Exhibit K
Project Background Information

- Phase I Inspection Report – National Dam Safety Program (1979)
- ERS & Carlson Testing, Inc.: Sieve Analysis and Organic Matter Content (2019)
- Emergency Action Plan: Camp Kwoneesum Dam (2021)
- Parr Excellence: Risk Assessment (2021)
- Intertek PSI: Asbestos Containing Materials Survey (2022)
- Rain for Rent: Diversion & Drawdown Systems Proposals (2023)
- 2023 Summer Spillway Flow Report

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

CAMP KWONEESUM DAM
SKAMANIA COUNTY, WASHINGTON
WA-131

PREPARED FOR:

HONORABLE DIXY LEE RAY
GOVERNOR, STATE OF WASHINGTON

PORTLAND, OREGON, AREA COUNCIL
OF THE
CAMP FIRE GIRLS, INC.
(OWNER)

CH2M HILL
BELLEVUE, WASHINGTON

OCTOBER, 1979

SEATTLE DISTRICT
UNITED STATES
ARMY CORPS OF ENGINEERS

PHASE 1 INSPECTION REPORT

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EXECUTIVE SUMMARY

Under contract with the Seattle District Corps of Engineers and with representation from the State of Washington Department of Ecology and the Portland Area Council of Camp Fire Girls, Inc., CH2M HILL inspected Camp Kwoneesum Dam on 5 March 1979 under the authority of Public Law 92-367. The dam is located on Wildboy Creek in Skamania County, Washington, approximately 10 miles northeast of Camas.

This report was compiled from information obtained during an onsite inspection, review of construction plans, and analysis of available hydrologic information. Findings were compared with engineering criteria that are currently accepted by most private and public agencies engaged in dam design, construction, and operation.

FINDINGS AND EVALUATION

Camp Kwoneesum Dam impounds water for recreational use for a Camp Fire Girls camp located at the dam. The 55-foot-high dam impounds about 154 acre-feet of water at dam crest, elevation 952 feet National Geodetic Vertical Datum (NGVD), previously Mean Sea Level (MSL). On the basis of criteria in U.S. Army Corps of Engineers Recommended Guidelines for Safety Inspection of Dams (Ref. 1), the project is intermediate in size. The dam is located such that its failure would cause extensive property damage to a downstream fish hatchery and possible loss of life at the hatchery. Therefore, the project is classified as having a high (Category 1) downstream hazard potential. Inspection criteria (Ref. 1) recommend that an intermediate sized project with a high downstream hazard potential be capable of safely handling the probable maximum flood (PMF). The PMF is the flood expected from the most severe combination of meteorologic and hydrologic conditions that are reasonably possible in the region.

An estimate of the PMF was made for the 3-square-mile drainage basin. The PMF resulting from the 72-hour general storm has an estimated volume of 6,500 acre-feet and a peak flow of 3,800 c.f.s. The base flow during the PMF was assumed to be 120 c.f.s. The routing of the PMF was started with the reservoir at elevation 947.4 feet NGVD (0.4 feet above the spillway crest) which is equivalent to a discharge of 120 c.f.s. The routing of the general storm PMF indicates the dam is not overtopped during this flood. However, the ridge between the spillway discharge channel and the dam will be overtopped at spillway discharges less than one-half of maximum flow,

causing water to impinge on the face of the dam. This flow could remove material from the face of the dam (near toe) and lead to instability and possible failure of the embankment. Stability of the right spillway wall is unknown. Failure of this wall could result in erosion of the rockfill and could endanager the dam embankment.

Because of the constrained capacity of the spillway discharge channel, the project cannot safely handle the PMF and is unsafe. Conditions more critical than the general storm PMF may exist during the thunderstorm PMF. No procedures are available for evaluating the magnitude of the thunderstorm PMF in the area of Camp Kwoneesum Dam.

The spillway weir wall could fail as the riprap support along the downstream face of the weir wall is removed by large discharges. This failure will not endanger the dam or cause significant downstream damage, but may reduce the recreational value of the project.

The low level outlet is not operational; therefore, drawdown of the reservoir below the spillway crest for emergency or maintenance purposes is not possible.

Visual inspection of the rockfill embankment of the dam and the upper portion of the concrete membrane revealed no signs of deformation or settlement. Some small trees are growing on the dam crest. No seepage was noticed at the downstream abutment contacts or at the outlet works exit or upslope. The embankment stability adequately conforms to recommended guidelines.

Inspection of the earth-dike section of the dam revealed no distress or excessive erosion. The stability adequately conforms to recommended guidelines.

RECOMMENDATIONS

Develop, implement, and periodically test an emergency downstream warning plan to alert residents in the event of imminent dam failure. Make the low level outlet functional and maintain it to ensure full operational capability. Remove all trees from the embankment. Construct a log boom(s) in the reservoir to protect the spillway from floating debris. Perform a study to determine the stability of the right spillway retaining wall under all conditions and take action as required. Perform a study to confirm report findings, which show that the ridge between the spillway channel and the dam embankment is overtopped by spillway discharge less than the PMF. Modify the project as required to ensure that discharge channel capacity is sufficient to contain PMF flows.

Richard L. Foster
Professional Engineer

PERTINENT DATA

1. GENERAL

Federal I.D. No. Camp Kwoneesum	WA-131
Owner	Portland, Oregon Area of the Camp Fire Girls, Inc.
Purpose	Recreation
Location	Section 8, T2N, R5E, Willamette Meridian
County, State	Skamania, Washington
Watershed	Wildboy Creek, Tributary West Fork Washougal River
USGS Quadrangle	Bridal Veil
Downstream Hazard Potential	Category 1 (High)

2. RESERVOIR

Drainage Area	3.0 square miles
Surface Area (normal pool)	9.2 acres
Normal Storage (spillway crest elevation 947 feet NGVD)	102 acre-feet
Maximum Storage (dam crest elevation 952 feet NGVD)	154 acre-feet
Surcharge Storage	52 acre-feet

3. SPILLWAY

Location	Left Abutment
Type	Uncontrolled, concrete weir
Length	160 feet
Crest Elevation	947 feet NGVD
Capacity (Elevation 952 feet)	4,900 c.f.s.

OUTLET WORKS

Discharge Conduit	30-inch diameter corrugated galv. steel pipe
Length	150 feet
Gate	Upstream, 30-inch diameter sluice gate with control on dam crest
Capacity (Elevation 947)	90 c.f.s. (currently inoperable)

4. DAM

Type	Rolled Rock-fill with 8-inch reinforced concrete upstream face
Crest Elevation	952 feet NGVD
Crest Length	425 feet
Crest Width	15 feet
Hydraulic Height (crest to toe)	55 feet
Upstream Slope	1 V on 1.5 H
Downstream Slope	1 V on 1.4 H

Chapter 1

BACKGROUND

1.1 INTRODUCTION

1.1.1 Authority and Scope

This report summarizes the Phase I inspection and evaluation of Camp Kwoneesum Dam, owned by Camp Fire Girls, Inc., Portland, Oregon.

The National Dam Inspection Act, Public Law 92-367 dated 8 August 1972, authorized the Secretary of the Army, through the Corps of Engineers, to conduct safety inspections of non-Federal dams throughout the United States. Pursuant to that authority, the Chief of Engineers issued "Recommended Guidelines for Safety Inspection of Dams" in Appendix D, Volume 1 of the U.S. Army Corps of Engineers' Report to the United States Congress on "National Program of Inspection of Dams" in May 1975.

The recommended guidelines were prepared with the help of engineers and scientists highly experienced in dam safety from many Federal and state agencies, professional engineering organizations, and private engineering consulting firms. Consequently, the evaluation criteria presented in the guidelines represent the comprehensive consensus of the engineering community.

Where necessary, the guidelines recommend a two-phased study procedure for investigation and evaluation of existing dam conditions, so deficiencies and hazardous conditions can be readily identified and corrected. The Phase I study is:

(1) a limited investigation to assess the general safety condition of the dam.

(2) based upon an evaluation of the available data and a visual inspection.

(3) performed to determine if any needed emergency measures and/or if additional studies, investigations, and analyses are necessary or warranted.

(4) not intended to include extensive explorations and analyses, or to provide detailed alternative correction recommendations.

The Phase II investigation includes all additional studies necessary to evaluate the safety of the dam. Included in Phase II, as required, should be additional visual inspections, measurements, foundation exploration and testing, material testing, hydraulic and hydrologic analyses, and structural stability analyses.

The authority for the Corps of Engineers to participate in the inspection of non-federally owned dams is limited to Phase I investigations with the exception of situations of extreme emergency. In these cases, the Corps may proceed with Phase II studies, but only to the extent needed to answer serious questions relating to dam safety that cannot be answered otherwise. The two phases of investigations outlined above are intended only to evaluate project safety and do not encompass in scope the engineering required to perform design or corrective modification work. Recommendations contained in this report may be for either Phase II safety analyses or detailed study for corrective work.

The responsibility for implementation of these Phase I recommendations rests with the dam owner and the State of . It should be noted that nothing contained in the National Dam Inspection Act, nor any action or failure to act under this act, shall be construed (1) to create liability in the United States or its officers or employees for the recovery of damage caused by such action or failure to act or (2) to relieve an owner or operator of a dam of the legal duties, obligations, or liabilities incident to the ownership or operation of the dam.

1.1.2 Purpose

The purpose of the inspection and evaluation is to identify conditions that threaten public safety, so that they may be corrected in a timely manner by non-Federal interests.

1.1.3 Inspection

The findings and recommendations in this report were based on visual inspection of the project, a review of available drawings, State of Washington Department of Ecology records, and an interview with the owner representative. Inspection procedures and criteria were those established by the Recommended Guidelines for Safety Inspection of Dams (Ref. 1).

Personnel present during the March 5, 1979 inspection included:

Ted Mix, Civil Engineer, State of Washington, Department of Ecology

Gary Hanson, District Supervisor, State of Washington, Department of Ecology
Gerry Anderson, Civil/Hydraulics Engineer, State of Washington, Department of Ecology
Karen House, Owner Representative, Portland Area Council Camp Fire Girls, Inc.

CH2M HILL personnel who participated in the field inspection and contributed to this report are:

Miles C. Bubenik, Geotechnical Engineer, Team Leader
Loren Bottorff, Hydrologist/Hydraulics Engineer
Ed Shorey, Geologist
Norbert Volny, Structural Engineer
Jerry Jacksha, Geotechnical Engineer

1.2 DESCRIPTION OF PROJECT

1.2.1 General

Camp Kwoneesum Reservoir results from construction of a dam located on Wildboy Creek, a tributary of the West Fork Washougal River. The project is in Skamania County about 10 miles northeast of Camas, Washington (see Plate 1). The Federal identification number for the dam is WA-131, and it is listed as having high downstream hazard potential (Category 1). The dam is located such that its failure would cause extensive property damage to a fish hatchery 4 miles downstream and possible loss of life at the hatchery. Therefore, the project is classified as having a high (Category 1) downstream hazard potential.

The 55-foot-high, 425-foot-long dam forms a 9-acre lake that has about 102 acre-feet of storage at the spillway crest and is used for recreation. The drainage area is 3.0 square miles and the principle water supply to the lake is Wildboy Creek.

A concrete weir spillway is located on the left abutment and separates the main rockfill embankment on the right from an earth dike. An upstream gated, low-level outlet is located near the center of the rockfill embankment (see Plate 2).

1.2.2 Regional Geology and Seismicity

Bedrock in the vicinity of Camp Kwoneesum Dam and Reservoir is volcanic flow rock. The flows probably correlate with the Eocene to Miocene age Skamania Volcanics. Hydrothermally altered and folded basalt, basaltic andesite and associated pryoclastic rocks comprise the Skamania Volcanics in the area (Ref. 2).

According to the seismic zone map in the recommended guidelines, Camp Kwoneesum Dam is in Seismic Zone 2. The seismic probability of Zone 2 is one of potential for moderate damage, based on the known distribution of damaging earthquakes.

1.2.3 Site Geology

The dam spans a narrow canyon which has cut through flows of basalt or basaltic andesite. The flows have been folded and generally strike northeasterly with a southeast dip. Logs of three test borings and seven test pits located in the vicinity of the dam are shown on Plates 3 and 4. The locations of the borings and test pits are shown on Plate 5. The logs indicate that the bedrock beneath the dam is weathered, gray basalt and weathered, yellow volcanic flow breccia. The rock is jointed and locally vesicular. Plans indicate (Plate 5) overburden material, 1.5 feet to 9 feet thick, was removed prior to construction of the dam. The overburden consists of red brown, clayey to fine sandy silt with cobbles and boulders.

Along the right abutment, rockfill has been placed directly against flow rock along the wall of the canyon. The flows dip southeasterly toward the dam and appear massive with jointing perpendicular to the flow. There is no evidence of seepage along the abutment.

Bedrock relationships are similar along the left abutment. Here, the flows dip southeasterly away from the dam. Jointing is more apparent and varies from blocky, to platy, to hackly in character. There is no evidence of seepage along the abutment.

The spillway is routed around the left abutment of the rock fill portion of the dam. Spillway discharges are directed over a rock cliff and fall about 35 feet to a pool immediately downstream from the toe of the dam. A cavern, approximately 15 feet high, is located below the waterfall and was probably created by erosion of poorly consolidated interflow material or weathered flow breccia. This erosion does not require corrective action and future undercutting should not endanger the embankment. The flow rock above the cavern is about 20 feet thick. The attitude of the flow is irregular but generally strikes northeasterly and dips 20 degrees southeast. The flow displays blocky jointing typically 2 feet apart. The rock appears to be sound, despite the blocky character.

Approximately 5 to 10 percent of the rock on the downstream face of the dam appears to be highly-weathered hydrothermally altered volcanic rock in various stages of disintegration to silty material.

1.2.4 Design and Construction History

The Camp Kwoneesum project design was completed in 1964 by Stevens and Thompson, Inc., Seattle, Washington, with geotechnical input from Shannon and Wilson, Portland, Oregon. Construction began in 1964 and was completed in 1965. A representative of Stevens and Thompson, Inc. (now called STRAAM) in Portland, Oregon, stated that during construction, the partially completed rockfill embankment and concrete membrane were subjected to the 1964 flood flows. Following the flood, reshaping of the select quarry waste (Section 2.3.1) was required and construction continued. The project contractor is unknown.

Chapter 2

INSPECTION AND RECORDS EVALUATION

2.1 HYDRAULICS AND STRUCTURES

2.1.1 Spillway

The spillway for Camp Kwoneesum Dam is an uncontrolled structure founded in rock at the left abutment (Plates 5 and 6). The 160-foot-long weir (elevation 947 feet NGVD) is an 8-inch-thick concrete wall. Riprap makes up the 1 V on 3 H sloping downstream face of the weir. The upstream side of the weir wall has been backfilled to elevation 945 feet NGVD (2 feet below the top of the wall). The alignment of the weir is such that two 40-foot lengths are perpendicular to the ends of an 80-foot section. (see Photo 1). Flow over the weir wall enters a trapezoidal discharge channel having an invert elevation of 936 feet NGVD with 1 V on 3 H side slopes and 26-foot bottom width. A bridge, with 3 piers, crosses the discharge channel at the dam axis. At this point the side slopes of the discharge channel change to 1 V on 2 H providing a 34-foot bottom width. Approximately 36 feet downstream from the bridge, the channel makes a 30 degree bend toward the dam. A 3-foot-high wedge-shaped rock berm has been placed in the channel at the bend for flow control. Approximately 60 feet downstream of this bend, a 2-foot-high concrete weir (Plate 5) (approximate elevation 937 feet NGVD) crosses the discharge channel. About 20 feet downstream beyond this weir the spillway discharge drops vertically over a rock face for 35 feet to the pool at the toe of the dam (see Photo 2). A concrete lip at the brink springs the flow away from the rock face to discharge directly to the pool. Concrete has been placed along the right side of the discharge channel between the weir and the concrete lip to direct the flow.

There is no log boom in the reservoir. Some logs have passed the spillway crest and are resting in the discharge channel upstream from the bridge. The spillway capacity would be greatly reduced if logs become jammed at the bridge piers during a large flood. Two wooden floating decks were lodged at the spillway crest at the time of the inspection, making about 60 feet of the crest length non-effective for low heads. These decks could also become jammed at the bridge piers during a large flood. It appears that some of the riprap on the downstream side of the concrete wall forming the spillway crest has been displaced, but in general, the spillway appeared in good condition. More of the riprap

will be displaced, possibly removing support for the concrete weir wall, at discharges less than maximum spillway capacity. It is not likely that failure of the wall will endanger the dam or cause significant downstream damage. However, failure of the wall at low discharges could create a sudden surge of flow in the creek and could endanger lives. Part of the spillway channel wall also serves as the left abutment retaining wall for the rockfill. Stability of this retaining wall is discussed in paragraph 2.3.3.

The discharge to the pool has undercut the rock cliff at the pool level. Continued undercutting will not likely affect dam safety. The ridge between the discharge channel and the dam is not high enough to confine maximum spillway discharges to the exit channel. Preliminary analysis indicates this wall may be overtopped at discharges less than one-half of maximum flow, causing water to impinge on the face of the dam. This condition could remove material from the downstream face of the dam near the toe, and lead to instability and possible failure of the rockfill embankment.

The spillway rating was developed by using the weir head-discharge relationship with head-dependent discharge coefficients varying from 2.75 to 3.32. The effective length of the upstream spillway crest was reduced by an amount up to 12 percent (varying with head) to account for contraction losses at the spillway corners. The control in the discharge channel was assumed to occur at the rock berm located at the channel bend. Flow in the discharge channel begins to submerge the upstream spillway crest at about 70 percent of maximum flow.

The maximum spillway discharge, with the reservoir at top of dam elevation, 952 feet NGVD, is estimated to be 4,900 c.f.s. The spillway rating curve is shown on Plate 7.

2.1.2 Outlet

The outlet works for Camp Kwoneesum Dam is located near the center of the dam. The intake structure could not be inspected as it was below reservoir level and the outlet conduit could not be inspected because the discharge end was half submerged by tailwater. The outlet conduit (Plate 8) is a 30-inch diameter corrugated steel pipe surrounded by 2 feet of compacted select quarry waste. The 150 feet of pipe through the embankment has a slope of 1 inch per foot.

The gate control and vent for the 30-inch diameter upstream sluice gate are located just below the crest of the dam and the gate stem follows the upstream face of the dam to the intake structure. The gate control is considered inoperable

because the casing has been penetrated and dented by several rifle bullets, and the gate has not been opened since the dam was completed. Since this is the project's low flow outlet, the reservoir can not be drained for emergency or maintenance purposes. The control handle was not at the site. The concrete outlet structure consists of a pair of divergent wing walls. Slight spalling of the concrete of the outlet structure was observed. The conduit discharges directly to a pool at the toe of the dam. The discharge capacity of the outlet works, in operating condition and with the reservoir at spillway crest elevation 947 feet NGVD, is estimated to be 90 c.f.s.

2.1.3 Freeboard

Routing of the general storm PMF indicates that 1 foot of freeboard exists above still water level. At the time of the inspection, the reservoir was 4.4 feet below the dam crest, approximately 0.6 feet above the spillway crest. No high water mark was observed. The fetch for wind-generated waves is less than 1,000 feet and wave runup on the embankment is estimated to be less than 1.5 feet. The operating freeboard during normal conditions is adequate to prevent overtopping by wind waves; however, during PMF conditions, wave overtopping is likely.

2.2 HYDROLOGY, CLIMATOLOGY, AND PHYSIOGRAPHY

2.2.1 General

The climate of the area is generally maritime in nature. The drainage basin is located in the Columbia River Gorge through the Cascade Mountain Range and experiences the exchange of air that takes place between eastern and western Washington. In summer, the flow is generally from west to east but there is some diurnal variation in direction caused by unequal heating on the two sides of the Cascades. In winter, the air flow is from east to west as colder air drains from eastern Washington. Severe ice storms, or "silver thaws", occur when rain falls through extremely cold air that occasionally flows west through the gorge. Thunderstorms occur one to three days each month from March through October.

The nearest climatological station (Elevation 440 NGVD) is at Skamania Fish Hatchery, about 3.5 miles south of Camp Kwoneesum Dam; however, only 14 years of records are available. A climatological station is located at Battle Ground (Elevation 295 NGVD) approximately 18 miles west of the basin. Mean annual precipitation at the Battle Ground station is 51.2 inches with 75 percent falling in October through March. Mean

December precipitation is 8.03 inches and mean July precipitation is 0.74 inches. Mean annual precipitation on the Camp Kwoneesum drainage basin is probably near 100 inches. Mean annual temperature at Battle Ground is 50.9 degrees Fahrenheit. Mean annual temperature on the Camp Kwoneesum drainage basin is probably about 6 degrees cooler than Battle Ground.

The drainage basin area for Camp Kwoneesum Dam is 3.0 square miles. The basin was burned several years ago by a forest fire and is now covered with a growth of young trees. The main inflow stream, Wildboy Creek, has an average gradient of 730 feet per mile. The basin elevations range from 950 feet NGVD at the dam to 2,725 feet NGVD on the northeasterly boundary. There are no stream flow gages in the basin or in surrounding basins. There are no gages of reservoir inflow, outflow, or elevation.

The spillway design flood developed by the design engineers, Stevens & Thompson Consulting Engineers, Inc., has a peak flow of 1,600 c.f.s. The spillway can pass this flood with almost 3 feet of freeboard remaining on the dam. The U.S. Weather Bureau's Technical Paper 28 (Ref. 3) was used by the design engineers to obtain a 100-year 6-hour rainfall of 4.5 inches, along with the procedure outlined in the U.S. Bureau of Reclamation publication Design of Small Dams (Ref. 4), to obtain the flood. Antecedent moisture condition III and runoff curve No. 70 were used. Better estimates of 100-year rainfall are now available from the NOAA Atlas 2 for Washington (Ref. 5). The 100-year 6-hour rainfall from the NOAA Atlas is 3.5 inches, 78 percent of the value used by the design engineers.

2.2.2 Reservoir Storage and Spillway Discharge

The reservoir has a surface area of 9.2 acres and a storage of about 102 acre-feet at spillway crest elevation 947 feet NGVD. Approximately 52 acre-feet of storage is available in the reservoir between the spillway crest and the dam crest. The spillway discharge with the reservoir at the dam crest is 4,900 c.f.s., about 405 acre-feet per hour.

2.2.3 Estimated Probable Maximum Flood

The probable maximum flood (PMF) is the flood expected from the most severe combination of critical meterologic and hydrologic conditions that are reasonably possible in the region. An estimate of the PMF was made during this dam safety analysis and was routed through the reservoir.

The procedures contained in U.S. Westher Bureau's Hydro-meteorological Report No. 43 (Ref. 6) and the Weather Bureau's 1967 memo (Ref. 7) were used to compute the probable maximum precipitation (PMP). The memo allows for some reduction of the PMP which was not originally contained in Report No. 43. A general storm PMP was selected for analysis. This storm produces 6.83 inches in 6 hours and 33.08 inches in 72 hours. Snowmelt (Ref. 8) was calculated for the entire 72 hour storm based on the assumption of an unlimited snowpack. The melt was arranged to the time sequence selected for the PMP.

The infiltration rate used for the basin was 0.15 inches per hour based on minimum retention rates for the soils of the basin. It was assumed that initial losses were satisfied by antecedent storms. The base flow during the PMF was assumed to be 120 c.f.s. which is equivalent to the discharge with a head of 0.4 feet on the spillway.

A triangular unit hydrograph for a 10-minute rainfall duration was developed for the 3-square-mile drainage basin by procedures outlined in Design of Small Dams (Ref. 4). A curvilinear fit of the triangular unit hydrograph was used. The PMP and snowmelt was applied to the unit hydrograph by means of the computer program, HEC-1 (Ref. 9). This estimate of the PMP and snowmelt produced a flood with a peak of 3,800 c.f.s. and a volume of 6,500 acre-feet.

The generalized storm may not be the most critical storm for the Camp Kwoneesum drainage basin. No procedure has been developed for estimating the Probable Maximum Precipitation intensity for warm season thunderstorms in this region, as has been done for the region east of the Cascade Mountains. Although the maximum intensity of thunderstorm precipitation in this basin would not be as great as for a location in Eastern Washington, it may exceed that of the generalized storm for durations up to one hour.

2.2.4 Flood Routing

The general storm PMF was routed through the reservoir by using the computer program HEC-1 (Ref. 9). The base flow during the PMF was assumed to be 120 c.f.s. The routing of the PMF was started with the reservoir at elevation 947.4 feet NGVD (0.4 feet above the spillway crest) which is equivalent to a discharge of 120 c.f.s. The routing resulted in a maximum water surface elevation of 951 feet NGVD with 1 foot of freeboard remaining. However, the ridge between the spillway discharge channel and the dam will be overtopped at spillway discharges less than one-half of maximum flow, causing water to impinge on the downstream face of the dam.

2.3 GEOTECHNICAL EVALUATION

2.3.1 Dam

The 55-foot-high curved axis rockfill embankment is 245 feet long, has a 160-foot-wide uncontrolled overflow spillway and a 100-foot-long earth dike. Total crest length is 425 feet (see Plates 5 and 9). The radius of the curved rockfill is 280 feet and the crest width is 15 feet. Plans show the rockfill has a 1 V on 1.4 H downstream slope and a 1 V on 1.5 H upstream slope with an 8-inch-thick reinforced concrete impervious membrane, embedded a minimum depth of 3 feet into "sound" rock at the upstream toe. The concrete face rests on 3 feet of bedding material that is called "select quarry waste" and is specified as "clean, well-graded rock from 1/4-inch to 3-inch size" placed in "12-inch layers and compacted with at least six passes of a 5'-6" wide grid roller weighing at least 30,000 pounds or by use of a vibratory compactor acceptable to the engineer."

The rockfill section of the dam between the spillway and the right abutment was placed on a stripped surface described as "relatively sound rock." The rockfill embankment material is a basalt obtained from a nearby quarry. The construction specifications (Ref. 10) required the following with respect to quality and placement of the rock:

> "hard and durable, which will resist excessive breakage during the hauling, placing, and compaction operations. The rock shall be clean, free draining and well graded to a maximum size of one cubic foot. Slab-like rock shall not be used. Rockfill dumped and spread in lifts not exceeding 3 feet in thickness in a manner that will assure a compact fill with a minimum of large voids. Each lift shall be compacted by at least six complete passes of the tracks of a crawler tractor weighing not less than 15 tons."

The upstream concrete membrane is 8 inches thick, placed on a compacted select filter material covered with 6-mil-thick polyethylene. The specifications (Ref. 10) require 3,000 psi concrete with a maximum slump of 2 1/2 inches. The concrete membrane was to be cast in continuous lifts, the first lift extending from the toe to 3 feet above the low-level outlet. Above this the specifications indicate the rockfill and select filter were to be completed to the dam crest and work on the concrete membrane delayed until completion of the embankment.

The exposed upper 7 feet of the concrete membrane was in excellent condition with no cracking, displacement, or open

joints. The condition of the concrete membrane at lower elevations could not be inspected and is unknown; however the lift construction, compaction, and requirement that the embankment be completed prior to construction of the concrete membrane suggest that settlement after construction was minor. Therefore, the concrete membrane should be in good condition.

The dike section extending from the spillway to the left abutment, (Plate 10) has a crest width of 15 feet and upstream and downstream slopes of 1 V on 2 H. The central impervious core has a 10-foot top width and 1 V on 1.5 H slopes. Core materials were obtained from required excavation and the shell material consists of "select quarry waste" previously described. Plans show a cutoff was excavated to a depth of 8 feet using 1 V on 1 H slopes. Based on test pit data (TP-3) in the dike area, the bottom of the cutoff is near basalt rock. Backfill for the cutoff trench and dike fill is specified as "6-inch minus material, free of organic matter, placed in lifts not exceeding 9-inches in thickness and compacted at or near optimum water content to obtain at least 100 percent of the Standard Proctor dry density."

Alder trees 2 to 6 inches in diameter exist on the crest of the dam, mainly between the rockfill embankment and the spillway. The downstream slope surface is almost entirely free of vegetation and showed no signs of movement. Coarse rock was located on the lower portion of the slope and finer rock exists near the crest (Photo 4). This condition appears to be segregation as a result of dumping material from the dam crest. As the bulk of the dam was not constructed in this manner, the downstream slope or embankment should not be adversely affected by this condition.

2.3.2 Foundation Conditions, Seepage, and Drainage

Construction specifications indicate that the rockfill was placed directly on the bedrock surface after removal of overburden soil. The dam embankment is free draining, and seepage past the concrete membrane would travel along the bedrock surface and exit at the embankment toe. As tailwater in the spillway plunge pool covered the embankment toe, it is not known if seepage is present. The embankment contains no piezometers and none are required.

The dike section of the dam contains no internal drainage system. Inspection of the downstream slope did not disclose any evidence of erosion caused by seepage. Normal water surface is at the base of the dike section.

