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April 9, 2015

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
Mail Code: DHAC, PJ-12
888 First Street, N.E.
Washington, D.C. 20426

RE: Priest Rapids Hydroelectric Project No. 2114-217
License Compliance Filing – Article 411 Transmission Line Avian Collision Protection Plan
2014 Annual Report

Dear Secretary Bose,

Public Utility District No. 2 of Grant County, Washington (Grant PUD) respectfully submits to the Federal Energy Commission Regulatory Commission (FERC) its 2014 Transmission Line Avian Collision Protection Plan Annual Report.

On April 15, 2010, Grant PUD filed its Transmission Line Avian Collision Protection Plan (Plan) with FERC. On August 24, 2010, FERC issued an approving and modifying Order. Per the Plan, Grant PUD is required to install bird flight diverters (BFDs) upon ten transmission line spans from 2011 – 2015, conduct avian surveys from 2011 – 2016 and every fifteen years thereafter, and provide annual reports to the U.S. Fish and Wildlife Service (USFWS), Washington Department of Fish and Wildlife (WDFW) and FERC by April 17 of each reporting year.

The Plan identified ten transmission line spans located within five different transmission line corridors for avian interaction studies and line marking. In 2010, Grant PUD proposed to install BFDs all on these transmission line spans to be in accordance with the guidelines set forth in "Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006," by the Edison Electric Institute and the Avian Power Line Interaction Committee (APLIC), or as such publication may be updated from time to. In 2012, APLIC updated its suggested practices.

In review of the APLIC publication released in 2012 (APLIC 2012), Grant PUD determined that that two of its three Midway transmission line spans were in accordance with the APLIC 2012 guidelines. The Midway transmission line spans are the interior spans of a five-span transmission line cluster thereby reducing avian collision potential due to the line configuration. As a result, Grant PUD proposed to its consulting parties – USFWS and WDFW – to not install BFDs on the two Midway transmission line spans. In addition, Grant PUD proposed to remove the overhead ground wires on one de-energized span, which will also reduce avian collision potential. Discussion of these proposals occurred over a number of

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occasions with the consulting parties; formal approval for these proposals were sought and received during the consulting parties review of the 2012 annual report in which the proposal was included. The USFWS and WDFW concurred with both of Grant PUD's proposals. On December 23, 2013, Grant PUD submitted an amendment request to FERC for License Article 411 be modified to reflect the agency-approved and APLIC-compliant avian collision minimization options for the four transmission line spans previously identified in the 2010 FERC Order. On May 6, 2014, FERC issued an order approving the Grant PUD's proposed modifications to not install BFDs on the two Midway transmission line spans.

FERC staff with any questions should contact Tom Dresser at 509-754-5088, ext. 2312 or by email at tdresse@gcpud.org.

Respectfully,

Ross Hendrick
License Compliance Manager

Enclosures: Final 2014 Transmission Line Avian Collision Protection Plan Report

Cc: Jessica Gonzales, USFWS
Steve Lewis, USFWS
Pat Verhey, WDFW

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Priest Rapids Project – FERC No. 2114

Transmission Line Collision Protection Plan

2014 Annual Report

License Article 411

Prepared by:

Environmental Assessment Services, LLC
Richland, Washington

For:

Public Utility District No. 2 of Grant County, Washington

April 2015

Executive Summary

On August 24, 2010, the Federal Energy Regulatory Commission (FERC) issued the order modifying and approving the Transmission Line Avian Collision Protection Plan (Plan) pursuant to Article 411 of the license for the Priest Rapids Project No. 2114 (Project). Per FERC's approval of the Plan, Public Utility District No. 2 of Grant County, Washington (Grant PUD) is required to ensure that 10 of its transmission line spans are compliant with the guidelines set forth in "Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006" or an updated publication. In 2010, Grant PUD proposed to install bird flight diverters (BFDs) upon ten transmission line spans within five transmission line corridors from 2011–2015, conduct avian surveys from 2011–2016 and every 15 years thereafter, and provide annual reports to the U.S. Fish and Wildlife Service, Washington Department of Fish and Wildlife, and FERC by April 17 of each report year.

Pursuant to the Plan, Grant PUD scheduled the installation of BFDs upon the overhead ground wires (OHGW) at the following corridors and years: 1) South Moran Slough (2011), 2) North Moran Slough (2012), 3) Wanapum Switchyard (2013), 4) Wanapum-Columbia/Moses Coulee (2014), and Midway/Columbia River (2015).

Avian surveys have been conducted seasonally each year at all five transmission line corridors to record avian interactions within 0.25 miles of each of the transmission lines. The Wanapum-Columbia/Moses Coulee transmission line corridor was generally characterized as a raptor location, having a high number (>10) of ledges and alcoves on the cliffs. The South Moran Slough, North Moran Slough, Wanapum Switchyard, and the Midway/Columbia River corridors were all generally characterized as waterfowl locations with open water, nesting habitat, and brood cover.

A total of 60 avian interaction surveys were conducted during 2014 and included a total of 3,818 bird observations. At least fifty-five different bird species were identified during 2014, including one species listed as endangered in Washington State.

