

PROPOSED

FY 2011

**NON-ROUTINE
MAINTENANCE
LIST**

JUNE 02, 2009

May 2009		Preliminary FY11 List of Hydropower Work Packages for Integrated System																
District	SWPA Region Priority	Project Name	Work Package Description	Totals		FY11		FY12		FY13		FY14		FY15		MW AT RISK	Estimated Economic Risk (\$1,000)	Cost Savings (\$1,000)
				Pkg Tot (\$1000)	Cum (\$1,000)	Ant. Expend.	Cum (\$1,000)											
SWL-01	1	Ozark	FY 2008 Rehabilitation Funding (FY 09 - FY 12 Work Plan)	94,000	94,000	14,000	14,000	2,300	2,300		0		0		0	100		
SWF-01	2	Whitney	Turbine and Generator Rehabilitation (FY 09 - FY 13 Work Plan)	22,700	116,700	4,000	18,000	1,670	3,970		0		0		0	30		
NWK-01	3	Truman	Inspection and Repair of Draft Tube Bulkheads, Cylinder Hoists, and Liner and Cavitation Damage (FY 05 & FY 06 Consolidated Project)	6,105	122,805	1,000	19,000	500	4,470		0		0		0	30	965/unit	
SWT-01	4	Webbers Falls	Generator Rewind (FY 08 Project)	6,000	128,805	1,000	20,000		4,470		0		0		0	6	8,362	
SWT-02	5	Webbers Falls	Miscellaneous Electrical & Mechanical Rehabilitation Work (FY 08 Project)	4,000	132,805	1,500	21,500		4,470		0		0		0	6	2,508	
SWT-03	6	Keystone	Transformer Oil Containment	450	133,255	450	21,950		4,470		0		0		0	35	2,110	
SWT-04	7	Denison	Turbine and Wicket Gate Replacement and Transformer Replacement and Relocation (Includes Oil Containment)	24,000	157,255	2,000	23,950	8,000	12,470	8,000	8,000	6,000	6,000		0	35		

Work/Funding Timeline: Rehabilitate Turbines 1 – 5 from May 2005 through May 2012 for \$94,000,000.

Estimated Losses in Revenue/Benefits/Risk Factor: Eventual failure of the generating units will result if rehabilitation is not completed.

Summary of Funding Argument(s):

- Rehabilitation will result in increased reliability.
- Timely repair with minimal interruption of service.
- Reduced likelihood of major failure.

Photographs: None.

Information Data Sheet for Customer Funding

Hydropower Plant: Whitney **Run of River** _____ **Storage** X
District: Fort Worth
No. of Units: 2 **Capacity of Units (MW) (Overload)** 30 (34) MW
Estimated Average Annual (MWH) (SWPA Annual Report) 73,000 MWh

Current Status of Project: Both units are available. The plant is 52 years old.

Item Proposed for Customer Funding: Replacement of both turbines, rewinding of both generators and replacement and upgrading of peripheral electrical and mechanical systems such as governors, exciters, coolers, controls, etc. (turbine, generator and associated equipment rehabilitation).

Reason for Item:

<u>X</u> Reliability	_____ Environmental
<u>X</u> Efficiency	_____ Forced Outage
_____ Safety	<u>X</u> Preventative Maintenance
_____ Cost Savings	<u>X</u> Obsolete
_____ NERC Compliance	

History of Outages/Deficiency: The rehabilitation of Whitney Powerhouse is discussed in the study and report approved by Headquarters in July 2001.

Solution: The contract for replacement of the turbines and rewinding of the generators was awarded in May 2007. The base bid was awarded for \$3.3 million. Continued funding for the remaining four options will be required to complete the contract. Performance of the contract options will take four to five years.

Scope of Work: Continued execution of the existing Turbine/Generator Contract.

Total Estimated Cost: \$22,700,000 over 5 years.

Costs/Impacts if Item is Not Funded:

- 1) Megawatts and Energy at Risk: 30 MW
- 2) Environmental Risk: None
- 3) Cost Savings: Delays in funding of the remaining options will cause possible termination of the contract and increased costs for delays and re-procurement of the contract.
- 4) Other: Eventual failure of the units due to increased age and usage will be the result if the rehabilitation of the turbines and generators are not completed.