2.3.3 Stability

Considering the 55-foot height, the high shear strength of the rockfill, the method of placement, the rock foundation, and the loading conditions, we believe that the rockfill dam adequately conforms to the recommended guidelines with respect to stability of both the downstream and upstream slopes.

The left abutment of the rockfill dam is retained by a 16-inch-thick reinforced concrete wall measuring 16 feet, unsupported height. This wall serves as the right spillway wall (see Photo 3). Plans show the wall is embedded 4 feet into sound rock. A wall section shows the reinforcing steel as No. 4 horizontal bars at 10-inch spacing and No. 4 vertical bars at 10-inch spacing at the spillway face, and at the rockfill face the horizontal steel is the same but there are No. 8 vertical bars at 6-inch spacing. This reinforcing is shown for the entire 20-foot depth.

Because design information is unavailable, the design parameters considered in analysis of wall stability are unknown and stability of the wall during a PMF storm is unknown. Failure of this wall would result in erosion of the rockfill and could endanger the embankment.

The stability of the earthen dike is only a consideration during high reservoir levels, as the water level is at the base during normal pool. The dike section is largely impervious and would not have sufficient time to become saturated during periods of high flows, so steady state seepage would not develop. We believe dike stability adequately conforms to the recommended guidelines.

2.4 PROJECT OPERATION AND MAINTENANCE

Operations and maintenance information was obtained from a discussion with Ms. Karen House of the Portland Area Council of Camp Fire Girls, Inc., as formal operations and maintenance plans do not exist.

2.4.1 Dam

Inspection and maintenance of the dam is performed by parents of the Camp Fire Girls during spring work parties. At this time debris is cleaned from the spillway area. No log boom is used to keep debris away from the spillway. Except for some small trees growing on the dam embankment, debris and the floating decks at the spillway, and the inoperable condition of the outlet works, the dam appeared to be well maintained.

2.4.2 Reservoir

The reservoir is maintained at almost a constant elevation throughout the year by the uncontrolled spillway. There is no operation of the reservoir by the Portland Area of Camp Fire Girls, Inc. The low level outlet is not operable.

2.4.3 Warning System

There is no formal warning plan for use in the event of impending dam failure.

2.5 SAFETY EVALUATION

The evaluation of downstream hazard potential presented in this report is based on visual observation and engineering judgment. A detailed hydraulic routing of a dam breach hydrograph is required to accurately evaluate the potential for downstream damage and effect of dam failure.

Wildboy Creek flows 1.6 miles from the dam in a steep (160 feet per mile), well-defined narrow, channel to the con fluence with the West Fork Washougal River. A fish hatchery, where approximately 14 people live and work, is located on the West Fork Washougal River approximately 2 miles downstream of the confluence with Wildboy Creek. This is the only known area of habitation that would be in danger as a result of failure of Camp Kwoneesum Dam. Approximately 0.7 miles downstream of the fish hatchery, the West Fork Washougal River joins the Washougal River. Numerous homes are located along the 13 miles of the Washougal River between the con-fluence with the West Fork and the Columbia River; however, these homes would probably not be affected by a failure of the dam.

The dam does not overtop during the general storm PMF. However, the downstream ridge between the spillway discharge channel and the dam will be overtopped at spillway discharges less than one-half of maximum flow, causing water to impinge on the face of the dam. This flow could remove material from the downstream face of the dam and lead to instability and potential failure of the embankment. Sustained high spillway discharges would be required to cause failure of the rock embankment and some warning would be associated with this discharge.

Flooding of the downstream fish hatchery could occur prior to the prevously described failure of Camp Kwoneesum Dam. However, dam failure would increase the potential for endangering the lives of many people and/or cause extensive property damage in addition to that occurring prior to failure.

Given the present inadequate spillway discharge channel capacity, Camp Kwoneesum Dam is unsafe until corrective action is completed.

CHAPTER 3

FINDINGS AND RECOMMENDATIONS

3.1 FINDINGS

Visual inspection of the dam, supplemented by analysis of the project in terms of the recommended guidelines performance standards, resulted in the following findings.

3.1.1 Size and Hazard Potential

The 55-foot-high Camp Kwoneesum Dam impounds 154 acre-feet at the crest of the dam. A failure of the dam would cause extensive damage to the fish hatchery and possible loss of life. On the basis of this information, and in accordance with the recommended guidelines (Ref. 1), the project is intermediate in size and the downstream hazard potential is high (Category 1).

3.1.2 Embankment Dam

Visual inspection of the rockfill embankment and the upper portion of the upstream concrete membrane revealed no displacement, deformation or settlement. Except for a few small trees growing on the dam crest, the dam appeared in good condition. As the toe of the rockfill was underwater because of the spillway discharge, toe seepage could not be observed. The downstream abutment contacts were dry. The embankment stability adequately conforms to the recommended guidelines.

Inspection of the earth dike section of the dam did not reveal any distress and only minor erosion of the upstream slope. As the water level at the time of the inspection and during normal operation is at the dike toe, the stability adequately conforms to recommended guidelines.

Stability of the right spillway wall is unknown and questionable. Failure of this wall could erode the rockfill and endanger the dam embankment.

3.1.3 Spillway and Reservoir Capacity

The reservoir has a surface area of 9.2 acres and a storage of about 102 acre-feet at spillway crest elevation 947 feet NGVD. Approximately 52 acre-feet of surcharge storage is available in the reservoir between spillway crest and dam crest. The discharge of the spillway, with the reservoir at the dam crest, is about 4,900 c.f.s. Inspection guidelines (Ref. 1) recommend that a dam of intermediate size and high

downstream hazard potential be capable of safely handling the PMF. Preliminary estimates of the PMF indicate that the spillway can pass the general storm PMF without overtopping the dam. However, the ridge between the discharge channel and the dam will be overtopped at spillway discharges less than one-half of maximum flow, causing water to impinge on the downstream face of the dam. This flow could remove material from the face of the dam (near toe) and lead to instability and possible failure of the embankment. Also, it is possible that the dam may overtop during the thunderstorm PMF for the basin.

There is no log boom in the reservoir to protect the spillway from being plugged by floating debris. Two wooden floating decks were lodged at the spillway crest, making about 60 feet of the crest length non-effective for low heads. These decks could jam against the spillway piers and reduce discharge. The spillway wier wall could fail as the riprap on its downstream face is susceptible to displacement by high discharges. It is not likely that this failure will endanger the dam or cause significant downstream damage.

3.1.4 Outlet Works

The outlet consists of a 30-inch-diameter corrugated steel pipe through the embankment with a slide gate on the upstream face, which was not in operating condition at the time of the inspection. The gate control casing has been penetrated and dented by several rifle bullets. In operating condition, the outlet works can pass an estimated 90 c.f.s. with the reservoir at spillway crest elevation 947 feet MSL. As this is the only low level outlet at the project, the reservoir cannot be lowered below the spillway crest for emergency or maintenance purposes.

3.1.5 Operation and Maintenance

Inspection and maintenance of the dam is performed by parents of the Camp Fire Girls during spring work parties. Except for some small trees growing on the dam embankment, debris and the floating decks at the spillways, and the inoperable condition of the outlet works, the dam appeared to be well maintained. There is no operation of the reservoir by the owners. The reservoir is maintained at almost a constant elevation throughout the year by the uncontrolled spillway.

3.1.6 Safety Evaluation

Based on the PMF developed for a general storm from procedures outlined in Hydrometerological Report No. 43 (Ref. 6), the PMF will not overtop the dam. However, the ridge between

the spillway discharge channel and the dam overtops at less than one-half the PMF. Flow from this overtopped ridge will impinge upon the downstream face of the dam and may remove material leading to instability and possible failure of the embankment. Conditions more critical than the general storm may exist during an intense local PMF, but no procedures are available for evaluating the magnitude of an intense local (thunderstorm) PMF for this area. Because the constrained capacity of the spillway discharge channel could result in impingement of discharge on the downstream face of the dam, leading to potential for failure of the embankment, the project cannot safely handle the PMF and is unsafe.

3.2 RECOMMENDATIONS

1. Immediately develop, implement, and periodically test an emergency downstream warning plan to alert residents in the event of imminent dam failure.

2. Make the low level outlet functional and maintain it to ensure full operational capability to permit reservoir drawdown for emergency or maintenance purposes.

3. Develop and implement an operation and maintenance plan.

4. Remove all trees from the dam embankment.

5. Construct a log boom(s) in the reservoir to protect the spillway from floating debris and remove logs from spillway discharge channel. Secure floating decks at a location removed from the spillway.

The above items will not make the dam safe but will provide an additional margin of safety during the period while the following engineering studies and modifications are being accomplished.

6. Determine stability of the right spillway wall under all flood conditions and take action as required.

7. Perform a detailed study to confirm report findings which show that the ridge between the discharge channel and the dam embankment will be overtopped by spillway discharges less than the PMF. Modify project as required to ensure that spillway channel will safely contain PMF flows.

8. Conduct periodic inspections by qualified engineers at least once every five years to determine whether there are any deficiencies in the condition of the project, adequacy and quality of maintenance, and methods of operation.

REFERENCES

1. U.S. Army Corps of Engineers, Office of the Chief of Engineers Report to the U.S. Congress, National Program of Inspection of Dams, Vol. 1, Appendix D, "Recommended Guidelines for Safety Inspection of Dams," Washington, D.C., Department of the Army, May 1975.

2. Trimble, D. E., 1963, Geology of Portland, Oregon, and Adjacent Areas: U.S. Geological Survey Bulletin 1119.

3. U.S. Weather Bureau, Technical Paper No. 28, Rainfall intensities for local drainage design in Western United States. Washington, D.C., 1956.

4. U.S. Department of the Interior, Bureau of Reclamation, Design of Small Dams, 2nd Edition, Washington D.C., 1973.

5. National Weather Service, NOAA Atlas 2, Precipitation Frequency Atlas of the Western United States, Volume IX - Washington, Silver Spring, Maryland 1973.

6. U.S. Weather Bureau, Hydrometeorological Report No. 43: Probable Maximum Precipitation, Northwest States, Washington, D.C., 1966.

7. Hydrometeorological Branch, U.S. Weather Bureau, "Memorandum: Probable Maximum Precipitation, Northwest States," 15 June 1967.

8. U.S. Army Corps of Engineers, "Runoff from Snowmelt," EM 1110-2-1406, January 1960.

9. U.S. Army Corps of Engineers, Hydrologic Engeneering Center, HEC-1 Flood Hydrograph Package, Davis, California, January 1973.

10. Stevens and Thompson, Inc., "Addenda to the Specifications for Construction of Camp Kwoneesum Dam for Portland Area Council Camp Fire Girls, Inc.," 25 February 1964.

APPENDIX

STATE OF
WASHINGTON

Dixy Lee Ray
Governor

DEPARTMENT OF ECOLOGY
Olympia, Washington 98504 PV-11 206/753-2240

Wilbur G. Hallauer, Director

October 11, 1979

Mr. R. P. Sellevold, P.E.
Chief, Engineering Division
Department of the Army
Seattle District, Corps of Engineers
P. O. Box C-3755
Seattle, Washington 98124

Dear Mr. Sellevold:

The draft safety inspection report for Camp Kwoneesum Dam has been reviewed by personnel in our Safety of Dams Section. In general, the findings appear to accurately reflect the condition of this project, and we concur with the recommendations that were made.

The opportunity to participate in this inspection and to provide comment on the report is most appreciated.

Yours truly,

Wilbur Hallauer

Wilbur G. Hallauer
Director

WGH:jpf

PORTLAND AREA COUNCIL
CAMP FIRE GIRLS
410 COMMUNITY SERVICE CENTER BUILDING
718 W. BURNSIDE • 224-7800 • PORTLAND, OREGON 97209

September 7, 1979

Mr. R. P. Sellevold, P.E.
Chief Engineering Division
Seattle District, Corps of Engineers
Department of the Army
P. O. Box C-3755
Seattle, WA 98124

Dear Mr. Sellevold:

On August 29, 1979 representatives of the Portland Area Council of Camp Fire Girls met with Mr. Gilbert Meigs, the Manager of STRAAM Engineers, Inc. in Portland, to review the Preliminary Phase I Inspection Report of the Camp Kwoneesum dam. All of the recommendations made in the report were discussed with Mr. Meigs, who assisted in the dam's design by STRAAM's predecessor.

It was gratifying for us to find that the engineers involved in the inspection concur with our belief that the dam was well designed and is basically very sound.

We are enclosing two photographs taken at the time of the construction of the dam. One of them will support our observation that the discharge of water over the spillway into the plunge pool has not been responsible for the undercutting of the rock cliff. That picture was taken in November of 1965 and clearly shows the undercut cliff at that time.

The other photograph shows the reinforced concrete retaining wall on the left abutment of the dam. The wall was built before the embankment was placed and the bridge erected. Therefore, it seems to us that the wall does not depend on the bridge for stability and that Recommendation #6 is unnecessary.

Recommendation #1. The recommendation pertaining to an emergency downstream warning system poses some problems since there is no electricity at the site. No one lives there except during seven or eight summer weeks. In view of the high incidence of vandalism experienced in the past, an automatic unattended warning system seems impracticable and unreliable. The Council plans to secure technical help as to what kind of effective and practical warning system could be devised. Mr. Ernest Gomez of the Dam Safety Office, Seattle District Corps of Engineers, has suggested to me that Mr. Ed Garland, an engineer with Washington State Department of Ecology, would be an appropriate person with whom to initiate a discussion of this situation.

Recommendation #2. After contact with Washington State officials, personnel from the Portland Area Council will test the low level outlet. It appeared

to us that discussion with fire protection personnel and those at the downstream fish hatchery would be wise before attempting to open the outlet gate control -- in case it was not possible to close it immediately. Perhaps Mr. Garland could give us some advice on this.

Recommendation #3. The Council will develop and implement a maintenance plan. We will seek advice on this matter also.

Recommendation #4. The trees will be removed from the dam embankment.

Recommendation #5. It will be necessary for the Council to investigate the most cost effective way to protect the spillway from floating debris and, at the same time, to retain the recreational swimming and boating area.

Recommendation #6. Comments were made on this recommendation earlier in this letter.

Recommendation #7. The Council recognizes the need to conduct an engineering study to confirm the preliminary findings of the report concerning the ridge between the discharge channel and the dam and whether or not the dam will be overtopped and the embankment eroded by spillway discharges.

Recommendation #8. It appeared to us that, given the data in the inspection report, future periodic inspections by qualified engineers would not be onerous.

We appreciate the extension of the deadline date for the submission of this letter. A report will be made to our Board of Directors at their regular meeting in September.

Sincerely,

Virginia Denton
Executive Director

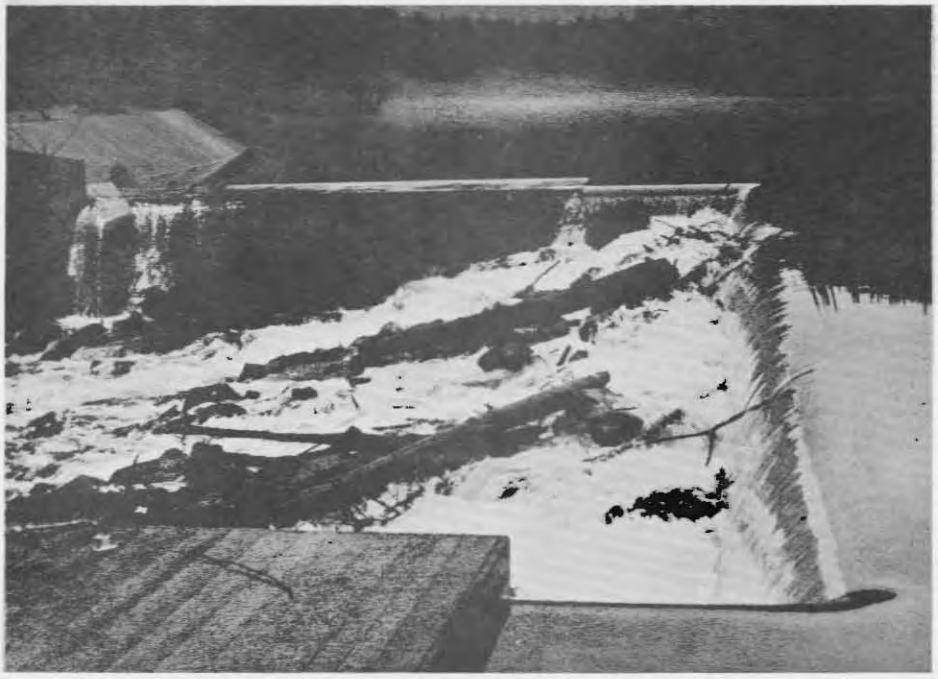
VCD/ce

Enclosures

cc: Gilbert Meigs
Russ Jones
Tom Sand
Molly Prehn
Jim Kirkland
Karen House

Portland Area Council of the Campfire Girls

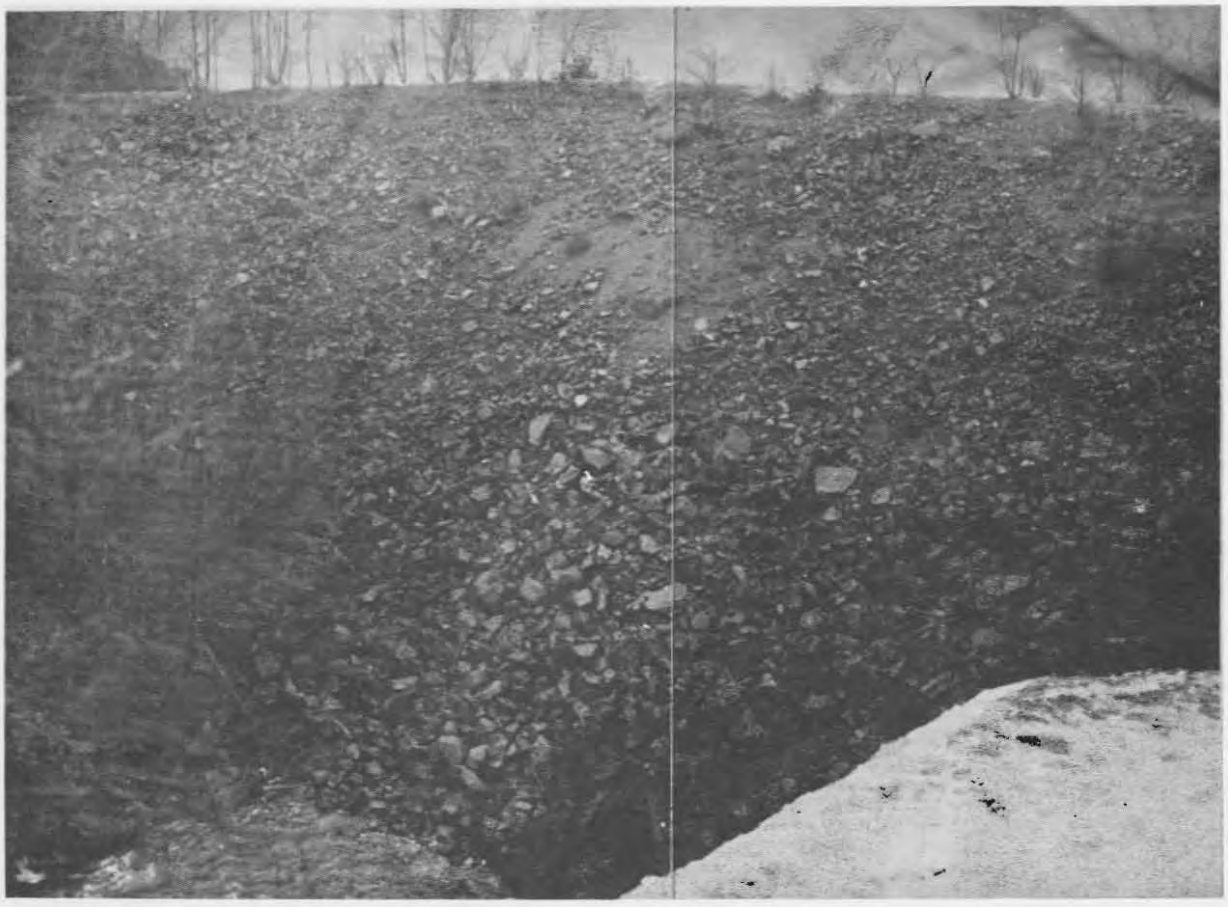
Support Photos for September 7, 1979 letter from Virginia Denton to R. P. Sellevold, P.E.



[PHOTO 1] Spillway Weir Wall

[PHOTO 2] Spillway
Plunge Pool

[PHOTO 3] Left Abutment at Spillway



[PHOTO 4] Downstream Slope

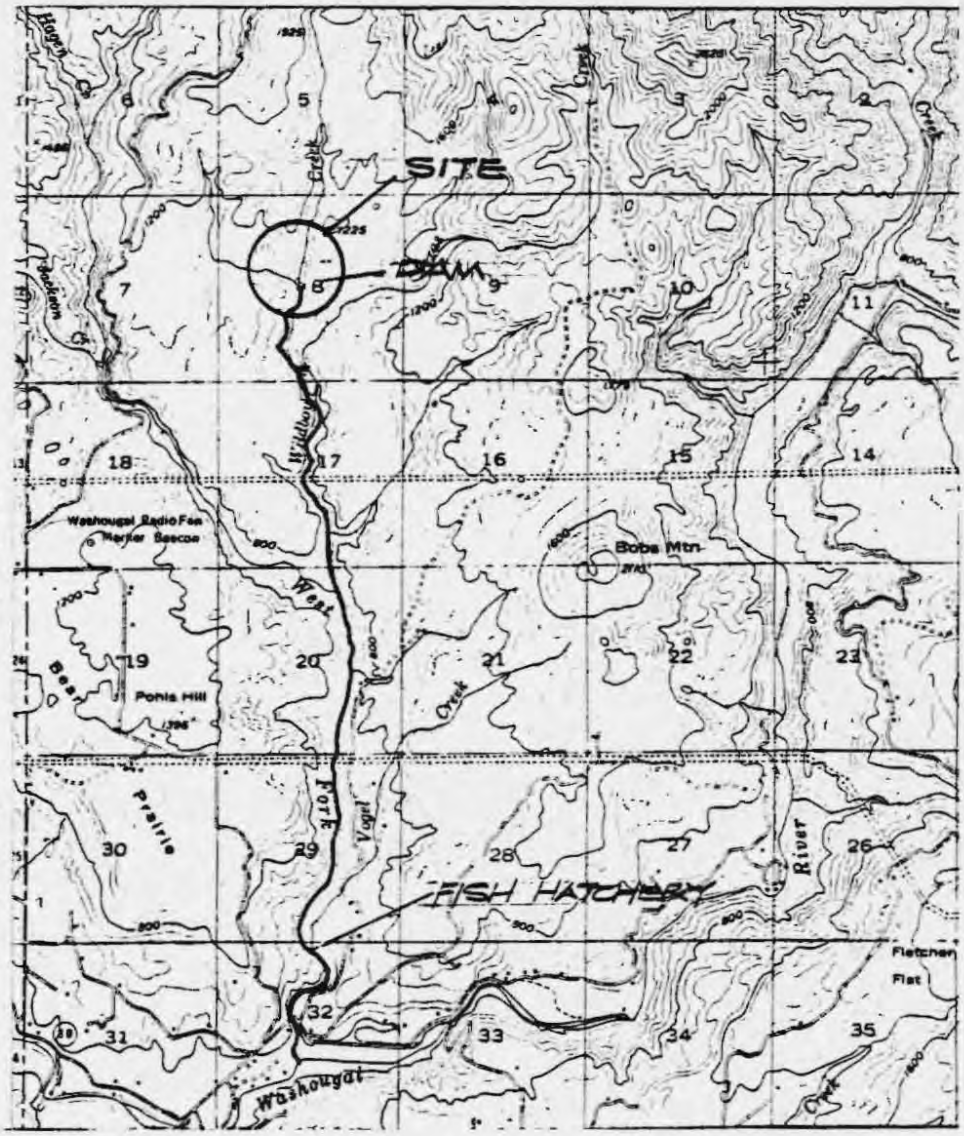
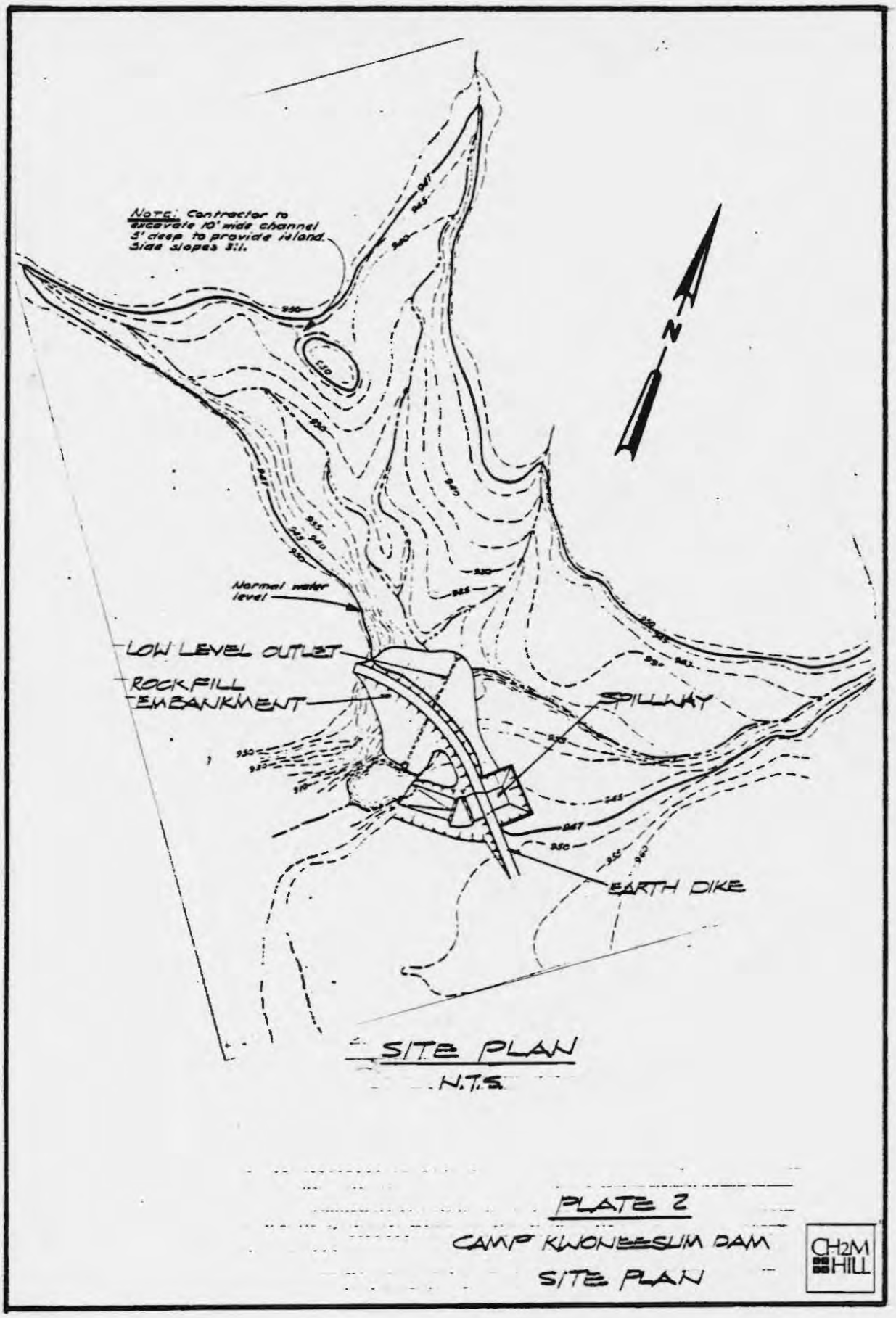


PLATE 1

CAMP KWONESSUM DAM

VICINITY MAP

CH2M HILL



SITE PLAN

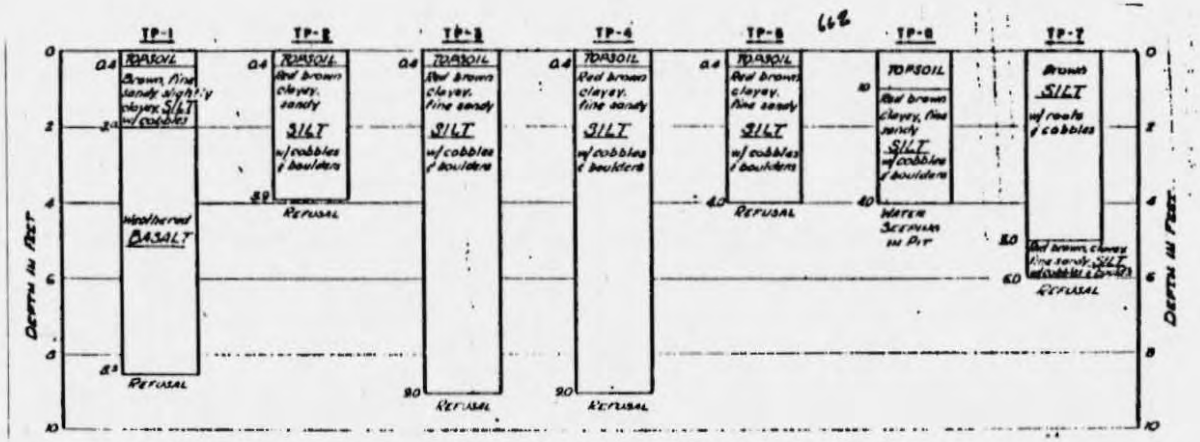
N.T.S.

