

Recreational Carrying Capacity Assessment

Priest Rapids Hydroelectric Project

Prepared for:

Public Utility District No. 2 of Grant County
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2016



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EXECUTIVE SUMMARY

Public Utility District No. 2 of Grant County (Grant PUD) commissioned this recreational carrying capacity study to assist in reporting recreation usage in the Priest Rapids Hydroelectric Project (Project) as required by the Federal Energy Regulatory Commission (FERC), as well as to inform Grant PUD's future recreation-related management decisions. This report presents the results of a capacity analysis of recreational resources and related use of the Project and is intended to assess the overall recreation capacity of the Project in relationship to its current recreational use level. This report specifically supports development of the FERC Form 80 requirement to report the capacity utilization of amenities on the Project, and informs a 2016 update to the Recreation Resource Management Plan for the Priest Rapids Project.

This analysis is based on the primary types of recreation capacity and the methods for measuring that capacity as recognized in the scientific literature (Manning, 2007). Findings from a separate *Recreation Site and Facility Inventory* (Grant PUD, 2015) suggest that environmental and managerial conditions are not limiting factors for the recreational carrying capacity of the Project. Experiential considerations (including boat launch parking and campsite availability) are therefore the focus of the recreational carrying capacity assessment presented in this report.

Survey data collected during the peak recreation use season in 2015 serve as the primary basis for most capacity analyses presented. These data were collected using rigorous, science-based procedures that reflect the most widely applied approach to assessing recreational carrying capacity – an indicators and standards-based approach integrating norms. At certain amenities, such as dispersed/lower use sites, or privately operated sites, the institutional knowledge of Grant PUD staff was relied upon as the most accurate and practical way to determine recreational carrying capacity

The analyses presented in this report generally show that peak season recreation use at the Project is well below its potential capacity. Recreation capacity utilization at the various FERC-defined amenity types is between 5% and 66%. However, some specific amenities had higher capacity utilizations. In particular, the boat launch areas at Vantage and Crescent Bar (Off-Island) were utilized at 75.2% and 76.3 % of their capacity, respectively, and the campgrounds at Ginkgo Petrified Forest State Park and Crescent Bar (Off-Island) were utilized at 86.2% and 78.6% of their capacity, respectively. The Priest Rapids and Wanapum Reservoirs, while not an amenity themselves, are below their recreational carrying capacity for boating. The reservoirs are utilized for boating, on average, at 42.2 % and 70.4% of their capacity during the peak use season.

Based on the results from the capacity analyses, further near-term monitoring of recreation capacity seems unwarranted. The analysis does not indicate a near-term need to continue to add or modify recreational amenities on the Project to increase capacity. However, it should be noted that user responses in surveys conducted for a related recreation use assessment indicated some potential site or service improvements that would enhance visitor

experiences, but these are not capacity-related. While specific issues and challenges related to capacity may emerge if use levels or types change, the capacity of the Project's amenities will not likely be exceeded prior to the next FERC Form 80 reporting in 2021. This report recommends continuing routine monitoring of recreation-related environmental impacts at dispersed sites, and seeking informal public input on recreation experiences and management at developed facilities to identify any emerging or site-specific capacity-related issues.

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A. INTRODUCTION

Public Utility District No. 2 of Grant County (Grant PUD) commissioned this study per Article 418 of its license requirements, as amended in September 2012, from the Federal Energy Regulatory Commission (FERC) for the Priest Rapids Hydroelectric Project (Project) (FERC Project No. 2114). A series of inter-related studies were conducted to assess and evaluate recreation resources and recreation use associated with the Project. This report presents the results of a capacity analysis of recreational resources and related use of the Priest Rapids Project. The intent of the study is to assess the overall recreation capacity of the Project in relationship to its current recreational use level. This analysis is based on the primary types of recreation capacity and the methods for measuring that capacity as recognized in the scientific literature (Manning, 2007).

Grant PUD received a new license in 2008 for continued operation of the Priest Rapids Hydroelectric Project, located on the mid-Columbia River in central Washington State. As a part of their relicensing agreement, Grant PUD was required to implement a number of substantial capital improvements to enhance recreation access and quality (see the *2015 Recreation Site and Facility Inventory* conducted by Grant PUD for details). Most of the capital improvements were completed between 2011 and 2015. Use levels at these sites may have changed substantially from the past and may change substantially in the future. Likewise, many of the capital improvements were implemented to enhance recreation facilities at the Project. All of these changes directly influence the recreation capacity of the Project and its individual recreation sites.

As part of its FERC license, Grant PUD is required to revise and file an update to the Priest Rapids Recreation Resource Management Plan (RRMP) in 2016. This report is one of several empirical sources of data to inform the revised RRMP. The approach applied in developing the current report has been updated from the *2000 Recreation Capacity Analysis* (EDAW, 1999) to reflect substantial changes in methods for assessing recreation capacity. Specifically, it applies an indicator and standard-based approach that is at the heart of contemporary and well-accepted carrying capacity frameworks. Finally, the results provide a means to meet the capacity reporting requirements associated with FERC Form 80, due in spring 2016.

B. STUDY GOALS

Several goals have been identified for this study, all of which focus on recreation use and capacity at facilities and sites in the study area:

- Assess the recreational carrying capacity of the study area for each of the amenity types defined by FERC and for boating on the Priest Rapids and Wanapum Reservoirs.
- Assess the overall recreational capacity of FERC-defined amenities by considering three different capacity dimensions – resources, facilities/management, and experiences – using empirical data collected in a rigorous, science-based manner.

- Identify which of the three capacity dimensions is the limiting factor for overall recreation carrying capacity.
- Summarize this analysis by determining to what degree the identifying recreation amenities and reservoirs have reached their overall recreational carrying capacity.

C. STUDY AREA

The Project is located on the mid-Columbia River in central Washington and includes Wanapum and Priest Rapids Reservoirs (see Figure C.1). The lower-most portion of the Project is the free-flowing Hanford Reach of the Columbia River. The study area includes all waters and adjacent lands within the FERC Project boundary. It includes all sites commonly utilized for public recreation, both developed and undeveloped. Two privately operated recreation areas – Crescent Bar Resort and Riverstone Resort – are included in the study area. The Project boundary includes 58 miles of the Columbia River from River Mile 395, approximately 2 miles downstream of the Priest Rapids Dam, upstream to a point approximately 0.5 mile downstream of Chelan County PUD’s Rock Island Dam at River Mile 453 (see Figure C.1).

Recreation Areas

Priest Rapids Project

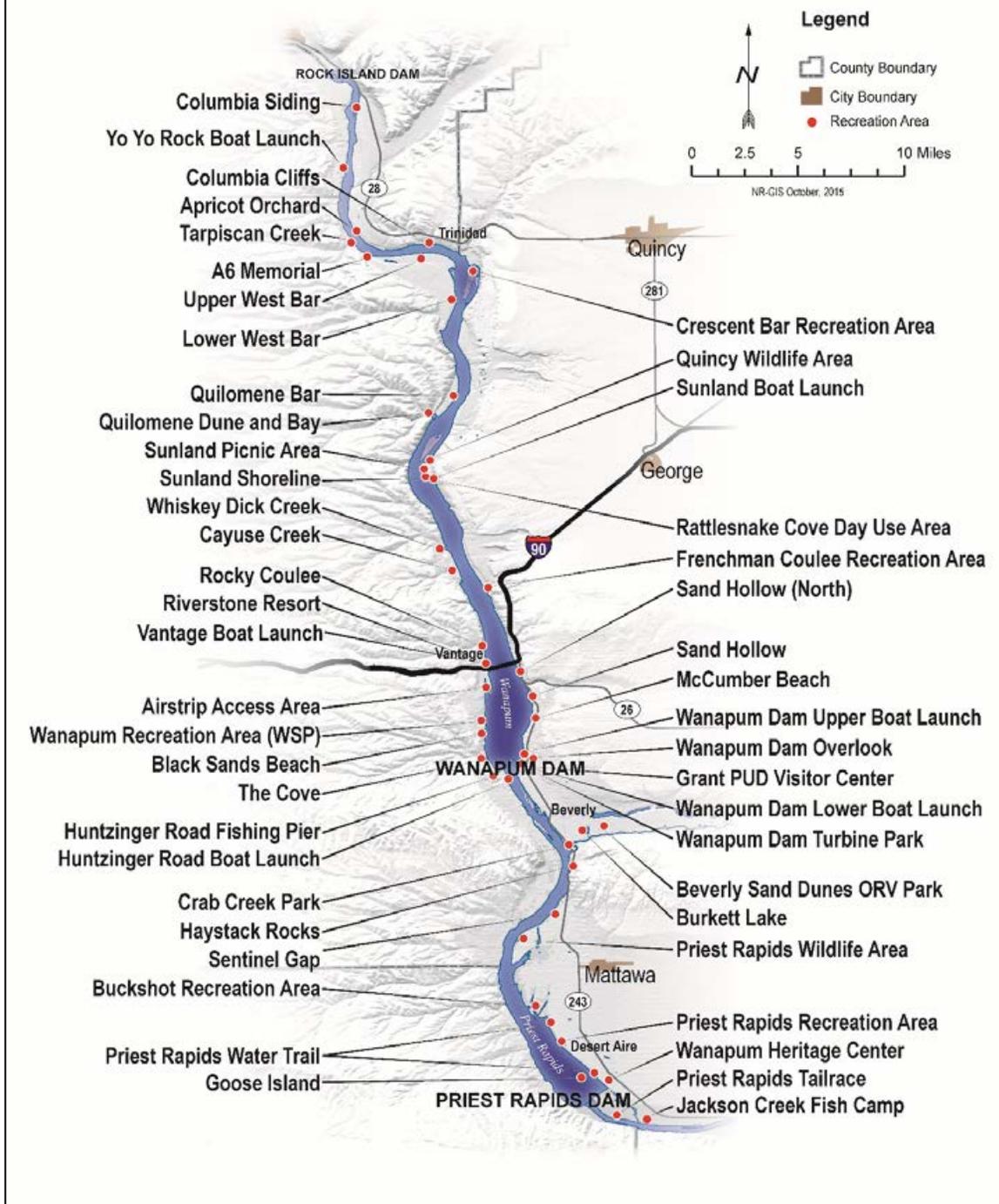


Figure C.1 Project map showing the recreation areas on Priest Rapids and Wanapum Reservoirs

