Preliminary Report of the Sediment Study Conducted at Gold Ray Reservoir, Jackson County, Oregon

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Executive Summary

A SONAR Survey was completed of Gold Ray Reservoir to determine water depth and sediment thicknesses in the slack water areas that extend from the dam to ~300 feet above the confluence with Bear Creek. A calculated volume of ~400,000 cubic yards of sediment occurs in the currently inundated area of Gold Ray Reservoir. The amount of gravel in the reservoir is ~60,000 cubic yards (about 15 percent of the total sediment volume). The remaining amount of sediment is probably dominated by sand (about 75 percent of total sediment) with a smaller proportion of mud (about 10 percent of total sediment).

The gradient of the Rogue River from the top of the Gold Ray Dam to just above the slack water of Gold Ray Reservoir is currently 4.9 feet per mile. With the removal of Gold Ray Dam, the gradient would be 11.1 feet per mile. This is consistent with the current gradient of 11.8 feet per mile calculated for the Rogue River a few miles upstream from Gold Ray Reservoir. The gradient of the Rogue River below Gold Ray Dam is 14.2 feet per mile, reflecting an increase as the river moves from a riverbed of alluvium to bedrock.

Overall, the sediment volumes calculated above for Gold Ray Reservoir are less than expected, especially with annual sediment loads of ~200,000 cubic yards calculated for Savage Rapids Dam downstream of this locality. There are three possibilities that may explain the “lack” of sediment in the reservoir: (1) sediment was deposited by a prograding delta that filled in the inundated area of the floodplain upstream from Gold Ray Dam, (2) the gradient of the Rogue River in this stretch is less, and therefore sediment yields are less, and/or (3) the extraction of gravels upstream decreased the availability of sediments delivered into the reservoir. The amount of sediment estimated to have been deposited on this inundated floodplain may be as much as 1,780,000 cubic yards.

This study also reveals the presence of the original log crib dam built in 1904 just upstream of the concrete Gold Ray Dam erected in 1941. A sediment wedge occurs upstream of the submerged log crib dam and inhibits deposition of sediments between the two structures, with the exception of river left.

Finally, this study provides important insights into the distribution and volume of sediment in Gold Ray Reservoir. The results of this study will be used to site the location of several sediment cores that will be used to characterize the grain size, metal concentration, and pesticide content of sediments in Gold Ray Reservoir.
Introduction

A. History

Gold Ray Dam is a 35-ft high structure that spans 394.2 ft across the Rogue River at mile 125.7 in Jackson County, Oregon (Fig. 1). The crest of the dam is at 1146 ft above mean sea level with a hydraulic height of 23 feet. Ownership of the dam and surrounding property (29 acres) was transferred to Jackson County by the Pacific Power & Light Company for the development of a recreational park in November of 1972. Currently, the dam is a significant barrier to salmon and steelhead migration as well as a liability risk for the County. In order to better plan for the ultimate fate of Gold Ray Dam, this study has been initiated to provide details about the reservoir’s history and the sediments impounded by the dam.

Gold Ray Dam is one of the oldest structures on the Rogue River and has an interesting history. The construction of the log crib dam started in 1903 and the powerhouse began generating electricity on December 7, 1904. This electricity was used primarily used by mining camps in the area, but then extended to provide electricity to the City of Medford. The present concrete dam was completed in 1941 and erected just downstream of the original log crib dam. During the 1964 flood, a discharge of 131,000 cfs was recorded at the site; the spillway has a design capacity of 80,000 cfs. There was no observed damage to the dam during the 1964 flood event. Power generation ceased in 1971 and in November of 1972 the dam was donated to Jackson County.

B. Objectives

The objectives of this study are to determine the volume and aerial extent of sediment in Gold Ray Reservoir on the Rogue River. This information is essential in determining the transportable sediment should Jackson County ultimately decide to notch or eliminate the dam. More specifically, these data will help determine the location for the recovery of sediment cores that will be used to assess sediment quality in the next phase of the project.
Methods

A reconnaissance of the Gold Ray Reservoir was conducted on November 21, 2008 to assess the accessibility and to recover preliminary depth measurements in preparation for a SONAR study. A weight on the end of a 50 ft tape measure was used to collect preliminary depths, measured to the closest tenth of a ft. The location of these depth measurements were determined using a Trimble GeoExplorer Global Positioning System unit keyed to NAD 83 CONUS.