PLATE 2

CAMP KWONESUM DAM

SITE PLAN

CH2M HILL



TEST. PIT LOGS

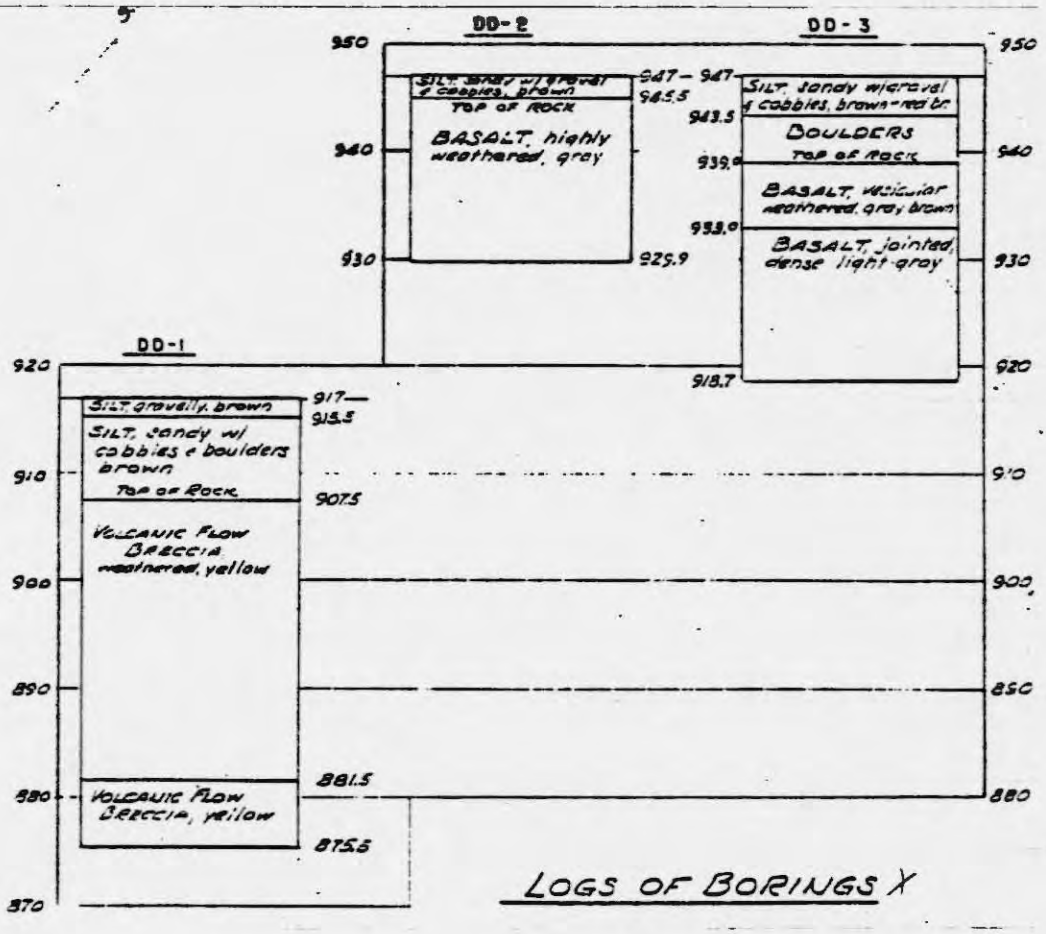
N.T.S.

PLATE 3

CAMP KNONEESUM DAM

TEST. PIT LOGS

CH2M HILL



LOGS OF BORINGS X

PLATE 4

CAMP KWONESUM DAM

BORING LOGS

CH2M HILL

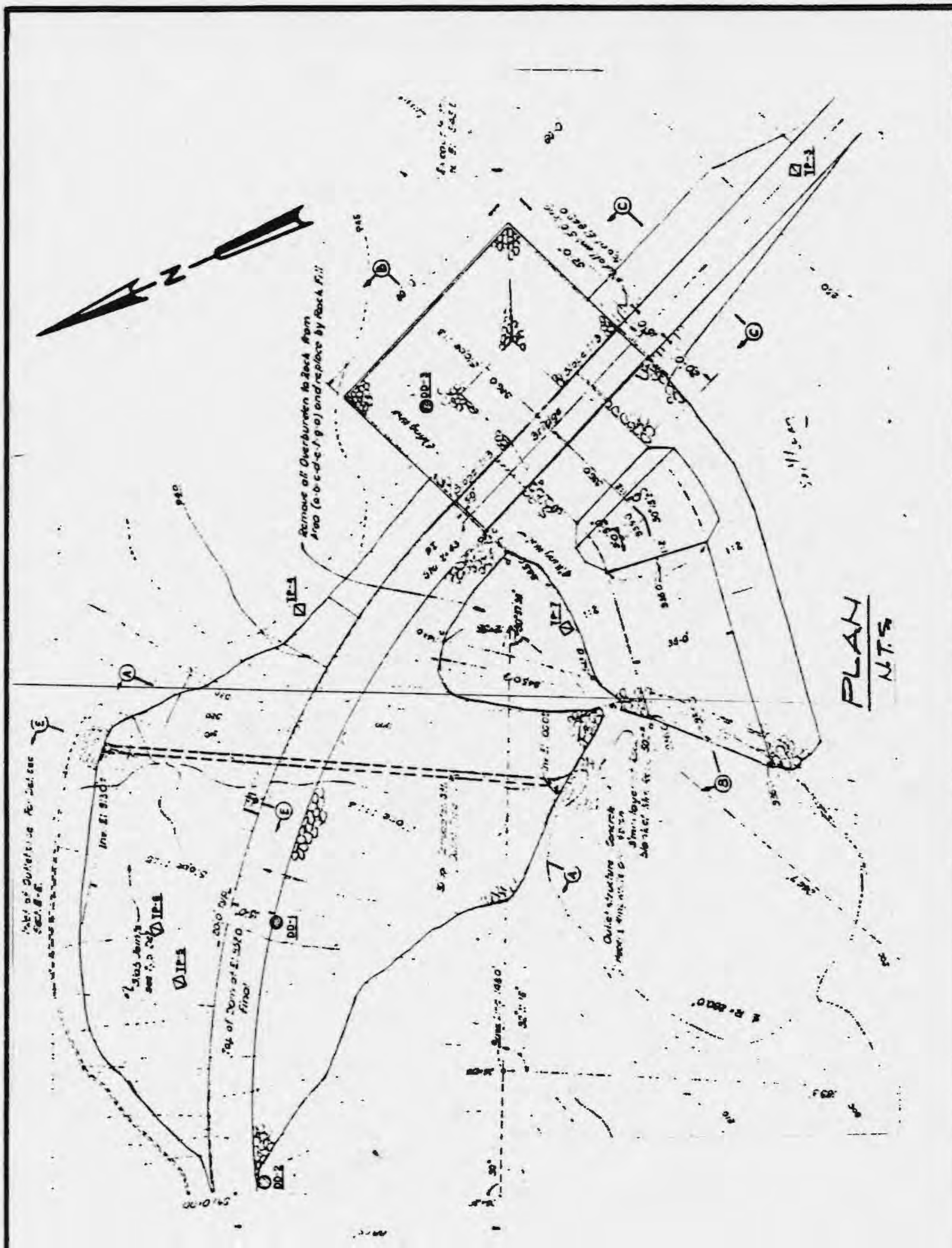
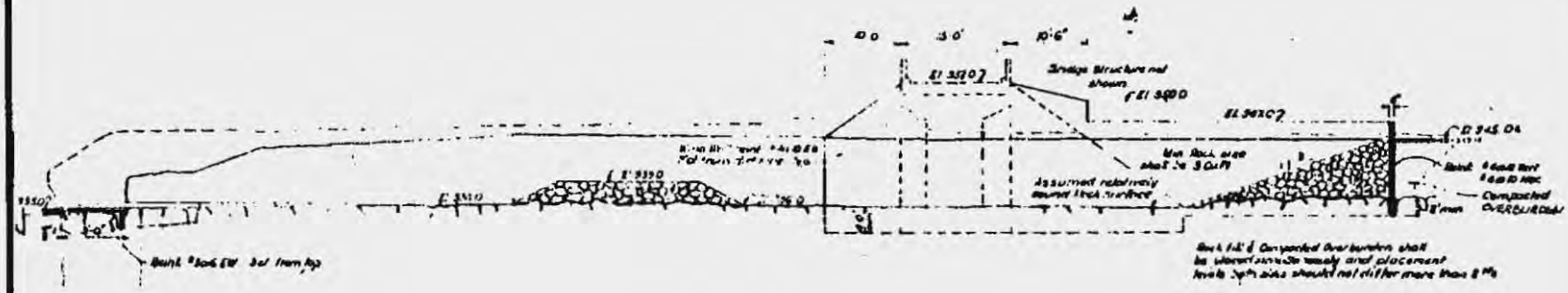


PLATE 5

CAMP KWONESUM DAM

DAM & SPILLWAY PLAN

CH2M HILL



SECTION B-B
1/8" = 1'-0"

PLATE 6
CAMP KNOWLESUM DAM
SPILLWAY PROFILE

CH2M HILL

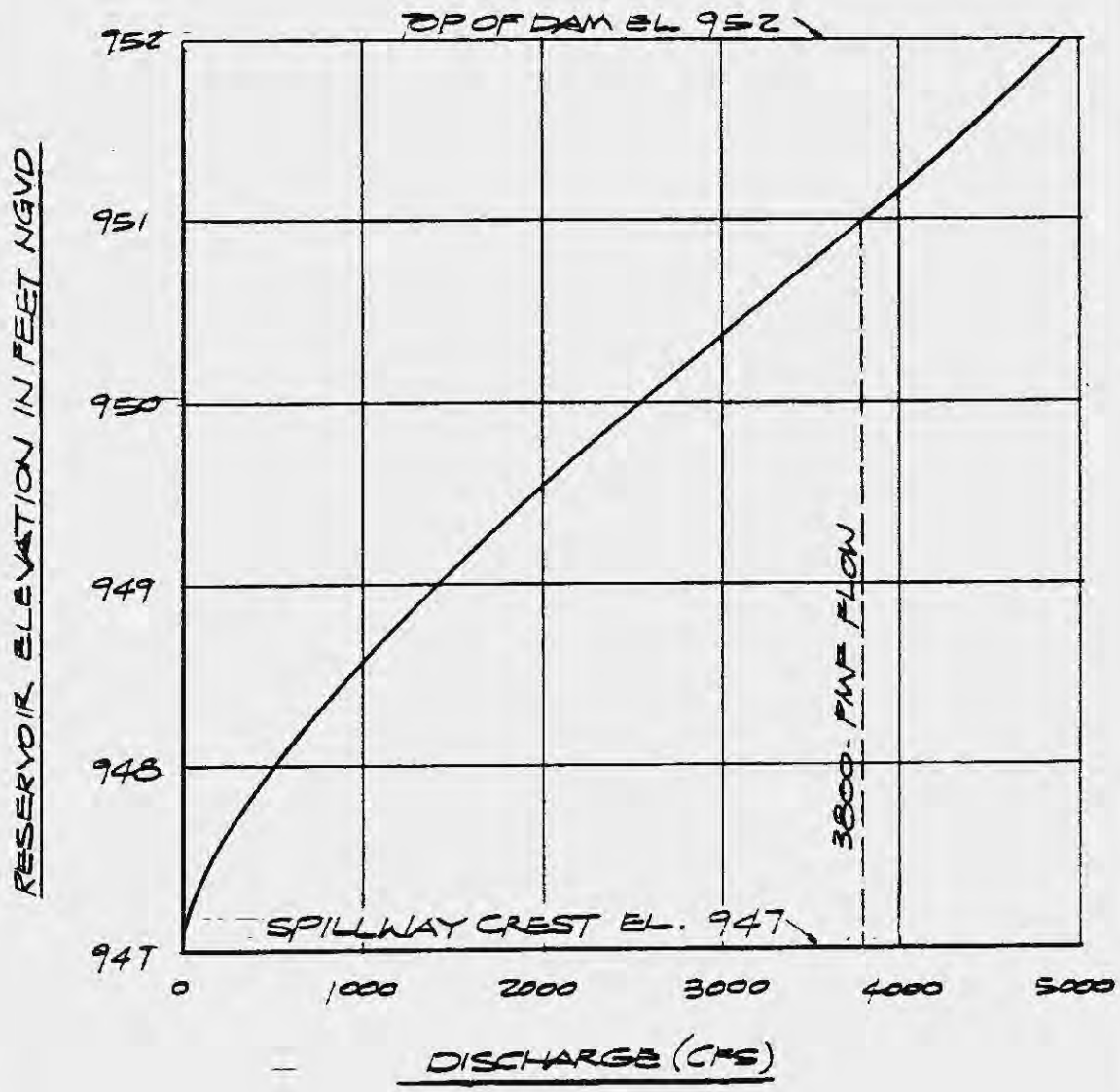
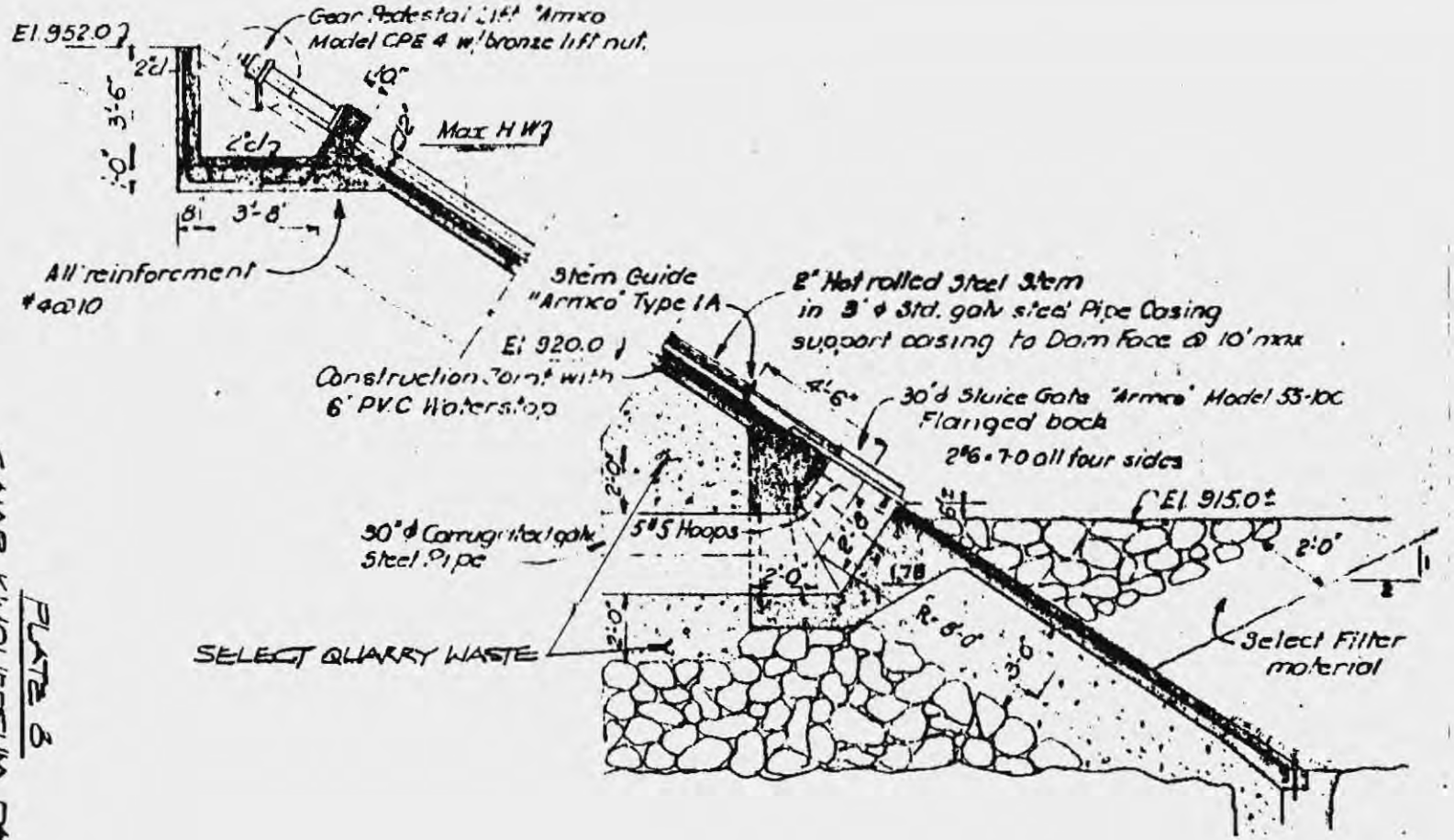


PLATE 1

CAMP KWONESUM DAM

SPILLWAY RATING CURVE

CH2M HILL



SECTION E-E

1/4" = 1'-0"

PLATE 8

CAMP KNONEESUM DAM

OUTLET SECTION

CH2M HILL

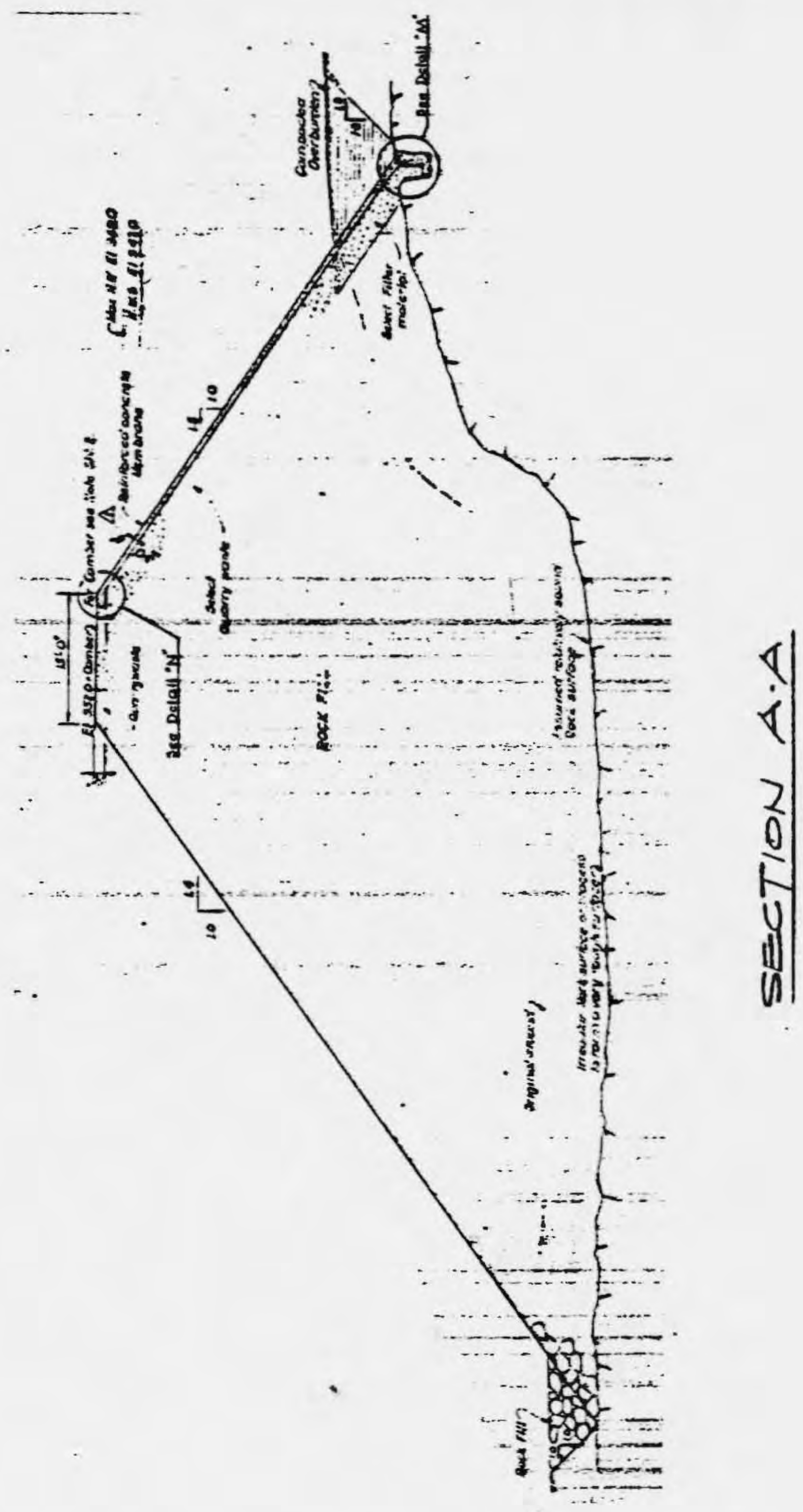
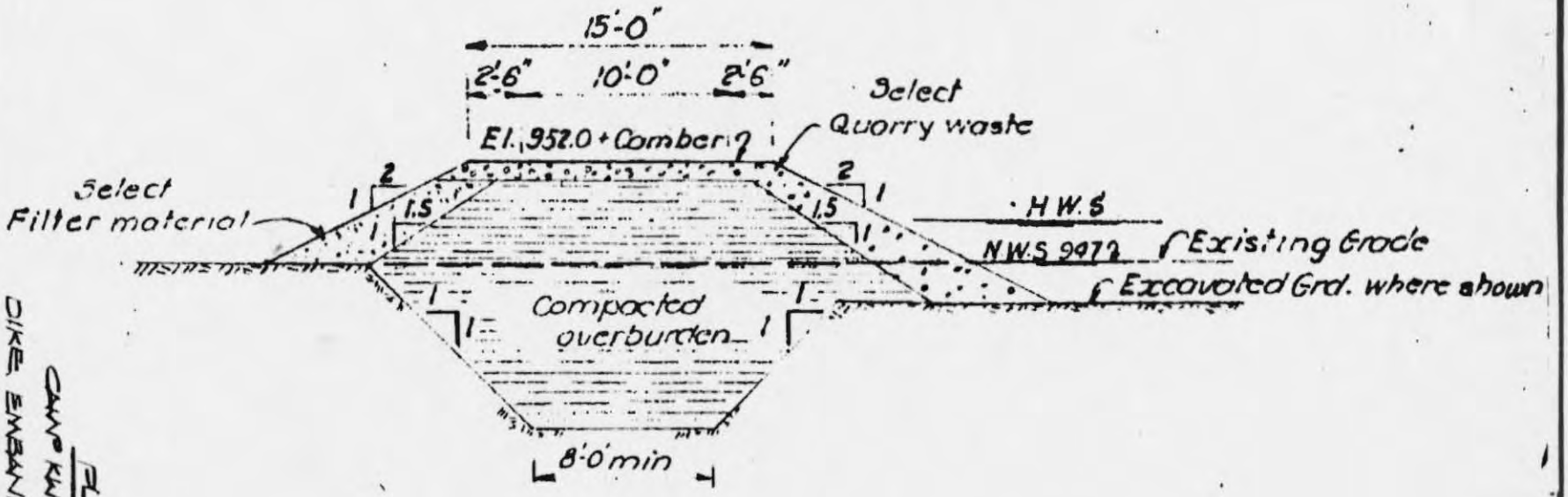


PLATE 9

CAMP KWONEESUM DAM

DAM EMBANKMENT SECTION

CH2M HILL



SECTION C-C
1/8" = 1'-0"

PLATE 10

CAMP KWONESUM DAM
DIKE EMBANKMENT SECTION

CH2M HILL

SURVEY CONTROL

Point #	Northing	Easting	Elevation	Descriptior
200	128187.70	1201730.91	931.80	Rebar
201	128178.52	1201744.39	931.38	Rebar
301	128615.20	1200873.90	934.73	Rebar
400	128597.09	1200858.99	931.96	Rebar
600	128717.97	1200387.71	931.73	Rebar
601	128721.71	1200359.19	931.86	Rebar
711	127819.15	1201162.14	936.43	Brass Cap
997	128100.03	1200973.16	936.45	Brass Cap
998	128114.32	1200905.04	936.32	Brass Cap
999	127990.90	1201075.72	936.52	Brass Cap
1001	128052.37	1201037.35	936.13	Brass Cap
1002	128021.95	1201064.24	936.22	Brass Cap
1003	127971.15	1201094.92	935.98	Brass Cap
1004	127900.58	1201130.28	936.02	Brass Cap

LEGEND

- EXISTING RIVER PATHWAYS
- EXISTING RESERVOIR
- EXISTING DAM AND SPILLWAY
- EXISTING GRADING
- CHANNEL CENTERLINE (2+00)
- SURVEY CONTROL (999)
- SEDIMENT SAMPLE

NORTH TRIBUTARY
WEST TRIBUTARY
EAST TRIBUTARY
FLOW
50+00
45+00
40+00
WEYERHAEUSER
KWONEESUM RESERVOIR EXISTING WSE = 931.03
APPROXIMATE DAM FOOT PRINT IS BASED ON CHM2 HILL DRAWINGS
EXISTING KWONEESUM EARTHEN DAM
EXISTING OUTLET PIPE
EXISTING KWONEESUM DAM CONCRETE SPILLWAY
WILDBOY CREEK
CAMP KWONEESUM
301
400
600
500601
997
1002
1003
101001
101004
4000998
4000999
711

N

0 100 200 Feet

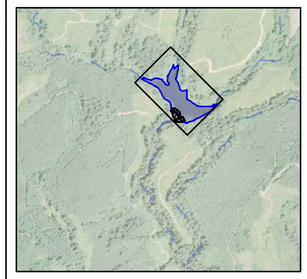
NOTES:

LIDAR WAS ACCESSED VIA WDNR LIDAR PORTAL. LIDAR IS 2M RESOLUTION AND HAS LIMITATIONS DUE TO QUALITY AND AGE OF DATA SET.

HORIZONTAL DATUM: NAD83 WASHINGTON STATE PLANES, SOUTH ZONE, US FOOT
VERTICAL DATUM: NAVD88

PLAN VIEW

Notes:



SHEET LOCATION

PRELIMINARY NOT FOR CONSTRUCTION

REV:	DESCRIPTION:	BY:	DATE:
3	-	-	-
2	-	-	-
1	-	-	-

STATUS: PRELIMINARY DESIGN

Ecosystem Restoration Services
302 W. Steuben St. #6
Bingen, WA 98605
www.ers4life.com

CLIENT: COWLITZ INDIAN TRIBE
7700 26TH AVE
VANCOUVER, WA, 98665

SITE: KWONEESUM DAM REMOVAL DESIGN

TITLE: KWONEESUM RESERVOIR AND DAM - EXISTING CONDITIONS

SCALE:	DATE:	DRAWN:	CHECKED:
	02/05/19	RP	BN

PROJ. NO:	DRAWING NO:	Total Sheets:
-	6	47

Carlson Testing, Inc.