The Wanapum development is characterized by a mix of features, which includes publicly accessible lands, steep topography, highway access, private ownership and other restricted access, agricultural activity, and park development. Wanapum Reservoir is approximately 38 miles long and runs through spectacular canyons with magnificent basalt cliffs and alluvial sand deposits. The reservoir is over 1 mile wide in some locations. Vantage is the largest town (unincorporated area) on the reservoir with a population of about 177 people. There are two residential/resort communities (much larger than Vantage) on the reservoir: Crescent Bar Resort and Sunland Estates.

Much of the undeveloped western shore of the reservoir, and portions of the eastern shoreline, are wildlife and waterfowl habitat lands managed by the Washington Department of Fish and Wildlife (WDFW). A vast majority of recreational access to and use of the reservoir is concentrated in the Interstate 90 (I-90) corridor/Vantage area and at Crescent Bar Resort and Sunland Estates. Recreation providers include Grant PUD, Washington State Parks and Recreation Commission, WDFW, Kittitas County, and private commercial interests such as the Riverstone Resort.

The downstream Priest Rapids development is characteristically different from the Wanapum development because of the shorter length of the reservoir (approximately 18 miles), lack of wide basins and sandy beaches open to public recreation use. It does not receive the same high volumes of recreational use as Wanapum Reservoir due largely to being farther away from concerts at The Gorge Amphitheater and I-90. A few miles below Wanapum Dam, the river passes through Sentinel Gap, a geologic landmark. Downstream of Sentinel Gap, the river valley opens up into wide slopes where private ownership and agricultural activity dominate the eastern shore. Highway 243 closely parallels the eastern shoreline in this area. Much of the western shoreline is part of the Yakima Training Center Military Reservation, which has highly restricted public access.

Public recreational access to Project lands and waters is widely available and dispersed. Since its construction in the late 1950s and early 1960s, the Project has provided the region with a variety of developed and dispersed recreation opportunities, including fishing, flat-water boating, camping, sightseeing, swimming, picnicking, waterskiing, personal watercraft (PWC) use, and other recreational activities. The sites and facilities at the Project have become an important centerpiece of the outdoor recreation opportunities in the central Washington region, attracting a substantial number of users. Like many other recreation facilities in the Pacific Northwest, recreation use is typically high during the summer peak season (Memorial Day to Labor Day) and is much lower during the remainder of the year. There are small, short-term increases in off-season recreational use associated with accessing Project lands and waters during various salmon runs and waterfowl hunting. As with most recreation sites, use is typically highest on weekends, and peaks on weekends associated with Memorial Day, Labor Day, and the July 4th Independence Day holiday, as well as scheduled concerts at The Gorge Amphitheater.

Much has changed with recreation to the Project since the last use carrying capacity analysis was conducted in 2000 (EDAW, 1999). As mentioned in the introduction, substantial capital improvements, including the addition of new recreation sites and facilities, have occurred on the Project within recent years. Demand for recreation resources and activities in the region

has grown and changed significantly over the years. Likewise, recreation activities (both societally and regionally) have evolved or changed in substantial ways. New forms of recreation, such as geocaching, wakeboarding, wake surfing, and stand-up paddle boarding, have even emerged in the last decade.

Outside the study area is The Gorge Amphitheater located on a high bluff above Wanapum Reservoir northwest of George, Washington. The Gorge Amphitheater draws large crowds (up to 40,000 visitors) from the Central Puget Sound area and elsewhere in the Pacific Northwest. Nine concerts, over 17 days, were held in 2015. Extended weekend use in the study area related to these concerts was documented in the 1996 and 1999 surveys and was found to be substantial (DE&S, 1997; EDAW, 2000). Since 1999, the Gorge Amphitheater has increased on site primitive camping opportunities (see Figure C.2).



Figure C.2 Aerial photo of The Gorge Amphitheater taken on a Labor Day Concert weekend in 2011. The circle in the upper right is 1/2 mile diameter camping area.

The study area includes a total of 130 recreation amenities located at 49 recreation sites. Most amenities (77) are on Wanapum Reservoir, while 53 are on Priest Rapids Reservoir. These sites and their associated amenities are detailed in a 2015 *Recreation Site and Facility Inventory* (Grant PUD, 2015). To understand the overall recreation capacity of FERC-defined amenities and the Project, empirical data were collected in 2015, where applicable and feasible, at all FERC-defined amenities and for boating on each reservoir. At amenities where recreation use is low and dispersed (i.e., hunting areas, informal use areas, and access points), privately managed, or was otherwise deemed inappropriate for conducting a survey, the institutional knowledge of Grant PUD staff was relied upon to assess recreational capacity.

D. RECREATIONAL CARRYING CAPACITY REVIEWED

The Concept

The concept of carrying capacity in recreation areas has received much attention in the scientific literature (for details see Manning, 2007). As applied to recreation areas, carrying capacity may be generally defined as “the amount and type of use that can be accommodated in a particular area while sustaining desired biophysical resources and opportunities for quality visitor experiences” (Lime, Anderson, & Thompson, 2004). The current model of carrying capacity is comprised of managerial, environmental, and experiential dimensions (Manning, 2007). These three dimensions are themselves types of carrying capacities for an area. The overall recreational carrying capacity for a site or area is determined by identifying the most limiting of these dimensions.

The managerial dimension is often concerned with the use of facilities as compared to the level of use a recreation provider plans for and is capable of accommodating. For this reason, it is sometimes termed a ‘facility capacity.’ It includes considerations of the designed specifications of each site, safety, available staffing, maintenance needs/requirements, and other management concerns. Managerial capacity is often assessed by engineers and staff working for the organization providing the recreation opportunities or access. However, for most recreation sites, times or places typically exist when more people could use the site or its facilities, so other dimensions of recreation carrying capacity (i.e., resource or experiential) become the limiting factor and the focus of attention for capacity determinations.

The environmental (i.e., resource) dimension is primarily concerned with recreational use and its potential impacts to ecosystem components such as wildlife, waters, vegetation, and soils (Hammitt & Cole, 1998). However, historic and cultural resources such as archeological sites and scenic views might be included as a resource. Expert opinion and assessments are often used for developing resource-related standards. In the case of resource impacts, experts provide the most valid judgment about what types and amounts of impacts are of concern, and when a recreational carrying capacity has been reached.

The experiential dimension is concerned with providing recreational opportunities that are of high quality and that are appropriate for a site. Most research and work on the carrying capacity of parks and other recreation sites has focused on this dimension (Manning, 2007). A benefit of this is that visitor experiences inherently include some related consideration of resource and management conditions.

The *Recreation Site and Facility Inventory* (Grant PUD, 2015) serves as the basis for assessing the managerial and environmental dimensions of recreational carrying capacity. This inventory found no serious or frequent issues suggesting resource conditions are being substantially impacted by recreation. Also, the condition of facilities was generally found to be either like-new or in need of routine maintenance. Five exceptions to this were found where renovations were needed to facilities; three of these are currently in some stage of being addressed. Overall, the findings from this inventory suggest that environmental and managerial conditions are not limiting factors for the recreational carrying capacity of the Project. Experiential considerations are therefore the focus of the recreational carrying capacity assessment in the remainder of this report.

Frameworks and Approaches

Several contemporary planning and management frameworks aid in establishing carrying capacities for recreation areas. These frameworks include *Visitor Experience and Resource Protection* (VERP) (NPS, 1997) and *Limits of Acceptable Change* (LAC) (Stankey et al., 1985). VERP was developed to address the need of national parks for “identification of and implementation commitments for visitor carrying capacities for all areas of the unit” as mandated by the National Parks and Recreation Act of 1978 (P.L. 95-625). As the name suggests, this planning framework is aimed at maintaining the quality of the visitor experience and protecting natural and cultural resources in the face of increasing visitor use. Similarly, LAC was developed for use by the U.S. Forest Service to help set recreation carrying capacities and address growing recreation impacts in a documented, logical manner (Stankey et al., 1985). Both of these frameworks have, since their inception, been widely applied, tested, and accepted as a best practice for establishing recreation carrying capacities. Furthermore, by following these frameworks the decisions that recreation site managers make regarding carrying capacity are documented, empirically derived, publicly informed, science-based, thoughtful, deliberate, and defensible.