Changes in key bird species flight behaviors (i.e. whether or not birds altered their flight when traveling near the transmission line corridor) were recorded at study sites within the South Moran Slough, North Moran Slough, and the Wanapum Switchyard corridors. Results were examined for differences associated with BFD installations. No significant differences in key bird species behaviors were observed at S. Moran Slough and Wanapum Switchyard. However, differences in behavior among key bird species were observed at the North Moran Slough site. The frequency of unaltered flight behaviors of wading bird species (herons etc.) increased after the BFDs were installed, whereas the unaltered flight behavior of passerine birds actually decreased after the BFDs were installed. Results suggest that wading birds are seeing the transmission lines that have BFDs earlier and as such, do not need to alter their flight within the 0.25 mile survey area to avoid the lines. Conversely, the flight behavior response of passerines is expected to occur at shorter distances and, as such, are more frequently being recorded within the 0.25 mile survey area. Both of these behavioral changes indicate BFD installations may be helping to reduce the frequency of avian collisions with the transmission lines.

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1.0 Introduction

On August 24, 2010, the Federal Energy Regulatory Commission (FERC) issued the order modifying and approving the Transmission Line Avian Collision Protection Plan (Plan) pursuant to Article 411 of the license for the Priest Rapids Project No. 2114 (Project)[1]. FERC's approval of the Article 411 requires the Public Utility District No. 2 of Grant County, Washington (Grant PUD) to ensure that 10 of its transmission line spans are compliant with the guidelines set forth in "Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006" or an updated publication. In 2010, Grant PUD proposed to install bird flight diverters (BFDs) on ten transmission line spans within five transmission line corridors during 2011–2015 calendar years, to conduct avian surveys from 2011–2016 and every 15 years thereafter, and to provide annual reports to the U.S. Fish and Wildlife Service (USFWS), Washington Department of Fish and Wildlife (WDFW) and FERC by April 17 of each report year.

In 2001, Grant PUD assessed the potential for avian collisions with its transmission system. Avian surveys were conducted at a total of 28 transmission line corridors and included substations and switchyards (Framatome ANP 2003). In general, the primary source of bird collisions within the transmission system is birds colliding with the overhead ground wires (OHGW). Installation of BFDs on OHGWs has been documented to reduce bird collisions in the range of 57-89% (Koops and De Jong 1982; Koops 1987).

Within the approved Plan, Grant PUD committed to install BFDs on five 230 kV transmission line corridors. Grant PUD committed to install BFDs on OHGW and any guy wires associated with the ten transmission line spans within the five transmission line corridors. It is not necessary to mark the transmission lines (T-lines); because, the 230 kV T-lines have a line diameter equal to or greater than one inch in diameter (APLIC 1994). Additionally, most BFDs and devices cannot be installed on energized conductors with voltages over 230 kV (APLIC 1994).

2.0 Materials and Methods

2.1 Bird Flight Diverter Installation

Pursuant to the Plan, Grant PUD scheduled the BFD installation on OHGWs as follows: 1) South Moran Slough (2011), 2) North Moran Slough (2012), 3) Wanapum Switchyard (2013), 4) Wanapum-Columbia/Moses Coulee (2014), and Midway/Columbia River downriver from Priest Rapids Dam (2015). All necessary outages associate with installation were scheduled to occur during the months of September and October.

2.2 Avian Surveys

Pursuant to the approved Plan, avian surveys were conducted at the five corridors (South Moran South, North Moran Slough, Wanapum Switchyard, Wanapum-Columbia/Moses Coulee, and Midway/Columbia River downriver from Priest Rapids Dam). The transmission line corridor surveys documented: 1) Site Information, 2) Avian Location Type, and 3) Avian Interaction to incorporate information within 0.25 miles of the transmission lines. See Appendix A for the datasheets used to record the data.

[1] 132 FERC ¶ 62,127 (2010)

2.2.1 Site Information Data

The Site Information included the following data:

- Date
- Surveyor
- Site Name
- Survey Period: Spring Migration (February–March); Nesting (April–May); Summer (July–August); Fall/Winter (Mid-September–November)
- Day Time Period: AM (survey started at civil twilight), Mid-Day, PM (survey concluded at civil twilight)
- Survey Start Time
- Survey End Time
- Bird Flight Diverter Status (Installed or Not Installed)
- Raptor Perches (Present/Absent)
- Large Migratory Flights (Present/Absent)
- Geographic Funnel (Present/Absent). River valleys and canyons are examples of geographic funnels.

2.2.2 Avian Location Types

The Avian Location Types were classified at Raptor Locations or Waterfowl Locations. Raptor Locations noted the presence of ledges and alcoves on cliffs as not applicable (N/A), Low (0-5), Moderate (6-10), or High (>10). The presence or absence of updrafts and thermals were also recorded for Raptor Locations.

Waterfowl Locations Types recorded data on open water, nesting habitat, and brood cover. Open water data were recorded as present or absent. Nesting habitat data were recorded as present or absent during the nesting survey period only. Nesting habitat data were not applicable during the other survey periods. Brood cover data were recorded as present or absent during the Nesting and Summer Survey Periods. Brood cover data were not applicable during the other survey periods.