Work/Funding Timeline:

<u>Activity Item</u>	<u>Time frame</u>	<u>Dollars</u>
Award of base bid	May 07	3,300,000
Award of Option 1	Feb 08	4,300,000
Award of Option 2	Feb 09	4,300,000
Award of Option 3	Feb 10	4,600,000
Award of Option 4	Feb 11	3,600,000
Award of optional items	Feb 08 – Feb11	2,600,000

Estimated Losses in Revenue/Benefits/Risk Factor: Eventual failure of the generating units will result if rehabilitation is not completed.

Summary of Funding Argument(s):

- Units are past their designed life.
- Rehabilitation will result in increased reliability.
- Increased power production due to up-rating of the rehabbed units.
- Increase unit reliability and availability.

Information Data Sheet for Customer Funding

Hydropower Plant: Harry S. Truman **Run of River** X **Storage**
District: Kansas City
No. of Units: 6 **Capacity of Units (MW) (Overload)** 160 (180) MW
Estimated Average Annual (MWH) (SWPA Annual Report) 244,000 MWh

Current Status of Project: All six units are currently available.

Item Proposed for Customer Funding: Inspection and Repair of Draft Tube Bulkheads, Cylinder Hoists, and Liner and Cavitation Damage.

Reason for Item:

- | | |
|---------------------------|---------------------------------------|
| <u> X </u> Reliability | <u> X </u> Environmental |
| <u> </u> Efficiency | <u> </u> Forced Outage |
| <u> X </u> Safety | <u> X </u> Preventative Maintenance |
| <u> X </u> Cost Savings | <u> </u> Obsolete |
| <u> </u> NERC Compliance | |

History of Outages/Deficiency: The draft tube liners are fabricated of carbon steel and are subject to corrosion and cavitation damage. The water at the project is highly corrosive and is detrimental to the liner, turbines, and structural supports resulting in corrosion damage and measurable reductions in unit efficiency. Sand blasting and vinyl painting of the liners will stop or greatly reduce the corrosive effect of the lake water, increase efficiency, and significantly reduce annual outage times by minimizing the amount of future cavitation repair work. Unit 6 was painted in 1993, but some repairs will be required to the existing vinyl paint. In order to perform the liner corrosion and cavitation repair work, the draft tube bulkheads will need to be inspected and repaired (if required) in accordance with Corps of Engineers' (COE) criteria outlined in Engineering Regulation (ER) 1110-2-8157, Responsibility for Hydraulic Steel Structures (HSS). ER 1110-2-8157 requires all HSS (bulkheads, stoplogs, gates, etc.) to receive a full initial inspection and follow-up periodic inspections every 25 years. The purpose of these inspections is to ensure the bulkheads are structurally sound and safe to use before Government or contractor personnel enter a dewatered area to perform maintenance or repair work. To ensure compliance with the ER and provide safety for Government and contractor personnel, a qualified structural engineer must inspect the bulkheads, determine their safety, and document the inspections. Structural and/or weld defects found during the inspections must be repaired before the bulkheads can be certified for use. The hydraulic power units and cylinders will have to be dismantled so the bulkheads can be removed from their slots and placed on the draft tube deck for these inspections. The operating stems and eye ends of the hydraulically operated draft tube bulkhead hoists (total of 12 hydraulic cylinders) are corroding and need to be repaired. Corrosion is occurring underneath the ceramic coating which protects the operating

stems and provides a sealing surface for the cylinders' internal seals and the nickel plating on the eye ends has failed. Continued corrosion of the operating stems will cause the protective ceramic coating to flake off and the hydraulic cylinders will no longer be able to operate and retain hydraulic oil. There is a potential of losing 900 gallons (from one cylinder) of hydraulic oil into the tailrace (Lake of the Ozarks) downstream of the power plant. Cylinder drift and cycling has also become a problem due to leakage past the internal piston seals. The number of cycles per day depends on the individual cylinder and fluid temperature, but some of the cylinders are cycling over 300 times a day to keep the draft tube bulkheads from drifting into the water passageway. Repair of the cylinders and installation of an automatic latching (dogging) mechanism is needed to prevent the bulkheads from drifting into the water passageways.