These frameworks share the same basic approach for determining recreational carrying capacity. They begin by directing managers to set objectives for desired resource and experiential conditions. These objectives then must be expressed quantitatively in the form of indicators and standards. Indicators are measurable, manageable variables that act as representations of desired conditions. Standards define the minimum acceptable condition of indicator variables. Next, the frameworks require that indicator variables be monitored. If monitoring suggests that standards are in danger of being violated, then a carrying capacity has been reached. According to these frameworks, a recreation carrying capacity has been reached when the condition of an indicator violates the standard set for that indicator.

Finally, if a carrying capacity has been reached then management action is required to ensure existing conditions are changed so that they do not violate standards. Management actions are context-specific but generally can include use limits, spatial or temporal redistribution of use, protection of the site from further impacts (e.g., site hardening), educating visitors in an attempt to reduce impacts, direct mitigation (e.g., picking up litter and replanting areas with impacted vegetation), or increasing the supply of recreation opportunities by building or redeveloping facilities.

To be most effective, indicators should meet several criteria. Two primary criteria are noted in the above definition of indicators: measurable and manageable. Indicators must be measurable to objectively determine their condition. Moreover, if indicators are outside the scope of managers' control then there may be little reason to focus on them in the context of management planning. Also, indicators should be significant to either recreation user and/or managers. Additional criteria for good indicators include being objective, specific, reliable, repeatable, related to visitor use, sensitive, efficient to measure, and integrative. All of these characteristics must be considered in combination with the context of application – specifically policy, political, resource, and managerial constraints – when choosing indicators. Ultimately, the weighing of these additional characteristics for the selection of a final list of indicators requires the informed judgment of recreation site managers.

Standards are a quantitative limit that may be used to determine what conditions are acceptable or unacceptable. Standards may be set by policy, law, facility design for safety and risk management, expert opinion, or normative research. Experiential carrying capacity assessments and the standards used for them have most often been based on normative theory and related empirical methods (Shelby & Heberlein, 1986; Vaske & Whittaker, 2004). Normative theory suggests that visitors may have shared beliefs about important aspects of their experiences, and standards for what constitutes acceptable or unacceptable conditions. These shared beliefs may be termed norms. Norms are typically identified by asking visitors to rate or identify acceptable conditions for a particular aspect of their experience. Photographs are often used to help visitors in their assessment of these conditions. The resulting norm may be used as a sound basis for experiential standards and carrying capacity assessments. Most research on experiential carrying capacity has focused on and supports the use of crowding-related aspects of a site visit – such as people at one time (PAOT) or the number of boats within view at one time.

In considering recreation capacity, it is important to note that capacity evaluations typically consider the peak use season. Recreation sites are often designed to accommodate use levels representative of typical peak use season and during the general times when visitors want to use these sites. Experiential standards and capacities are therefore based on a site's ability to accommodate this typical peak use demand. However, capacity determinations and recreation management (specifically facility development) should not be based solely on accommodating just a few of the highest use days of the year. For example, it is often not practical or possible to design and operate recreation sites for the extreme peaking of use during holidays. This is acknowledged by FERC on Form 80, in defining peak weekends (i.e., holidays) as times when capacity may typically be exceeded.

E. METHODS

This report assesses the experiential dimension of recreation capacity for the sites/amenities and each reservoir at the Project. ‘People at one time at recreation sites,’ ‘number of boats at one time,’ and ‘waiting times to launch a boat,’ serve as the indicators of focus for most amenities and for the reservoirs. Standards are derived based on the normative approach, which is described further below. Data used to analyze and assess the recreational carrying capacity at the Project were collected in a 2015 visitor survey. Survey data were collected based on recreation sites, since it was deemed impractical to survey users of individual amenities. These site-level data are then used as a basis for amenity-level capacity assessments presented later in this report. The methods for conducting this survey and the results of it are fully reported in the *Recreation Use Assessment Report* (Hallo et al., 2016). Appendix A shows the survey itself, and Appendix B shows all of the site-level photos referenced for use in the survey.

Following a normative approach to experiential standards, several questions were asked in the aforementioned survey about the use conditions that visitors found acceptable and the use conditions they typically saw while recreating. Specifically, these survey questions pertained to the number of boats seen on the reservoir (if they boated), the waiting time to launch a boat (if they boated), and the number of people encountered at the recreation site they were using when sampled. Photos of a boating area (presented in report Section F) and the recreation site (Appendix B) were presented with survey questions to help provide a basis for and more validity to respondents’ answers. Responses to the questions regarding acceptable conditions represent an experiential standard based on social norms. Because they represent empirical findings, these standards are presented in the results section of this report. By comparing the use conditions reported as typically seen to these standards, the experiential carrying capacity was assessed.

As mentioned, experiential carrying capacities are often based on perceptions of crowding, so determining capacities at low-use dispersed areas (i.e., access points, hunting areas, and informal use areas) is problematic. Likewise, capacity assessments should be based on empirical data, but in some places, either practicality or ownership may preclude collection of such data. For example, it was impractical to collect use data associated with hunting in this report because it occurs at a distinctly different time of year than other recreation activities. Also, the collection of use data at marinas, campgrounds, and the Crescent Bar golf course was not feasible because of the private ownership and/or operation of these facilities. In some cases, secondary data from the recreation provider was available for use, but this was often incomplete or difficult to interpret. In cases where collection of use data was not feasible or possible, an expert-based assessment represents the best available approach for capacity determinations. Grant PUD staff’s institutional knowledge is used to estimate the capacity of these amenities.

A recreational capacity assessment was conducted for all amenities on the Project and for boating on both the Priest Rapids and Wanapum Reservoirs. The list of amenities where capacity was considered is provided in the *Recreation Site and Facility Inventory* report (Grant PUD, 2015). The results reported in the following section used the best available data and science-based techniques.

F. RESULTS

Results of the carrying capacity analysis are presented for each amenity type on the Project, which is the unit of reporting for FERC Form 80. How the capacity was assessed at each amenity type and the basis of each assessment are also detailed. Where possible, these results are based on the 2015 visitor surveys described in the preceding section and detailed in the *Recreation Use Assessment Report* (Hallo et al., 2016), and any exceptions are noted and explained. All capacities refer to peak season use times of June through mid-September.

Boat Launch Areas

Seventeen boat launches are located on the Project. Waiting times (in minutes) to launch a boat and percentage of parking occupied on weekends were considered the two primary indicators for the carrying capacity of these amenities. For waiting times to launch a boat, survey respondents were asked several questions related to this indicator. Data were collected and analyzed at the reservoir and Project level for boat launches. The results associated with questions related to boat launch waiting times are shown in Tables F.1 through F.3.

Table F.1 Response to the question “Did you have to wait to use a boat launch today?”

	Yes	No	N
Priest Rapids Reservoir	3.2%	96.8%	31
Wanapum Reservoir	17.6%	82.4%	216
Entire Project	15.8%	84.2%	247

Table F.2 Responses to the question “If you waited, how long did you wait to use a boat launch today?”

	Wait Time (in minutes)						Mean	SD	Min	Max	N
	1	5	10	15	16	20					
Priest Rapids Reservoir	-	-	50.0%	50.0%	-	-	12.5	3.5	10	15	2
Wanapum Reservoir	2.6%	36.8%	47.4%	2.6%	2.6%	7.9%	6.8	5.5	0	20	38
Entire Project	2.5%	35.0%	47.5%	5.0%	2.5%	7.5%	6.7	7.8	1	20	40

Note: Mean waiting times for all people who reported launching a boat was 1.4 minutes. This accounts for the large percentage of people who reported not having to wait to launch a boat.

Table F.3 Responses to the question “How long of a wait to launch your boat is acceptable to you?”

	Acceptable waiting times (in minutes)							Mean	SD	Min	Max	N
	0	1-5	6-10	11-15	16-20	21-25	>25					
Priest Rapids Reservoir	22.2%	33.3%	11.1%	27.8%	-	-	5.6%	9.3	10.7	0	45	18
Wanapum Reservoir	12.4%	20.7%	33.7%	20.1%	7.1%	0.6%	5.3%	11.4	12.5	0	120	169
Entire Project	13.4%	21.9%	31.6%	20.9%	6.4%	.5%	5.3%	11.2	12.3	0	120	187

Responses to the visitor survey showed that, on average, visitors felt waiting 11.2 minutes to launch a boat was acceptable. This value represents an experiential standard for boat launch use. Boat launch users reported having to wait 1.4 minutes, on average, to launch their boat. By comparing the conditions reported to this standard, it can be suggested that **boat launch amenities on the Project are, on average, utilized at 12.5% of their capacity based on wait times to launch a boat.**

The percentage of parking occupied on weekends at boat launches was the second indicator considered. Field cameras were used to collect photo-based data on the number of vehicles and boat trailers in boat launch parking areas (Hallo et al., 2016). These data were then compared to the number of available parking spots in that area to determine, on average, what percentage of parking spots were occupied at boat launches (Table F.4). It should be noted that only 15 of the boat launch areas are considered. This is because no parking is associated with The Cove boat/hand launch or the Crescent Bar On-Island boat launch (Grant PUD, 2015).