2.2.3 Avian Interaction Survey Data

The avian interaction survey collected data within 0.25 miles of the transmission line spans. The avian interaction survey recorded data for observation time, bird category, number of birds, listing status, vertical plane interaction, weather, and behavior. The survey time lengths were two hours during the nesting, summer, and fall/winter survey periods and three hours for the spring migration survey period. Observation time was recorded as military time. Bird categories were recorded as follows:

A) Birds of Prey,

B) Waterfowl,

C) Wading Birds (e.g. herons),

D) Shorebirds (e.g. plovers, sandpipers),

E) Aerialists (e.g. pelicans, gulls, terns),

F) Fowl-Like Birds,

G) Passerine (e.g. songbirds), or

H) Misc. Non-Passerine Birds (e.g. doves, swifts, hummingbirds, woodpeckers, kingfishers).

Listing status included any state or federal listing status for the particular bird species. The vertical plane interaction data were recorded as follows:

- N/A (Did Not Intersect T-Line),
- 0–10 ft.,
- 11–25 ft.,
- 26–50 ft.,
- 51–100 ft., or
- >101 ft.

Additionally, the distance was specific to birds flying in the following four vertical zones, as follows:

1). N/A (Did Not Intersect T-Line),
2). below transmission lines,
3). between transmission lines and OHGWs, and
4). above OHGWs.

Weather included notes relating to cloud cover, precipitation, wind speed. Behavior data were recorded as defined in Table 1 (source Framatome ANP 2003).

Table 1 A description of the behavior data recorded during avian interaction surveys.

Unaltered Flight	Flight above or below (but not among) the transmission lines that includes no observable alterations in flight altitude, direction, speed or other flight characteristic that could be construed as a response to the transmission line structures, wires, or OHGW.
Flight Among Lines	Flight between transmission line wires, OHGW, or both that exhibited no observable alterations in flight altitude, direction, speed or other flight characteristic that could be construed as a response to the transmission line structures, wires, or OHGW.
Altered Flight	Any change in flight altitude, direction, speed, or other flight characteristic in apparent response to a transmission line structure, wire, or OHGW. The behavior occurs as the bird approaches the structure, wire or OHGW giving the individual the time necessary to make a relatively minor flight adjustment and avoid the structure.
Abrupt Altered Flight	Any change in flight altitude, direction, speed, or other flight characteristic in apparent response to a transmission line structure, wire, or OHGW occurring in very close proximity to a transmission line structure and involving a rapid and/or major flight adjustment to avoid the structure.
Flushed	Rapid take off from vegetative cover, water, or ground that was construed as being a direct result of disturbance (usually by the observer, but also including

	passing vehicles).
Perched on Tower	Perching on any transmission line tower, OHGW support, or structure that supports a wire, including those associated with a substation or switchyard.
Perched on Wire	Perching on any wire associated with the transmission line, substations, or switchyards, or adjacent distribution lines including OHGW or support (guy) wires.
Perched on Other	Perching on vegetation, fences or posts, autos and other machinery, cliffs, distribution poles, or any other man-made structures.
On Water/Ground	Stationary or moving on the ground, or on water (e.g., loafing, foraging on the surface, diving, or swimming).

3.0 Results and Discussion

3.1 Bird Flight Diverter Installation

A complete list of BFD installation progress is presented in Table 2. BFDs installation on the OHGW's at the North Moran Slough was completed on November 9, 2012. The Wanapum Switchyard corridor BFD's were installed on September 30, 2013. The Wanapum-Columbia/Moses Coulee BFD's were installed on October 3, 2014.

Table 2 The bird flight diverter installation completion dates for transmission line corridors.

Date of Completion	Span of BFD Installation	Corridor
8/30/2011	Priest Rapids - Midway 230kV Line #3 between Structures #211 and #212	S. Moran Slough
9/12/2011	Priest Rapids - Midway 230kV Line #1 between Structures #11 and #12	S. Moran Slough
10/10/2011	Priest Rapids - Midway 230kV Line #2 between Structures #111 and #112	S. Moran Slough
11/9/2012	Priest Rapids 230kV Line between Structures #76 and #77	N. Moran Slough
9/30/2013	Wanapum-Priest Rapids 230kV Line, Structures #1 and #2	Wanapum Switchyard
10/03/2014	Wanapum-Columbia 230kV Line, Structures #132 and #133	Wanapum-Columbia / Moses Coulee

3.2 Avian Surveys

3.2.1 Site Information Data & Avian Location Types

The five transmission line corridors were characterized by site information and avian location descriptions. The transmission line corridor site information data of avian location type, raptor perch presence/absence, geographic funnel presence/absence, and large migratory flight

presence/absence are presented in Table 3. The Wanapum-Columbia/Moses Coulee transmission line corridor was the only raptor location, and the site was characterized as having a high number (>10) of ledges and alcoves on the cliffs with intermittent updrafts present on warm sunny days. The South Moran Slough, North Moran Slough, Wanapum Switchyard, and the Midway/Columbia River corridors were all characterized as waterfowl locations. The waterfowl site characterization data of open water, nesting habitat, and brood cover are presented in Table 4, Table 5, and Table 6, respectively. The surveys conducted during 2014 were presented for all five transmission line corridors survey sites with respect to the survey season and daytime period as shown in Table 7. During 2014, the spring migration surveys were performed between February 20 and March 29, the nesting season surveys were conducted between April 14 and May 30, the summer season surveys were conducted between August 6 and August 27, and the fall/winter season surveys were conducted between October 21 and November 28 (Table 7).