The SONAR study was conducted on November 22 to November 23, 2008. A portable EdgeTech # 3100 P sub-bottom profiling system with an EdgeTech SB 424 tow fish was used for collecting the data. A lap top was connected to the profiling system, providing a live data feed and the ability to digitally record the SONAR data for each transect. In addition, a Trimble GeoExplorer Global Positioning System unit keyed to NAD 83 CONUS was integrated to the profiling system, providing latitude and longitude data for the transects.

The SONAR system was operated from an inboard boat on loan from the Jackson County Sheriff’s Office. The tow fish was pulled behind the boat at about 5 ft below the water surface using a tow cable and back-up ropes. Two additional boats were provided by Jackson County District 4 Fire & Rescue as a safety precaution.

Three longitudinal and three cross-sectional transects were completed on the main channel of the Rogue River extending from approximately 300 ft above the dam to approximately 400 ft upstream of the confluence with Bear Creek. Two cross-sectional transects were pulled at 30 and 60 ft parallel to the dam. Finally, the tow fish was rigged to buoys and floated to within 5 ft of the dam, and then pulled upstream to provide transects perpendicular to the dam at Pier 2, Pier 3, & Pier 5. Refer to Figure 2 for the location of these transects.

Longitudinal transects were also conducted for Kelly Slough (River Right) and South Slough by pulling the tow fish 3 ft below the water line. The shallow tow was needed to avoid interference from river weed. In addition, the sloughs were much shallower, which necessitated the use of a smaller boat and a shallower placement of the tow fish. Again, refer to Figure 2.

![Figure 2. Location of longitudinal and cross-sectional transects used to collect SONAR data in the Gold Ray Reservoir](image)
The SONAR data was compiled and then hard copies printed for each of the longitudinal and cross-sectional transects. Water depth and sediment thickness were interpreted from these SONAR profiles. Sediment thicknesses in some profiles were extremely difficult to resolve because of the interference produced by the river weed and shallow water depths. Finally, the interpretation of sediment thicknesses by the SONAR data was limited because there are no sediment cores to calibrate the collected data. From the SONAR data, a water depth map (Plate 1) and isopach map of sediment (Plate 2) were drafted. From these maps, the volume of sediment was calculated for the reservoir.

Reconstructions of the geomorphology of the Rogue River prior to dam construction, extent of the inundated area of the reservoir, and progression of sediment filling of the reservoir, was determined by reviewing historical photographs. Additional information about deposition of sediments in the reservoir was determined by observing changes in geomorphology and reservoir surface area by comparing aerial photographs from August 1952, February 1965, July 1990, August 2000, and February 2003.

Finally, gradients of the Rogue River were calculated using the 7.5-Minute Sams Valley and Gold Hill USGS Topographic Maps (Scale: 1:24,000). The elevation of Gold Ray Dam, along with the hydraulic height, was used to calculate the current river gradient and the gradient if the dam were to be removed.

Results

Using the isopach map created from the SONAR data, a volume of ~400,000 cubic yards of sediment occurs in the currently inundated area of Gold Ray Reservoir (Plates 1 and 2). Gravel in the reservoir is most likely restricted to the upper reach just below the riffle and makes up a portion of the submerged bars just downstream of the confluence with Bear Creek. With this assumption, amount of gravel in the reservoir is 60,000 cubic yards (~15 percent of the total sediment volume). The remaining amount of sediment is probably dominated by sand (~75 percent of total sediment) with a smaller proportion of mud (~10 percent of total sediment). The volumes of sand versus mud is estimated based upon push cores recovered in Kelly Slough and on the bar on river left near the mouth of South Slough. Additionally, most of the mud would most likely be “flushed” during flooding events, as the gradient permits transport of clay and silt over the dam.

The gradient of the Rogue River from the top of the dam to just above the beginning of slack water upstream of Gold Ray Reservoir is currently 4.9 feet per mile. With the removal of Gold Ray Dam, the gradient would be 11.1 feet per mile. This is consistent with the current gradient of 11.8 feet per mile calculated for the Rogue River a few miles upstream from Gold Ray Reservoir. The gradient of the Rogue River below Gold Ray Dam is 14.2 feet per mile, reflecting an increase as the river moves from a riverbed of alluvium to bedrock.

Overall, the sediment volumes calculated above for Gold Ray Reservoir are somewhat surprising, especially with annual sediment loads of ~200,000 cubic yards calculated for Savage Rapids Dam downstream of this locality. There are several possibilities that may explain the “lack” of sediment in Gold Ray Reservoir.