It was necessary to make two adjustments to improve the accuracy of parking capacity utilization estimates based on vehicle/trailer photo-based count data. First, an adjustment was needed to account for the number of vehicles and trailers that generally occupy one parking spot; a parking spot could be occupied by a vehicle, a trailer, or in many cases both a vehicle and a trailer. This was done by taking a subsample of photos and examining them in detail to determine an adjustment factor to apply to the counts from the field cameras. This adjustment value was site specific, but it ranged from 1.09 at Frenchman Coulee to 1.92 at Priest Rapids Recreation Area (PRRA). These values suggest that most parking spots at Frenchman Coulee are occupied by a single vehicle or trailer, while at PRRA most parking spots are occupied by a vehicle and a trailer.

Second, an adjustment to the total number of parking spots at a few boat launches was needed. At a few sites the field cameras could not capture the entire boat launch parking area (e.g., Wanapum Recreation Area Boat Launch), or counts of vehicles and trailers could be not accurately conducted on the field camera photos because some of the parking areas were so distant (e.g., Crescent Bar Off-Island Boat Launch). At these sites the number of

parking spots available was adjusted to correspond to the field camera viewshed. At all other boat launch areas the total number of parking spots listed in the *Recreation Site and Facility Inventory* report (Grant PUD, 2015), or otherwise provided by Grant PUD staff, was used.

Table F.4 Percentage of boat launch parking occupied on weekends

	Average non-Peak Weekend Parking Capacity Utilization
Buckshot Boat Launch	1.0%
Crescent Bar Off-Island Boat Launch	76.3%
Frenchman Coulee Boat Launch	66.5%
Huntzinger Boat Launch	12.7%
Priest Rapids Recreation Area – consisting of four boat launches	23.2%
Sunland Boat Launch	37.8%
Vantage Boat Launch	75.2%
Wanapum Lower Boat Launch	5.1%
Wanapum Recreation Area Boat Launch (Ginkgo Petrified Forest State Park)	27.3%
Wanapum Upper Boat Launch	24.7%
Yo Yo Rock Boat Launch	16.2%
Total Average	33.3%

Based on the results in Table F.4, it can be suggested that **boat launch amenities on the Project are, on average, utilized at 33.3% of their capacity based on the percentage of parking occupied on weekends.** Since this capacity utilization is higher than the one reported for waiting times above, it is likely the limiting factor in recreational use and capacity determinations. **It is therefore recommended that capacity based on parking occupancy be used in FERC Form 80 reporting.**

Access Areas

Twelve access areas are located on the Project. These are very low-use-level sites and are characterized by dispersed spatial and temporal use patterns. Data on use levels at these sites were collected and reported in the Recreation Use Assessment Report (Hallo et al., 2016). However, it was not practical or possible to collect survey data for these access areas because of their low use levels. Instead, capacity estimates are most accurately determined based on Grant PUD institutional knowledge. Based on this knowledge, the aforementioned use level data, and the general sensitivity of these areas from both environmental and cultural perspectives, these informal use areas are utilized, on average, at 50% of their capacity.

Informal Use Areas

Nine informal use areas are located on the Project. Eight of these are very low-use-level sites and are characterized by dispersed spatial and temporal use patterns. Data on use levels at these sites were collected and reported in the Recreation Use Assessment Report (Hallo et al., 2016). However, it was not practical or possible to collect survey data for these informal use areas because of their low use levels. Instead, capacity estimates are most accurately determined based on Grant PUD institutional knowledge. Based on this knowledge and the aforementioned use level data these informal use areas are utilized, on average, at 50% of their capacity. This capacity utilization reflects the institutional knowledge and judgment that these informal use areas are both environmentally and culturally sensitive to impacts from recreation, even at the current low levels of use.

At the Quilomene Dune and Bay informal use area, the amount of use is much higher and this area is much more resistant to recreational impacts. This suggests that the visitor experience at this site should be the predominate focus of carrying capacity. Therefore, a survey was administered there to measure both a standard for people at one time at this site and the use current conditions. Survey results there showed that, on average, visitors felt that 637.0 people at one time was acceptable, yet they typically experienced 266.9 people at one time at the site. This suggest that use at Quilomene Dune and Bay is at 41.9% of its capacity.

The site-level capacity utilizations indicate that **informal use areas on the Project are currently utilized, on average, at 49.1% of their capacity.**

Hunting Areas

Ten hunting areas are located on the Project. All of these are characterized by very low use levels and dispersed spatial and temporal use patterns. Also, use occurs at a distinctly different time of year (e.g., the fall season) than most other recreation. Because of this, it was not practical or possible to collect data for these hunting areas. Instead, capacity estimates are best (i.e., most accurately) determined based on Grant PUD institutional knowledge. In applying this, Grant PUD staff considered that hunters, including the waterfowl hunters who are frequent of these areas, typically desire a relatively greater amount of space than other recreation user types. This space is needed from both experience (i.e., seeing/harvesting game) and safety perspectives. Also, the satisfaction of hunters was thought to likely decline if use were to increase three-fold from current levels. Based on this, **hunting areas are utilized, on average, at 33% of their capacity.**

Overlook Vistas

Four overlook vistas are located on the Project. The number of people at one time (PAOT) was considered the primary indicator for the carrying capacity of these amenities. A survey was administered at these sites to measure both a standard for PAOT at each site and the current use conditions. The results associated with questions related to PAOT at overlook vista sites are shown in the Table F.5. When considered together, it suggests that **overlook vista sites are utilized, on average, at 19.8 % of their capacity.**

Table F.5 Capacity assessment for overlook vistas.

	Standard for Acceptable PAOT	Current Conditions for PAOT	Capacity Utilization
Burkett Lake Recreation Area	5.7	2.3	40.4%
Wanapum Dam Overlook	37.3	5.4	14.5%
Wanapum Turbine Park	41.4	1.9	4.6%
Entire Project	-	-	19.8%

Picnic Areas

Fourteen picnic areas are located on the Project. The number of people at one time (PAOT) was considered the primary indicator for the carrying capacity of these amenities. A survey was administered at these sites to measure both a standard for PAOT at each site and the current use conditions. The results associated with questions related to PAOT at picnic area sites are shown in the Table F.6. When considered together, it suggests that **picnic area sites are utilized, on average, at 29.5% of their capacity.**

Table F.6 Capacity assessment for picnic areas.

	Standard for Acceptable PAOT	Current Conditions for PAOT	Capacity Utilization
Crescent Bar Recreation Area (CBRA) On-Island	128.2	82.4	64.3%
Frenchman Coulee Recreation Area	51.4	6.2	12.1%
Priest Rapids Recreation Area (PRRA)	41.3	11.4	27.6%
PRRA (North Picnic Area)	41.3	11.4	27.6%
Rattlesnake Cove	55.2	16.2	29.3%
Rocky Coulee	35.4	4.8	13.6%
Sand Hollow	59.8	31.5	52.7%
Sand Hollow	59.8	31.5	52.7%
Sunland Estates Park	98.3	18.9	19.2%

continued.../

	Standard for Acceptable PAOT	Current Conditions for PAOT	Capacity Utilization
The Cove	75.8	1.5	2.0%
Vantage Boat Launch	73.4	18	24.5%
Wanapum Dam Overlook	37.3	5.4	14.5%
Wanapum Recreation Area (Ginkgo Petrified Forest State Park)	116.3	52.3	45.0%
Wanapum Turbine Park	41.4	1.9	4.6%
Entire Project	-	-	27.8%

Reservoir Fishing Platform

The only reservoir fishing amenity located on the Project is the Huntzinger Fishing Pier. The number of people at one time (PAOT) was considered the primary indicator for the carrying capacity of this site. A survey was administered there to measure both a standard for PAOT and the current use conditions. Survey results showed that, on average, visitors felt that 5.7 people at one time was acceptable, yet they typically experienced 2.0 people at one time at the site. This suggests that Huntzinger Fishing Pier, and the **reservoir fishing platforms on the project are utilized, on average, at 35.1% of their capacity.**

Tailwater Fishing Access

One tailwater fishing access is located on the Project, the Jackson Creek Fish Camp. The number of people at one time (PAOT) was considered the primary indicator for the carrying capacity of this site. A survey was administered there to measure both a standard for PAOT and the current use conditions. Survey results there showed that, on average, visitors felt that 14.7 people at one time was acceptable, yet they typically experienced 1.0 people at one time at the site. This suggests that Jackson Creek Fish Camp, and **tailwater fishing access sites on the project are utilized, on average, at 6.8% of their capacity.**

Trails

Three designated trails are located on the Project. The number of people at one time (PAOT) was considered the primary indicator for the carrying capacity of these amenities. Trail encounters was not used as an indicator because survey data, as previously mentioned, was collected at the site level and used as a proxy for amenity-level analyses. A survey was administered at the three trail sites to measure both a standard for PAOT at each site and the current use conditions. Results associated with questions related to PAOT at trail sites are shown in the Table F.7. These results are used to calculate capacity utilization of trails at both Frenchman Coulee and PRRA. However, a calculated capacity utilization of 40.4% from survey results at Burkett Lake Recreation Area seems suspect, where only six (6)

people total were counted during the 2015 season (Hallo, et al. 2016). For this trail the report's PI (Dr. Jeffrey Hallo) opted, with Grant PUD input, to adjust the capacity utilization to 10% in the table below based on empirical use counts. When considered together, it suggests that **trail sites are utilized, on average, at 16.6% of their capacity.**

Table F.7 Capacity assessment for trail areas.

