annual Increase or Decrease in Project Generation and Value of Power Due to Changes in Project Operations

NSPW is not proposing any material changes to the operation of the Project that would result in a decrease in Project generation or value of power produced by the Project.[25]

19. Remaining Undepreciated Net Investment, or Book Value, of the Project

The undepreciated net investment of the Project as of December 31, 2022 was $2,232,503 (book cost) and $2,402,272 (accumulated depreciation).

20. Annual Operation and Management Costs

The annual O&M expenses for the Project including administrative costs, insurance, taxes, depreciation, and general operations and maintenance costs are estimated to be $207,982 per year. A breakdown of the expenses is provided in **Tables A-3** and **A-4**.

Table A-3 Annual Operation and Management Costs

Item	Cost
General O & M Expenses (5-year average)	$207,982
Insurance	N/A[26]
2022 Property Taxes	$15,314
2022 Depreciation	$551,124
Average Annual O & M Cost	**$774,420**

[24] A total for the O&M Costs is not listed here because not all the costs are incurred annually.
[25] Due to the short duration of the planned deviations for ice removal events, and their timing during high inflow periods (which matches the natural hydrologic cycle) they are not considered a material change to operations. Since planned deviations for ice removal will typically occur during periods of high inflow when flows exceed the capacity of the generating units, they are not expected to result in a loss of generation.
[26] NSPW pays a lump sum for insurance costs per operating company (i.e., NSPW, NSPM), therefore there are no insurance costs specific to the White River Project.

Table A-4 Cost Breakdown of General O&M Expense Category[27] (2018 to 2022)

Cost	2018	2019	2020	2021	2022	2018-2022 Mean
Employee Expenses	$11,766	$11,794	$7,636	$14,401	$30,732	$15,266
Labor	$165,630	$144,741	$118,673	$143,027	$209,742	$156,363
Materials & Commodities	$23,762	$25,769	$9,158	$12,776	$27,016	$19,696
IT Costs	$36					
Miscellaneous	$29,849	$6,974	$1,626	$3,113	$8,980	$10,108
Outside Services	$11,538	$7,985	$3,046	$10,075	$67	$6,542
Total General O&M Costs	**$242,581**	**$197,262**	**$140,139**	**$183,393**	**$276,536**	**$207,982**

21. One-Line Diagram of Electrical Circuits

The One-line Diagram of Electrical Circuits is shown in **Appendix A-4**.

22. Lands of the United States

There are no federal lands located within the Project boundary.

23. Public Utilities Regulatory Policy Act

The Licensee reserves any future rights it may have under the Public Utility Regulatory Policies Act (PURPA) as it pertains to the Project.

24. Supporting Design Report

The supporting design report is considered Critical Energy Infrastructure Information and has been filed accordingly as a separate document with this application.

25. Applicant's Electricity Consumption Efficiency Improvement Programs

The Applicant is committed to energy conservation by using demand side management (DSM) measures as a means to meet customer energy needs. Cost-effective DSM resources, in the form of capacity and energy savings, are in essence "purchased" from the customer through incentives, subsidies, rate structures, or other means needed to meet system DSM goals and commitments. NSPW offers programs for the residential, commercial, and agricultural sectors. Specific options in these programs include, but are not limited to:

[27] Includes administrative costs.

Residential Programs

- Residential Rate Plans
    - Time of Day Service
    - Optional Off-Peak Service
    - Savers Switch Credit
- Residential Rewards {Focus on Energy (FOE)[28]}
    - Energy Saving Tips
    - Home rebates
        - Home Performance
        - Simple Energy Efficiency
        - New Homes
- Renewable Choices
    - Renewable Connect
    - Solar Connect Community
    - Net metering

Business Programs

- Equipment Rebates
- Energy Audits
- Renewable Programs
    - Renewable Connect
    - Solar
    - Working with Third Party Providers
- Energy Efficient Buildings
    - Multi-Family Building Efficiency (FOE)
    - Custom Efficiency
    - Efficient Facilities (FOE)
    - Energy Benchmarking
- Rate Programs
    - Electric Rate Savings
    - Savers Switch for Business

Farm Programs

- Farm Rewiring
- Agriculture and Farm Rebates

The Applicant's conservation programs have been approved by the Public Service Commission of Wisconsin.

[28] Funded through the Focus on Energy® program. Focus on Energy® is Wisconsin's energy efficiency and renewable resource program. It is funded by Wisconsin's investor-owned utilities and participating municipal and electric cooperative utilities, including NSPW's parent company, Xcel Energy.

26. Works Cited

NSPW. (1991). *Exhibit A of the License Application for the White River Hydroelectric Project, FERC No. 2444.* 1991.

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US Geological Survey. (n.d.). *USGS 04027500 White River near Ashland, WI, Water System Information System Web Interface*. Retrieved November 1, 2022, from https://waterdata.usgs.gov/monitoring-location/04027500/#parameterCode=00065&period=P7D