Geotechnical Office (503) 601-8250
Eugene Office (541) 345-0289
Salem Office (503) 589-1252
Tigard Office (503) 684-3460

REVISED January 14, 2019

January 11, 2019
T1805918
Lab Log **#18-0928**

Ecosystem Restoration Services – Bill Norris
817 Devon Ct
Hood River, OR 97031

RE: SIEVE ANALYSIS AND ORGANIC MATTER CONTENT TESTING
KWONEESUM DAM REMOVAL – LAB TESTING
CLARK COUNTY, WASHINGTON

As requested, Carlson Testing Inc. has completed six (6) sieve analysis and organic matter content tests conducted on samples of sand, gravel and silt. The material was supplied by the native source and sampled by your representative on an unknown date from various locations on the jobsite and delivered to our Tigard facility on December 20, 2018. Testing was completed on January 10, 2019. Test results are for information only; specifications were applied per client. Following are the test results:

WASHED SIEVE ANALYSIS – ASTM C117/ASTM C136

MATERIAL DESCRIPTION: SILTY GRAVEL WITH SAND AND COBBLES (GP-GM)**
SAMPLE LOCATION: DAM SPILLWAY

Sieve Size	Percent Passing (%)	Specifications*
4"	100	----
3"	89	----
2"	89	----
1 1/2"	82	----
1"	77	----
3/4"	74	----
3/8"	69	----
1/4"	67	----
#4	65	----
#10	60	----
#20	54	----
#50	44	----
#100	37	----
#200	29.5	----

WASHED SIEVE ANALYSIS – ASTM C117/ASTM C136

MATERIAL DESCRIPTION: GRAVELLY SAND WITH SILT (SP)**
SAMPLE LOCATION: EAST TRIBUTARY IN LAKE #2

Sieve Size	Percent Passing (%)	Specifications*
1"	100	----
3/4"	98	----
3/8"	94	----
1/4"	88	----
#4	84	----
#10	71	----
#20	57	----
#50	26	----
#100	12	----
#200	7.6	----

WASHED SIEVE ANALYSIS – ASTM C117/ASTM C136

MATERIAL DESCRIPTION: SANDY GRAVEL (GP)**
SAMPLE LOCATION: WEST TRIBUTARY CHANNEL SAMPLE #2

Sieve Size	Percent Passing (%)	Specifications*
3"	100	----
2"	89	----
1"	68	----
3/4"	55	----
1/2"	42	----
3/8"	37	----
1/4"	31	----
#4	29	----
#10	23	----
#20	18	----
#50	9	----
#100	6	----
#200	4.2	

WASHED SIEVE ANALYSIS – ASTM C117/ASTM C136

MATERIAL DESCRIPTION: GRAVELLY SAND (SP)
SAMPLE LOCATION: NORTH TRIBUTARY IN LAKE #2

Sieve Size	Percent Passing (%)	Specifications*
2"	100	----
1"	92	----
3/4"	87	----
1/2"	80	----
3/8"	77	----
1/4"	72	----
#4	69	----
#10	57	----
#20	37	----
#50	10	----
#100	6	----
#200	4.7	

WASHED SIEVE ANALYSIS – ASTM C117/ASTM C136

MATERIAL DESCRIPTION: SANDY GRAVEL WITH SILT (GP)**
SAMPLE LOCATION: EAST TRIBUTARY #1 AT DETLA

Sieve Size	Percent Passing (%)	Specifications*
2"	100	----
1"	93	----
3/4"	84	----
1/2"	74	----
3/8"	67	----
1/4"	59	----
#4	54	----
#10	42	----
#20	31	----
#50	19	----
#100	13	----
#200	9.2	

WASHED SIEVE ANALYSIS – ASTM C117/ASTM C136

MATERIAL DESCRIPTION: SAND, SILT AND GRAVEL** SAMPLE LOCATION: NORTH TRIBUTARY #1 SOUTH EDGE		
Sieve Size	**Percent Passing (%)**	**Specifications***
3"	100	----
2"	91	----
1"	64	----
3/4"	54	----
1/2"	43	----
3/8"	38	----
1/4"	32	----
#4	30	----
#10	24	----
#20	17	----
#50	8	----
#100	5	----
#200	3.3	

*Testing is for information only as no specifications were applied.
** Sample does not meet minimum test size due to insufficient material provided by client.

ORGANIC MATTER – ASTM D2974

Test Number	Moisture Content % (Method A)	Ash Content % (Method C)	Organic Content % (Method C)
1 (East Trib #1)	10.8 %	84.9 %	10.1 %
2 (East Trib #2)	17.7 %	84.1 %	15.9 %
3 (Dam)	5.1 %	87.6 %	12.4 %
4 (North Trib)	1.9 %	95.9 %	4.1 %
5 (West Trib)	3.6 %	93.9 %	6.1 %
6 (North Trib)	2.8 %	93.0 %	7.0 %

**** Revised report to correct Lab Log number ****

Respectfully submitted,
CARLSON TESTING, INC.

Ty Toller
Laboratory Manager

kb

cc: Ecosystem Restoration Services – Bill Norris BILL@ERS4LIFE.COM
Inter-Fluve Inc – Mike Brunfelt, R.G. MBRUNFELT@INTERFLUVE.COM

Camp Kwoneesum Dam
Emergency Action Plan

Project Name: Camp Kwoneesum Dam

Dam Safety Office File Number: SA 28-131

Location: 7 miles NE of Washougal, Skamania County, on Wildboy Creek, tributary of the West Fork Washougal River

Owner: Columbia Land Trust

Issue Date: December 2021

Revised Date:

Introduction

Why is an Emergency Action Plan (EAP) so important? If an emergency situation arises, you do not want to be scrambling to figure out what to do. Your completed EAP will be an invaluable resource during an unusual event or emergency. It will help you to act quickly and strategically, thereby reducing the risk of injury or loss of life and minimizing property damage.

For those of you unfamiliar with the language of dams, two diagrams and a glossary are provided in the Appendix. There are also some tips to get you started on your EAP.

Ecology's Dam Safety Office (DSO) is always available to help and assist you. But remember that as the dam owner, you are ultimately responsible for the maintenance and safety of your dam.

Table of Contents

Note: Since your additions or other changes may affect page numbers, they are left blank here.

Dam Basics: impacted area and dam description

Potentially impacted downstream area:
(What would be impacted if there was a dam failure?)

Please describe the property(s) downstream of the dam (agricultural, residential, industrial, critical wildlife habitat, etc.):

Wildboy Creek immediately downstream of Kwoneesum dam flows through the Wildboy property owned by Columbia Land Trust and managed as a natural area, with no industrial or residential uses. After the confluence with the West Fork Washougal River, land use transitions to primarily rural residential, with lot sizes generally greater than one acre. This land use is present downstream until the Washougal River reaches the town of Washougal, WA. Both Wildboy Creek and the West Fork Washougal River, as well as the main stem Washougal River contain valuable spawning and rearing habitat for Steelhead trout and salmon. This habitat has been degraded by a history of splash damming and subsequent souring to move logs downstream, and was further impacted by an unintentional release of water from Kwoneesum Dam in the 1990s. In addition to potential loss of life and property, a failure of Kwoneesum dam would likely result in additional habitat degradation and death of resident fish.

Additional information on impacted areas, if available:
See people at risk tab (Appendix A)

Located on: Wildboy Creek, tributary

Downstream flood path: Wildboy Creek Creek/River to West Fork Washougal River

Description of the dam
(Refer to graphic of typical dam and Glossary in Appendix, if needed.)

Official dam name: Camp Kwoneesum Dam

State I.D. number: SA 28-131

Dam owner and/or operator: Columbia Land Trust

Owner: Columbia Land Trust, info@columbialandtrustl.org

Dam operator telephone numbers: Columbia Land Trust, Ian Sinks (360) 213-1206

E-mail address: isinks@columbialandtrust.org

Address: 850 Officers Row, Vancouver, WA 98661

Section 8 Township 02N Range 05 East (or) Latitude: 454017.09 Longitude: -1221308.24

County Skamania, WA

Type of dam (ex: earthfill, concrete, rockfill) Concrete-faced rock-filled embankment dam

Dam height:55 feet Crest length: 320 Crest width:15ft

Maximum storage: 102-acre feet. Normal storage: 96.2-acre feet.

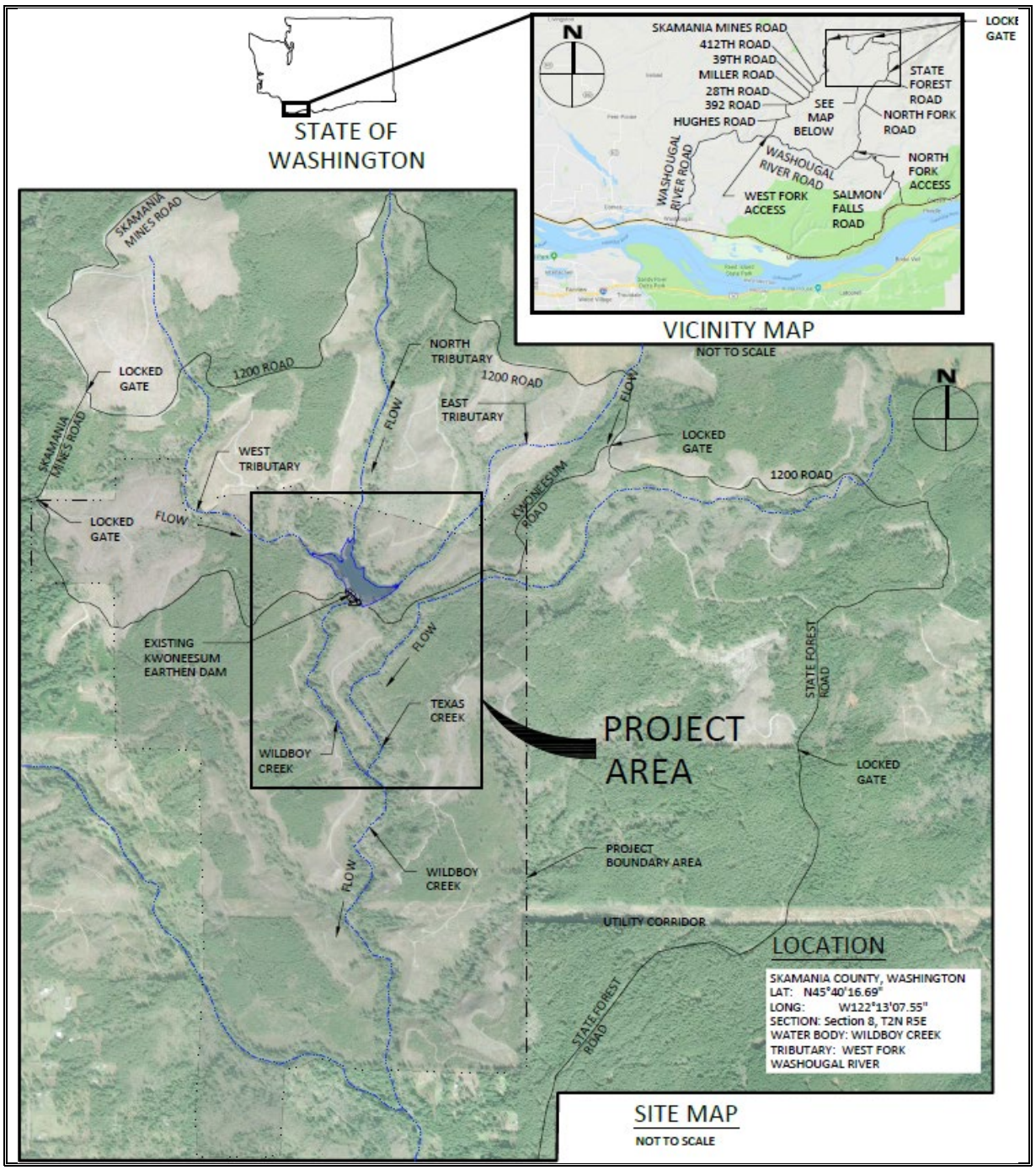
Downstream hazard classification: High, Class 1C

Number of homes in the dam break floodplain (the number of homes that would be in the path of flood water if the dam should fail): 21

Directions to the dam (note any locked gates or other access issues):

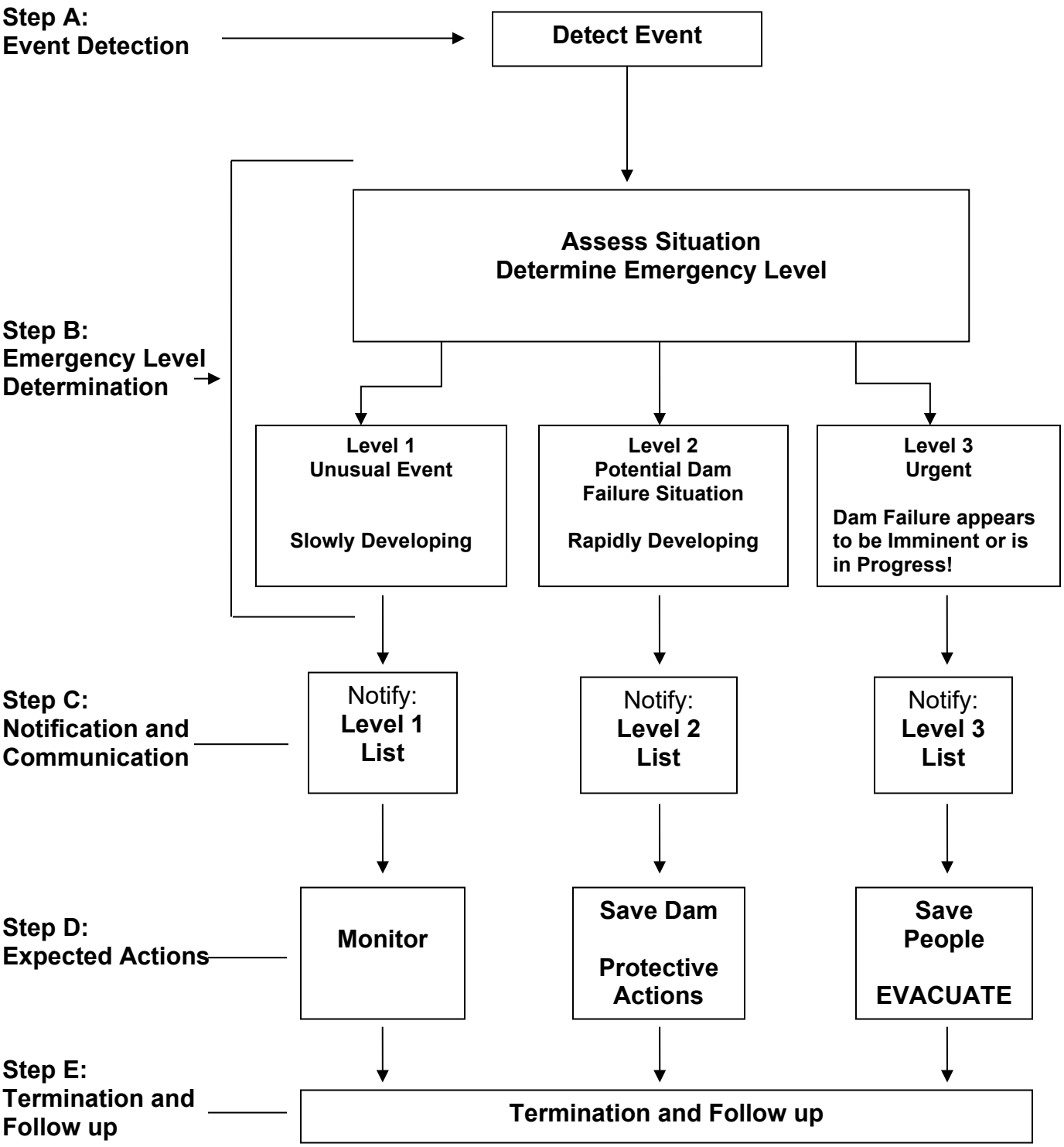
Commencing in Washougal, WA at the intersection of Hwy. 14 and Washougal River Road, take Washougal River Road for 10.9 miles to North Fork Road, turn left on North Fork Road and proceed 2.5 miles to the end of the pavement, continue 1.9 miles past the end of pavement to a locked Weyerhaeuser gate, with permission, proceed through the gate on the 1230 Road for 1.1 miles to the 1200 road, turn left on the 1200 road for 1.1 miles to the road to Kwoneesum Dam, turn left through a locked gate and proceed 1.2 miles to the dam site.

Draw or insert LOCATION MAP here:



Emergency Action Plan Overview: Steps A - E

This flowchart presents the basic steps to take in an unusual event or emergency. Details on each step follow.



STEP A: Detect/recognize the event

Unusual or emergency events can be detected by:

- Observations made at or near the dam.
- Earthquakes felt or reported at or near the dam.
- Other conditions that can cause an unusual or emergency event at the dam. For example, forecasts of a severe weather event, a flash flood, upstream dam failures or releases.

STEP B: Determine the Emergency Level (1-3)

You need to evaluate the potential extent of the emergency *before* you notify the appropriate people/agencies. The Emergency Level determines your next steps. Responding to a slowly developing event clearly requires a different response than an imminent dam failure, for example.

The Guidance table on the next page is a quick reference guide to events, situations and levels. For more detailed examples, see Appendix.

Emergency Level 1 - Unusual event, slowly developing

This event is not normal but has not yet threatened the operation or structural integrity of the dam. This event could affect the structural integrity of the dam if left unchecked. The dam operator, technical support (Engineer) and state dam safety officials should be contacted to investigate the situation and recommend actions to be taken. Communications gear suitable for the occasion must be included. If hazardous weather conditions exist or are anticipated, vehicle suitability for the trip and provisions for personnel need to be considered. Once on-site, the condition of the dam should be closely monitored, especially during storm events, to detect the development of a potential or imminent dam failure situation. The local law enforcement should be informed if it is determined that the situation may possibly develop into a worse condition that may require emergency actions.

Emergency Level 2 - Potential dam failure, rapidly developing

This event may eventually lead to dam failure and potential flooding downstream, but there is not an immediate threat of dam failure. This emergency level also applies when uncontrolled flow through the dam's spillway has or is likely to result in flooding of downstream areas, but is not yet affecting buildings or roads, or posing a significant risk to health, safety, or welfare. All the preparations outlined for Emergency Level 1 should be employed. Law enforcement should be notified of this emergency situation and placed on alert. The dam operator should closely monitor the condition of the dam and periodically report the status of the situation to the law enforcement officials. If the dam condition worsens and failure becomes imminent, law enforcement must be notified immediately of the change in the emergency level to evacuate people at risk downstream.

Technical support and state dam safety officials, if not already on-site or en route, should be contacted to evaluate and recommend remedial actions to prevent failure of the dam. The dam operator should initiate remedial repair (note local resources that may be available – see Appendix B- 1). Time available to employ remedial actions may be hours or days.

Emergency Level 3 - Urgent; dam failure appears imminent or is in progress

This is an urgent event, where a dam failure is occurring or is clearly about to occur and cannot be prevented. If this situation occurs in combination with high water from West Fork Washougal River, Texas Creek and Vogel, flash flooding will occur. The amount of

flooding and resulting damage will be dependent upon the severity of the event that is causing the high water in the uncontrolled watershed upstream of habited areas.

- If a breach occurs during the dry season when inflow to the reservoir level is low, the escaped water will raise water levels in habited areas downstream at a clearly noticeable rate. People should take heed and leave the immediate surroundings of the river, moving to higher ground until the water level recedes.
- If a breach occurs when thunderstorms or winter rapid snow melt have created high water conditions throughout the watershed and in particular downstream of the dam, the effects of the dam breach may not be immediately noticeable but will marginally raise the water surface in habited areas. The flood conditions already present will alert parties at risk and lead to abandonment of endangered facilities and habitations.

This event level is also applicable when flow through the dam's spillway is flooding buildings or roads. The dam owner **will contact 911** and the **responsible Emergency Services** to evacuate people at risk and close roads in the flood path if necessary.

Guidance for Determining the Emergency Level

(more detailed examples in Appendix; also graphics of typical dam and possible dam failures)

Emergency Level 1: Non-emergency, unusual event, slowly developing.
Emergency Level 2: Potential dam failure situation, rapidly developing.
Emergency Level 3: Urgent; dam failure appears to be imminent or is in progress.

Event	Situation	Emergency Level
Earthquake	Measurable earthquake felt or reported within (50) miles of the dam	1
	Earthquake resulting in visible damage to the dam or appurtenances	2
	Earthquake resulting in uncontrolled release of water from the dam	3
Embankment cracking	New cracks in the embankment greater than 1/2–inch wide and greater than 2-feet deep, without seepage	1
	Cracks in the embankment with seepage emerging	2
Embankment movement	Visual movement/slippage of the embankment slope	1
	Sudden or rapidly proceeding slides of the embankment slopes	2
Flooding	National Weather Service issues a flood warning for the area	1
	The reservoir elevation reaches the predetermined notification trigger elevation of 36 inches below dam crest	2
	The reservoir elevation reaches the predetermined notification trigger elevation of 24 inches below dam crest	3
	Spillway flow is flooding roads and people downstream	3
	Flood flows are overtopping the dam	3
Instruments	Instrumentation readings beyond predetermined values	1
Sabotage/Vandalism	Damage to the dam or appurtenances with no impacts to the functioning of the dam	1
	Modification to the dam or appurtenances that could adversely impact the functioning of the dam	1
	Damage to the dam or appurtenances that has resulted in seepage flow	2
	Damage to the dam or appurtenances that has resulted in uncontrolled water release	3
Security threat	Verified bomb threat that, if carried out, could result in damage to the dam	2
	Detonated bomb that has resulted in damage to the dam or appurtenances	3
Seepage	New seepage areas in or near the dam	1
	Boils observed downstream of dam	1
	Boils observed downstream of dam with cloudy discharge	2
	New seepage areas with cloudy discharge or increasing flow rate	2
	Cloudy flow and one or more of the following (with constant reservoir level): accelerating rate of flow, expanding flow at exit point, or buildup of soils	3
Sinkholes	Observation of new sinkhole in reservoir area or on embankment	2
	Rapidly enlarging sinkhole	3
Spillways	Principal spillway severely blocked with debris or structurally damaged	1
	Principal spillway leaking with muddy flows	1
	Principal spillway blocked with debris and pool is rapidly rising	2

Step C: Notification and communication

Once you have determined the Emergency Level (in Step B), follow the appropriate notification steps below. How you proceed will depend on the identified Emergency Level. Your prepared list of "Owner/operator contact numbers" and individual responsibilities follows.

Emergency Level 1: Slowly developing failure or unusual situation

If there is a **slowly developing failure** or **unusual situation**, where dam failure is not imminent but could occur if no action is taken, dam-tending personnel should:

1. Contact the appropriate persons associated with your dam. Your list is on the next page, "Owner/operator contact numbers".

2. Notify Local Emergency Services (509) 427-9490 of the potential problem and keep them advised of the situation.
    - Be sure to ask if there are any immediate actions you can take to reduce the risk of failure.

3. If the event is *during office hours*, call the Ecology Dam Safety Office, (360) 407-6872 for an evaluation of the dam.
    - Be sure to ask if there are any immediate actions you can take to reduce the risk of failure.

4. If necessary, implement the preventative actions described under ***Step D*** of this plan, under the direction of a professional engineer.

5. **If the situation deteriorates,** be prepared to notify downstream residents ("List of people, structures and roads at greatest risk" follows next page**).**

Emergency Level 2: Potential dam failure, rapidly developing

If there is a potential dam failure, contact the appropriate authorities immediately *in the order listed below*.

1. Call 9-1-1

2. Contact the appropriate persons associated with your dam. Your list is on the next page, "Owner/operator contact numbers."

3. Call County/City Emergency Services or Sheriff

	Name	Position	Phone
1.	Skamania County Sheriff	Dispatcher	(509) 427-9490
2.	Jon Carlson	Skamania Co. Emergency Services	(509)427-8076

4. Call the State Division of Emergency Management
   a. Call the Duty Officer (available 24 hours/day) at **1-800-258-5990**
   b. Clearly state that this is a "**dam safety emergency**"

5. If it is during *regular office hours*, contact the Ecology Water Resources receptionist at, (360) 407-6872, and you will be transferred to an engineer.

6. If the situation deteriorates, be prepared to notify downstream residents ("List of people, structures and roads most at risk", after next page**).**

Emergency Level 3: Urgent; dam failure appears imminent or is in progress

If a dam failure is imminent or in process, immediately contact the appropriate authorities *in the order listed below.*

1. Call 9-1-1

2. Contact the appropriate persons associated with your dam. Your list is at the bottom of this page, "Owner/operator contact numbers."

3. Notify persons immediately downstream from the dam of the failure ("List of people, structures and roads most at risk" on next page). Refer also to the Inundation Map, on last page of document.

4. Call County/City Emergency Services or Sheriff

	Name	Position	Phone
1.	Skamania County Sheriff	Dispatcher	(509) 427-9490
2.	Jon Carlson	Skamania Co. Emergency Services	(509)427-8076

5. Call State Division of Emergency Management
   a. Call the Duty Officer (available 24 hours/day) at **1-800-258-5990**
   b. Clearly state that this is a "**dam safety emergency**"

6. If it is during *regular office hours*, contact the Ecology Water Resources receptionist at, (360) 407-6872, and you will be transferred to an engineer.

7. Begin any recommended procedures; take preventative actions as described in ***Step D*** of this plan under the direction of a professional engineer.

Owner/operator contact numbers

It is important that no one person becomes overwhelmed during an unusual event or an emergency. The following list indicates who is responsible for each predetermined duty.

	Name	Phone	Email	Responsibility
1.	Ian Sinks	(360) 213-1206	isinks@columbialandtrust.org	Primary
2.	Simon Apostol	(360) 947-9647	sapostol@columbialandtrust.org	Secondary
3.	Jennifer Zarnoch	(360) 903-2443	jzarnoch@columbialandtrust.org	Tertiary

List of people, structures and roads at greatest risk

In order of proximity to the dam (also refer to Inundation Map at end of document)

Type of structure (residence/business/ road/other) **Parcel number**	**Name and address**	**Phone number (if available)**	**Approximate depth & time flood may arrive (if available)**
1. Residence 02-05-20-0-0-0204-00 1401 Mathews Road Washougal, WA 98671	Michael C Spady 1401 Mathews Road Washougal, WA 98671	(360)837-1503 (360)837-1030	Depth: 4 feet Time: 15-17 min
2. Residence 02-05-20-0-0-0202-00 1411 Mathews Road Washougal, WA 98671	Timmy & Mary Sheppard P.O. Box 761 Washougal, WA 98671	(360)837-1876	Depth: 4 feet Time: 15-17 min
3. Residence 02-05-20-0-0-0203-00 1402 Mathews Road Washougal, WA 98671	Zachery Scott 1029 ½ West 24 Street Los Angeles, CA 90007	(360)837-2694 (310)470-0998 (310)470-7552 (818)259-3803	Depth: 4 feet Time: 17-19 min
4. Residence 02-05-20-0-0-0100-00 282 Linda Lane Washougal, WA 98671	Frank & Suzanne Deshirlia 282 Linda Lane Washougal, WA 98671	(360)687-4766	Depth: 4 feet Time: 18-20 min
5. Residence 02-05-20-0-0-0110-00 362 Linda Lane Washougal, WA 98671	Gerald & Linda Harteloo 362 Linda Lane Washougal, WA 98671	(360)837-1708	Depth: 4 feet Time: 19-21min
6. Residence 02-05-20-0-0-1500-00 502 Linda Lane Washougal, WA 98671	Benjamin Leslie 502 Linda Lane Washougal, WA 98671	(860)535-9240	Depth: 4 feet Time: 20-22 min
7. & 8. Residence, Fish Hatchery 02-05-29-0-0-0700-00 391 Steelhead Road Washougal, WA 98671	Skamania Hatchery 391 Steelhead Road Washougal, WA 98671	(360)837-3131	Depth: 4 feet Time: 30-32 min

Type of structure (residence/business/ road/other) Parcel number	Name and address	Phone number (if available)	Approximate depth & time flood may arrive (if available)
9. Residence 02-05-32-3-0-0500-00 402 Laurel Lane Washougal, WA 98671	Daniel & Zakia Smith 402 Laurel Lane Washougal, WA 98671	(360)760-1471	Depth: 4 feet Time: 40-42 min
10. Residence 02-05-32-3-0-1500-00 222 Laurel Lane Washougal, WA 98671	Robb Olmsted, Trustee 222 Laurel Lane Washougal, WA 98671	(360)837-1756	Depth: 4 feet Time: 47-49 min
11. Residence 02-05-32-3-0-1700-00 152 Laurel Lane Washougal, WA 98671	Gail Bellamy 152 Laurel Lane Washougal, WA 98671	(360)837-3305	Depth: 4 feet Time: 51-53 min
12. Residence 02-05-32-3-0-1600-00 192 Laurel Lane Washougal, WA 98671	Cynthia O'Mealy 192 Laurel Lane Washougal, WA 98671	(360)837-3618	Depth: 4 feet Time: 52-54 min
13. Residence 02-05-32-3-0-1102-00 31 Kingfisher Lane Washougal, WA 98671	Joe Allen & JoAnn McArthur, Trustees 31 Kingfisher Lane Washougal, WA 98671	(360)837-2150	Depth: 4 feet Time: 52-54 min
14. Residence 02-05-32-3-0-1800-00142 Laurel Lane Washougal, WA 98671	Thomas Flynn 142 Laurel Lane Washougal, WA 98671	(360)837-3670	Depth: 4 feet Time: 52-54 min
15. Residence 02-05-32-3-0-1301-00 82 Laurel Lane Washougal, WA 98671	Michael & Laura McGinley 82 Laurel Lane Washougal, WA 98671	(360)837-3164	Depth: 4 feet Time: 52-54 min
16. Residence 02-05-32-3-0-2400-00 71 Laurel Lane South Washougal, WA 98671	Beverly Schwartz, Trustee 71 Laurel Lane South Washougal, WA 98671	(360)837-3367	Depth: 4 feet Time: 53-55 min

Type of structure (residence/business/ road/other) Parcel number	Name and address	Phone number (if available)	Approximate depth & time flood may arrive (if available)
17. Residence 02-05-32-3-0-1112-00 11 Kingfisher Lane Washougal, WA 98671	Jona & Cory Patterson 8505 29th Avenue, N.W. Seattle, WA 98117	(206)617-2627 (206)781-2728 (915)691-0063	Depth: 4 feet Time: 53-55 min
18. Residence 02-05-32-3-0-2900-00 141 Laurel Lane South Washougal, WA 98671	Stanley & Sharlene Steudler 141 Laurel Lane South Washougal, WA 98671	(360)837-3309	Depth: 4 feet Time: 54-56 min
19. Residence 02-05-32-3-0-3300-00 151 Laurel Lane South Washougal, WA 98671	John Cannon 151 Laurel Lane South Washougal, WA 98671	(360)837-3878	Depth: 4 feet Time: 54-56 min
20. Residence 02-05-32-3-0-3301-00 41 Sweetie's Crossing Washougal, WA 98671	Richard Dvorchak 41 Sweetie's Crossing Washougal, WA 98671	(360)837-1049 (503)629-8958 (503)810-5601	Depth: 4 feet Time: 54-56 min
21. Residence 01-05-05-2-2-0102-00252 Laurel Lane, South Washougal, WA 98671	Mark Gustafson 252 Laurel Lane, South Washougal, WA 98671	(360)837-3748	Depth: 4 feet Time: 57-59 min

Step D: Expected actions: take preventative actions

The following actions may help to prevent or delay a dam failure after an emergency is first discovered. **These actions should only be performed *under the direction of* the Dam Safety Office, or other qualified professional engineers.** This list includes some of the more likely issues; it is not intended as a comprehensive list. (See Appendix for graphics of typical dam and possible failures.)