	Standard for Acceptable PAOT	Current Conditions for PAOT	Capacity Utilization
Burkett Lake Recreation Area	5.7	2.3	10.0%*
Frenchman Coulee Recreation Area	51.4	6.2	12.1%
PRRA	41.3	11.4	27.6%
Entire Project	-	-	16.6%

*Adjusted

Active Recreation Areas

Two active recreation areas are located on the Project, both within the Crescent Bar Recreation Area. The number of people at one time (PAOT) was considered the primary indicator for the carrying capacity at one of these, while playable rounds of golf played was the indicator at the other. For the former, a survey was administered to measure both a standard for PAOT and the current use conditions. For the latter, two Professional Golf Association faculty at Clemson University estimated what percent of potential playable rounds of golf were actually played, based on secondary data provided by the staff at the golf course. These secondary data reported that 3,299 rounds of golf (9-holes) were played in August and September 2015. The results associated these active recreation areas are shown in the Table F.8. When considered together, it suggests that **active recreation areas are utilized, on average, at 49.7% of their capacity.**

Table F.8 Capacity assessment for active recreation areas.

	Standard for Acceptable PAOT	Current Conditions for PAOT	Capacity Utilization
CBRA On-Island	128.2	82.4	64.3%
CBRA On-Island (Golf Course)	-	-	35.0%
Entire Project	-	-	49.7%

Campgrounds and Campsites

Five campgrounds with a total of 211 campsites are located in the Project. The number of campsites occupied on weekends was considered the primary indicator for the carrying capacity of these campgrounds and campsites. Reservation records were used to determine the number of weekend nights that campsites were occupied during peak season, June through mid-September (Table F.9). At PRRA and Sand Hollow this number of reserved nights was increased by 25% to account for ‘drop-in’ (i.e., unreserved) camping. To determine capacity utilization the number of weekend nights that campsites were occupied was compared to the total number of weekend nights available for the campsites during peak season. At Jackson Creek Fish Camp and Rocky Coulee limited records of ‘drop-in’ camping were used to estimate the capacity utilization. The results associated with these campgrounds and campsites are shown in Table F.9. When considered together, it suggests that **campgrounds and campsites are utilized, on average, at 33.3% of their capacity.**

Table F.9 Capacity assessment for campgrounds and campsites.

	Total Number of Weekend Nights Available	Total Number of Weekend Nights Occupied	Capacity Utilization
CBRA Off-Is.	1,770	1391	78.6%
PRRA	392	216	55.1%
Sand Hollow	1,120	198	17.7%
Jackson Creek Fish Camp	-	-	5.0%
Rocky Coulee	-	-	10.0%
<i>Wanapum Recreation Area (Ginkgo Petrified Forest State Park)</i>	1,700	1,465	86.2%
Entire Project	-	-	33.3%*

*The campground and the 50 campsites at Wanapum Recreation Area (Ginkgo Petrified Forest State Park) was excluded from this calculation because it technically lies outside the Priest Rapids Project even though large portions of the picnic area and boat launch, and all of the swim area are within the Project. The campground was utilized on average 86.2% in 2015. Since the visitors fluidly use the park, which influences the amount of recreational use within the Priest Rapids Project, it should be noted that when the utilization of the campground is included in the Project-level calculation for campgrounds, they are utilized, on average 42.1% of their capacity.

Dispersed Camping Areas

Three dispersed camping areas are located on the Project. Since no established campsites exist there are no reservation records available, the number of people at one time (PAOT) was considered the primary indicator of carrying capacity. A survey was administered at these sites to measure both a standard for PAOT at each site and the current use conditions. Results associated with questions related to PAOT at dispersed camping areas are shown in the Table F.10. These results are used to calculate capacity utilization at both Buckshot Recreation Area and Beverly Sand Dunes ORV Park. However, a calculated capacity utilization of 41.9% from survey results at Quilomene Dune and Bay seems high, where only 91 people total were estimated to use the site during the 2015 season (Hallo et al., 2016). Also, this use estimate likely represents approximately 30 camping groups. For this area the report's PI opted, with Grant PUD staff input, to adjust the capacity utilization to 25% in the table below based on empirical use counts. When all results are considered together, it suggests that **dispersed camping area sites are utilized, on average, at 11.4% of their capacity.**

Table F.10 Capacity assessment for dispersed camping areas.

	Standard for Acceptable PAOT	Current Conditions for PAOT	Capacity Utilization
Beverly Sand Dunes ORV Park	51.2	4.3	8.4%
Buckshot Recreation Area	503	3	0.6%
Quilomene Dune and Bay	637.0	266.9	25.0%*
Entire Project	-	-	11.4%

*Adjusted

Marinas

Two marinas are located on the Project, both of which are privately operated. The number of weekend days that boat slips were occupied was considered the primary indicator for the carrying capacity of these marinas. Reservation records were used to determine the number of weekend nights that marina slips were occupied at the CBRA off-island marina. Data from the marina at Riverstone Resort were unavailable at the time of this report because it was not in operation. The results associated with marinas are shown in Table F.11. These results suggest that the CBRA off-island marina and **marinas on the Project are utilized, on average, at 66.2% of their capacity.**

Table F.11 Capacity assessment for marinas.

	Total Number of Weekend Days Available	Total Number of Weekend Days Occupied	Capacity Utilization
CBRA Off-Is.	600	397	66.2%
Riverstone Resort	Data unavailable – Not in operation in 2015		
Entire Project	-	-	66.2%

Visitor Centers

At the time of data collection for this report (Summer 2015), both the Wanapum Heritage Center and the Grant PUD Visitor Center were under construction and not open to the public. Both facilities opened in the fall/winter of 2015. Based on this, the visitor centers' capacity utilization during the time of reporting was 0.0%.

Swimming Areas

Four swimming areas are located on the Project. The number of people at one time (PAOT) was considered the primary indicator of carrying capacity at these sites. A survey was administered at these sites to measure both a standard for PAOT at each site and the current use conditions. The results associated with questions related to PAOT at swimming area sites is shown in Table F.12. When considered together, it suggests that **swimming area sites are utilized, on average, at 38.7% of their capacity.**

Table F.12 Capacity assessment for swimming areas.

	Standard for Acceptable PAOT	Current Conditions for PAOT	Capacity Utilization
PRRA	41.3	11.4	27.6%
Rattlesnake Cove	55.2	16.2	29.3%
Sand Hollow	59.8	31.5	52.7%
Wanapum Recreation Area (Ginkgo Petrified Forest State Park)	116.3	52.3	45.0%
Entire Project	-	-	38.7%

Other Project Amenities

One other amenity is located on the Project that is uncategorized by FERC: the Beverly Sand Dunes ORV Park. The number of people at one time (PAOT) was considered the primary indicator for the carrying capacity of this site. A survey was administered there to measure both a standard for PAOT and the current use conditions. Survey results there showed that, on average, visitors felt that 51.2 people at one time was acceptable, yet they typically experienced 4.3 people at one time at the site. This suggests that **Beverly Sand Dunes ORV Park, the only amenity listed under the ‘other’ category on FERC Form 80, is utilized, on average, at 8.4% of its capacity.**

Recreation Capacity of the Reservoirs

Standards exist for safe and effective boating capacities on reservoirs (Table F.13). Standards are expressed in *surface acres of water per boat*, which is the indicator for carrying capacity on a waterbody. Most of these standards are generalized, and many depend on the type of recreation being conducted and the actual context of application. These standards are intended for application to boats on the water actively engaged in recreation, not boats docked, moored, or beached on land.

Table F.13 Existing standards for boating capacities on reservoirs.

Source	Standard for Acres/Boat
National Recreation and Parks Association	4
Bureau of Outdoor Recreation	3-18
Arizona Outdoor Recreation Coordinating Commission	10-20
Wisconsin Comprehensive Plan	20
Louisiana Parks and Recreation Commission	20
Cascade Reservoir Resource Management Plan	25
Haas et al. (2011) – Bureau of Reclamation (for suburban and rural developed waters)	10-50
(for Rural Natural)	50-110
Warren and Rea (1989)	1.3-12

Sources if not marked above - NRPA (1981); EDAW (1981, 1990); BOR, USDI (1970); URDC (1977).