Solution: The draft tube bulkhead cylinder work will include redesign of the ceramic protective coating system, repair/rebuilding of the hydraulic cylinders with the redesigned ceramic coating system, and design and installation of an automatic dogging mechanism to prevent cylinder drift. **The draft tube bulkheads will be removed from their slots and inspected and repaired in accordance with COE criteria in concurrence with the hydraulic cylinder repair contract to avoid a duplication of work effort.** The anodes on the bulkheads will also be replaced. Cavitation repair and painting of the draft tube liners and turbines will be performed after the draft tube bulkheads cylinders have been repaired and the draft tube bulkheads inspected/repared and certified for service.

Scope of Work: Perform engineering and design to develop a new protective coating system that protects the operating stems and an automatic latching dogging device that prevents cylinder drift. Prepare plans and specifications and advertise/award a contract to repair/rebuild the cylinders and install the dogging devices. COE (Kansas City District) will be responsible for the inspection and repair of the draft tube bulkheads. Work will include a visual inspection of all welds, documentation of inspection results, and repair of any weld and/or structural defects. Inspection and repair work will be performed by contract with COE oversight. Power Plant personnel will be responsible for purchasing and replacing the bulkheads' anodes. Also prepare plans and specifications for cavitation and corrosion repair work, sandblasting, and painting of draft tube liners, discharge rings, turbine runners, blades and wicket gates on all six units. Hired labor will be used to complete cavitation repair work and painting will be completed by contract.

Total Estimated Cost: \$6,105,000 over 7 years (FY 06 - \$1,390,000; FY07 - \$545,000; FY08 - \$1,005,000; FY09 - \$500,000; FY10 - \$1,165,000; FY11 - \$1,000,000; FY12 - \$500,000).

Costs/Impacts if Item is Not Funded:

- 1) Megawatts and Energy at Risk: Loss of 30 MW/unit of available generating capacity (180 MW total for six units).
- 2) Environmental: High risk of polluting (900 gal/cylinder) the Lake of the Ozarks.
- 3) Cost Savings: Avoid expensive repairs, environmental cleanup costs, and potential fines if repaired before a failure occurs. Major reduction in costs associated with future cavitation repair work.
- 4) Other: Unanticipated failure of bulkheads could lead to the loss of life and/or property damage. Reduces risk of extended unit outages.

Work / Funding Timeline:

<u>Activity Item</u>	<u>Time Frame</u>	<u>Dollars</u>
E&D, Protective Coating & Repair Alternatives	Feb – Aug 07	40,000
P&S, Cyl. Repair/Replacement	May 07 – Sep 08	30,000
Contract Admin. (Cyl. Repair)	Oct 08 – Nov 08	10,000
Cylinder Repair Contract	Dec 08 – Jul 11	3,060,000
S&A (Cyl. Repair)	Dec 08 – Jul 11	160,000
Bulkhead Inspection/Repair Work	Dec 08 – Jul 11	300,000
Anode Replacement	Dec 08 – Jul 11	30,000
P&S, Draft Tube/Turbine Painting	Jan – Jul 11	12,000
Contract Admin. (Paint Contract)	Aug - Oct 11	8,000
Cav. Repair/Blast & Paint 6 Units	Jan 11 – Sep 13	<u>2,455,000</u>
	Total =	6,105,000

Duration with/without Customer Funding: Item has been submitted through the Corps' normal budget cycle. Lack of available funding through COE channels appears to be getting worse. Customer funding would prevent failure of the bulkheads and/or hydraulic cylinders resulting in loss of life or property and extended unit outages. Funding of this item would also reduce the likelihood of a significant oil spill into the tailrace water downstream of the power plant resulting in environmental cleanup costs, potential violations and fines, and unit unavailability. Customer funding would also prevent extended outages for cavitation repair work, thereby increasing unit efficiency, availability and reliability. Without customer funding cavitation repair costs will continue to increase and unit efficiency will decrease.

Estimated Losses in Revenue/Benefits/Risk Factor: All units becoming unavailable as the bulkheads and/or hydraulic cylinders failed. Loss of available generation capacity for all six units is 180 MW (30 MW/unit). Loss of generation capability for an average year is 12.6 GWh. Estimated costs for recovering a failed cylinder is \$75,000/bulkhead cylinder. The costs for cleaning up an oil spill would also add to the overall costs of a failed cylinder. All units becoming in need of extensive cavitation repair work on the discharge rings, blades and liner. Annual cost savings for cavitation

repair work is estimated at \$110,000. 30 MW of available generating capacity would be lost to perform cavitation repair on each unit.