Table 3 Avian location type and site descriptive data of raptor perches, geographic funnel, and large migratory flights for the five transmission line corridors.

Corridor	Avian Location Type	Raptor Perches	Geographic Funnel	Large Migratory Flights
South Moran Slough	Waterfowl	Present	Absent	Absent
North Moran Slough	Waterfowl	Present	Absent	Absent
Wanapum Switchyard	Waterfowl	Absent	Absent	Absent
Wanapum-Columbia/Moses Coulee	Raptor	Present	Present	Absent
Midway/Columbia River downriver from Priest Rapids Dam	Waterfowl	Absent	Present	Absent

Table 4 Open water habitat waterfowl characterization data for the four waterfowl transmission line corridors.

	Open Water			
Corridor	Spring Migration	Nesting	Summer	Fall/Winter
South Moran Slough	Present	Present	Present	Present
North Moran Slough	Present	Present	Present	Present
Wanapum Switchyard	Present	Present	Absent	Absent
Midway/Columbia River downriver from Priest Rapids Dam	Present	Present	Present	Present

Table 5 Nesting habitat characterization data for the four waterfowl transmission line corridors.

	Nesting Habitat			
Corridor	Spring Migration	Nesting	Summer	Fall/Winter
South Moran Slough	N/A	Present	N/A	N/A
North Moran Slough	N/A	Present	N/A	N/A
Wanapum Switchyard	N/A	Present	N/A	N/A
Midway/Columbia River downriver from Priest Rapids Dam	N/A	Present	N/A	N/A

Table 6 Brood cover habitat characterization data for the four waterfowl transmission line corridors.

Corridor	Brood Cover			
	Spring Migration	Nesting	Summer	Fall/Winter
South Moran Slough	N/A	Present	Present	N/A
North Moran Slough	N/A	Present	Present	N/A
Wanapum Switchyard	N/A	Present	Present	N/A
Midway/Columbia River downriver from Priest Rapids Dam	N/A	Present	Present	N/A

Table 7 Avian survey dates conducted during 2014 at the five transmission line corridors with respect to survey period and daytime period.

Survey Period	Corridor	AM	Mid-Day	PM
Spring Migration	South Moran Slough	03/23/14	03/23/14	03/31/14
	North Moran Slough	03/27/14	02/21/14	02/21/14
	Wanapum Switchyard	3/29/2014	3/19/2014	3/19/2014
	Wanapum-Columbia	3/28/2014	3/28/2014	3/28/2014
	Midway	02/23/14	02/20/14	2/20/2014
Nesting	South Moran Slough	4/17/2014	4/16/2014	4/16/2014
	North Moran Slough	5/30/2014	4/14/2014	5/29/2014
	Wanapum Switchyard	5/31/2014	4/14/2014	5/28/2014
	Wanapum-Columbia	5/24/2014	5/24/2014	5/21/2014
	Midway	5/28/2014	5/15/2014	5/30/2014
Summer	South Moran Slough	8/26/2014	8/25/2014	8/26/2014
	North Moran Slough	8/25/2014	8/6/2014	8/22/2014
	Wanapum Switchyard	8/24/2014	8/24/2014	8/25/2014
	Wanapum-Columbia	8/23/2014	8/23/2014	8/24/2014
	Midway	8/27/2014	8/18/2014	8/23/2014
Fall/Winter	South Moran Slough	10/22/2014	10/22/2014	10/21/2014
	North Moran Slough	10/23/2014	10/23/2014	11/23/2014
	Wanapum Switchyard	10/21/2014	10/21/2014	11/4/2014
	Wanapum-Columbia	10/27/2014	10/27/2014	10/26/2014
	Midway	11/5/2014	10/15/2014	11/28/2014

3.2.2 Avian Interaction Surveys

A total of 60 avian interaction surveys were conducted during 2014 at the five transmission line corridors. At least fifty-five different bird species were identified during 2014. Species and state and federal listing statuses is presented in Table 8. The American white pelican (*Pelecanus erythrorhynchos*) was the only species observed that currently has state and/or federal Threatened or Endangered species listing status (Table 8). A total of 3,818 bird observations were recorded during the 2014 survey period (Table 9). Bird observations were summarized by

site and season in Tables 9 and 10 respectively. Passerine species continue to be the most abundant for all sites. In 2014, the most abundant passerines were red-winged blackbirds, consistent with prior years. Red-tailed hawks were the most abundant bird of prey species. Canada geese were the most abundant waterfowl species. American white pelicans were the most abundant aerialists observed during 2014. Northern flickers were the most common miscellaneous, non-passerine bird species, consistent with past years.

Bird interaction behavior data are presented in Tables 11 and 12 with respect to their flight across the transmission lines (i.e., above the OHGW, between OHGW and the T-Lines, or below T-Lines). The majority of birds flying above the OHGW were waterfowl species while the majority of birds flying between or under the OHGW and T-lines were passerine species. Of the 3,818 observations made during 2014, no bird collisions were documented, and no abruptly altered flight behaviors were observed, however, a number of altered flight patterns were documented.