First, historic photographs show that prior to the construction of Gold Ray Dam water flowing in a channel to the north of the vegetated floodplain (Fig. 3). The Rogue River may have been in the process of switching to this northern channel prior to the construction of the log crib dam. In addition, the older channel (present-day main channel of the Rogue River) probably...
established significant levees and were filled with sand and mud. With the construction of the log crib dam, the floodplain between these two channels became inundated (Fig. 4). The Rogue River continued to follow this newly avulsed channel and created a delta that filled in the low

Figure 4. Inundated area that resulted after the completion and filling of the reservoir from the construction of the log crib dam. Photograph ~1936.

lying areas of the floodplain between the two channels (Fig. 5). This area would have been further inundated after the construction of the concrete dam in 1941, providing additional space for sediments to accumulate. This hypothesis is further supported by the presence of distributary channels and sand bars observed on the August 1952 aerial photograph of this part of the reservoir. Using the additional surface area of the Gold Ray Reservoir present in August 1952,
this would account for an additional 160,000 cubic yards of sediment assuming a thickness of 3 ft of sediment (Fig. 6). Extrapolating for this entire area, the amount of sediment deposited may be close to ~890,000 cubic yards, again assuming 3 ft of sediment. If 6 feet of sediment were deposited, then the accumulation could be on the order of 1,780,000 cubic yards. Finally, if the Gold Ray Dam were removed, the sediment deposited in this area most likely would not be mobilized, and would result in an elevated terrace along the Rogue River.

Another possibility is a decreased sediment transport rate due to lower gradients of the Rogue River above the Gold Ray Reservoir. The gradient of the Rogue River above the reservoir is 11.8 feet per mile and 4.9 feet per mile from the dam to just upstream of the slack
water area of the reservoir in the Rogue River, compared to 14.2 feet per mile below Gold Ray Dam. This may result in decreased amounts of sediment transport into Gold Ray Reservoir, especially gravels. Therefore, this may result in decreased sediment yields in the stretch of the Rogue River above Gold Ray Dam.

A final explanation for the “lack” of sediment in the reservoir is the gravel extraction activities that are taking place above the dam. These activities may be decreasing the amount of available sediment that may be mobilized by the Rogue River.

**Submerged Log Crib Dam**

Another unexpected result of this study was the discovery that most, if not all, of the original log crib dam constructed in 1904 remains intact just above the concrete dam erected in 1941. This can be seen in the SONAR profiles that were collected perpendicular to the dam (Fig. 7) and on the February 2003 aerial photograph (Fig. 8). The presence of the submerged log crib dam is a significant historic and scientific discovery and would need to be addressed in a plan that proposes removal of Gold Ray Dam.

![Figure 7. SONAR Profile along the Pier 5 transect perpendicular from the concrete dam upstream showing the submerge log crib dam. Note the sediment wedge that is impounded by the log crib dam and the lack of sediment between the log crib dam and the concrete dam.](image)

![Figure 8. Aerial photograph with an inset photograph showing the location and presence of the 1904 log crib dam.](image)
Conclusions

A volume of 400,000 cubic yards of sediment occurs in the currently inundated area of Gold Ray Reservoir. Overall, the sediment volumes calculated above for Gold Ray Reservoir are less than expected, especially with annual sediment loads of ~200,000 cubic yards calculated for Savage Rapids Dam downstream of this locality. There are three possibilities that may explain the “lack” of sediment in the reservoir: (1) sediment was deposited by a prograding delta that filled in the inundated area of the floodplain upstream from Gold Ray Dam, (2) the gradient of the Rogue River in this stretch is less, and therefore sediment yields are less, and/or (3) the extraction of gravels upstream decreased the availability of sediments delivered into the reservoir. The amount of sediment estimated to have been deposited on this inundated floodplain may be as much as ~1,780,000 cubic yards.

The gradient of the Rogue River from the dam to just upstream of where the slack water begins in Gold Ray Reservoir is 4.9 feet per mile. With the removal of Gold Ray Dam, the gradient would be 11.1 feet per mile. This is consistent with the current gradient of 11.8 feet per mile calculated for the Rogue River a few miles upstream from Gold Ray Reservoir. The gradient of the Rogue River below Gold Ray Dam is 14.2 feet per mile, reflecting an increase as the river moves from a riverbed of alluvium to bedrock.

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References


Korblic, P., 1996, Gold Ray historic assessment and stabilization plan: unpublished request for funding from the Jackson County historical fund.