30 MW/unit x 32 weeks x 5 days/week x 3 hours/day x \$67/MWh \approx \$965,000/unit

Summary of Funding Argument(s):

- Corps funding is not available.
- Prevent loss of control or failure of draft tube bulkhead cylinders.
- Possible loss of life and/or property if a bulkhead would fail.
- Loss of 30 MW/unit of available generating capacity (180 MW total for six units).
- Increased unit reliability and availability.
- Funding needed to reduce cavitation repair costs.
- Extended outage times required for extensive repair work.
- Increased spillway erosion due to the inability to generate.
- Dam Safety risk due to spillway erosion.
- High potential for environmental pollution.
- Extended unit outage times required for extensive repair work.

Photographs:



Information Data Sheet for Customer Funding

Hydropower Plant: Webbers Falls **Run of River** X **Storage** _____
District: Tulsa
No. of Units: 3 **Capacity of Units (MW) (Overload)** 60 (69)
Estimated Average Annual Energy (MWH) (SWPA Annual Report) 213,000

Current Status of Project: 2 Units operational with the capability to run at 46 megawatts.

Item Proposed for Customer Funding: Generator Rewind of Unit 1, Unit 2 and Unit 3.

Reason for Item:

- | | |
|---|--|
| <input checked="" type="checkbox"/> Reliability | <input type="checkbox"/> Environmental |
| <input checked="" type="checkbox"/> Efficiency | <input type="checkbox"/> Forced Outage |
| <input type="checkbox"/> Safety | <input checked="" type="checkbox"/> Preventative Maintenance |
| <input type="checkbox"/> Cost Savings | <input checked="" type="checkbox"/> Obsolete |
| <input type="checkbox"/> NERC Compliance | |

History of Outages/Deficiency: The generators are the original equipment installed when the powerhouse was built in 1973. One unit has experienced a coil failure which was repaired. The Webbers Falls Powerhouse Major Rehabilitation Report identified the generators as an equipment item that needed to be replaced. With the turbine rehabilitation at Webbers Falls, it is possible that a 6 MW uprate could be realized at the Webbers Falls powerplant.

Solution: Rewind the Generators for Unit 1, Unit 2 and Unit 3.

Scope of Work: Rewind the units.

Total Estimated Cost: \$6,000,000 (FY08 - \$2,000,000; FY09 - \$2,000,000; and FY10 – \$2,000,000)

Costs/Impacts if Item is Not Funded:

- 1) Megawatts and Energy at Risk: 23 MW
- 2) Environmental Risk: N/A
- 3) Cost Savings: N/A
- 4) Other: N/A

Work / Funding Timeline:

<u>Activity Item</u>	<u>Time frame</u>	<u>Dollars</u>
Rewind Unit 3	Sept 08 – May 09	\$2,000,000
Rewind Unit 1	Sept 09 – May 10	\$2,000,000
Rewind Unit 2	Sept 10 – May 11	\$2,000,000

Duration with/without Customer Funding: Without customer funding, the Units will continue to operate at the current rating (23 MW) and the obtainable uprate (2 MW per unit, 6 MW for the powerhouse) will not be realized. Delay in the rewind of the units will result in less power and energy that is available. The work item has been submitted through the Corps' normal budget cycle.

Estimated Losses in Revenue/Benefits/Risk Factor: If customer funding is not available, the generator rewind will be delayed until funds are available. Federal funds are not expected in the next 10 years.

$$6 \text{ MW} \times 520 \text{ weeks} \times 5 \text{ days/week} \times 8 \text{ hours/day} \times \$67/\text{MWh} \approx \$8,362,000$$

Summary of Funding Argument(s):

- Corps funding is not available at this time.
- Increased unit capacity
- Increased reliability and availability.
- Timely replacement with interruption of service timed with turbine rehabilitation outage.
- Reduced likelihood of major failure.

Photographs: None.

Information Data Sheet for Customer Funding

Hydropower Plant: Webbers Falls **Run of River** X **Storage** _____
District: Tulsa
No. of Units: 3 **Capacity of Units (MW) (Overload)** 60 (69)
Estimated Average Annual Energy (MWH) (SWPA Annual Report) 213,000

Current Status of Project: 2 Units operational with the capability to run at 46 megawatts.