Table 13 illustrates the number of seasons currently available for comparing changes in bird responses (altered or unaltered flight patterns) that may be associated with installing BFDs on the transmission lines. Statistical comparisons [two-tailed Student's t-Test ($\alpha \leq 0.05$)] of either altered and unaltered bird flight behavior were performed when there were: 1) at least three altered or unaltered observations per treatment group, 2) at least twenty total observations for a given bird category within both the pre- and post-BFD installation periods, and 3) at least three seasons of both pre-BFD and post-BFD installation records. Based on these minimum sample size criteria, statistical comparisons of the bird flight behavior data were available at South Moran Slough, North Moran Slough, and Wanapum Switchyard sites (Tables 14 through 16). Values used in pre- and post-BFD installation statistical comparisons were generated by calculating the percentage of the selected behavior (altered or unaltered) out of total number of observations recorded for each bird category for each season given that at least one observation of each respective bird category was made.

No differences in bird behavior could be detected at the South Moran Slough and Wanapum Switchyard sites (see Tables 14 and 16). Birds of prey (i.e., raptors) and passerine birds (i.e., songbirds) are reported to have the keenest sight of all birds, and they can resolve details at distances 2.5-3 times the distances of humans (Gill 2007). No differences in the pre-BFD-installed and post-BFD-installed behavior data could reveal that the birds of prey already observed the OHGWs prior to BFD installation. It is acknowledged that there were only three seasons of pre-BFD data available for this comparison which may influence statistical results. It is also possible that cluster span configurations, such as the South Moran Slough corridor three-span cluster, increase the visibility of the wires (APLIC 2012). As a result, the installation of BFDs at clustered-span corridors likely does little to reduce collision potential for bird species with excellent vision that most likely observed the wires prior to BFD installation. It is also likely that waterfowl behaviors at this site may have been influenced by hunting activities. Shotgun shells were frequently observed at this site by the surveyors. This type of human activity may decrease the use of this area by waterfowl and wading bird species.

At the North Moran Slough site, there was a significant difference ($\alpha \leq 0.05$) detected in the unaltered flight behavior of both wading birds and passerines. The frequency of unaltered flight behaviors of wading bird species (herons etc.) increased after the BFDs were installed, whereas the unaltered flight behavior of passerine birds actually decreased after the BFDs were installed. A decrease in the frequency of unaltered flights for larger birds, such as herons, suggests that the BFDs are increasing the visual profile of the static wires and as a result, the birds are altering

their flight in order to avoid the lines. The premise is that wading birds are seeing the transmission lines that have BFDs earlier, and as such, do not need to alter their flight as often within the 0.25 mile survey area to avoid the lines. On the contrary, the flight behavior response of passerines is expected to occur at shorter distances, and as such, are more frequently being recorded to respond to the BFDs (i.e., alter their flight) within the 0.25mile survey area. Both of these behavioral changes indicate BFD installations may be helping to reduce the frequency of avian collisions with the transmission lines.

A marked decline in the total number of bird observations have been noted at all five sites since the transmission line avian surveys were initiated in 2011 (Table 13). The most notable declines have been observed at the Wanapum-Columbia Coulee (~31%), North Moran Slough (~30%), and Midway (~27%). Declines in excess of 10% have also been noted elsewhere. The causes for these declines are not known but changes in land-use practices (orchard developments) at Wanapum-Columbia Coulee site are thought to have contributed to the declines at that site. If low total bird interaction observations continue at the Wanapum-Columbia Coulee in 2014 (n=203), the ability to discern statistically significant changes in the bird behavior associated with BFD installations there will be greatly limited.

Table 8 Bird species identified during the 2014 avian interaction surveys with their state and federal listing statuses.

Bird Category	Species	State Listing Status	Federal Listing Status
Birds of Prey	American Kestrel		
	Cooper's Hawk		
	Northern Harrier		
	Red-Tailed Hawk		
	Misc. Owl		
Waterfowl	American Coot		
	American Wigeon		
	Bufflehead		
	Canada Goose		
	Common Goldeneye		
	Common Merganser		
	Double-Crested Cormorant		
	Green-Winged Teal		
	Mallard		
	Northern Shoveler		
	Pied-Billed Grebe		
	Scaup		
	Western Grebe	Candidate	
Wading Birds	Great Blue Heron		
	Great Egret		
	Night Heron		
Shorebirds	Dunlin		
	Killdeer		
Aerialists	American White Pelican	Endangered	
	Forster's Tern		
	Misc. Gull		
Fowl-Like Birds	California Quail		
	Ring-Necked Pheasant		
Passerines	American Crow		
	American Goldfinch		
	American Robin		
	Bank Swallow		
	Barn Swallow		
	Black-Billed Magpie		
	Brewer's Blackbird		
	Brown-Headed Cowbird		
	Bullock's Oriole		
	Cliff Swallow		
	Common Raven		
	Eastern Kingbird		
	European Starling		
	Horned Lark		
	House Finch		
	Lark Sparrow		
	Misc. Sparrow		
	Misc. Swallow		
	Northern Shrike		
	Red-Winged Blackbird		
	Tree Swallow		
	Western Kingbird		
	Western Meadowlark		
	White-Crowned Sparrow		
	Wilson's Warbler		
	Yellow-Headed Blackbird		
	Yellow-Rumped Warbler		
Non-Passerines	Belted Kingfisher		
	Common Nighthawk		
	Mourning Dove		
	Northern Flicker		