Other factors that might influence the application of the general standards shown above to the Project reservoirs include the following:

- Water depth is a factor in the study area due to shallow areas in some locations outside the main river channel, as well as periodic pool level fluctuation.
- The shoreline of Wanapum and Priest Rapids reservoirs is somewhat irregular, and the river/reservoir is relatively narrow in some locations. Thus, when compared to wide lake or reservoir basins, the study area cannot be efficiently utilized by as many boaters, particularly those with large acreage requirements (waterskiing and PWC use). In some areas, however, the river/reservoir is very wide (one mile, Segment D).
- Boating-related activities that require large amounts of space tend to be popular in the study area. For example, jet skiing and waterskiing are prevalent.

Based on the range of standards in Table F.13 and contextual factors described above, a boating capacity standard of between 15 and 20 surface water acres per boat was applied in the 2000 Recreation Capacity Analysis (EDAW, 2000). However, because published standards for boating capacity vary so widely and many are from sources that may be out of date (i.e., 30 or more years old) or from a different context, standards for boating capacity on the Project's reservoirs were developed. Specifically, visitor perceptions of safe boating conditions were used to develop a normative standard. This indicator is based on the same concepts as published standards, but the updated scientific methods used to develop it (described below) allows for public input and for the concepts to more accurately take into account the Project users, use types, and specific context where boating is occurring.

Surveys conducted at individual recreation sites in 2015 contained a section asking people who boated to evaluate six photos that showed a range of boat crowding on the lake (Figure F.1). Photos 1 through 6 depicted 27.4, 13.7, 9.1, 6.9, 4.6, and 3.4 surface acres of water per boat, respectively. Photos were developed to balance the type, placement (foreground versus background), and movement (under power versus not under power) of boats to help prevent bias from these factors.



P
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1

27.4 surface acres of water per boat



P
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2

13.7 surface acres of water per boat

Figure F.1 Study Photos of Boat Density



P
h
o
t
o
3

9.1 surface acres of water per boat



P
h
o
t
o
4

6.9 surface acres of water per boat

Figure F.1(con't) Study Photos of Boat Density



P
h
o
t
o
5

4.6 surface acres of water per boat



P
h
o
t
o
6

3.4 surface acres of water per boat

Figure F.1 (con't) Study Photos of Boat Density

Survey respondents were asked:

“We would like to know how many boats you think could use the segments of the reservoirs that you used today without you feeling too crowded and unsafe. To help judge this, we have a series of photos that show different numbers of boats. Please look at these photos.

Please rate each photo by indicating how acceptable you think it is based on the number of boats shown. A rating of -4 means the number of boats is “very unacceptable”, and a rating of +4 means the number of boats is “very acceptable”.

The evaluations of each photo, on average, are presented for each reservoir in Tables F.14 and F.15, and are graphed in the form of a social norm curve in Figures F.2 and F.3.

Table F.14 Norm curve data for Priest Rapids Reservoir

	Mean	SD	N
Photo 1	3.14	1.6	21
Photo 2	3.19	1.5	21
Photo 3	2.81	1.5	21
Photo 4	2.33	1.9	21
Photo 5	.81	2.5	21
Photo 6	.24	2.7	21

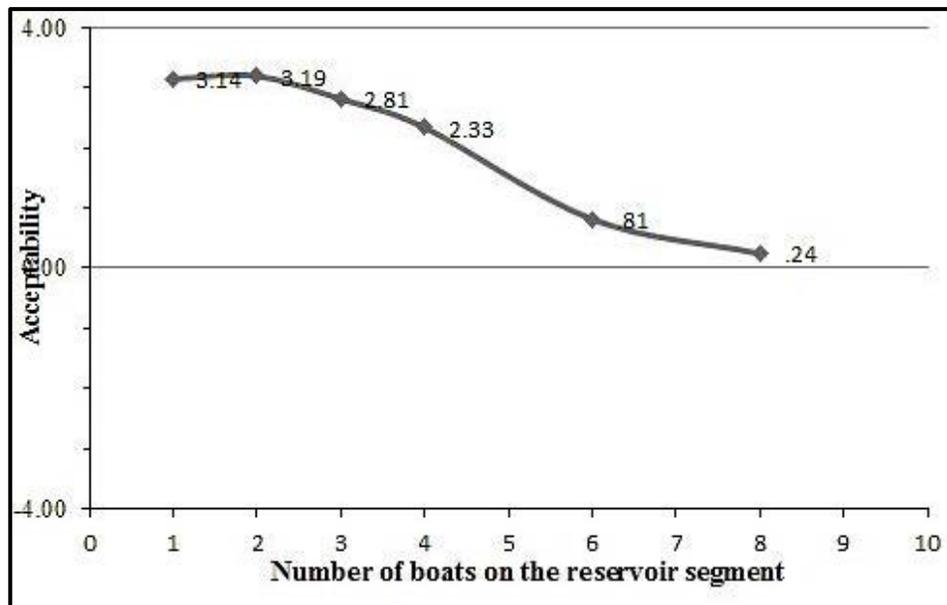


Figure F.2 Social norm curve for the acceptability of number of boats without feeling too crowded and unsafe at Priest Rapids Reservoir

Table F.15 Norm curve data for Wanapum Reservoir

	Mean	SD	N
Photo 1	3.3	1.7	169
Photo 2	3.3	1.6	167
Photo 3	3.2	1.6	165
Photo 4	2.9	1.8	163
Photo 5	2.3	2.1	170
Photo 6	1.9	2.5	169

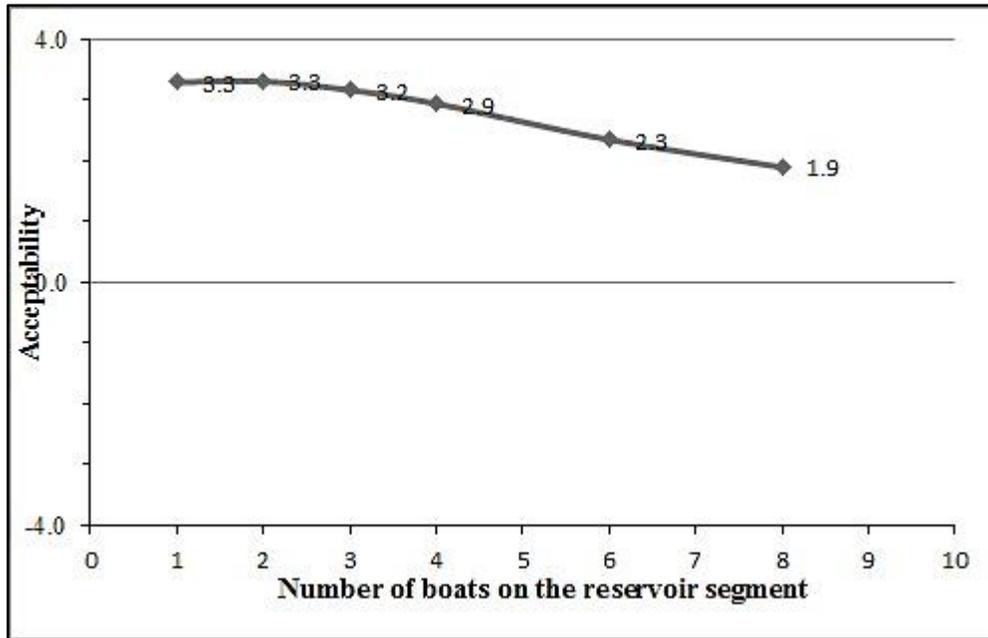


Figure F.3 Social norm curve for the acceptability of number of boats without feeling too crowded and unsafe at Wanapum Reservoir

In the same survey, boaters were asked, “Which photo shows the highest number of boats that should be allowed on the reservoir segments you used today? In other words, at what point should boats be restricted from using the reservoir because it is too crowded and unsafe? (If you think use should not be restricted, please indicate).” Results from this question are shown in Tables F.16 through F.17 below.

Table F.16 Highest number of boats to be allowed on the reservoir.

	Photo 1	Photo 2	Photo 3	Photo 4	Photo 5	Photo 6	Mean	SD
Priest Rapids Reservoir	12.5%	-	12.5%	37.5%	25.0%	12.5%	4.0	1.5
Wanapum Reservoir	1.8%	8.9%	8.9%	14.3%	25.0%	41.1%	4.8	1.4

Table F.17 Agreement that none of the photos show a high enough number of boats to restrict use

	Yes	No	N
Priest Rapids Reservoir	58.8%	41.2%	17
Wanapum Reservoir	68.2%	31.8%	154

These results above suggest that a boating capacity standard of 15 to 20 surface acres of water per boat, as previously applied to the Project, is unsupported by empirical data and too restrictive. A boating density of 3 acres of water per boat is, on average, acceptable to boaters of both the Priest Rapids and Wanapum Reservoirs. Also, 7 acres of water per boat was reported, on average, as the maximum boat density before use should be restricted because it is too crowded and unsafe. However, it should be noted that both of these potential standards for boating density (i.e., 3 and 7 acres per boat) are based on the most restrictive, conservative interpretation of the above results. Specifically, a majority of survey respondents felt that boating use should not be restricted even when boat densities are greater than 3 acres per boat, and users of Wanapum Reservoir also found such boat densities still acceptable. However, to protect the visitor experience for an overwhelming majority of boaters, a standard of 5 acres per boat is applied in the boating capacity determinations that follow.