Item Proposed for Customer Funding: Remaining Electrical and Mechanical work at the Webbers Falls Powerhouse to complete the powerhouse rehabilitation to increase reliability and to enable the uprate of the units.

Reason for Item:

- | | |
|---|--|
| <input checked="" type="checkbox"/> Reliability | <input type="checkbox"/> Environmental |
| <input checked="" type="checkbox"/> Efficiency | <input type="checkbox"/> Forced Outage |
| <input type="checkbox"/> Safety | <input checked="" type="checkbox"/> Preventative Maintenance |
| <input type="checkbox"/> Cost Savings | <input checked="" type="checkbox"/> Obsolete |
| <input type="checkbox"/> NERC Compliance | |

History of Outages/Deficiency: The Webbers Falls Powerhouse Major Rehabilitation Report identified the turbines and generators as the major equipment items that needed to be replaced. A benefit of replacing the generators is an anticipated 6 MW uprate. For the powerplant to operate with the increased capacity, the main power cables and generator main bus need to be uprated as well. Also, the maintenance elevator, air compressor, clearwell tank for the packing box water, trash racks, electrical distribution centers, HVAC system and powerplant emergency generator need replacement due to their existing condition. The maintenance elevator is unreliable and is required to efficiently and safely move personnel and equipment for maintenance and repair; the clearwell tank, which is used to store the clean water required by the packing boxes, has corroded and is leaking; the station and governor air compressors are existing equipment and are worn out; the trashracks have holes and failing; the electrical distribution centers have breakers that are not properly rated for the duty and the spare parts are difficult to obtain; the HVAC is obsolete and is unable to keep the controlled areas cooled; and the emergency generator is obsolete and not able to provide the necessary load reliably. All of these items need replacement to complete the major rehabilitation at Webbers Falls. In addition, it will be necessary to make electrical control, power, and relaying changes to incorporate the new equipment

Solution: Repair / replace the main power cables, main bus, maintenance elevator, air compressors, clearwell tank for the packing box water, trash racks, electrical distribution centers, HVAC system and powerplant emergency generator.

Scope of Work: Perform the required electrical and mechanical work needed to replace the main power cables, main bus, maintenance elevator, air compressor, clearwell tank for the packing box water, trash racks, electrical distribution centers, HVAC system and powerplant emergency generator including electrical control, power and relaying changes required for the uprate and new equipment.

Total Estimated Cost: \$3,500,000

Costs/Impacts if Item is Not Funded:

- 1) Megawatts and Energy at Risk: 23 MW
- 2) Environmental Risk: N/A
- 3) Cost Savings: N/A
- 4) Other:N/A

Work / Funding Timeline:

<u>Activity Item</u>	<u>Time frame</u>	<u>Dollars</u>
Remaining Electrical and Mechanical Rehab Work	May 08 – May 11	\$3,500,000

Duration with/without Customer Funding: Without customer funding, the needed rehabilitation work will not be repaired which may result in continued frequent forced outages and lost generation. The work item has been submitted through the Corps' normal budget cycle.

Estimated Losses in Revenue/Benefits/Risk Factor: If customer funding is not available, the remaining rehabilitation work will be delayed until funds are available. Federal funds are not expected in the next 3 years.

$$6 \text{ MW} \times 156 \text{ weeks} \times 5 \text{ days/week} \times 8 \text{ hours/day} \times \$67/\text{MWh} \approx \$2,508,000$$

Summary of Funding Argument(s):

- Corps funding is not available at this time.
- Increased reliability and availability.
- Timely repair with minimal interruption of service.
- Reduced likelihood of major failure.

Information Data Sheet for Customer Funding

Hydropower Plant: Keystone

Run of River X **Storage** _____

District: Tulsa

No. of Units: 2

Capacity of Units (MW) (Overload) 70 (80)

Estimated Average Annual Energy (MWH) (SWPA Annual Report) 228,000

Current Status of Project: 2 generators operational with the capability to run at 80 megawatts.

Item Proposed for Customer Funding: Transformer Oil Containment.