Table 9 **Summary of bird observations at each transmission line corridor during 2014.**

Bird Category	Species	Midway	North Moran Slough	South Moran Slough	Wanapum Switchyard	Wanapum Columbia	Grand Total
Birds of Prey	American Kestrel			1	3		4
	Cooper's Hawk			3			3
	Northern Harrier	1	9	2			12
	Red-Tailed Hawk		5	1	4	7	17
	Misc. Owl		4				4
Birds of Prey Total		1	18	7	7	7	40
Waterfowl	American Coot			75			75
	American Wigeon			5			5
	Bufflehead	18	1	38			57
	Canada Goose	129	102	4			235
	Common Goldeneye	34		14			48
	Common Merganser	48		2			50
	Double-Crested Cormorant	20	2				22
	Green-Winged Teal		3	3			6
	Mallard	69	72	45	8		194
	Northern Shoveler			1			1
	Pied-Billed Grebe	18	9	23			50
	Scaup			1			1
	Western Grebe	20		2			22
Waterfowl Total		356	189	213	8		766
Wading Bird	Great Blue Heron	12	9	6			27
	Great Egret	1	1	1			3
	Night Heron	1	9	3			13
Wading Birds Total		14	19	10			43
Shorebirds	Dunlin		1				1
	Killdeer		1				1
Shorebirds Total			2				2
Aerialists	American White Pelican	50	16	4			70
	Misc. Gull	42		1			43
	Forster's Tern			3			3
Aerialists Total		92	16	8			116
Fowl-Like Birds	California Quail		2			20	22
	Ring-Necked Pheasant					1	1
Fowl-Like Birds Total			2			21	23
Passerines	American Crow	85	4	2		4	95
	American Goldfinch		1		1	5	7
	American Robin	3	5	2	9	29	48
	Barn Swallow		2	6			8
	Black-Billed Magpie	60	37	20	48		165
	Brown-Headed Cowbird	2					2
	Bullock's Oriole	5	2				7
	Cliff Swallow	64	256	142	74	79	615
	Common Raven	16		1	4	4	25
	Eastern Kingbird	2					2
	European Starling	40	8	150	75		273
	Horned Lark				2		2
	House Finch		19	92	4	34	149
	Lark Sparrow		1				1
	Misc. Sparrow		1				1
	Misc. Swallow	1					1
	Northern Shrike				1		1
	Red-Winged Blackbird		349	587	108		1044
	Western Kingbird	10		4	2		16
	Western Meadowlark	9	1	1	7		18
	White-Crowned Sparrow				1	8	9
	Yellow-Headed Blackbird				9		9
	Yellow-Rumped Warbler			9			9
	Tree Swallow			61			61
	Bank Swallow	8	2	27			37
	Wilson's Warbler			4			4
	Brewer's Blackbird	11	2		165		178
Passerines Total		316	690	1108	510	163	2787
Non-Passerines	Belted Kingfisher		1	5			6
	Common Nighthawk		1				1
	Mourning Dove		5				5
	Northern Flicker	4	3	4	6	12	29
Non-Passerines Total		4	10	9	6	12	41
Grand Total		**783**	**946**	**1355**	**531**	**203**	**3818**

Table 10 Summary of bird observations for each survey period during 2014.

Bird Category	Species	Fall/Winter	Nesting	Spring Migration	Summer	Grand Total
Birds of Prey	American Kestrel	1	1	1	1	4
	Cooper's Hawk				3	3
	Northern Harrier	4	2	5	1	12
	Red-Tailed Hawk	4	4	8	1	17
	Misc. Owl		4			4
Birds of Prey Total		9	11	14	6	40
Waterfowl	American Coot		8	47	20	75
	American Wigeon		2	3		5
	Bufflehead		12	45		57
	Canada Goose	141		78	16	235
	Common Goldeneye		11	37		48
	Common Merganser	32			18	50
	Double-Crested Cormorant				22	22
	Green-Winged Teal		3	3		6
	Mallard	36	39	49	70	194
	Northern Shoveler			1		1
	Pied-Billed Grebe	15	7	11	17	50
	Scaup			1		1
	Western Grebe			2	20	22
Waterfowl Total		224	82	277	183	766
Wading Birds	Great Blue Heron	2	10	5	10	27
	Great Egret	1			2	3
	Night Heron	3	4	2	4	13
Wading Birds Total		6	14	7	16	43
Shorebirds	Dunlin		1			1
	Killdeer		1			1
Shorebirds Total			2			2
Aerialists	American White Pelican		51	4	15	70
	Misc. Gull	41	1		1	43
	Forster's Tern		3			3
Aerialists Total		41	55	4	16	116
Fowl-Like Birds	California Quail		2		20	22
	Ring-Necked Pheasant	1				1
Fowl-Like Birds Total		1	2		20	23
Passerines	American Crow	8		79	8	95
	American Goldfinch	1			6	7
	American Robin		23	21	4	48
	Barn Swallow		4	1	3	8
	Black-Billed Magpie	22	34	71	38	165
	Brown-Headed Cowbird		2			2
	Bullock's Oriole		7			7
	Cliff Swallow	356	29		230	615
	Common Raven	3	16	4	2	25
	Eastern Kingbird				2	2
	European Starling	62	16	13	182	273
	Horned Lark				2	2
	House Finch	103	20	2	24	149
	Lark Sparrow				1	1
	Misc. Sparrow	1				1
	Misc. Swallow				1	1
	Northern Shrike		1			1
	Red-Winged Blackbird		305	320	419	1044
	Western Kingbird		15		1	16
	Western Meadowlark	2	6	1	9	18
	White-Crowned Sparrow			4	5	9
	Yellow-Headed Blackbird				9	9
	Yellow-Rumped Warbler		9			9
	Tree Swallow		37	24		61
	Bank Swallow	1			36	37
	Wilson's Warbler				4	4
	Brewer's Blackbird	178				178
Passerines Total		737	524	540	986	2787
Non-Passerines	Belted Kingfisher	1	1	2	2	6
	Common Nighthawk				1	1
	Mourning Dove		4		1	5
	Northern Flicker	8	4	13	4	29
Non-Passerines Total		9	9	15	8	41
Grand Total		1027	699	857	1235	3818