Your list of supplies and resources, which may be needed to carry out the necessary actions, follows the examples.

1. Erosional seepage or leakage (piping) through the embankment, foundation, or abutments

- Plug the flow with whatever material is available (hay bales, bentonite, or plastic sheeting if the entrance to the leak is in the reservoir).
- Lower the water level until the flow decreases to a non-erosive velocity or until it stops.
- Place a blanket filter (a protective sand and gravel filter) over the exit area to hold materials in place.

- Continue lowering the water level until the reservoir reaches a safe elevation.
- Continue operating at a reduced level until repairs are complete.

2. Excessive seepage and high level saturation of the embankment

- Lower the water to a safe level.
- Continue frequent monitoring for signs of slides, cracking, or concentrated seepage.
- Continue operations at a reduced level until repairs are complete.

3. Excessive settlement of the embankment

- Lower the water level by releasing it through the outlet, or by pumping or siphoning.
- If necessary, restore freeboard, preferably by placing sandbags.
- Lower water to a safe level.
- Continue operating at a reduced level until repairs can be made.

4. Failure of an appurtenant structure such as an outlet or spillway

- Implement temporary measures to protect the damaged structure, such as closing an outlet or providing temporary protection for a damaged spillway.
- Employ experienced, professional divers, if necessary, to assess the problem and possibly implement repair.
- Lower the water level to a safe elevation. If the outlet is inoperable, pumping, siphoning, or a controlled breach may be required.

5. Mass movement of the dam on its foundation (spreading or mass sliding failure)

- Immediately lower the water level until excessive movement stops.
- Continue lowering the water level until a safe level is reached.
- Continue operation at a reduced level until repairs are complete.

6. Overtopping by flood waters

- Open outlet to its maximum safe capacity.
- Place sandbags along the dam crest to increase freeboard and force more water through the spillway and outlet.
- Provide erosion-resistant protection to the downstream slope by placing plastic sheets or other materials over eroding areas.
- Divert flood waters around the reservoir basin if possible.

7. Reduction in freeboard and/or loss of dam crest width

- Place additional rip rap or sandbags in damaged areas to prevent further embankment erosion.
- Lower the water level to an elevation below the damaged area.
- Restore freeboard with sandbags or earth and rock fill.
- Continue close inspection of the damaged area until the storm is over.

8. Slide on the upstream or downstream slope of the embankment

- Lower the water level at a rate, and to an elevation, that is considered safe given the slide condition. If the outlet is damaged or blocked, pumping, siphoning, or a controlled breach may be required.
- Restore lost freeboard by placing sandbags or fill in the top of the slide.
- Stabilize slides on the downstream slope by weighting the toe area with additional soil, rock, or gravel.

9. Spillway back cutting threatening reservoir evacuation

- Reduce the flow over the spillway by fully opening the main outlet.
- Provide temporary protection at the point of erosion by placing sandbags, rip rap materials, or plastic sheets weighted with sandbags.
- When inflow subsides, lower the reservoir to a safe level.

- Continue operating at a lower water level to minimize spillway flow.

Supplies and resources

In an emergency situation, equipment and supplies (such as sandbags, fill materials, equipment and laborers) may be needed on short notice. The table below lists supplies and how to access them.

Item	Contact	Phone	Location
Earthmoving Equipment	ERS	(360) 210-7726	Washougal, WA
	BCI Contracting	(503) 806-0606	Portland, OR
Sand and Gravel	J.L Storedahl	(360) 882-7316	Vancouver, WA
	Cadman – Fisher West	(503) 254-7770	Camas, WA
Sandbags	Home Depot	(360) 442-6873	Vancouver, WA
Pumps	Mersino	(503) 816-6246	Portland, OR
	BCI Contracting	(503) 806-0606	Portland, OR
Pipe	ADS	(360) 607-8321	Washougal, WA
Laborers	ERS	(360) 210-7726	Washougal, WA
Civil Engineering	Parr Excellence, Inc	(541) 490-3897	Bingen, WA

Step E: Termination and follow-up

Your responsibilities do not end once the immediate crisis is over; you must still do a formal termination and follow-up.

Termination responsibilities for Level 1 unusual event

If you have activated the EAP, you must take actions to conclude the EAP once the event is over and you have followed all the needed procedures.

- Contact Ecology's Dam Safety office and your dam engineer to further investigate the situation and recommend corrective actions if necessary.
- Document the situation with photographs and/or video, note times and conditions.
- Inspect the full length of the upstream slope, crest, downstream slope, and downstream toe of the dam. Check the reservoir area, abutments, and downstream channel of the dam.

Termination responsibilities for Level 2 or 3 emergencies

Your Local Emergency Manager is responsible for terminating the EAP operations for a Level 2 or Level 3 emergency, and relaying this decision to the dam owner.

- The Washington State Dam Safety Engineer must assure the dam is inspected to determine if any hazardous conditions exist.
- If it is determined that hazardous conditions no longer exist, the Washington State Dam Safety Supervisor will advise the Local Emergency Manager to terminate EAP operations.
- The person who made the original calls must inform each person contacted that the emergency has ended.

This page left blank for notes and additional information.

APPENDIX

I. Why this plan is important -- and some initial preparation guidance

II. Examples of emergency situations – to help determine Emergency Level (1-3)

III. Dam diagram and possible dam failures (graphics)

IV. Glossary and Water Equivalents Table

V. Final plan approval and signatures

VI. For more information

VII. Inundation map

I. Why this plan is important -- and some initial preparation guidance

Why is this plan so important? If an emergency situation arises, you do not want to be scrambling to figure out what to do. Your completed Emergency Action Plan (EAP) will be an invaluable resource during an unusual event or emergency. It will help you to act quickly and strategically, thereby reducing the risk of injury or loss of life and minimizing property damage.

Ecology's Dam Safety Office (DSO) is always available to help and assist you. But remember that as the dam owner, you are ultimately responsible for the maintenance and safety of your dam.

Your EAP defines responsibilities and provides procedures designed to:

- Identify conditions that may endanger the dam.
- Begin remedial actions to prevent or minimize the downstream impacts of a dam failure.
- Notify local emergency personnel and effectively communicate conditions.
- Warn downstream residents of impending or actual failure of the dam.
- Conclude the response to the unusual or emergency event.

What do I need to do?

Your EAP will only be as useful as the quality of the information included. You, as dam owner or representative, need to do your homework **before** an emergency. You are responsible for researching and filling out the following designated sections (the Dam Safety Office can help):

1. Front page and Dam Basics (including Location Map)
2. Notification and communication: One of most essential parts of your plan.

   When you are preparing, or revising, your notification lists:
   - Determine **who** is responsible for notifying persons in the flood path if an evacuation is necessary. This information will be determined by your local police or sheriff (use the non-emergency phone number) and the State Division of Emergency Management at (800) 562-6108 or by e-mail: www.emd.wa.gov/myn/myn_contact_info.shtml.
   - Contact information for local and county emergency response officials can be found at the website maintained by the Department of Ecology and the Local Emergency Planning Committees within Washington State (LEPC): https://ecology.wa.gov/LEPCcontacts
   - For assistance in completing your "List of people, structures and roads at greatest risk", contact local emergency personnel.
3. Supplies and resources
4. Approval of Emergency Action Plan
5. Inundation map

Read through the whole plan before it's needed, so you know what is included and understand the general emergency process. For example, it is important to become familiar with the three different emergency levels and situations before an event occurs. After an unusual or emergency event is detected or reported, the dam owner or representative is responsible for classifying the event into one of the three emergency levels.

II. Examples of Emergency Situations
To help you determine the Emergency Level (1-3)

Assessing the Emergency Level is essential for proceeding in a strategic and effective way in a potential emergency. We urge you, the dam owner, to use conservative judgment in determining whether a condition at the dam constitutes an emergency. (Refer to Appendix, graphics of typical dam and possible dam failures.)

Some of the conditions that usually constitute an emergency situation include:

- Dam failure due to aging, or design and construction oversights.
- Significant flow through the emergency spillway or overtopping of the embankment due to extreme weather events (weather conditions that may exceed design expectations).
- Accidental or intentional damage to the dam.

The examples below identify some of the more likely emergency level conditions, presented for guidance only:

1. Embankment movement and cracking
2. Embankment overtopping
3. Emergency spillway flows
4. Seepage and sinkholes
5. Wildfire impacts
6. Other problems

1. Embankment Movement and Cracking

Emergency Level 2 - Potential dam failure; rapidly developing:

- Settlement of the crest, slopes, abutments and/or foundation of the dam that may eventually result in breaching of the dam.
- Significant increase in length, width, or offset of cracks in the crest, slopes, abutments, and/or foundation of the dam, which may eventually result in breaching of the dam.

Emergency Level 3 - Urgent; dam failure is imminent or in progress:

- Sudden or rapid progression of slides, settlement, or cracking of the embankment crests, slopes, abutments, and/or foundation, where breaching of the dam appears imminent or is in progress.

2. Emergency Spillway Flows

Emergency Level 2 - Potential dam failure; rapidly developing:

- Significant erosion or head cutting of the spillway is occurring, but a breach of the spillway crest (that would result in an uncontrolled release from the reservoir) does *not* seem imminent.
- Flow through the emergency spillway *is likely to* cause flooding that threatens harm to any person, home, or road downstream from the dam.

Emergency Level 3 – Urgent; dam failure is imminent or in progress:

- Significant erosion or head cutting of the spillway is occurring at a rapid rate and a breach of the control section appears imminent.
- Flow through the emergency spillway is causing flooding that threatens harm to any person, home, or road downstream from the dam.

3. Embankment Overtopping

Emergency Level 2 - Potential dam failure; rapidly developing:

- The reservoir level has reached the top of the dam and is projected to continue to rise.
- Flow is occurring over the embankment, but it is not eroding the embankment slope, and the reservoir is expected to recede.

Emergency Level 3 - Urgent; dam failure is imminent or in progress:

- Flow is occurring over the embankment and is causing erosion damage to the embankment slope.
- The reservoir level has exceeded the top of the dam and is expected to continue to rise.

4. Seepage and Sinkholes

Emergency Level 2 - Potential dam failure; rapidly developing:

- Cloudy seepage or soil deposits are observed at seepage exit points or from internal drain outlet pipes.
- New or increased areas of wet or muddy soils are present on the downstream slope, abutment, and/or foundation of the dam, and there is an easily detectable and unusual increase in volume of downstream seepage.
- Significant new or enlarging sinkhole(s) on or near the dam.
- Reservoir level is falling without apparent cause.
- The following known dam defects are or soon will be inundated by a rise in the reservoir:
  1) Sinkhole(s) located on the upstream slope, crest, abutment, and/or foundation of the dam; or
  2) Transverse cracks extending through the dam, abutments, or foundation.

Emergency Level 3 - Urgent; dam failure is imminent or in progress:

- Rapid increase in cloudy seepage or soil deposits at seepage exit points, to the extent that failure appears imminent or is in progress.
- Rapid increase in volume of downstream seepage, to the extent that failure appears imminent or is in progress.
- Water flowing out of holes in the downstream slope, abutment, and/or foundation of the dam, to the extent that failure appears imminent or is in progress.
- Whirlpools or other evidence exists indicating that the reservoir is draining rapidly through the dam or foundation.
- Rapid enlargement of sinkhole(s) is forming on the dam or abutments, to the extent that failure appears imminent or is in progress.
- Rapid increase in flow through crack(s) which is eroding materials, to the extent that failure appears imminent or is in progress.

5. Wildfire Impacts on Dams

Emergency Level 1 - Non-emergency, unusual event; needs response to reduce risk or likelihood of a Level 2 incident

- Incident: **Wildfire at the dam or in the upstream watershed**.
  Responses:
  - Inspect and assess damage to dam, spillways, and appurtenant facilities.
  - Assess whether access to the dam may be vulnerable to blockage by debris flows.
  - Assess whether spillways may be vulnerable to blockage by debris flows or by floating debris in the reservoir.
  - Assess increased hydrologic risk. Watershed assessment by a qualified engineer or engineering hydrologist. See Burned Watershed guidance from the Dam Safety Office at https://ecology.wa.gov/Water-Shorelines/Water-supply/Dams/Emergency-planning-response/Risk-analysis-planning
  - Determine access routes and procedures for safe access to the dam during adverse conditions, and communications procedures to activate the EAP.

- Incident: **Forecast for rain** in the vicinity of the dam or upstream watershed.
  Responses:
  - Observe for actual rainfall, be prepared to respond.

- Incident: **Flash Flood Watch** (not Warning) issued by National Weather Service for the vicinity of the dam or upstream watershed.
  Responses:
  - Observe for actual rainfall, be prepared to respond.

- Incident: **Actual rain** in the vicinity of the dam or upstream watershed.
  Responses:
  - Observe runoff and spillway performance, be prepared to respond.

Emergency Level 2 - potential failure situation; needs timely response to reduce risk or likelihood of a dam failure.

- Incident: **Forecast for heavy rain** in the vicinity of the dam or upstream watershed.
  Responses:
  - Observe for actual rainfall, be prepared to respond.

- Incident: **Flash Flood Warning** issued by National Weather Service for the vicinity of the dam or upstream watershed.
  Responses:
  - Observe for actual rainfall, be prepared to respond.

- Incident: **Heavy rain or thunderstorm** in the vicinity of the dam or upstream watershed.
  Responses:
  - Observe runoff and spillway performance, be prepared to respond.

Emergency Level 3 - urgent; dam failure is imminent

- Incident: **Spillway begins to erode**
  Response:
  - Follow Level 3 protocol in your EAP.

- Incident: **Dam overtopping**
  Response:
  - Follow Level 3 protocol in your EAP.

6. Other Problems

In case of other problems occurring that might pose a threat to the dam safety, contact the Dam Safety Office and explain the situation as well as possible.

III. Dam Diagram and Possible Dam Failures

A quick look at some dam basics: a typical dam labeled with common terms, and graphic with some of the more common types of failures shown.

Dam Diagram

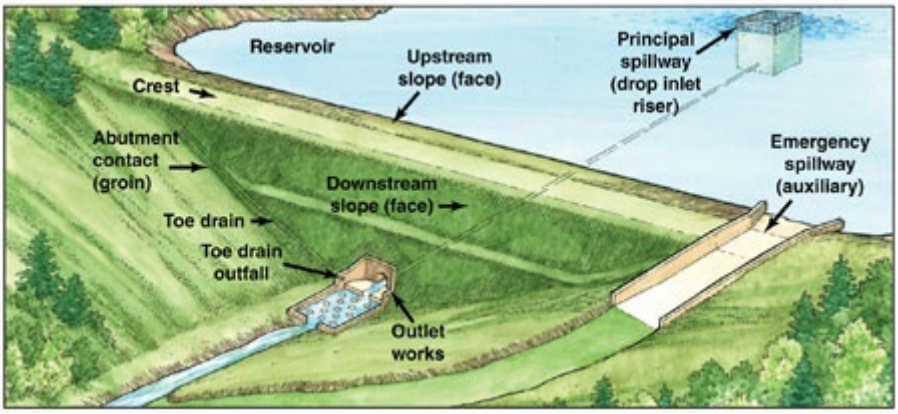


Figure 1—Typical dam diagram showing common terms.

Possible Dam Failures

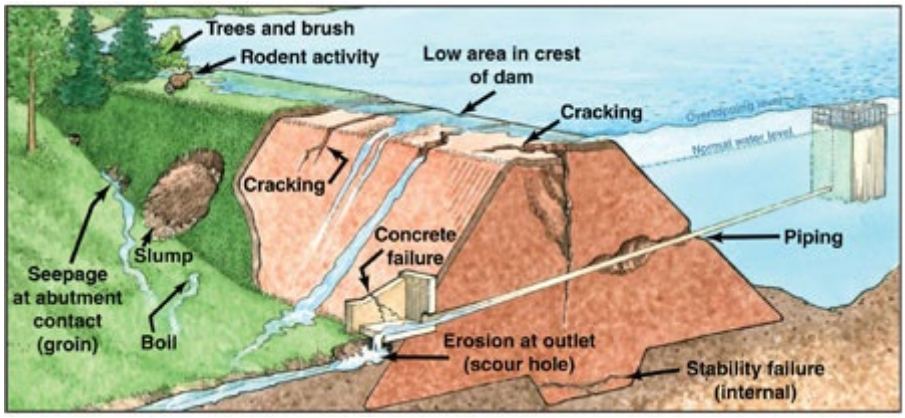


Figure 2—Some causes of dam failures.

Source: USDA Forest Service; http://www.fs.fed.us/t-d/pubs/htmlpubs/htm12732805/page02.htm

IV. Glossary

Abutment — That part of the valley side against which the dam is constructed. The left and right abutments of dams are defined with the observer looking in the *downstream* direction from the dam.

Acre-foot — The volume of one acre of surface area to a depth of one foot. One acre-foot is equal to 43,560 cubic feet or 325,850 gallons. It is enough water to cover an acre of land, about the size of a football field, one foot deep.

Appurtenances — Structures associated with, but secondary to, a dam. Examples include outlets, spillways, tunnels, etc.

Berm — A nearly horizontal step in the sloping profile of an embankment dam. Also a step in a rock or earth cut.

Boil — A disruption of the soil surface due to water discharging from below the surface. Eroded soil may be deposited in the form of a ring (miniature volcano) around the disruption.

Breach — An opening through a dam that allows the uncontrolled draining of a reservoir. A controlled breach is a constructed opening. An uncontrolled breach is an unintentional opening caused by discharge from the reservoir. A breach is generally associated with the partial or total failure of the dam.

Conduit — A closed channel (round pipe or rectangular box) that conveys water through, around, or under the dam.

Crest of dam: — See "Top of dam"

Dam — A man-made barrier, together with appurtenant structures, constructed above the natural surface of the ground for the purpose of impounding (holding) water. Water may contain any substance in combination with sufficient water to exist in a liquid or slurry state.

Dam failure — The uncontrolled release of a dam's impounded water.

Dam owner — Any person, private or non-profit company, special district, federal, state, or local government agency, or any other entity in direct routine control of a dam and reservoir, and/or directly involved in the physical operation and maintenance of a dam.

Downstream	Situated or moving in the direction in which a stream or river flows.
Drawdown	The difference between a water level and a lower water level in a reservoir within a particular time.
Emergency	A condition that develops unexpectedly, endangers the structural integrity of the dam and/or downstream human life and property, and requires immediate action.
Emergency Action Plan	A written document prepared by the dam owner, describing a detailed plan of actions for response to emergency or unusual events, including alerting and warning emergency officials in the event of a potential or imminent dam failure or other emergency related to the safety of the dam and public.
Emergency Level	Levels 1-3 (low to high); used to assess the potential extent of the emergency. Once assessed, the Level determines your next steps.
Embankment	A wall or bank of earth built to prevent a river flooding an area.
Engineer	A Professional Engineer registered and licensed in the State of Washington. The engineer must be sufficiently qualified and experienced in the design, construction, and safety evaluation of the type of dam under consideration.
Filter	One or more layers of granular material graded (either naturally or by selection) which allow seepage through or within the layers while preventing the migration of material from adjacent zones.
Floodplain	An area adjoining a body of water or natural stream that may be covered by floodwater. Also, the downstream area that would be inundated or otherwise affected by the failure of a dam or by large flood flows.
Freeboard	The vertical dimension between the crest (or invert) of the emergency spillway and the crest of the dam.
Hazard Classification	The placement of a dam into one of three categories (High, Significant & Low) based on the hazard potential derived from an evaluation of the probable adverse consequences due to failure or improper operation of the dam.
Impoundment	A body of water confined within an enclosure, such as a reservoir; impound (v.) to confine within an enclosure or within limits.

Instrumentation	An arrangement of devices installed into or near dams that provide measurements to evaluate the structural behavior and other performance parameters of the dam and appurtenant structures.
Inundation Map	A map depicting the area downstream from a dam that would reasonably be expected to be flooded in the event of a failure of the dam.
Local Emergency Manager	Person(s) responsible for developing, organizing, and exercising a community's emergency operations plan. Typically, City Police or Fire Department, or County Sheriff's Department personnel act as the Local Emergency Manager.
Overtopping	When water rises over the sides of the dam.
Outlet	A conduit (usually regulated by gates or valves) used for controlled or regulated releases of water from the reservoir.
Piping	The progressive development of internal erosion by seepage.
Reservoir	A body of water impounded by a dam and in which water can be stored.
Rip rap	Loose stone used to form a foundation for a breakwater or other structure.
Seepage	The natural movement of water through the embankment, foundation, or abutments of the dam.
Sinkhole	A cavity in the ground caused by erosion and providing a route for surface water to disappear underground.
Slide	The movement of a mass of earth down a slope on the embankment or abutment of the dam.
Spillway	An appurtenant structure that conducts overflows from a reservoir.
Spillway (principal)	The overflow structure designed to limit or control the operating level of a reservoir, and first to be activated in runoff conditions.
Spillway (emergency)	The appurtenant structure designed to pass the Inflow Design Flood in conjunction with the routing capacity of the reservoir and any principal or service spillway(s).
Spillway crest	The lowest level at which water can flow over or through the spillway.

State Dam Safety Engineer	For purposes of this EAP, the Washington State Department of Ecology Dam Safety Office engineer(s) responsible for safety inspections, plan review and determining the safe reservoir storage level of assigned dams.
Toe of dam	The junction of the downstream slope or face of a dam with the ground surface; also referred to as the downstream toe. The junction of the upstream slope with ground surface is called the upstream toe.
Top of dam (dam crest)	The elevation of the uppermost surface of a dam, usually a road or walkway, excluding any parapet wall, railings, etc.
Upstream	Moving or situated in the opposite direction from that in which a stream or river flows; nearer the source.

Water Equivalents Table

Water is measured under two conditions: at rest and in motion. Water at rest is measured by volume. Water in motion uses units of flow – a unit of volume for a specified period of time.

acre-foot: covers one acre of land, to a depth of one foot
cfs: cubic feet per second
gpd: gallons per day
gpm: gallons per minute

Volume units

1 cubic foot…….7.48 gallons……. 62.5 lbs of water
1 acre foot……...43,560 cubic feet……. 325,851 gallons

Flow units

1 cfs…….. 7.48 (gps)
1 cfs….. 448.8 gpm 646,272 gpd 1.98 acre-ft./day
1,000 gpm…… 2.23 cfs……. 4.42 acre-ft./day
1 million gpd…….. 694 gpm…….. 1.55 cfs

V. Final Plan review and signatures

Once you have completed your plan, it needs to go through several review processes.

Upon receipt of the EAP, please review the document and if you have any comments or suggestions please contact the Ecology Dam Safety Office or the owner/operator within the next 30 days or the DSO will consider the plan acceptable.

The following persons have received a copy of the Emergency Action Plan:

Dam Operator: Ian Sinks March 24, 2022, isinks@columbialandtrust.org

Dam Operator: Simon Apostol, March 24, 2022, sapostol@columbialandtrust.org

Skamania Emergency Management, John Carlson, March 24, 2022 JohnC@co.skamania.wa.us

Peter Barber, Restoration Ecologist – Cowlitz Indian Tribe, March 24, pbarber@cowlitz.org

Ecology Dam Safety Office: Charlotte Lattimore, March 24, 2022, clat461@ecy.wa.gov

VI. For more information

This form is a simplified emergency action plan template provided by the Washington State Department of Ecology (Form #ECY 070-37; originally published January 2003; last revised: June 2016).

Also available is the comprehensive *Emergency Action Plan* template and the accompanying *Guidelines for Developing Dam Emergency Action Plans*.

You can request a copy of these, or any other Ecology publication, by calling 360-407-6872, or by emailing us at ecypub@ecy.wa.gov.