Reason for Item:

X Reliability

X Environmental

____ Efficiency

X Forced Outage

____ Safety

____ Preventative Maintenance

____ Cost Savings

____ Obsolete

____ NERC Compliance

History of Outages/Deficiency: The transformers are 45 years old and SPCC regulations require oil containment. If a transformer fails and oil is released into the tailrace, the environmental cleanup would impact the plant availability until cleanup has been completed. This project was identified to be funded in FY 2011 by the Transformer Oil Containment Work Group (TOCWG).

Solution: Construct oil containment.

Scope of Work: Produce plans and specifications for oil containment.

Total Estimated Cost: \$450,000

Costs/Impacts if Item is Not Funded:

- 1) Megawatts and Energy at Risk: 35 MW
- 2) Environmental Risk: Potential of an oil release.
- 3) Cost Savings: N/A
- 4) Other: N/A

Work / Funding Timeline:

<u>Activity Item</u>	<u>Time frame</u>	<u>Dollars</u>
E&D/P&S	Jan 11 – Apr 11	40,000
Procurement	May 11 – Aug 11	5,000
Contract	Sep 11 – May 12	405,000

Duration with/without Customer Funding: Customer funding would prevent possible extended outages, thereby increasing unit reliability, efficiency and output. Without customer funding, maintenance costs will continue to increase and unit reliability will decrease.

Estimated Losses in Revenue/Benefits/Risk Factor: In case of a failure that cannot be controlled 11 MW of capacity could be lost. Estimated forced outage time would be about 30 weeks.

$$35 \text{ MW} \times 30 \text{ weeks} \times 5 \text{ days/week} \times 6 \text{ hours/day} \times \$67/\text{MWh} \approx \$2,110,000$$

Summary of Funding Argument(s):

- Reduced likelihood of an extended outage due to environmental remediation caused by a transformer failure.
- The TOCWG has reported that this project should be customer funded in FY 2011.

Photographs: None.

Maintenance Data Sheet for Customer Funding

Hydropower Plant: Denison **Run of River** **Storage**
District: Tulsa
No. of Units: 2 **Capacity of Units (MW)** 84
Estimated Average Annual Energy (MWh) (SWPA Annual Report) 219,000

Current Status of Project: All units are currently available for service.

Item Proposed for Customer Funding: Replace turbine runner and wicket gates, transformers and switchgear.

Reason for Item: (Check All that Apply)

<input checked="" type="checkbox"/> Reliability	<input type="checkbox"/> Environmental
<input checked="" type="checkbox"/> Efficiency	<input type="checkbox"/> Forced Outage
<input type="checkbox"/> Safety	<input checked="" type="checkbox"/> Preventative Maintenance
<input type="checkbox"/> Cost Savings	<input checked="" type="checkbox"/> Obsolete
<input type="checkbox"/> NERC Compliance	

History of Outages/Deficiency: The existing turbine runner and wicket gates are original equipment 60 years old. The turbine efficiency has deteriorated from the original design and modern designs provide more efficient turbines. The wickets have corroded and no longer provide a seal when they are closed. Water leakage past the wicket gates is so severe that at times the brakes do not turn on when the unit is shutdown because the unit does not slow down enough to operate the speed switch. This requires personnel to go to the site to shut the unit down. This causes excessive wear on the brakes. A new turbine and set of wicket gates would be more resistant to corrosion. In addition, the scroll case is also corroded and has lost its protective coating. The scroll case also requires sandblasting and repainting. The transformers are not adequately sized to operate at the anticipated uprated capacity of the turbine. In addition, it is impracticable to install containment around the existing transformers. The Switchgear and bus are also not adequately rated to operate at the anticipated uprate.

Solution: Replace turbine and wicket gates, and main power transformers and switchgear.

Scope of Work: Contract for the replacement of turbine and wicket gates, and main power transformers and switchgear.

Total Estimated Cost: \$24,000,000

Duration with/without Customer Funding: Without customer funding, the turbine runner and wicket gates will continue to deteriorate. The wicket gates will deteriorate to point where the unit will not be able to be safely shutdown requiring the wicket gates to be rebuilt. This rebuild will require the weld buildup and grinding to correct profile. This will require each unit to be out of service for a minimum 3 months while these repairs are being made at an estimated cost of \$250,000. This repair will provide negligible efficiency improvements over replacement of the entire turbine.