Table 11 Flight distribution of birds intersecting the transmission line spans presented by bird category during 2014.

Type and Proximity of Transmission Line	Vertical Plane (ft)	Birds of Prey	Waterfowl	Wading Birds	Shorebirds	Aerialists	Fowl-like Birds	Passerines	Non-Passerine Misc	Grand Total
Above OHGW	>101	8	55			6				69
	0-10	3	4	1		1		229	1	239
	11-25		56	2		2		170		230
	26-50	6	10	3		22		24		65
	51-100	2	82	1		3		3		91
Above OHGW Total		19	207	7		34		426	1	**694**
Below T-Lines	>101							6		6
	0-10		1	1		1		57	2	62
	11-25	3		2				225	4	234
	26-50	2	4	6	1	9		562	7	591
	51-100		202	11		32	13	277	8	543
	N/A		1			1				2
Below T-Lines Total		5	208	20	1	43	13	1127	21	**1438**
Between	0-10	1	3			1		342		347
	11-25					3		22		25
Between Total		1	3			4		364		**372**
N/A	11-25		3					78	3	84
	N/A	15	345	16	1	35	10	792	16	1230
N/A Total		15	348	16	1	35	10	870	19	**1314**
Grand Totals		**40**	**766**	**43**	**2**	**116**	**23**	**2787**	**41**	**3818**

Table 12 Bird flight behaviors observed during 2014.

Bird Category	Abrupt Altered Flight	Altered Flight	Flight Among Wires	Flushed	On Ground	On Water	Perched on Other	Perched on Tower	Perched on Wire	Unaltered Flight	Totals
Birds of Prey					2		5	3		30	**40**
Waterfowl		10	17	2	70	363	16			288	**766**
Wading Birds		5	2	2	2	10	2			20	**43**
Shorebirds					1		1				**2**
Aerialists	2	3			1	30				80	**116**
Fowl-like Birds				13	10						**23**
Passerines		16	298	8	75		388	181	332	1489	**2787**
Non-Passerine Misc.			1		2		20	1	1	16	**41**
Totals	**2**	**34**	**318**	**25**	**163**	**403**	**432**	**185**	**333**	**1923**	**3818**

Table 13 Seasons of available data for 2014 statistical comparison.

Site	# Seasons of Pre-BFD data	# Seasons of Post-BFD data	Installation Year	Statistical Comparison
South Moran Slough	3	13	2011	2013
North Moran Slough	7	9	2012	2013
Wanapum Switchyard	11	5	2013	2014
Wanapum-Columbia	12	0	Scheduled for 2014	Scheduled for 2015
Midway	16	0	Scheduled for 2015	Scheduled for 2016

Table 14 Comparison of pre-BFD installation and post-BFD installation bird flight behavior data at South Moran Slough (2011 through 2014).

Bird Category	Pre-BFD Observation Summary				Post-BFD Observation Summary				Altered Behavior Statistics			Unaltered Behavior Statistics		
	# Seasons	# alt (1.06%)	# unalt (17.87%)	Total Obs.	# Seasons	# alt (2.7%)	# unalt (35.93%)	Total Obs.	P(T<=t)	df	Significant	P(T<=t)	df	Significant
A: Birds of Prey	3	2	8	20	13	7	18	34				0.18	4	no
B: Waterfowl	3	6	43	110	13	21	116	615	0.465	12	no	0.40	3	no
C: Wading Birds	3	1	7	8	13	14	26	54						
D: Shorebirds	3	0	1	3	13	0	1	1						
E: Aerialists	3	0	2	2	13	1	22	24						
F: Fowl-Like Birds	3	0	0	0	13	0	0	0						
G: Passerine Birds	3	14	309	2004	13	84	1492	4001	0.773	5	no	0.07	10	no
H: Non-Passerine Misc.	3	0	19	30	13	3	52	77				0.34	11	no
Total		**23**	**389**	**2177**		**130**	**1727**	**4806**						

Table 15 Comparison of pre-BFD installation and post-BFD installation bird flight behavior data at North Moran Slough (2011 through 2014).