Websites

Association of State Dam Safety Officials (ASDSO): http://www.damsafety.org/

Ecology dam safety emergency response: https://ecology.wa.gov/Water-Shorelines/Water-supply/Dams/Emergency-planning-response

Ecology general dam safety information: https://ecology.wa.gov/Water-Shorelines/Water-supply/Dams

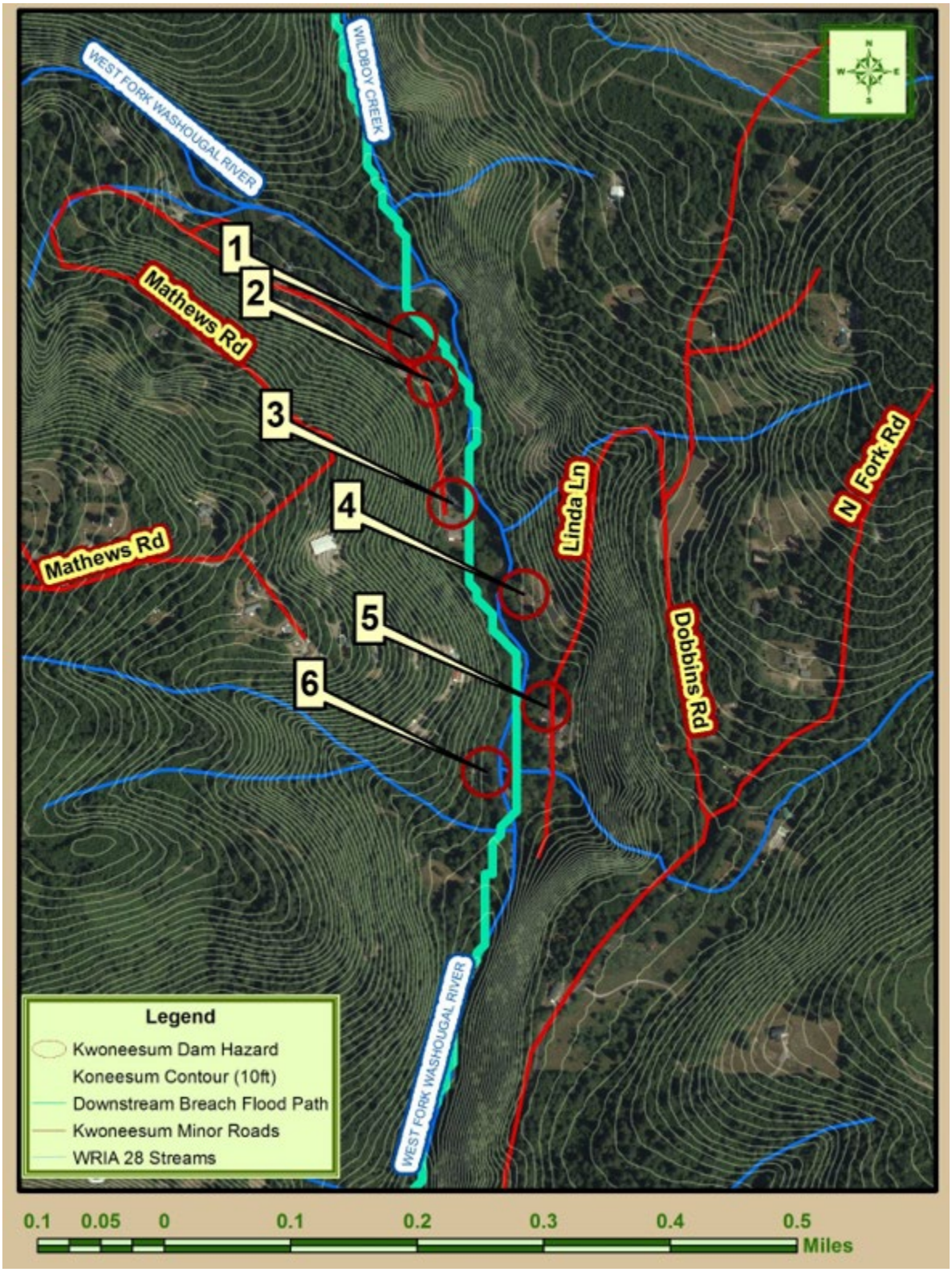
Federal Emergency Management Agency (FEMA) Dam Safety: http://www.fema.gov/dam-safety

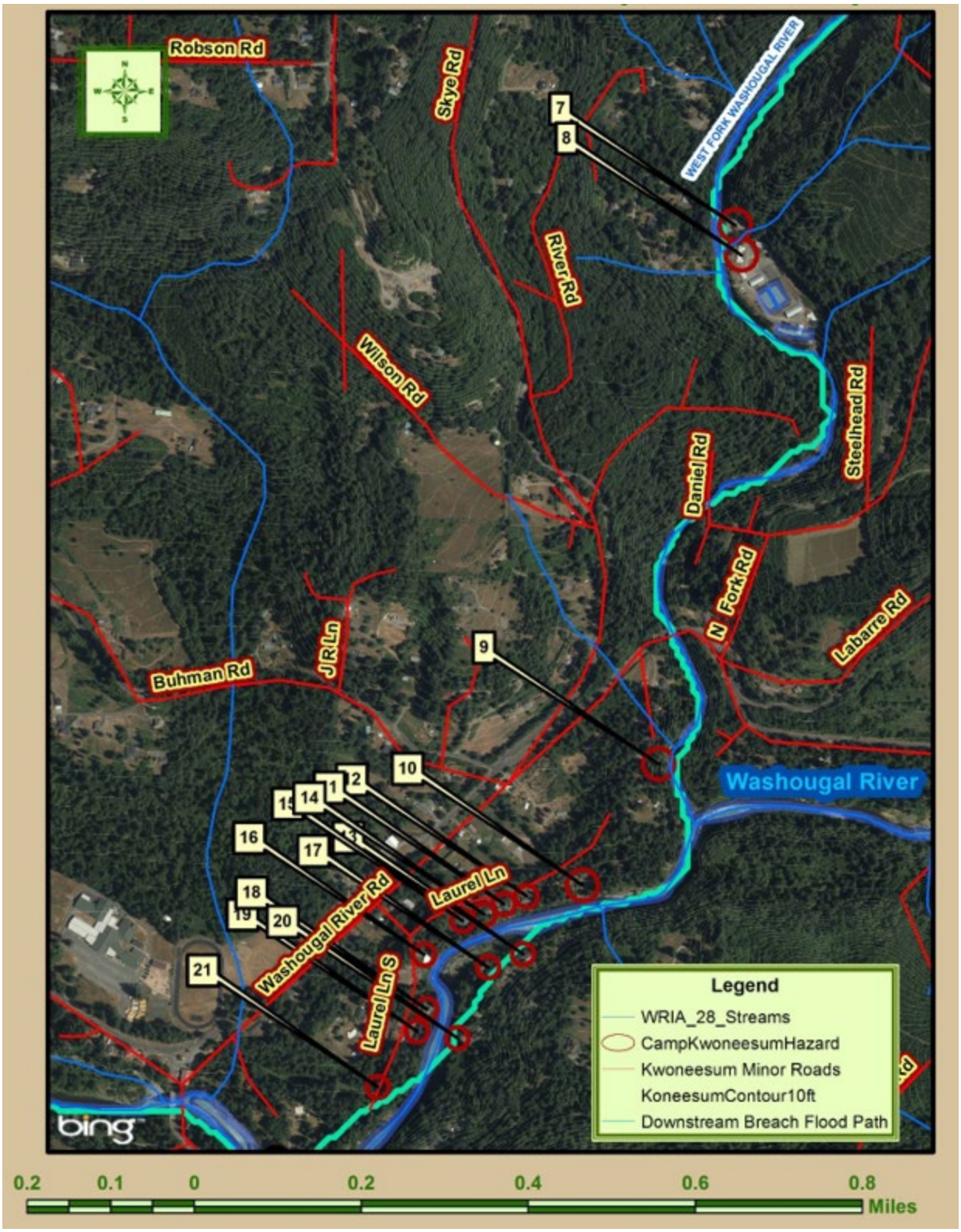
Special accommodations

To request ADA accommodation for disabilities, call Ecology's Water Resources Program at 360-407-6872. Persons with impaired hearing may call Washington Relay Service at 711. Persons with speech disability may call TTY at 877-833-6341.

VII. Inundation map

21 homes could be affected by a major flood caused by a sudden breach of the dam. These homes are marked on the following inundation map. Flood waters would reach the first home approximately 15 minutes after the dam failure. Also note businesses and roads that could be affected.




Robson Rd
Skye Rd
WEST FORK WASHOUGAL RIVER
River Rd
Wilson Rd
Daniel Rd
Steelhead Rd
N Fork Rd
Labarre Rd
J R Ln
Buhman Rd
Washougal River
Laurel Ln
Washougal River Rd
Laurel Ln S
7
8
9
10
1
2
14
15
16
17
18
19
20
21
Legend
WRIA_28_Streams
CampKwoneesumHazard
Kwoneesum Minor Roads
KoneesumContour10ft
Downstream Breach Flood Path
bing
0.2
0.1
0
0.2
0.4
0.6
0.8
Miles

Kwoneesum Dam Removal Risk Assessment

SUBMITTED TO

Cowlitz Indian Tribe
7700 26th Avenue
Vancouver, WA 98665

PREPARED BY

Parr Excellence
302 W Steuben St., #6
Bingen, WA 98605

March 2021

Table of Contents

Statement of Purpose

This report qualitatively assesses risks associated with removal of obsolete Kwoneesum Dam and restoration of stream habitat in Wildboy Creek versus the risks associated with maintaining the dam and reservoir in perpetuity. In the context of this report, risk is determined as a combined product of the potential impact of a restoration alternative as well as the relative probability of that impact resulting from restoration activities.

Two alternative restoration activities are compared in this assessment: 1) no action, and 2) dam removal following active sediment removal. The no-action alternative would require the landowner to maintain the dam in place which would include repair of the dam to bring it into compliance with the Washington State Department of Ecology (DOE). The dam removal alternative would remove the dam structure, partially remove and reuse impounded sediments, install large wood and gravel habitat features in Wildboy Creek, and stabilize newly exposed floodplain surfaces with native trees and shrubs.

The potential risks posed by either of these activities are assessed as impact probabilities in the following categories, which were developed to address areas of concern raised during pre-permit consultation:

1. Risk to Native Fish and Wildlife Habitat

2. Risk to Downstream Landowners

3. Risk to Stream Users

4. Risk to Public Infrastructure

Description of Restoration Alternatives

No Action

The no action alternative includes maintaining the current conditions of Kwoneesum Dam and its reservoir, requiring operation and maintenance by the landowner, Columbia Land Trust (CLT). Maintaining the dam is of paramount importance to avoid dam break and potential loss of life. Based on the latest Dam Safety Inspections by the Department of Ecology (Guy and Lee, 2015; Guy and Ordonez, 2006), the dam carries a high hazard potential due to the potential for property damage or loss of life in the case of a dam failure. There were 21 properties found to be at risk in the 2015 inspection, with associated residents.

A protocol of regular inspection and maintenance will be needed as well as the qualified personnel to perform these tasks. Inspection in 2015 resulted in required repairs to the face of the dam, its upstream lining, spillway, and low-level conduit. These dam maintenance obligations are outside of the scope of CLT's current management plan for the property. Dam safety inspections are required about every 5 years and would likely cost tens of thousands of dollars. In addition to maintenance obligations, CLT would need to institute a public safety protocol to manage liability while allowing public recreational access to the site. Furthermore, DOE Dam Safety Guidelines states, "The average life expectancy of a dam is about 50 years…" (DOE, 2020). Kwoneesum dam is beyond the average life expectancy so

operations and maintenance costs will likely increase drastically as the dam infrastructure continues to deteriorate. CLT prefers to avoid this risk to public safety.

Dam Removal Following Active Sediment Removal

This alternative involves reservoir drawdown, sediment removal, dam removal, large wood and gravel habitat feature installation, and stabilization of newly exposed soils with native shrubs and trees.

The process of dam removal would begin with diverting tributary flows around the reservoir, drawing down the reservoir, and then mechanically removing accumulated sediments. Drawdown would begin in the spring and impounded fine sediments would be removed as seasonal flows recede, prior to the regulatory in-water work window in summer. Crews will install anchored wood structures in the former reservoir and install native plants and shrubs to permanently stabilize soils and begin forest establishment.

The dam removal design includes habitat enhancement of approximately 4,000 feet of Wildboy Creek downstream of the dam to provide habitat and offset impacts from splash dam log drives and Kwoneesum Dam Construction. The enhancement plan includes placement of gravel and installation of wood structures.

Since gravel sources are limited in the watershed, the rock waste materials from dam removal are proposed for beneficial use. The rock filled dam material will be used for access roads in the reservoir and to contain and dewater fine sediments. The dam construction materials are angular, but they can provide gravel source material in the upper Washougal watershed over the long-term as they are rounded by erosion. In the short-term, rock materials from the dam that are placed in Wildboy Creek would be covered with rounded stream gravels recovered from the impoundment, the dam construction spoils disposal area, or imported. Additional rock recovered from dam removal are also proposed to be placed along the margins of the former reservoir where they can eventually become long-term gravel sources to Wildboy Creek and the Washougal River.

Large wood structures would be placed in the 4,000-foot reach downstream of the existing dam. The large wood will retain the gravel placed to restore habitat. The large wood will be anchored to retain gravel to prevent it from mobilizing during flood events. The large wood will be sealed to the stream bed with a gradation of wood, rock, and streambed gravel. The proposed combination of materials will emulate pre-splash dam era habitat conditions in Wildboy Creek, and the removal of the dam will allow the stream to sustain its habitat features into the future.

Background

Kwoneesum Dam is a 55-foot-high, 425-foot-long rock filled structure impounding approximately 102 acre-feet of water in a 9.2-acre reservoir. The Portland Area Council of Camp Fire Girls constructed the dam in 1965, impounding Wildboy Creek to provide a recreational amenity for Camp Kwoneesum. Longview Fibre purchased the surrounding property in the 1980s and managed the forest for commercial timber production. In March 2020, the Columbia Land Trust (CLT) purchased the property. CLT manages the property for non-motorized day-use recreation and sustainable forestry (Sinks, 2020 *pers comm*). Maintaining Kwoneesum Dam is generally inconsistent with CLT's mission, which is to "Conserve and care for the vital lands, waters, and wildlife of the Columbia River region through sound science and strong relationships."

Wildboy Creek is a tributary to the West Fork Washougal River, the Washougal River, and ultimately the Columbia River. Wildboy Creek is designated critical habitat for Lower Columbia steelhead, which are listed as threatened under the federal Endangered Species Act. Kwoneesum Dam blocks steelhead access to approximately 6.5 miles of stream habitat and interrupts downstream gravel and wood transport through Wildboy Creek, preventing the stream from naturally recovering from cumulative watershed impacts.

In the project area and downstream, recreation centers around water resources. This has been the historical use of the reservoir and continues to be so. The reservoir and the stream are the main recreational attractions. Swimming and fishing in the reservoir and non-motorized use of the surrounding area, such as horseback riding, are the favored recreational activities on CLT land. In Wildboy Creek downstream of the dam, there is a period of seasonal use by the whitewater kayaking community.

Downstream of the project area, 21 rural residential parcels have been identified in Dam Safety Inspection Reports in 2006 and 2015 as at-risk in the case of a dam-failure outburst flood. The presence of these residences puts Kwoneesum Dam in a high-risk category. Public at-risk infrastructure includes the fish hatchery on the West Fork Washougal River and the Washougal River Road bridge over the West Fork Washougal River.

Cumulative Watershed Impacts

Major disturbances to the Wildboy Creek Watershed include the loss of old growth timber from the 1902 Yacolt Burn wildfire, operation of a splash dam for salvage logging operations, modern clear-cut logging, and Kwoneesum Dam construction by the Camp Fire Girls during 1964-65. The combined effects of the Yacolt Burn, splash dam operations, and construction of Kwoneesum Dam have disrupted geomorphic processes on Wildboy Creek for over a century. The watershed's current condition, although familiar, adversely affects ecological conditions and the ability of functional ecological systems to self-repair.

Yacolt Burn and Timber Harvest Impacts

Land-use has directly impacted channel habitat and geomorphic processes in the Wildboy Creek watershed since the 1902 Yacolt Burn and the onset of industrial timber harvest. Current timber harvest impacts are displayed in Figure 1, which shows the drainage basin to Kwoneesum Dam. Research into the effects of timber harvest practices on stream function has shown alterations to hydrologic patterns,

Figure 1, Aerial Photograph of Upstream Basin, Google Earth (2018)

sediment delivery, and large wood delivery to stream channels with resultant reductions in the quantity and quality of available habitat. Natural recovery times following the cessation of timber harvest are likely to be on the scale of several decades to centuries depending on the degree of degradation of timescale of processes such as riparian forest re-growth.

The existing forest conditions displayed in the aerial photograph above were preceded by the Yacolt Burn of 1902. The Yacolt Burn immolated 500,000 acres and approximately 12 billion board feet of timber in Clark, Cowlitz, and Skamania Counties (Atwell, 1975). Snags from the Yacolt Burn are visible in Figure 2 during Kwoneesum Dam construction over 60 years after the fire.

Figure 2, Yacolt Burn snags visible during dam construction over 60 years after fire

Splash dams were widely used in the early 20th century to facilitate downstream log drives from more remote upland logging areas to mills situated in the lowlands. Splash dams are log crib structures with a removable gate to release the dam's impoundment (Figure 3). Alternatively, a single-use dam would be blasted with dynamite to release the logs held in its impoundment. After release from the impoundment, logs would travel downstream on the induced flood flow in an action known as a log drive.

Figure 3. Historic photo illustrating a typical splash dam and its function. This dam is on the Coquille River of Oregon, circa 1912. From Montgomery and Naiman, 2006.

To facilitate the log drive, the channel would be "improved" downstream of the dam by clearing it of large wood, boulders and other obstructions using dynamite or mechanical means. Side-channels and other openings off the main channel would usually be filled so as not to catch logs moving downstream. These activities alone greatly decreased habitat availability and channel complexity (Figure 4). In addition to mechanical channel modifications, the release from the splash dam was often much greater than the 100-year flood magnitude in upper elevation streams, dramatically scouring the simplified channels. The immediate effects were disastrous for salmon runs, often within four years—a single generation of salmon and steelhead. Splash dam practices continued into the first half of the 20th century and the impacts to habitat and river function are persistent into the present. (Miller, 2010; Napolitano, 1998; Phelps, 2011).

Studies have found that splashed streams continue to be narrow and incised. Channel incision generally reduces floodplain connectivity, which decreases availability of off-channel habitat that is critical to juvenile salmonids. Incision also concentrates flows in the channel, increasing sediment transport capacity and decreasing the retention of substrate necessary for spawning. The effects of splash dams have been shown to include greater percentages of exposed bedrock in the bed and banks, less gravel retention, fewer deep pools, and less large wood relative to similar streams that were not subject to splash dam practices. All these results are negative habitat outcomes for in-channel habitat that is critical to salmonid survival.

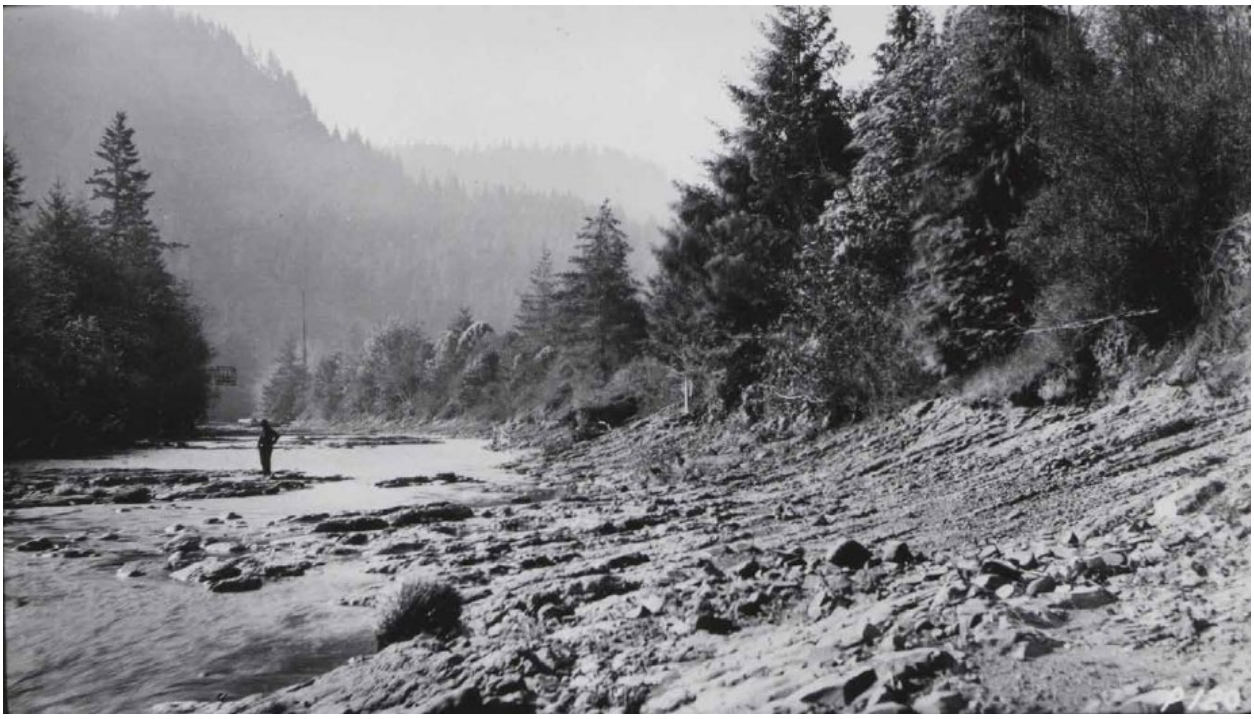


Figure 4. Historic photo of the middle fork Coquille river circa 1929. The photo depicts the result of long -term splash damming with a stream that has been eroded to bedrock. From Miller, 2010.

Wildboy Creek exhibits typical symptoms of splash-dammed streams. Historic photographs (e.g., Figure 5) show what is almost certainly a remnant splash dam structure at the present-day site of Kwoneesum Dam. Wildboy Creek downstream of the dam is now primarily a bedrock reach with simplified habitat exemplified by low frequency of large wood, little gravel retention, and consequently, low hydraulic complexity available for salmonids attempting to utilize the stream for spawning and rearing (Figure 6).

Figure 5. Historical photo of the remnant splash dam at the site of what would be Kwoneesum dam. Photo credit - Courtesy of Nancy King, Camp Fire Columbia

Figure 6. Photo of Wildboy Creek bedrock stream, splash dam activity continually stripped this reach of gravel and large wood, and the closing of the dam perpetuated this condition.

Kwoneesum Dam and Current Conditions

The completion of Kwoneesum Dam in 1965 exacerbated the damage that was done to the ecosystem of Wildboy Creek during the Yacolt Burn, splash dam, and industrial timber harvest eras. The impacts of the dam were enacted through the initial construction of the dam itself and perpetuated through the complete disconnection of natural functions that would have provided the potential for the system to eventually recover from late 19th and early 20th century timber harvest practices. Dam construction included excavation of material to create the reservoir behind the dam. Riparian areas were cleared and grubbed, and alluvium was excavated and removed to increase reservoir capacity (Figure 7). Impacts are discussed more thoroughly in the next section.

Figure 7. Historical photograph taken during the construction of Kwoneesum Dam showing preparation of the area upstream of the dam to create reservoir capacity. Photo credit - Courtesy of Nancy King, Camp Fire Columbia

Existing Stream Habitat and Dam Conditions

The legacy effects of historical timber harvest and dam building on Wildboy Creek have resulted in degraded habitat, diminished water quality, a fish passage barrier, and a disruption of the processes that would eventually create natural habitat features. The channel of Wildboy Creek is incised and simplified with low amounts of large wood, gravel retention, or in-channel habitat relative to its probable pre-disturbance state analogous to undisturbed stream systems in the Pacific Northwest. The degraded condition, created by splash dam and other timber harvest methods, and by the presence of Kwoneesum Dam, greatly reduces opportunities for successful steelhead spawning and rearing in Wildboy Creek. The declining trend in salmonid populations in the watershed are expected to continue the if the dam's disruption of geomorphic progression and ecological function persists.

Kwoneesum Dam cuts off upstream sources of large wood and gravels and the dam alters the natural hydrologic regime and water quality. Figure 8 shows completion of construction on Kwoneesum Dam illustrating the total barrier to sediment and wood delivery to Wildboy Creek downstream. The majority of sediment sampled in the reservoir is currently silt and clay with only about 10% alluvial sediment retained in the reservoir since dam construction. This is a likely indicator that upstream sediment sources were altered by timber harvest, a common result of clear-cutting activities. The reservoir slows water and increases surface area exposed to the sun. The result is elevated stream temperatures downstream of the dam in Wildboy Creek and its receiving waters. The dam also creates an impassable barrier to upstream migrating fish, particularly ESA-Listed steelhead, from 6.5 miles of habitat upstream of the dam.

Figure 8. Historical photo of the concrete lined upstream face of Kwoneesum dam immediately after construction and before filling the reservoir. The dam is a complete barrier to natural processes and fish migration. Photo credit - Courtesy of Nancy King, Camp Fire Columbia.

Public access to the structure itself creates a potential for injury or death. The plunge pool beneath the dam spillway is an attractive nuisance where some visitors take the 30-foot plunge off the spillway (Figure 9).

Risk Assessment

This risk assessment presents a qualitative determination of the likelihood of an impact occurring as a direct result of either of the restoration alternatives being carried out. Thus, in this case risk is a product of probability and impact. The greatest risk will be assigned to those activities that yield the highest magnitude of potential impact and the highest likelihood of occurrence. The conclusions that result from this level of assessment are limited to relative comparisons and do not yield a clear result in some cases.

Figure 9, Screen capture from https://www.youtube.com/watch?v=4jtaczu2GFU

Background information provides most of the context and means for discerning probability of impact determinations for each category.

Impact Identification

Risk to Native Fish and Wildlife Habitat

This assessment recognizes that the greatest impact to native fish and wildlife habitat and populations in the project area and the contributing watershed is the disruption and impairment of habitat forming processes, loss of habitat, or degradation of the quality of existing habitat.

Actions that increase the probability of the perpetuation of or increase in the degraded state of habitat and the disruption of habitat forming processes are assessed here as the greatest risk.

Risk to Downstream Landowners

This assessment recognizes that the greatest impact to the safety of property and human life downstream of the project area are large floods and the associated factors of inundation, erosion, and transport of large wood and sediment.

Actions that increase the probability of higher magnitude flood peaks, increased bank erosion and loss of land, or property damage due to flood processes are assessed as the greatest risk.

Risk to Stream Users

This assessment recognizes that the greatest impact to the safety of stream users in the project area are factors that pose risk of physical harm or death due to typical recreational use of lake and stream environments.

Actions that increase the probability of injury or death while typical lake and/or stream recreational activities are taking place are assessed as the greatest risk.

Risk to Public Infrastructure

This assessment recognizes that the greatest impact to public infrastructure in the project area and downstream in the watershed are threats of damage or destruction to roads and/or bridges and a national fish hatchery via large floods, erosion, and the transport of large wood and sediment.

Actions that increase the likelihood of damage or destruction of public infrastructure, primarily through increased flooding and the associated processes, are assessed as the greatest risk.

Risk Assessment Results

Risk to Native Fish and Wildlife Habitat

Summary of Assessed Risk: This assessment finds that the no action alternative poses the greatest risk to Native Fish and Wildlife Habitat through the high probability of the continuation of the primary negative impacts to fish and wildlife in the project area: degradation of habitat and disruption of habitat forming processes.

Please note that multiple sub-sections are included in this particular category in order to more clearly present the multiple factors contributing to the quality of fish and wildlife habitat in the project area.

No Action

Stream Habitat

Taking a no action approach at Kwoneesum Dam results in a high probability of continuation of the existing disruptions to process and habitat connectivity and continuity that are having the greatest impact on habitat. A low probability case of dam failure would alleviate process disruption in the long-term, but short-term impacts would be severe. Existing conditions are significantly degraded by the effects of historical timber harvest activities and over 50 years of the dam being in place. Logging and the dam have altered sediment generation, transport, and retention dynamics as well as removed large wood elements in the channel and floodplain. Sediment is blocked by the dam creating a lack of habitat-forming gravels transported into the downstream reach, and clear water scour below the dam that mobilizes gravels that are present. In addition, there is no large wood being delivered from upstream sources to stream reaches below the dam. This reduces the extent of large wood in Wildboy Creek that would retain gravel and drive habitat forming processes. The resulting incised bedrock channel is oversimplified and lacks the natural processes needed to create complex habitat. In retaining the dam, 6.5 miles of upstream habitat continues to be inaccessible to native anadromous or resident fish.

Water quality has a high probability to remain impaired under the no action alternative. Only in the low probability case of a dam failure would water quality issues be alleviated in the long-term, though short-term impacts would be severe. The primary water quality issue is the heat trap created by the reservoir that unnaturally increases water temperature during the summer months. Kwoneesum reservoir warms the cool water flowing into the reservoir before it is released downstream. Fed by snowmelt and groundwater, the headwaters of Wildboy Creek provide the coldest water in the watershed. The mean tributary summer water temperature in 2019 was 56 degrees Fahrenheit (F); a temperature logger at the outlet of the dam measured a peak summer temperature of 74 F. Elevated water temperatures have harmful effects on salmonids, including disrupted metabolism, increased susceptibility to toxins, vulnerability to disease, decreased dissolved oxygen availability, reduced food supply, and inability to avoid predators. This warmed water flows downstream, adversely affecting fish habitat in Wildboy Creek.

No action presents low risk to current native riparian vegetation conditions. Existing vegetation conditions include established riparian areas in the tributary streams upstream of the reservoir, shoreline and upland vegetation around the reservoir, and riparian vegetation downstream of Kwoneesum Dam. However, these vegetation communities represent disturbed conditions relative to a pre-dam native conditions, and there is a low likelihood of recovery to a pre-disturbance condition with the no action alternative. The no action alternative ultimately reduces the potential areal extent of the native riparian zone that would occupy the existing footprint of the reservoir if the dam were removed and tributary channels restored. Keeping the dam in place continues to obstruct natural hydrology, delivery of sediment and nutrients, and artificially increases stream temperature all of which negatively impact riparian conditions.

Native Fish Species of Special Concern

The no action alternative has a high probability of maintaining the historical and ongoing high-impact impairments that currently limit viability of native anadromous and resident fish populations. Specifically, ESA-listed coho and steelhead are the focus of the restoration design. The presence of the dam perpetuates the acutely damaging effects of timber harvest activities in the late 19th and early 20th centuries on stream habitat for all coho and steelhead life stages. Splash dam activities removed of large wood and hydraulic complexity from the channel, blocked floodplain habitat, and stripped the stream of

gravels and habitat forming sediment. The dam cements these degraded conditions by interrupting the longitudinal continuity of processes that would eventually serve to rejuvenate lost habitat. The dam also obstructs access to 6.5 miles of functional habitat upstream of the dam that would support species of concern.

Wildlife

A no action alternative creates a high probability of moderate impact to wildlife in the project area. The main impact is the continuation of the disruption of the ecosystem functions that are served by a natural stream system and functioning riparian corridor. Considering that riparian habitat is of primary importance to most wildlife on the landscape, this affects most all wildlife in the area. The landward mobility of many wildlife species in the project area gives them the ability to move to areas of favorable conditions up or downstream, which lowers the risk. A much lower probability, but higher short-term impact posed by the no action alternative is the risk of catastrophic dam failure, which would create high mortality risk for wildlife over a short time scale. The species affected by a dam failure would be those that reside in or near the reservoir most of the time, and those species that reside continuously in the near-channel riparian zone downstream of the dam.

Dam Removal Following Active Sediment Removal

Stream Habitat

The dam removal alternative with active sediment removal presents a low risk to native fish and wildlife. By re-establishing natural sediment and large wood transport, water quality, and habitat continuity this restoration scenario presents the lowest potential for the continuation of disrupted process and disconnected habitat. Habitat construction following dam removal further decreases the potential for current detrimental impacts to fish and wildlife to continue. Large wood placements in Wildboy Creek and stream channel grading and habitat creation in the former reservoir alleviate the current impacts and provides an avenue for complex habitat to form naturally in the future.