Finally, boaters were asked in the survey “Which photo looks most like the number of boats you typically saw on the reservoir segments you used today?” This question provides an assessment of current boating use conditions (i.e., densities) based on the perception of recreational boaters of each reservoir. The value in assessing use conditions in this manner, as opposed to counts conducted by trained observers, is that it provides the most valid basis for comparison with crowding standards, which are also based on boaters’ perceptions.

Table F.18 Number of boats typically seen on the reservoir

	Photo 1	Photo 2	Photo 3	Photo 4	Photo 5	Photo 6	Mean	SD
Priest Rapids Reservoir	30.0%	30.0%	25.0%	5.0%	5.0%	5.0%	2.4	1.4
Wanapum Reservoir	13.1%	13.8%	15.4%	18.5%	11.5%	27.7%	3.9	1.8

Based on the survey results reported above, boaters typically experienced 11.9 and 7.1 acres per boat on the Priest Rapids and Wanapum Reservoirs, respectively. By comparing these with a standard of 5 acres per boat, it suggest that **the Priest Rapids and Wanapum Reservoirs are utilized for boating, on average, at 42.2 % and 70.4% of their capacity, respectively.** By combining these findings, it suggests that **the Project is being utilized for boating, on average, at 56.3% of its capacity.**

G. CONCLUSIONS AND RECOMMENDATIONS

Recreation use during the peak use season is well below its capacity at the Project. Recreation use at the Project utilizes between 5% and 66% of the recreation capacity at FERC-defined amenity types. Where site-level data were analyzed, the campgrounds at Crescent Bar (Off-Island) and Wanapum Recreation Area (Ginkgo Petrified Forest State Park) had the highest capacity utilization at 78.6% and 86.2%, respectively. Also, the boat launch areas at Vantage and Crescent Bar (Off-Island) were highly utilized at 75.2% and 76.3 % of their capacity, respectively. The Project's reservoirs, while not an amenity themselves, are below their recreational carrying capacity for boating. The Priest Rapids and Wanapum Reservoirs are utilized for boating, on average, at 42.2 % and 70.4% of their capacity during the peak use season.

These findings are based predominantly on the results of substantial data collected in 2015. The data collected in 2015 uses rigorous, science-based procedures that reflect the most widely applied approach to assessing recreational carrying capacity – an indicators and standards-based approach integrating norms. Specifically, Manning (2007) in his book *Parks and Carrying Capacity: Commons Without Tragedy* describe this approach to recreational carrying capacity, which is backed by over 30 years of scientific inquiry and applied in numerous recreational contexts across the U.S. This approach has also been integrated into the most current frameworks for recreational carrying capacity and visitor use planning, and it is being applied by the Principal Investigator to help develop the first formal Visitor Use Management Plan in the U.S. National Parks. At certain amenities like the visitor center, privately operated sites, and lower use sites, such as informal use areas, access areas, and hunting areas, the collection of empirical data was not practical or possible. Therefore, the institutional knowledge of Grant PUD staff is the most accurate way to determine the recreational carrying capacity of these sites.

As with all empirical data collection efforts, the current study and results may be influenced or limited by several factors. The primary factors related to this report's results include the timing of data collection, field conditions during data collection, and the number of surveys collected at each site. Survey sample sizes that most results are based upon (see Hallo et al., 2016) are a reflection of both surveying effort and the number of users at a site. For this report, surveying effort was approximately four days at each surveyed recreation site. This level of effort represents a substantial increase over the prior study conducted in 1999. However, it represents a pragmatic level of effort given the large number of recreation sites and amenities provided at the Project. The number of sites surveyed was increased substantially from the 1999 study. Further considerations of study limitations, including data collection timing and field conditions, are presented in the *Recreation Use Assessment Report* (Hallo et al., 2016).

Substantial improvements have occurred in recent years to the recreational amenities on the Project. From 2009 through 2015, Grant PUD modified and/or added facilities at 23 recreation sites across the Project. This involved investing \$29,923,140 in capital improvements, including extending or improving boat launches, installing toilets, enhancing picnic areas or adding new ones, adding or redesigning campsites, developing trails, increasing day use areas, and improving recreational access (B. Harshman, personal

communication, March 17, 2016). This amount does not include the costs of operating and maintaining these facilities (e.g., \$644,426 in 2015), or sizable planned spending for future recreation improvements at Crescent Bar. However, this amount does include costs associated with facility design and permitting. This intense and substantial level of investment in recreational facilities is much higher than at most publicly accessible recreation areas.

Recreation management approaches were improved at the same time. Periodic monitoring and cleanup was implemented at some key dispersed recreation sites. At some developed sites, management approaches were modified to educate users through signage, improved policies, or increased maintenance. These management changes served to further protect natural resources from recreation impacts and/or to promote higher quality recreational experiences. Given the recent and substantial improvements to recreation facilities and their management, it seems logical that recreation use is well-below its capacity on the Project.

Based on the results from the capacity analysis, further near-term monitoring of recreation capacity seems unwarranted. Additionally, modification of recreational amenities on the Project for the purpose of increasing capacity is not warranted. However, it should be noted that user responses in surveys conducted for the Recreation Use Assessment (Hallo et al., 2016) indicated some potential site or service improvements that would enhance visitor experiences, but these are not capacity-related. Specific issues and challenges related to capacity might emerge if use levels or types change, but it is not anticipated that the capacity of the Project's amenities will be exceeded by the time of the next FERC Form 80 reporting in 2021. We recommend continuing routine monitoring of recreation-related environmental impacts at dispersed sites, and seeking informal public input on recreation experiences and management at developed facilities to identify any emerging or site-specific capacity related issues.

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APPENDIX A
2015 Recreation User Survey

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Date: _____
Time of Day (24hr): _____
Site: _____

2015 Recreation User Survey

As a recreation provider along the Columbia River, Grant PUD is interested in hearing about your recreation visit to Priest Rapids or Wanapum Reservoirs. Your participation is important to us and will help us determine current and future recreation needs. **Thank you for your participation.**

1. How many people are in your vehicle today, including yourself? _____

2. What is your zip code? _____

3. Please indicate which of the following activities you are participating in on this trip (*mark all that apply*):

- | | | |
|--|--|--|
| <input type="checkbox"/> Swimming/visiting the beach | <input type="checkbox"/> Resting/relaxing | <input type="checkbox"/> Camping |
| <input type="checkbox"/> Boating | <input type="checkbox"/> Picnicking | <input type="checkbox"/> Waterskiing/tubing/wakeboarding |
| <input type="checkbox"/> Riding jetskis/waverunners | <input type="checkbox"/> Attending a concert | <input type="checkbox"/> Hiking |
| <input type="checkbox"/> Photography | <input type="checkbox"/> Fishing | <input type="checkbox"/> Canoeing/kayaking/paddle boarding |
| <input type="checkbox"/> Wildlife Viewing | <input type="checkbox"/> Visiting a dam | <input type="checkbox"/> Golf |
| <input type="checkbox"/> Other _____ | | |

4. Of the activities listed above, which is your **primary** activity on this trip? _____

5. What did you like the **most** about your visit to this recreation site?

6. What did you like the **least** about your visit to this recreation site?

7. How much time will you spend on your current trip?

_____ Number of hours **OR** _____ Number of days, if 24 hours or more

8. If your current trip extends into two or more days, what type of overnight accommodations did you use on your trip? (*mark all that apply*)

- Campground (RV or tent) → Location: _____
- Rented cabin/condo/home/motel/hotel → Location: _____
- Your own home/property
- Other (*Please specify*): _____

9. a. Did any of the following conditions adversely affect your trip? (mark all that apply)

- Strong winds
- Lack of shade from the sun
- Low water levels
- Lack of shelter from the weather
- Lack of ADA accessibility

b. If you checked any of the above conditions, describe how they affected your trip?

10. Grant PUD is interested in your opinion about the level of existing development and management at the reservoirs. Please indicate a response for any of the following facilities you used during your visit.