Bird Category	Pre-BFD Observation Summaries				Post-BFD Observation Summaries				Altered Behavior Statistics			Unaltered Behavior Statistics		
	# Seasons	# alt (2.07%)	# unalt (37.28%)	Total Obs.	# Seasons	# alt (5.53%)	# unalt (62.11%)	Total Obs.	P(T<=t)	df	Significant	P(T<=t)	df	Significant
A: Birds of Prey	7	0	30	43	9	1	21	33				0.956	13	no
B: Waterfowl	7	40	468	530	9	81	725	867	0.589	10	no	0.657	11	no
C: Wading Birds	7	7	44	53	9	9	11	32	0.106	8	no	**0.001**	9	**yes**
D: Shorebirds	7	0	7	8	9	0	1	3						
E: Aerialists	7	3	30	38	9	2	23	25				0.409	8	no
F: Fowl-Like Birds	7	0	0	0	9	0	0	0						
G: Passerine Birds	7	21	676	2728	9	39	691	1400	0.288	9	no	0.837	10	no
H: Non-Passerine Misc.	7	0	21	23	9	0	10	26				**0.038**	9	**yes**
Total		**71**	**1276**	**3423**		**132**	**1482**	**2386**						

Table 16 Comparison of pre-BFD installation and post-BFD installation bird flight behavior data at the Wanapum Switchyard (2011 through 2014).

Bird Category	Pre-BFD Observation Summaries				Post-BFD Observation Summaries				Statistic Summaries (Altered Behavior)			Statistic Summaries (Unaltered Behavior)		
	# Seasons	# alt (3.86%)	# unalt (51.96%)	Total Obs.	# Seasons	# alt (0.65%)	# unalt (57.29%)	Total Obs.	P(T<=t)	df	Significant	P(T<=t)	df	Significant
A: Birds of Prey	11	2	53	106	5	0	4	7						
B: Waterfowl	11	4	186	193	5	0	8	8						
C: Wading Birds	11	0	0	0	5	0	0	0						
D: Shorebirds	11	0	0	0	5	0	0	0						
E: Aerialists	11	0	0	0	5	0	0	0						
F: Fowl-Like Birds	11	0	13	19	5	0	0	0						
G: Passerine Birds	11	73	764	1643	5	3	406	717	0.27	10	no	0.96	11	no
H: Non-Passerine Misc.	11	1	60	110	5	2	22	36				0.577	3	no
Total		**80**	**1076**	**2071**		**5**	**440**	**768**						

Table 17 Trends in Total Number of Bird Observations (2011 – 2014).

Corridor	2011	2012	2013	2014	Grand Total
Midway	2148	883	1101	783	**4915**
North Moran Slough	2687	1498	680	946	**5811**
South Moran Slough	2429	2066	1150	1355	**7000**
Wanapum Switchyard	834	1015	459	531	**2839**
Wanapum-Columbia	669	390	267	203	**1529**
Grand Total	**8767**	**5852**	**3657**	**3818**	**22094**

4.0 Acknowledgements

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Appendix A
Article 411 Survey Forms

Article 411 Transmission Line Collision Protection Plan Survey
Site Description Survey Form

Date: _____ **Surveyor:** _____

Site:

☐ Wanapum – Columbia (Span 1)
Type D1 Towers,
3 T-Lines
2 OHGW's

☐ Wanapum Switchyard (Span 2)
Type A2 Tangent & DS Towers,
3 T-Lines
2 OHGW's

☐ North Moran Slough (Span 3)
Type TR1 & Tangent A1 Towers,
3 T-Lines
2 OHGW's

☐ South Moran Slough (Span 4, 6, and 8)
Type A1 Tangent Towers,
3 T-Lines/Span
1 OHGW/Span

☐ Priest – Midway (Span 5, 7, and 9)
Type B2 Special Towers,
3 T-Lines/Span
2 OHGW's/Span

☐ Midway – Frenchman (Span 10)
Type SC Special Towers,
3 T-Lines
2 OHGW's

Survey Period

☐ Spring Migration (Feb – Mar)
☐ Summer (July – Aug)
☐ Nesting (April – May)
☐ Fall/Winter (Mid-Sept – Nov)

Day Time Period

☐ AM ☐ Mid-Day ☐ PM Start Time: _____ End Time: _____

Bird Flight Diverters Installed?

☐ Yes ☐ No

Miscellaneous Information (Presence/Absence)

☐ Raptor Perches
☐ Large Migratory Flights
☐ Geographic Funnel (i.e., Canyons/Valleys)

Avian Location Type:

☐ Raptor Location Type

Ledges & Alcoves on Cliffs
☐ N/A
☐ Low (0-5)
☐ Moderate (6-10)
☐ High (>10)

Updrafts/Thermals
☐ Present ☐ Absent

☐ Waterfowl Location Type

Open Water
☐ Present ☐ Absent

Nesting Habitat (Nesting Survey Only)
☐ Present ☐ Absent ☐ N/A

Brood Cover (Nesting/Summer Survey)
☐ Present ☐ Absent ☐ N/A