The dam removal and the habitat construction process carry some inherent risk for sediment release and temporary turbidity spikes as well as risks of fuel or hydraulic fluid leaks from machinery. However, these are relatively low-level probability and short duration impacts. In terms of turbidity release potential, the metered release of water from the dam site into Wildboy Creek, and removal of sediment prior to dam removal, minimizes the chance for a spike in turbidity during deconstruction. This method also minimizes the potential for deposition of silt and clay in Wildboy Creek. In terms of the potential for impacts from construction activities, best management practices (BMPs) indicated in the Department of Ecology's current stormwater manual will be in place and observed.

Native Fish and Species of Special Concern

The risks to native fish and wildlife through dam removal and habitat construction are medium probability of short-duration, low-severity impacts. The impact risks include accidental release of fine sediment during dam removal and construction, as well as the temporary but certain impacts during construction such as clearing and grubbing for access and other impacts to land surfaces and vegetation. The design of the construction project intentionally recognizes all the risks and takes every feasible step to mitigate for them in BMPs and safeguards. The controlled removal of reservoir sediments will minimize fine sediment flux downstream of the dam which, if released uncontrolled, would pose lethal

conditions to fish through increased turbidity. Controlled sediment removal will also minimize the deposition of fine sediment in sensitive habitats that could cause longer-term impacts to fish populations. Sediment would be removed prior to dam removal and not be allowed to affect fish in the project area at any time during construction.

Dam removal also presents a potential mortality impact to native fish that might be in the reservoir during dam removal. This would be a high impact, but the probability is reduced through mitigation efforts during construction. As the reservoir is drained, fish stranding in the increasingly turbid water poses a mortality risk. This will be mitigated through WDFW-assisted fish removal from the reservoir using an electrofishing boat. This action decreases the probability of the fish mortality impact during drawdown and greatly decreases the impact and therefore the risk of this alternative.

Wildlife

The greatest level of risk to wildlife concerns those species that rely directly on the reservoir for habitat. These are most likely to include waterfowl and amphibians. Habitat loss is the impact expected for these species as the reservoir is drawn down and the dam is removed. Short term loss of habitat is certain, though the ultimate impact is an unknown since new habitats will form as the landscape readjusts after dam removal. These species are mobile and can move to suitable replacement habitat nearby, particularly when the drawdown of the reservoir is gradual and takes place over several days. The reservoir is a recent artificial feature, and not natural habitat for these species. This alternative takes measures to reduce risk to wildlife during construction through gradual drawdown and mechanical dam removal. Ultimately, this alternative re-creates the natural habitat that was supported by the landscape. The restoration of a naturally functioning riparian zone and stream habitat will provide critical ecosystem services beyond those provided by the dam and reservoir.

Risk to Downstream Landowners

Summary of Assessed Risk: The no action alternative is assessed as being the highest risk due to unlikely but catastrophic impacts of dam failure. In the case of dam failure, an outburst flood could cause grave danger to property and human life downstream of the dam. In addition, Kwoneesum Dam is not designed for flood control and does not provide protection for potentially damaging flood events and so shares a similar natural flood risk as the dam removal alternative even in a repaired and fully maintained state.

Washington Department of Ecology (DOE), Dam Safety Office has identified that dam failure poses a hazard to 21 downstream properties and public infrastructure including the Washougal River Steelhead Hatchery. The 2006 dam safety report further identifies, “Between 1.9 and 2.3 miles downstream of the dam, a dam break flood would likely threaten several homes. At this location four homes lie within 2 feet above the lowest elevation of the likely flood profile. Another 4 houses lie within 5 feet above the profile bottom.” (Guy and Ordonez, 2006) The number of at-risk properties is likely to increase with land currently being developed for rural residential homes.

The Cowlitz Tribe sent 42 notices to downstream landowners via registered mail on, March 12, 2021. The correspondence stated the intent to remove Kwoneesum dam, provided an executive summary of this risk assessment and provided a link for the full text of this risk assessment. The complete correspondence with attachments is provided in Appendix A.

No Action

The no action alternative presents the greatest risk to downstream landowners. Under this alternative there is a low probability of the largest impact event, catastrophic failure of Kwoneesum Dam. The greatest potential for catastrophic flooding arises from the currently degraded condition of Kwoneesum Dam and its noted potential for failure (DOE, 2015). The 2015 DOE dam safety inspection report details the conditions requiring maintenance and repair which included settling and slumping of the crest and face of the dam, debris accumulation in the spillway forebay, and damage to the low-level conduit control and outlet. These are the types of ongoing maintenance issues that need to be consistently addressed to avoid risk of dam failure. A catastrophic release of the dam through structural failure stands to endanger up to 21 existing structures and their inhabitants, with continued residential development steadily increasing the number of at-risk properties.

It is important to note that natural flood risk exists for downstream landowners regardless of catastrophic failure and regardless of dam repair and maintenance. Kwoneesum dam does not provide flood control even in a properly operational state.

Dam Removal Following Active Sediment Removal

The primary risk posed to downstream landowners by dam removal is the restoration of a natural flood regime. The probability of this risk conforms to flood recurrence probability (ie high probability of the annual flood, low probability of the 100 year flood), and presents a low to medium impact. Because Kwoneesum dam is a run-of-the-river dam that does not function as a flood control dam, it is likely that flood peaks will remain similar under dam removal conditions. Thus, there is no expectation of increased peak flood magnitude under dam removal conditions. Another aspect of a restored natural flood regime is the large wood and sediment that is carried by flood waters and could cause property damage downstream. However, the contributing area upstream of the dam is small and unlikely to generate significant sediment or wood loads. This is evidenced by the sediment that has accumulated in the reservoir which is composed of less than 10% sand and gravel and is mainly very fine grain material. The unintentional reservoir evacuation in May of 1997 is an analog for potential sediment delivery downstream. This release did not result in any reported property damage or accumulated sediment in residential areas. Most of the sediment deposited immediately downstream of the dam.

Stable large wood placements in Wildboy Creek and its upstream tributaries are part of the restoration design and will also serve to capture and store sediment and woody debris being transported through the project area. These structures are designed to mimic the natural function of large wood in stream channels including sediment and woody debris retention. Also, large wood is designed to reconnect the channel and floodplain, dispersing floodwaters laterally and attenuating peak flows naturally.

Risk to Stream Users

Summary of Assessed Risk: The greatest risk to stream users is posed by the unauthorized use of the dam which poses a distinct threat of injury. There is demonstrated probability of this kind of use and a high potential impact. It is important to note that the dam removal alternative poses a significant risk to kayakers using Wildboy Creek in the project area due to placement of large wood in the channel. There are steps being taken to mitigate this risk in the design process.

Currently, the CLT manages the Kwoneesum Dam site for non-motorized public recreational day-use, which generally centers around the reservoir which is used for swimming and canoeing and the

surrounding hills which are used for hiking and horseback riding. The creation of the reservoir and its original intended use included full-time supervision during use periods. That supervisory aspect is not included in the management plan of the current owner. Unsupervised public access creates a serious safety concern and "attractive nuisance" around the dam and spillway. Additional public use occurs downstream of the dam with a seasonal boating season utilized by whitewater kayakers.

No Action

The greatest risk posed to stream users under the no action alternative are hazards associated with water recreational activities as well as unauthorized uses of the dam and spillway. The impact associated with this risk is serious injury and death. The probability of these types of uses is high, however prediction of the probability of injury is difficult and a risk level is hard to assign. What is certain is that a no action alternative would retain the reservoir and dam as main focal points for stream users within the project area. The dam itself is currently a public safety hazard in being a feature that attracts investigation by people using the area. There is a point on the dam spillway that has been used for jumping into Wildboy Creek since the dam was put in place. This poses a risk of injury from jumping or to anyone accessing the dam.

Mitigation of this risk involves landowner investment into security and public safety measures that are outside the scope of their intended management plan. It is the nature of humans to occasionally attempt to circumvent measures taken to provide for their own safety, and so no reasonable attempt on the part of the landowner to secure the dam is going to be 100% effective. Thus, the existing dam would remain a safety hazard to stream users.

Dam Removal Following Active Sediment Removal

The primary risk associated with the dam removal alternative is increased obstacles to boaters using Wildboy Creek downstream of the dam site. The probability of use of Wildboy Creek by whitewater kayakers is high, and the potential impact of increased large wood in the channel is serious injury or death. This combination poses a high risk to this group of stream users. The dam removal alternative would reduce risk currently posed by unauthorized access to the dam and emergency spillway, and recreation in the reservoir.

Mitigation of the increased risk to boaters includes consideration of safe passage in design, such as filling beneath and upstream of channel spanning wood to avoid "strainers". Also, there are other put-in locations available to the boating community, such as further downstream near the confluence with Texas Creek, or use Texas Creek as an alternative. If kayakers paddle Wildboy Creek following installation of channel spanning large wood structures, risk will be increased. The design team has reached out to the boating community to solicit comments on the restoration design and this risk assessment.

Risk to Public Infrastructure

Summary of Assessed Risk: The no action alternative poses the greatest risk to public infrastructure due to the potential for catastrophic failure of Kwoneesum Dam. Regular operation and maintenance of the dam would decrease this risk, but the dam is not a flood control structure and risk of flood damage similar to the dam removal alternative remains.

Public infrastructure potentially affected includes a national steelhead hatchery and Washougal River Road where it bridges the West Fork Washougal River. Identification of at-risk structures is derived from

periodic dam safety inspections performed by DOE. The 2006 DOE periodic inspection report specifically mentions the Washougal River Steelhead Hatchery (3.9 miles downstream of the dam) as at-risk in the case of dam failure. The report states that the hatchery, housing, and structures on the property would be inundated. This facility is considered public infrastructure for the sake of this assessment.

No Action

Under the no action alternative, the greatest risk to public infrastructure is the potential for catastrophic failure of Kwoneesum Dam in its current impaired state. This is a low probability event with a potentially high impact. Sudden release of the 150-acre-foot reservoir would be expected to produce an unnaturally large peak flow magnitude in Wildboy Creek. We know from the results of an accidental release of the emergency release valve in May 1997 that the channel immediately downstream from the dam was filled with feet of sediment and evidence showed that flow overtopped the bankfull elevation and deposited fine sediment on the floodplain. A full breach of the dam would create a much larger flow in Wildboy Creek and create the greatest risk to downstream infrastructure.

This risk is mitigated through regular inspection, maintenance, and repair as warranted. However, even in a repaired condition, annual and larger floods are not mitigated by Kwoneesum dam, and damage to infrastructure remains as much a concern as in the case of dam removal.

Dam Removal Following Active Sediment Removal

There is low to medium risk to public infrastructure posed by the dam removal alternative due to the low probability of a significant amount of sediment or large wood being delivered to infrastructure sites following dam removal. There is variable probability each year of a significant flood event, with variable impacts depending on the magnitude of the flood. The peak magnitude will be likely to change little with the dam removed, as Kwoneesum Dam does not currently provide any flood control features. The May 1997 accidental evacuation of the reservoir and mitigation following the release are analogs to the potential for increased sedimentation and large wood accumulation under the dam removal alternative. In the May 1997 case, the large amount of sediment was released from the reservoir, but the majority of it was deposited in the reach immediately downstream of the dam, with no reports of sediment deposition at infrastructure locations. Following the release, whole trees were felled into Wildboy Creek downstream of the dam. All of these trees have been washed out of the project area, but none of them have been reported at infrastructure locations.

Summary

This report presents the results of a qualitative assessment of risks associated with two alternative approaches to habitat restoration at Kwoneesum Dam. The alternatives include no-action (maintain Kwoneesum Dam and reservoir), or dam removal following active sediment removal. The assessment relies on a probability of impact approach to determining risk in four categories: Native Fish and Wildlife Habitat; Downstream Landowners; Stream Users; and Public Infrastructure. In each of these categories, a primary impact was identified as that factor that is currently or has the potential to create the greatest negative outcomes for a given category. The greatest risk in each category is assigned to that alternative action with the highest combination of probability and impact.

In every category, the greatest risk stems directly from the presence of the dam. The dam creates risk through degradation of natural processes and conditions, safety risks to recreators, and a potential for

dam failure and catastrophic release of the reservoir. Though risk can be reduced in some of these categories through upgrades to the structure of the dam, complete removal of the structure provides the ultimate benefit and alleviates the source of risk completely. In terms of natural processes, habitat formation, and access to high quality habitat for ESA-Listed native fish in the system, only dam removal can alleviate the certain impacts created by the dam. Removal of the dam does increase other impact concerns, particularly transport of sediment and wood into sensitive infrastructure areas and increased obstacles for kayakers in Wildboy Creek downstream of the dam.

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Appendix F

Cowlitz Tribe downstream landowner notification correspondence is provided in the following pages.

Cowlitz Indian Tribe

Natural Resources Department

March __, 2021

To….
Street address
City, state, zip

Re: Notice of Kwoneesum Dam Removal Project

Dear …,
The Cowlitz Indian Tribe's Natural Resource Department, in partnership with the Columbia Land Trust, is planning a comprehensive habitat restoration project on Wildboy Creek, a tributary to the West Fork Washougal River. You are receiving this letter because we have identified you as a downstream property owner and want you to be aware of the project. The major project elements include removing an obsolete dam, excavating excess sediment from the impoundment, placing gravel and wood habitat features in Wildboy Creek, and permanently stabilizing newly exposed surfaces with native trees and shrubs.

Wildboy Creek provides habitat for wild winter steelhead and coho salmon, both listed as threatened under the federal Endangered Species Act. The project has been designed to restore salmon and steelhead access to 6.5 miles of headwater streams, reduce catastrophic risk to downstream landowners, reduce liability for the project site landowner, and improve stream habitat quality for fish and wildlife.

The Portland Area Council of Camp Fire Girls, Inc. constructed the dam in 1965 to provide a recreational amenity for Camp Kwoneesum. The impoundment was used by the group until it sold the land to Longview Fibre in 1985. In 2019, the Columbia Land Trust purchased the property for conservation, and identified the dam as a legacy concern for its ongoing damage to natural resources and risk to recreational users and downstream landowners.

A comprehensive risk assessment commissioned by the Tribe as part of the permitting process shows that conducting the project poses substantially lower risks to

downstream landowners, fish and wildlife, and recreationists than leaving the obsolete dam in place. I have attached an executive summary for your information. While dam failure is an unlikely occurrence, the Washington Department of Ecology, Dam Safety Office has Kwoneesum Dam listed with a 1C 'high risk' Hazard Class due to the potential loss of life (7-30 lives) in the event of a catastrophic breach. This project will eliminate the risk of a dam breach event, improving safety for downstream landowners. Increased risks associated with the project are limited to whitewater kayakers who could encounter structures placed to improve fish habitat. Outreach to the whitewater community is ongoing and separate from our outreach to downstream landowners.

During June 2022, construction crews will begin the process of re-routing the three tributary creeks around the dam, then drawing reservoir water down behind the dam and drying accumulated sediment for removal, sorting, and permanent stabilization. Once the reservoir has been drawn down and completely dewatered, crews will use heavy machinery to gradually disassemble the dam and its associated structures. Crews will secure wood and backfill logs structures with spawning gravel in Wildboy Creek on Columbia Land Trust property to improve in-stream habitat for salmon and steelhead during the same period. Because of its remote location, we do not anticipate persistent noise impacts to neighbors from construction activities, and traffic volumes should resemble typical logging and recreational use.

We are excited about this project and its benefits to fish, wildlife, and landowners. If you would like to learn more, please give me a call.

Sincerely,

Peter Barber
Restoration Ecologist, Natural Resources Department
(360) 839-9299 or email pbarber@cowlitz.org.

Cowlitz Indian Tribe
Natural Resources Department

Executive Summary: Kwoneesum Dam Removal Risk Assessment

In March 2020, the Columbia Land Trust (CLT) purchased 1,288 acres of Wildboy Creek property from Weyerhaeuser. Included in this purchase was Kwoneesum Dam, a 55-foot-high, 425-foot-long rock filled structure impounding approximately 102 acre-feet of water in a 9.2-acre reservoir. The dam, built in 1965 by the Portland Chapter of Camp Fire Girls, poses a variety of risks to CLT, downstream landowners, recreationists, and natural resources. The Cowlitz Indian Tribe is partnering with CLT to remove the dam and restore access to 6.5 miles of habitat upstream of the dam for salmon and steelhead. In addition, the Tribe will implement other stream restoration efforts that complement dam removal to benefit fish and wildlife. The Kwoneesum Dam Removal Risk Assessment is part of the design and permitting process for the project.

This report qualitatively assesses risks associated with two alternatives: no-action (maintain Kwoneesum Dam and reservoir), or dam removal and associated habitat restoration actions. The report assesses risk based on the probability and severity of impacts across four categories: Native Fish and Wildlife Habitat, Downstream Landowners, Stream Users, and Public Infrastructure.

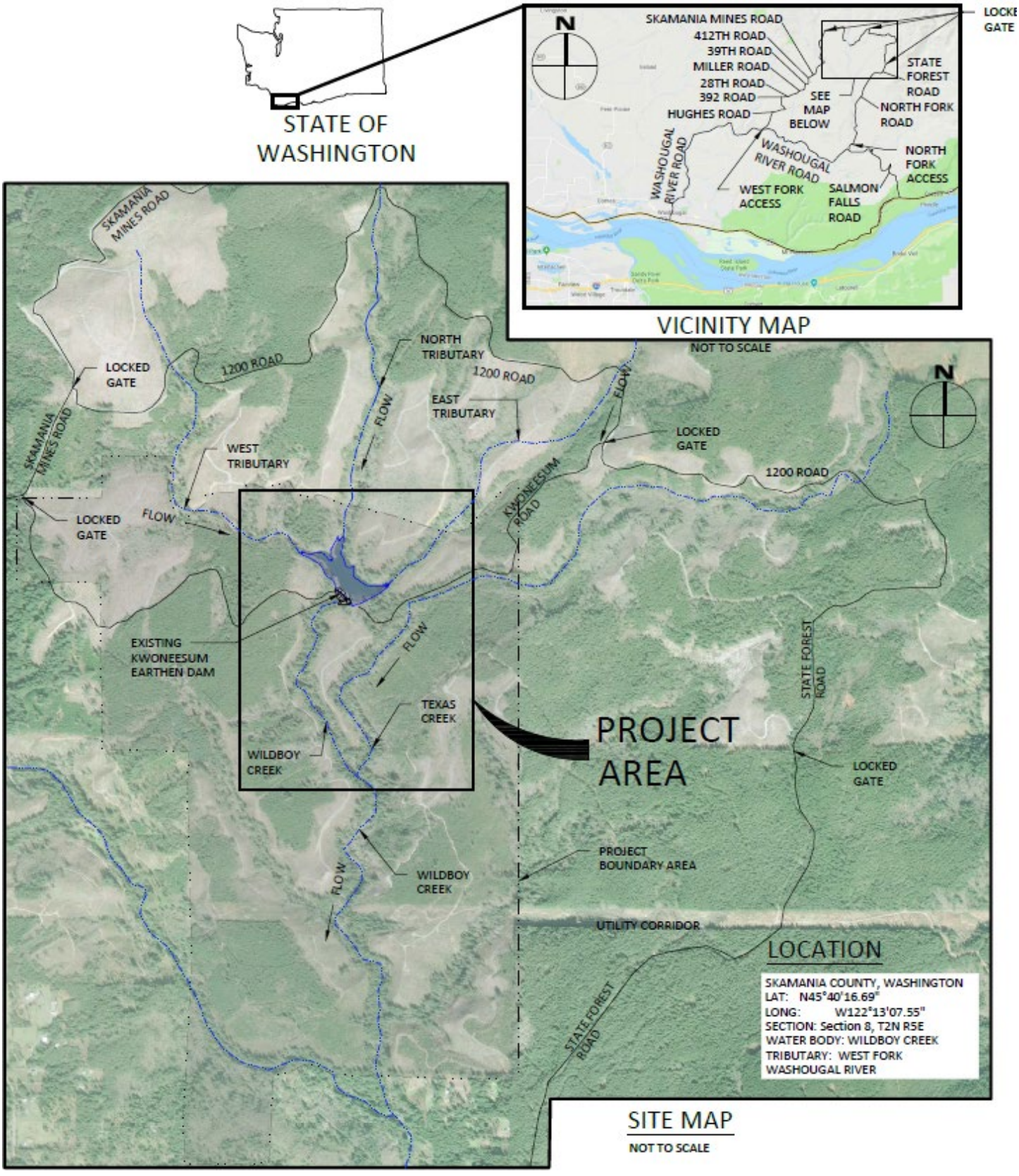
In all four categories, keeping the dam intact (the no-action alternative) poses the greatest risk. Left in place, the dam is certain to impact native fish and wildlife habitat by blocking fish passage, increasing stream temperatures, and preventing natural transport of wood and streambed gravel to habitat downstream. Risk to downstream landowners and public infrastructure (such as bridges and a fish hatchery) is highest with the dam left in place because the aging structure poses a risk of failure and flooding. The dam poses risks to recreational visitors, particularly from falls or jumps from the dam structure, but dam removal and in-stream restoration may increase risk to whitewater kayakers in Wildboy Creek, which is being addressed through design features and direct outreach to the whitewater community.

The full report can be found here:
https://drive.google.com/file/d/1WBzi148x2pSrc4K2d2z3gYmScR3BzsAG/view?usp=sharing

Project Vicinity Map: Kwoneesum Dam Removal Project

Landowner: Columbia Land Trust

Location: Skamania County, WA



Camp Kwoneesum Dam
Washougal, Washington

Prepared for

Cowlitz Indian Tribe
Justin Isle
31320 NW 41st Avenue
Ridgefield, Washington 98642

Prepared by

Professional Service Industries, Inc.
6032 N Cutter Circle, Suite 480
Portland, Oregon 97217

June 15, 2022

PSI Project 0581562-1

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psiusa.com

June 15, 2022

Mr. Justin Isle
Cowlitz Indian Tribe
31320 NW 41st Avenue
Ridgefield, Washington 98642

Subject: Asbestos-Containing Material Survey
Camp Kwoneesum Dam
Washougal, Washington
Project Number: 0581562-1

Dear Mr. Isle:

Professional Service Industries, Inc. (PSI), an Intertek Company, was retained by the Cowlitz Indian Tribe to perform an Asbestos-Containing Material (ACM) survey for the Camp Kwoneesum Dam located near Washougal, Washington. Written authorization to perform this survey was provided on June 1, 2022, based on execution of PSI's Proposal Number 0581-374602 dated May 23, 2022. The ACM sampling area consisted of the cement dam area and the two surrounding structures. This survey was performed in preparation for a planned demolition project.

PSI thanks you for choosing us as your consultant for this project. Please contact us at 503-289-1778 if you have any questions or we may be of further service.

Respectfully Submitted,

PROFESSIONAL SERVICE INDUSTRIES, INC.

Carl Purdy
Project Manager

Robert White
Principal Consultant

TABLE OF CONTENTS

1 EXECUTIVE SUMMARY

1.1 GENERAL INFORMATION

Professional Service Industries, Inc. (PSI), an Intertek Company, was retained by the Cowlitz Indian Tribe to perform an Asbestos-Containing Material (ACM) survey for the Camp Kwoneesum Dam. The survey area consisted of the original cement dam area, added trusses, retaining wall and spillway as well as two former open and roofed structures. The location was to the northeast of Washougal, Washington. This survey was performed in preparation for a planned demolition project.

1.2 AUTHORIZATION

Written authorization to perform this survey was provided on June 1, 2022, by Rudy Salakory for PSI's Proposal Number 0581-374602 dated May 23, 2022.

1.3 SUMMARY OF FINDINGS

The scope of work included the sampling of suspect ACM at the Camp Kwoneesum Dam area. No other hazardous materials were observed at the time of the survey. The survey was conducted on June 6, 2022, by PSI representative Carl Purdy under technical guidance of PSI Principal Consultant Robert White.

1.3.1 ASBESTOS-CONTAINING MATERIALS

A total of twenty-four (24) samples of suspect ACM were collected representing six (6) homogenous materials. Materials that were sampled during the survey included cement associated with the dam area along with the cement and exterior roofing and felt of two associated open-air structures. **Asbestos was not detected in any of the sampled materials.** A summary of lab result information is provided in Section 2 of this report.

2 RESULT SUMMARY

2.1 ACM SURVEY RESULTS

A material is considered by the Environmental Protection Agency (EPA) to be asbestos containing if at least one sample collected from an area shows asbestos present in an amount greater than one percent (>1%). Specific removal requirements apply if ACM will be disturbed during maintenance, renovation, or demolition activities.

The following homogeneous building material types were sampled as part of this survey. Results are summarized in the table below. Sample locations are, for the most part, indicated in the table where samples were collected. A copy of the laboratory result is provided in appendix of this report. **Asbestos was not detected in any of the samples.**

TABLE 1 – ASBESTOS SAMPLING RESULTS

Material No.	Material Description	Sample Location	NESHAP Category [2]	cond.[3]	No. of Samples	% ACM	Quantity
1	Cement, Gray	Main Dam	NA	G	7	ND	NA
2	Cement, Gray	Retaining Walls/Trusses	NA	G	5	ND	NA
3	Cement, Gray	Spillway	NA	G	3	ND	NA
4	Roofing, Black Felt, Black	Building 1	NA	G	3	R = ND F = ND	NA
5	Roofing, Black Felt, Black	Building 2	NA	G	3	R = ND F = ND	NA
6	Cement, Gray	Building 2	NA	G	3	ND	NA

[2] NESHAP Category= I, II or RACM [3] Cond. = Condition of Materials (Either good, fair or poor.) *Layer not detected in all samples.
ND = No Asbestos Detected NA = Not Applicable SF = square feet
C = Cement R = Roofing F = Felt

3 WARRANTY

PSI warrants that the findings contained herein have been prepared in general accordance with the standard of care exercised within the asbestos and lead-based paint testing and abatement industries. PSI recognizes that raw laboratory test data are not usually sufficient to make all abatement and management decisions.

The survey included inspection of reasonably accessible materials such as above or behind suspended ceilings, walls or other non-permanent structures. PSI did not, however, inspect or sample inaccessible areas.

The information contained in this report is based upon the data furnished by the client and observations and test results provided by PSI. These observations and results are time dependent, are subject to changing site conditions, and revisions to Federal, State and local regulations.

PSI did not provide any service to investigate or detect the presence of moisture, mold or other biological contaminates in or around any structure, or any service that was designed or intended to prevent or lower the risk of the occurrence of the amplification of the same. Client acknowledges that mold is ubiquitous to the environment with mold amplification occurring when building materials are impacted by moisture. Client further acknowledges that site conditions are outside of PSI's control, and that mold amplification will likely occur, or continue to occur, in the presence of moisture. As such, PSI cannot and shall not be held responsible for the occurrence or recurrence of mold amplification. No other warranties are implied or expressed.

3.1 USED BY THIRD PARTIES

This report was prepared pursuant to the contract PSI has with the client. That contractual relationship included an exchange of information about the subject sites that was unique and between PSI and the client and serves as the basis upon which this report was prepared. Because of the importance of the communication between PSI and the client reliance or any use of this report by anyone other than the client for whom it was prepared, is prohibited and therefore not foreseeable to PSI.

Reliance or use by any such third party without explicit authorization in the report does not make said third party a third-party beneficiary to PSI's contract with the client. Any such unauthorized reliance on or use of this report, including any of its information or conclusions, will be at third party's risk. For the same reasons, no warranties or representations, expressed or implied in this report, are made to any such third party.

3.2 UNIDENTIFIABLE CONDITIONS

This report is necessarily limited to the conditions observed and to the information available at the time of the work. Due to the nature of the work, there is a possibility that conditions may exist, which could not be identified within the scope of work or which were not apparent at the time of our site work. This report is also limited to information available from the client at the time it was prepared. The report may not represent all conditions at the subject sites as it only reflects the information gathered from specific locations.

4 METHODS

4.1 ASBESTOS

Inspection and sampling procedures were performed in accordance with the guidelines published by the EPA in 40 CFR Part 763 Subpart E, October 30, 1987. Sampling procedures include collection of at least 3 samples of all suspect friable and non-friable materials as recommended by EPA Guidance document 700/B-92/001, February 1992. An EPA accredited inspector performed the inspection and survey as described below.

The survey consisted of three major activities: visual inspection, sampling, and quantification of building materials. Although these activities are listed separately, they are integrated tasks.

4.1.1 VISUAL INSPECTION

An initial building walkthrough was conducted to determine the presence and condition of suspect materials that were accessible and/or exposed. Materials, which were similar in general appearance, were grouped into homogeneous sampling areas.

HOMOGENEOUS MATERIAL CLASSIFICATIONS

A preliminary walkthrough of the building was conducted to determine areas of materials, which were visually similar in color, texture, general appearance, and which appeared to have been installed at the same time. Such materials are termed "homogeneous materials" by the EPA. During this walkthrough, the approximate locations of these homogeneous materials were also noted.

Following the EPA inspection protocol, each identified suspect homogeneous material was placed in one of the following EPA classifications:

1. **Surfacing Materials** (spray or trowel applied to building members).

2. **Thermal System Insulation** (materials generally applied to various mechanical systems).

3. **Miscellaneous Materials** (any materials which do not fit either of the above categories).