	Too high				About right				Too low	Don't know
Level of public recreation development	<input type="checkbox"/>	N/A								
Number of restrooms/toilets	<input type="checkbox"/>	N/A								
Quality of restrooms/toilets	<input type="checkbox"/>	N/A								
Number of picnic or day use areas	<input type="checkbox"/>	N/A								
Quality of picnic or day use areas	<input type="checkbox"/>	N/A								
Amount of shoreline available for use	<input type="checkbox"/>	N/A								
Number of boat launches	<input type="checkbox"/>	N/A								
Quality of boat launches	<input type="checkbox"/>	N/A								
Number of swim/sunbathing areas	<input type="checkbox"/>	N/A								
Quality of swim/sunbathing areas	<input type="checkbox"/>	N/A								
Number of hiking trails	<input type="checkbox"/>	N/A								
Quality of hiking trails	<input type="checkbox"/>	N/A								
Number of public docks	<input type="checkbox"/>	N/A								
Quality of public docks	<input type="checkbox"/>	N/A								
Number of campsites	<input type="checkbox"/>	N/A								
Quality of campsites	<input type="checkbox"/>	N/A								
Cost to use facilities	<input type="checkbox"/>	N/A								
Quality of on-line campground reservation system	<input type="checkbox"/>	N/A								

11. Please indicate the extent that the following issues were problems for you during your visit today. (mark one response for each item)

	No Problem							Big Problem		Don't Know or Not Applicable
	→									
Litter around the reservoir shoreline	<input type="checkbox"/>	N/A								
Adequate safety and security	<input type="checkbox"/>	N/A								
Adequate protection from the wind	<input type="checkbox"/>	N/A								
Adequate information/warnings provided	<input type="checkbox"/>	N/A								
Disruptive behavior by others	<input type="checkbox"/>	N/A								
Other (please specify): _____	<input type="checkbox"/>	N/A								

12. Help us understand crowding issues by answering the following questions. (mark one response for each item)

	Not at all Crowded		Slightly Crowded		Moderately Crowded		Extremely Crowded		Don't Know or Not Applicable	
How crowded did you feel today?	1	2	3	4	5	6	7	8	9	N/A
How crowded did you <u>expect</u> to feel today?	1	2	3	4	5	6	7	8	9	N/A

13 a. If you used the area shown in **photo A**, what is the maximum number of people you think could use the recreation site pictured at any one time without you feeling too crowded?

Number of people _____

b. What is the maximum number of people that you saw actually using the recreation site pictured at any one time during your visit today?

Number of people _____ OR Don't know or can't remember

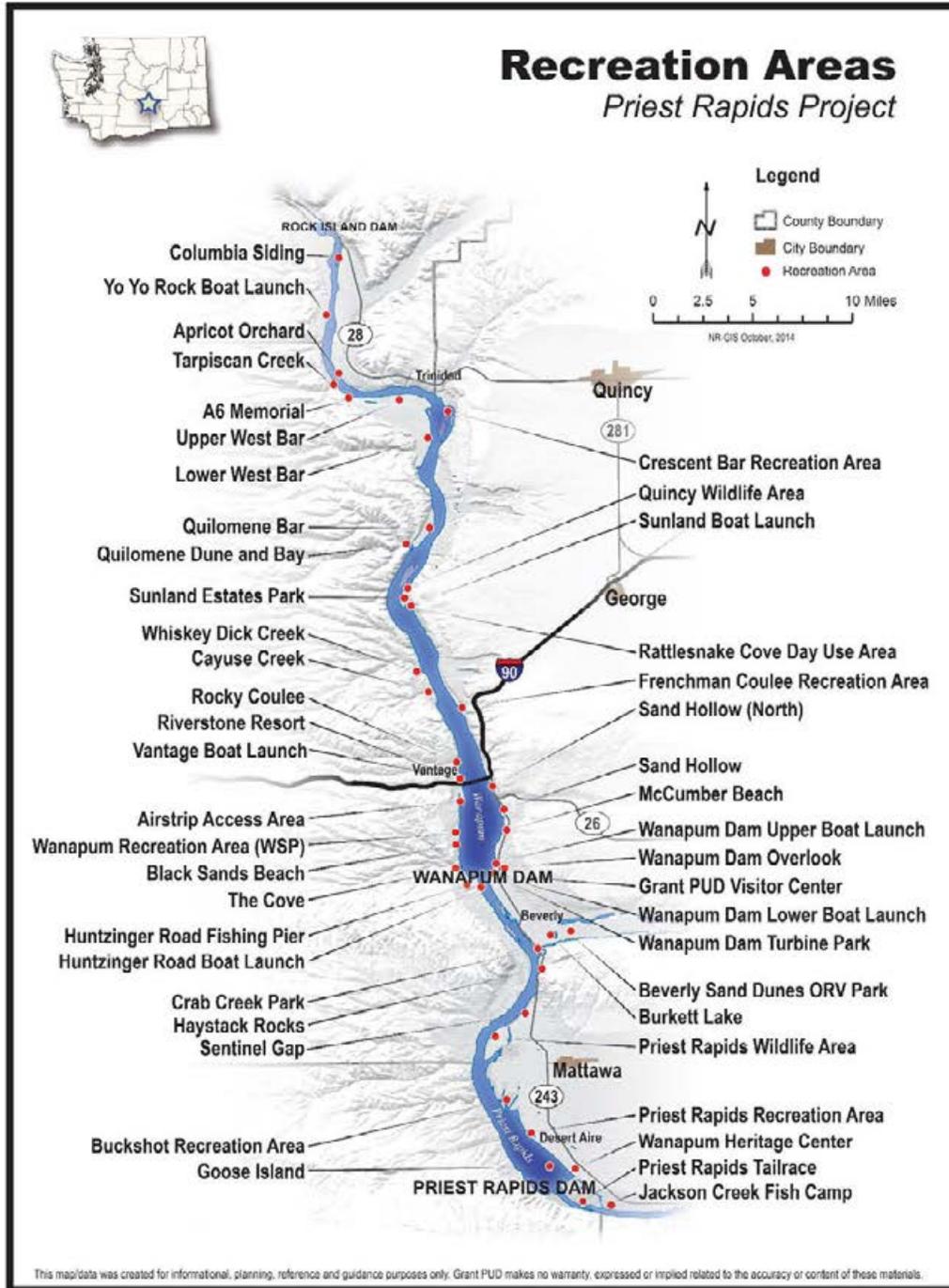
14. Please estimate how much money you and your party will spend TODAY while on this trip (e.g., fuel, lodging, restaurants, groceries, admissions, fees, outdoor gear, etc.).

\$ _____

15. If you could ask Grant PUD to change some things about the way they manage recreation at Wanapum and Priest Rapids reservoirs, what would you ask them to do?

Please complete the remaining questions only if you were on the water today (boating, fishing, etc.). If you were not on the water today, thank you for completing the survey!

16. What areas of the Priest Rapids/Wanapum reservoirs did you use today? Please mark a line on the map on the next page showing where you traveled on the water today, and place an 'X' at any locations where you stopped for more than 30 minutes



17. a. Did you have to wait to use a boat launch today?

Yes → How long did you wait? _____ minutes

No

b. How long of a wait to launch your boat is acceptable to you? _____ minutes

18. We would like to know how many boats you think could use the segments of the reservoirs that you used today without you feeling too crowded and unsafe. To help judge this, we have a series of photos that show different numbers of boats. Please look at these photos.

a. Please rate each photo by indicating how acceptable you think it is based on the number of boats shown. A rating of -4 means the number of boats is "very unacceptable", and a rating of +4 means the number of boats is "very acceptable". (Circle one number for each photograph.)

	Very Unacceptable					Very Acceptable			
Photo 1	-4	-3	-2	-1	0	+1	+2	+3	+4
Photo 2	-4	-3	-2	-1	0	+1	+2	+3	+4
Photo 3	-4	-3	-2	-1	0	+1	+2	+3	+4
Photo 4	-4	-3	-2	-1	0	+1	+2	+3	+4
Photo 5	-4	-3	-2	-1	0	+1	+2	+3	+4
Photo 6	-4	-3	-2	-1	0	+1	+2	+3	+4

b. Which photo shows the highest number of boats that should be allowed on the reservoir segments you used today? In other words, at what point should boats be restricted from using the reservoir because it is too crowded and unsafe? (If you think use should not be restricted, please indicate)

Photo number: _____

OR

None of the photos show a high enough number of boats to restrict use.

c. Which photo looks most like the number of boats you typically saw on the reservoir segments you used today?

Photo number: _____

We thank you for your time and input on this survey. If you have any further questions regarding this survey or the area in general, please feel free to contact Grant PUD at (509) 754-0500 or lands@grantpud.org.

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APPENDIX B

Study Photos Referenced in the Survey as “Photo A”

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Study Photos Referenced in the Survey as “Photo A”



Buckshot Recreation Area



Crescent Bar Marina



Crescent Bar Off-Island Boat Launch



Crescent Bar Off-Island Campground



Crescent Bar On-Island Picnic Area



Crescent Bar On-Island Boat Launch



Beverly ORV Park – Dispersed Camping



Burkett Lake Trail



Frenchman Coulee Boat Launch and Picnic Area



Huntzinger Fishing Pier



Huntzinger Boat Launch



Jackson Creek Fish Camp Campground



PRRA Trail



PRRA Swim Area



PRRA Boat Launch



PRRA North Picnic Area



PRRA Picnic Area



Rattlesnake Cove Swim Area and Picnic Area



Rocky Coulee Campground



Rocky Coulee Picnic Area



Sand Hollow Campground



Sand Hollow Picnic Area (North)



Sand Hollow Picnic Area (South)



Sand Hollow Swim Area



Sunland Picnic Area



Sunland Boat Launch



The Cove Picnic Area



Wanapum Turbine Park Picnic Area



Vantage Boat Launch



Wanapum Dam Overlook



Wanapum Dam Lower Boat Launch



Wanapum Dam Upper Boat Launch



Wanapum Recreation Area (WSP) Boat Launch



Wanapum Recreation Area (WSP) Picnic Area



Wanapum Recreation Area (WSP) Swim Area