FRIABILITY CLASSIFICATIONS

A Regulated Asbestos-Containing Material (RACM) as defined by National Emissions Standard for Hazardous Air Pollutants (NESHAP), is any (a) Friable asbestos material, (b) Category I non-friable ACM that has become friable, (c) Category I non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading, or (d) Category II non-friable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of renovation operations.

Following the EPA inspection protocol, each identified suspect homogeneous material was placed in one of the following EPA classifications:

- **RACM Friable Materials** NESHAP defines a friable ACM as any material containing more than one percent asbestos, which, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.

- **Category I Non-friable** NESHAP defines a Category I non-friable ACM as packing, gaskets, resilient floor covering (except sheet flooring products which are considered friable), and asphalt roofing products which contain more than one percent asbestos.

- **Category II Non-friable** NESHAP defines a Category II non-friable ACM as any material, except for a Category I non-friable ACM, which contains more than one percent asbestos and cannot be, reduced to a powder by hand pressure when dry.

4.1.2 SAMPLING PROCEDURES

Following the walkthrough, the inspector collected selected samples of accessible materials identified as suspect ACM.

EPA guidelines were used to determine the sampling protocol. Sampling locations were chosen to be representative of the homogeneous material.

Samples of surfacing material were collected in general accordance with the EPA sampling protocol outlined in the EPA publication, "Asbestos in Buildings: Simplified Sampling Scheme for Friable Surfacing Materials" (EPA 560/5-85-030a, October 1985). Representative samples were taken preferentially from already damaged areas or areas which were the least visible.

Samples of miscellaneous materials were taken as randomly as possible while again attempting to sample already damaged areas so as to minimize disturbance of the material. Multiple sampling was used to assess each miscellaneous material unless the total quantity of accessible material was less than 260 square feet.

4.1.3 QUANTIFICATION

Quantities of accessible and/or exposed building materials that were suspected of containing asbestos were estimated. Taking approximate measurements in the field performed this estimation.

4.1.4 LABORATORY PROCEDURES

METHOD OF ANALYSIS

Analysis was performed at PSI Laboratories of Pittsburgh, Pennsylvania, a National Volunteer Laboratory Accreditation Program (NVLAP), and accredited laboratory. A chain-of-custody, documenting the possession of the samples from the time they were collected until analyzed and stored, was submitted with the bulk samples. The original chain-of-custody accompanied the materials at all times. Custody documentation began at the time samples were collected and each transferor retained a copy of the chain-of-custody record.

Analysis was performed by using the bulk sample for visual observation and slide preparation(s) for microscopic examination and identification. The samples were mounted on slides and then analyzed for asbestos (chrysotile, amosite, crocidolite, anthophyllite, and actinolite/tremolite), fibrous non-asbestos constituents (mineral wool, paper, etc.) and non-fibrous constituents. Refractive indices, morphology, color, pleochroism, birefringence, extinction characteristics, and signs of elongation identified asbestos. The same characteristics were used to identify the non-asbestos constituents.

The microscopist visually estimated relative amounts of each constituent by determining the volume of each constituent in proportion to the total volume of the sample, using a stereoscope.

All bulk samples were analyzed by Polarized Light Microscopy (PLM) with dispersion staining as described by the method of the determination of asbestos in bulk insulation, EPA/600/R-93/116, July 1993. This is a standard method of analysis in optical mineralogy and the currently accepted method for the determination of asbestos in bulk samples. A suspect material is immersed in a solution of known refractive index and subjected to illumination by polarized light. The characteristic color displays which result enable mineral identification.

It should be noted that some ACBM might not be accurately identified and/or quantified by PLM. As an example, the original fabrication of vinyl floor tiles routinely involved milling of asbestos fibers to extremely small sizes. As a result, these fibers may go undetected under the standard PLM method. Transmission Electron Microscopy (TEM) is recommended for a more definitive analysis of these materials.

For bulk samples, which are found to contain <1% asbestos, Point Count Analysis as described by the method for the determination of asbestos in accordance with Environmental Protection Agency's (EPA) "Interim Method for Identification of Asbestos in Bulk Insulation Samples" (40 CFR 763, Appendix A, Subpart F), is often utilized. As part of this method, a bulk sample is reduced, in an effort to dissolve any non-asbestos constituents, such as calcite. As a result of this reduction process, a concentrated sample is then obtained and analyzed. A minimum number of counts for each sample are 400. The number of identified asbestos points is divided by 400, then multiplied by 100 in order to calculate the percentage. Each asbestos type is quantified individually.

5 NOTICES, PERMITS, AND LICENSES

Asbestos was not identified in materials sampled at this location. Additional suspect materials not identified in this survey will be assumed as asbestos-containing and will be subject to the requirements set forth in all applicable local, state, and federal regulations until tests are performed to confirm the absence of asbestos.

APPENDIX A – INSPECTOR CERTIFICATIONS

Certificate of Completion

This is to certify that

Carl Purdy

has satisfactorily completed
4 hours of refresher training as an

AHERA Building Inspector

to comply with the training requirements of
TSCA Title II, 40 CFR 763 (AHERA)

EPA Provider # 1085

185114
Certificate Number

ARGUS PACIFIC
TRAINING • CONSULTING
A Terracon COMPANY

May 18, 2022 Expires in 1 year.
Date(s) of Training

Exam Score: N/A
(if applicable)

Instructor: Ed Edinger

ARGUS PACIFIC, INC / 21905 64th AVE W, SUITE 100 / MOUNTLAKE TERRACE, WASHINGTON 98043 / 206.285.3373 / ARGUSPACIFIC.COM

AIHA Laboratory Accreditation Programs, LLC

acknowledges that

Intertek-PSI, Inc.

850 Poplar St Pittsburgh, PA 15220-2828

Laboratory ID: LAP-100373

along with all premises from which key activities are performed, as listed above, has fulfilled the requirements of the AIHA Laboratory Accreditation Programs (AIHA LAP), LLC accreditation to the ISO/IEC 17025:2017 international standard, General Requirements for the Competence of Testing and Calibration Laboratories in the following:

LABORATORY ACCREDITATION PROGRAMS

☑	**INDUSTRIAL HYGIENE**	Accreditation Expires: July 01, 2022
☑	**ENVIRONMENTAL LEAD**	Accreditation Expires: July 01, 2022
☑	**ENVIRONMENTAL MICROBIOLOGY**	Accreditation Expires: July 01, 2022
☐	**FOOD**	Accreditation Expires:
☐	**UNIQUE SCOPES**	Accreditation Expires:

Specific Field(s) of Testing (FoT)/Method(s) within each Accreditation Program for which the above named laboratory maintains accreditation is outlined on the attached Scope of Accreditation. Continued accreditation is contingent upon successful on-going compliance with ISO/IEC 17025:2017 and AIHA LAP, LLC requirements. This certificate is not valid without the attached Scope of Accreditation. Please review the AIHA LAP, LLC website (www.aihaaccreditedlabs.org) for the most current Scope.

Cheryl O. Morton

Cheryl O Morton
Managing Director, AIHA Laboratory Accreditation Programs, LLC

Revision19.1: 07/28/2021

Date Issued: 07/28/2021

AIHA Laboratory Accreditation Programs, LLC

SCOPE OF ACCREDITATION

Intertek-PSI, Inc.
850 Poplar St Pittsburgh, PA 15220-2828

Laboratory ID: LAP-100373
Issue Date: 07/29/2021

The laboratory is approved for those specific field(s) of testing/methods listed in the table below. Clients are urged to verify the laboratory's current accreditation status for the particular field(s) of testing/Methods, since these can change due to proficiency status, suspension and/or withdrawal of accreditation.

The EPA recognizes the AIHA LAP, LLC ELLAP program as meeting the requirements of the National Lead Laboratory Accreditation Program (NLLAP) established under Title X of the Residential Lead-Based Paint Hazard Reduction Act of 1992 and includes paint, soil and dust wipe analysis. Air and composited wipes analyses are not included as part of the NLLAP.

Environmental Lead Laboratory Accreditation Program (ELLAP)

Initial Accreditation Date: 06/01/1996

Component, parameter or characteristic tested	Technology sub-type/Detector	Method	Method Description *(for internal methods only)*
Airborne Dust	AA	NIOSH 7082	N/A
Paint	AA	EPA SW-846 3050B	N/A
		EPA SW-846 7000B	N/A
Settled Dust by Wipe	AA	EPA SW-846 3050B	N/A
		EPA SW-846 7000B	N/A
Soil	AA	EPA SW-846 3050B	N/A
		EPA SW-846 7000B	N/A

A complete listing of currently accredited ELLAP laboratories is available on the AIHA LAP, LLC website at: *http://www.aihaaccreditedlabs.org*

AIHA Laboratory Accreditation Programs, LLC

SCOPE OF ACCREDITATION

Intertek-PSI, Inc.
850 Poplar St Pittsburgh, PA 15220-2828

Laboratory ID: LAP-100373
Issue Date: 08/18/2021

The laboratory is approved for those specific field(s) of testing/methods listed in the table below. Clients are urged to verify the laboratory's current accreditation status for the particular field(s) of testing/Methods, since these can change due to proficiency status, suspension and/or withdrawal of accreditation.

Environmental Microbiology Laboratory Accreditation Program (EMLAP)

Initial Accreditation Date: 07/01/2005

EMLAP Scope Category	Field of Testing (FOT)	Component, parameter or characteristic tested	Method	Method Description *(for internal methods only)*
Fungal	Air - Direct Examination	Spore Trap Air Samples	WI-620	In House: Direct Microscopic Examinaton of Spore Traps
Fungal	Bulk - Direct Examination	Swab, wipe, bulk, dust, etc.	WI-621	In House: Direct Microscopic Examination of Surface and Bulk Samples
Fungal	Surface - Direct Examination	Tape, swab, wipe, bulk, dust, etc.	WI-621	In House: Direct Microscopic Examination of Surface and Bulk Samples

A complete listing of currently accredited EMLAP laboratories is available on the AIHA LAP, LLC website at: *http://www.aihaaccreditedlabs.org*

AIHA Laboratory Accreditation Programs, LLC

SCOPE OF ACCREDITATION

Intertek-PSI, Inc.
850 Poplar St Pittsburgh, PA 15220-2828

Laboratory ID: LAP-100373
Issue Date: 07/29/2021

The laboratory is approved for those specific field(s) of testing/methods listed in the table below. Clients are urged to verify the laboratory's current accreditation status for the particular field(s) of testing/Methods, since these can change due to proficiency status, suspension and/or withdrawal of accreditation.

Industrial Hygiene Laboratory Accreditation Program (IHLAP)

Initial Accreditation Date: 03/01/1987

IHLAP Scope Category	Field of Testing (FOT)	Technology sub-type/Detector	Published Reference Method/Title of In-house Method	Component, parameter or characteristic tested
Asbestos/Fiber Microscopy Core	Phase Contrast Microscopy (PCM)	-	NIOSH 7400	Asbestos/Fibers
Asbestos/Fiber Microscopy Core	Phase Contrast Microscopy (PCM)	-	WI-307	Asbestos/Fibers

A complete listing of currently accredited IHLAP laboratories is available on the AIHA LAP, LLC website at: *http://www.aihaaccreditedlabs.org*

APPENDIX B - ASBESTOS LABORATORY RESULTS AND CHAIN OF CUSTODY DOCUMENTATION

REPORT OF BULK SAMPLE ANALYSIS FOR ASBESTOS

TESTED FOR: Intertek/PSI, Inc.
6032 North Cutter Circle Suite 480
Portland, OR 97217
Attn: Carl Purdy

Project ID: 0581562-1
Cowlitz Indian Tribe
Kwoneesum Dam
Washougal, WA

Date Received: 6/8/2022 **Date Completed:** 6/13/2022 **Date Reported:** 6/13/2022

Analyst: Lori Huss **Work Order:** 2206157 **Page:** 1 of 2

Client ID	Lab ID (Layer)	Sample Description (Color, Texture, Etc.) *Analyst's Comment*	Asbestos Content (Percent and Type)	Non-asbestos Fibers (Percent and Type)
1-1	001A	(1) Gray, Cement, Homogeneous	NO ASBESTOS DETECTED	None Reported
1-2	002A	(1) Gray, Cement, Homogeneous	NO ASBESTOS DETECTED	None Reported
1-3	003A	(1) Gray, Cement, Homogeneous	NO ASBESTOS DETECTED	None Reported
		(2) Brown, Other, Homogeneous	NO ASBESTOS DETECTED	95% Cellulose Fiber
		Mesh		
1-4	004A	(1) Gray, Cement, Homogeneous	NO ASBESTOS DETECTED	None Reported
		(2) Brown, Other, Homogeneous	NO ASBESTOS DETECTED	95% Cellulose Fiber
		Mesh		
1-5	005A	(1) Gray, Cement, Homogeneous	NO ASBESTOS DETECTED	None Reported
		(2) Brown, Other, Homogeneous	NO ASBESTOS DETECTED	95% Cellulose Fiber
		Mesh		
1-6	006A	(1) Gray, Cement, Homogeneous	NO ASBESTOS DETECTED	None Reported
		(2) Brown, Other, Homogeneous	NO ASBESTOS DETECTED	95% Cellulose Fiber
		Mesh		
1-7	007A	(1) Gray, Cement, Homogeneous	NO ASBESTOS DETECTED	None Reported
		(2) Brown, Other, Homogeneous	NO ASBESTOS DETECTED	95% Cellulose Fiber
		Mesh		
2-8	008A	(1) Gray, Cement, Homogeneous	NO ASBESTOS DETECTED	None Reported

Quantitation is based on a visual estimation of the relative area of bulk sample components, unless otherwise noted in the "Comments" section of this report. The results are valid only for the item tested as received. This report may not be used to claim product endorsement by NVLAP or any agency of the U.S. Government. Method used: E.P.A. Interim Method for the Determination of Asbestos in Bulk Insulation Samples (EPA 600/M4-82-020). Polarized Light Microscopy is not consistently reliable in detecting asbestos in floor coverings and similar non-friable organically bound materials. Quantitative Transmission Electron Microscopy is currently the only method that can be used to determine if the material can be considered or treated as non-asbestos containing. Samples will be disposed of within 30 days unless notified in writing by the client. No part of this report may reproduced, except in full, without written permission of the laboratory. The reporting limit is 1% by weight. NVLAP Lab Code 101350-0.

Respectfully submitted,
PSI, Inc.

George Skarupa

Approved Signatory
George Skarupa

Client ID	Lab ID (Layer)	Sample Description (Color, Texture, Etc.) *Analyst's Comment*	Asbestos Content (Percent and Type)	Non-asbestos Fibers (Percent and Type)
2-9	009A	(1) Gray, Cement, Homogeneous	**NO ASBESTOS DETECTED**	None Reported
2-10	010A	(1) Gray, Cement, Homogeneous	**NO ASBESTOS DETECTED**	None Reported
2-11	011A	(1) Gray, Cement, Homogeneous	**NO ASBESTOS DETECTED**	None Reported
2-12	012A	(1) Gray, Cement, Homogeneous	**NO ASBESTOS DETECTED**	None Reported
3-13	013A	(1) Gray, Cement, Homogeneous	**NO ASBESTOS DETECTED**	None Reported
3-14	014A	(1) Gray, Cement, Homogeneous	**NO ASBESTOS DETECTED**	None Reported
3-15	015A	(1) Gray, Cement, Homogeneous	**NO ASBESTOS DETECTED**	None Reported
4-16	016A	(1) Black, Roofing, Homogeneous	**NO ASBESTOS DETECTED**	10% Fibrous Glass
		(2) Black, Felt, Homogeneous	**NO ASBESTOS DETECTED**	85% Cellulose Fiber
4-17	017A	(1) Black, Roofing, Homogeneous	**NO ASBESTOS DETECTED**	10% Fibrous Glass
		(2) Black, Felt, Homogeneous	**NO ASBESTOS DETECTED**	85% Cellulose Fiber
4-18	018A	(1) Black, Roofing, Homogeneous	**NO ASBESTOS DETECTED**	10% Fibrous Glass
		(2) Black, Felt, Homogeneous	**NO ASBESTOS DETECTED**	85% Cellulose Fiber
5-19	019A	(1) Black, Roofing, Homogeneous	**NO ASBESTOS DETECTED**	10% Fibrous Glass
		(2) Black, Felt, Homogeneous	**NO ASBESTOS DETECTED**	85% Cellulose Fiber
5-20	020A	(1) Black, Roofing, Homogeneous	**NO ASBESTOS DETECTED**	10% Fibrous Glass
		(2) Black, Felt, Homogeneous	**NO ASBESTOS DETECTED**	85% Cellulose Fiber
5-21	021A	(1) Black, Roofing, Homogeneous	**NO ASBESTOS DETECTED**	10% Fibrous Glass
		(2) Black, Felt, Homogeneous	**NO ASBESTOS DETECTED**	85% Cellulose Fiber
6-22	022A	(1) Gray, Cement, Homogeneous	**NO ASBESTOS DETECTED**	None Reported
6-23	023A	(1) Gray, Cement, Homogeneous	**NO ASBESTOS DETECTED**	None Reported
6-24	024A	(1) Gray, Cement, Homogeneous	**NO ASBESTOS DETECTED**	None Reported

Report Notes: **(PT) Point Count Results**

Quantitation is based on a visual estimation of the relative area of bulk sample components, unless otherwise noted in the "Comments" section of this report. The results are valid only for the item tested as received. This report may not be used to claim product endorsement by NVLAP or any agency of the U.S. Government. Method used: E.P.A. Interim Method for the Determination of Asbestos in Bulk Insulation Samples (EPA 600/M4-82-020). Polarized Light Microscopy is not consistently reliable in detecting asbestos in floor coverings and similar non-friable organically bound materials. Quantitative Transmission Electron Microscopy is currently the only method that can be used to determine if the material can be considered or treated as non-asbestos containing. Samples will be disposed of within 30 days unless notified in writing by the client. No part of this report may reproduced, except in full, without written permission of the laboratory. The reporting limit is 1% by weight. NVLAP Lab Code 101350-0.

Respectfully submitted,
PSI, Inc.

George Skarupa

Approved Signatory
George Skarupa

6032 N. Cutter Circle, Suite 480
Portland, OR 97217
Phone: 503.289.1778
Fax. 503.289.1918
Intertek.com/building
psiusa.com

2206157

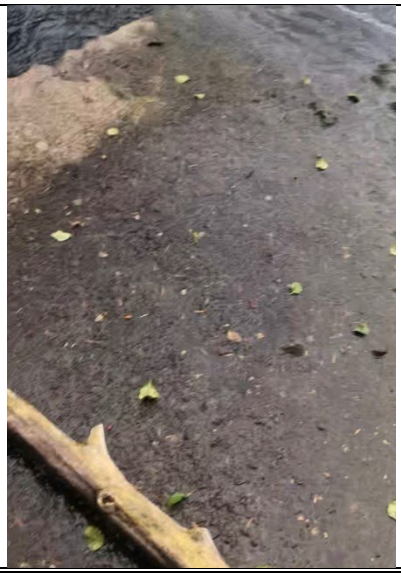
Chain of Custody – Sample Location – Asbestos

Date: 6/6/22

Project No.:	0581562-1	**Client Name:**	Cowlitz Indian Tribe
Field Inspector:	Carl Purdy	**Building Name/No.:**	Kwoneesum Dam Washougal, WA
Relinquished by: (Print)	Carl Purdy	**Signature: (Time and Date)**	Carl Purdy 1PM 6/7/22
Relinquished to: (Print)		**Signature: (Time and Date)**	6/8/22 9a
1st Positive Stop:	No	**Notes/Analysis:**	PLM
Turnaround Time:	3 Day	**Results to:**	Whitney.barlow@intertek.com cc: carl.purdy@intertek.com

Sample Group	Sample Number	Material Description	Sample Location	Quantity (SF/LF)
1	1	Cement	Main Dam	NA
	2			
	3			
	4			
	5			
	6			
	7			
2	8	Cement	Retaining Trusses	NA
	9			
	10			
	11			
	12			
3	13	Cement	Spillway	NA
	14			
	15			
4	16	Roofing	Building 1	200
	17			
	18			
5	19	Roofing	Building 2	800
	20			
	21			
6	22	Cement	Building 2	800
	23			
	24			
1	25			
	26			

APPENDIX C - PHOTOGRAPHS

	**HM #1** **Cement – Gray**
	**HM#2** **Cement – Gray**
	**HM #3** **Cement – Gray**

	**HM #4** **Roofing – Black**
	**HM #5** **Roofing – Black** **Paper – Black**
	**HM#6** **Cement – Gray**

APPENDIX D – SAMPLE LOCATION DRAWING

GROUND LEVEL

NORTH
W E
S

TREE AREA

ND 1–1

ND 1–2

RESERVOIR

CAMP KWONEESUM DAM

ND 1–3

ND 1–4

ND 1–5

DIRT/EARTH AREA

ND 1–6

ND 2–8

ND 2–9

TREE AREA

3–13 ND

ND 2–12

ND 1–7

BUILDING 1 LOCATION

2–11 ND

2–10 ND

3–14 ND

CEMENT SPILLWAY

3–15 ND

BUILDING 2 LOCATION

intertek psi
Total Quality. Assured.
ENVIRONMENTAL SERVICES
6032 North Cutter Circle, Suite 480
Portland, Oregon 97217
(503) 289–1778

CAMP KWONEESUM DAM
WAHOUGAL, WASHINGTON

PROJECT: ASBESTOS AND LEAD SAMPLE LOCATION PLANS

DRAWN BY:	DATE:	APPROVED BY:
EFD	6/10/22	C.P.

DRAWING NO.	PROJECT NO.:
1562–1	0581562–1

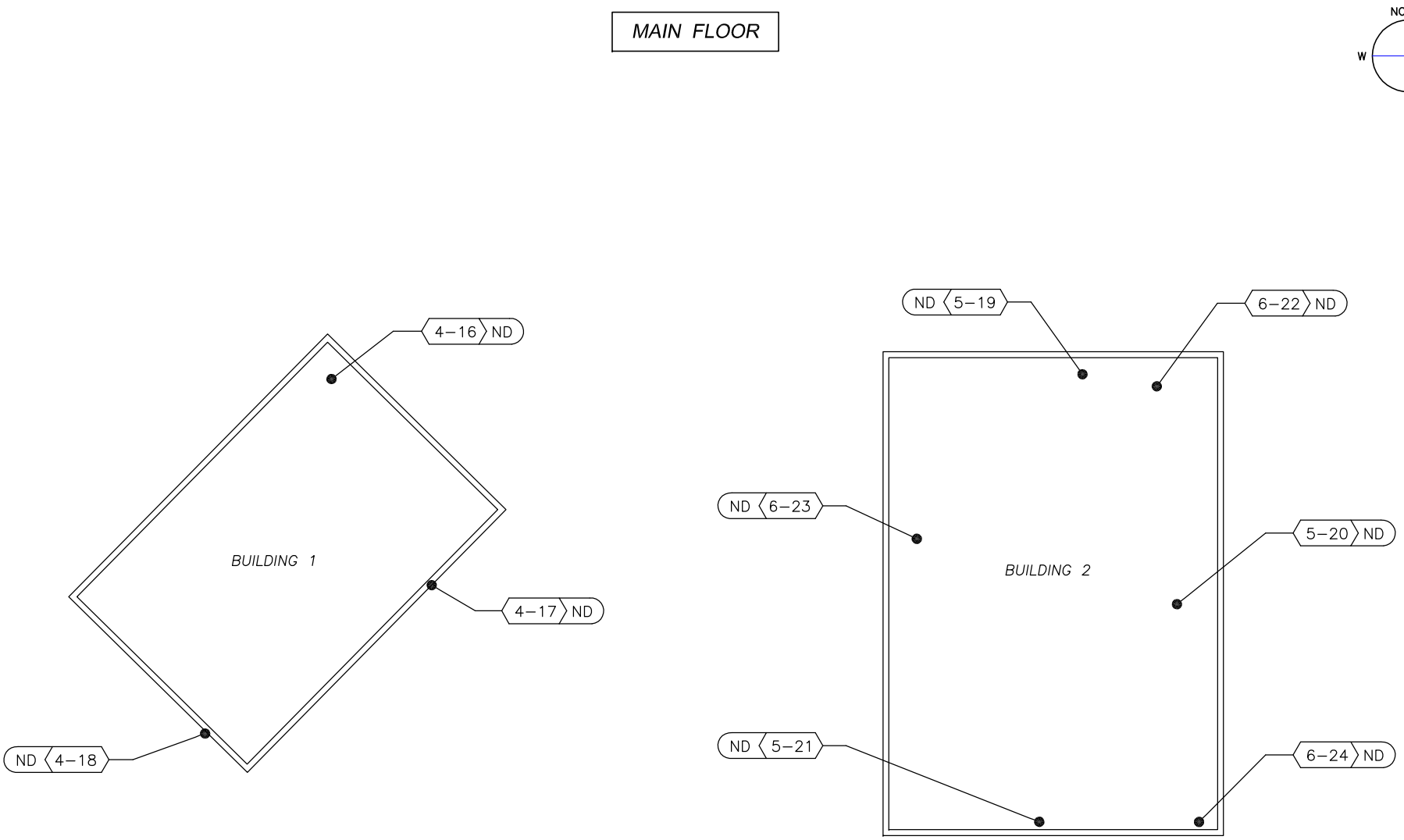
ASBESTOS
3–15 ND
SAMPLE NUMBER
SAMPLE RESULT

SAMPLE LEGEND

NA = NOT ANALYZED
N or ND or NEG = NONE DETECTED
P or POS = POSITIVE

LEAD
P–2 NEG
SAMPLE NUMBER
SAMPLE RESULT AND DESCRIPTION
NEG = NEGATIVE
POS = POSITIVE

MAIN FLOOR



intertek psi Total Quality. Assured. ENVIRONMENTAL SERVICES 6032 North Cutter Circle, Suite 480 Portland, Oregon 97217 (503) 289-1778	CAMP KWONEESUM DAM - BUILDINGS WAHOUGAL, WASHINGTON PROJECT: ASBESTOS AND LEAD SAMPLE LOCATION PLANS	DRAWN BY: EFD	DATE: 6/10/22	APPROVED BY: C.P.	ASBESTOS SAMPLE NUMBER 6–24 ND SAMPLE RESULT
		DRAWING NO. 1562–2	PROJECT NO.: 0581562–1		

SAMPLE LEGEND

NA = NOT ANALYZED
N or ND or NEG = NONE DETECTED
P or POS = POSITIVE

LEAD
SAMPLE NUMBER
P–2 NEG
NEG = NEGATIVE
POS = POSITIVE
SAMPLE RESULT AND DESCRIPTION

Rain For Rent
11035 NE Marx St
Portland, OR, 97220
503-262-7246
rainforrent.com
BWIDING@rainforrent.com

Preliminary

Cowlitz Indian Tribe
Account: 7102408
1055 9th Ave Suite B
Longview, WA, 98632
Justin Isle

Dear Justin Isle,

Thank you for your inquiry. As requested, please find attached our proposal 1059-IND-2054780 for 3 Creek Diversion Gravity Proposal. We value this opportunity to provide a solution for your liquid handling need and we are committed to partnering with you to ensure your project's safe execution and completion.

To convert this proposal into a confirmed order WITHOUT ANY CHANGES, please click the "Start Signing" button to begin the electronic signature process.

If you would like to CHANGE anything in this proposal or discuss anything further, please call Brian Widing at 503-262-7246.

Thank you, and I look forward to working with you.

Regards,

Brian Widing
BWIDING@rainforrent.com
Mobile: 503-969-8951
Branch: 503-262-7246
11035 NE Marx St
Portland, OR, 97220

Proposal #	1059-IND-2054780	Project Name	3 Creek Diversion Gravity Proposal
Date Prepared	1/23/2023	Est. Delivery Date	6/1/2023
Prevailing Wage	No	Est. Completion Date	6/28/2023

Project Location

Camp Kwoneesum Dam
Washougal, WA, 98671

Project Summary

Cowlitz Tribe is planning work to remove the Kwoneesum dam near Washougal, WA. Prior to dam removal, 3 tributaries will need to be dammed and diverted to the nearby Texas creek. There will need to be 20 CFS of flow capability between the creeks. This quote should be used for budgetary purposes only at this time until a more formal job walk can be performed.

STATEMENT OF WORK

RFR Responsibilities & Scope of Work

Rain for Rent (RFR) will provide the following:
___x__ Delivery, installation, removal, pickup of all quoted materials/equipment with assistance from contractor during loading, unloading, and movement of equipment into place on site.
_____ Delivery/pickup of equipment only, no installation/removal or onsite labor
_____ Delivery/pickup of equipment and RFR technician(s) to work with Customer's crew
__x___ Customer _____ RFR will operate system
_____ Will Call: RFR will gather & prepare equipment for customer pickup
_____ Equipment Sale

Cowlitz Tribe is planning work to remove the Kwoneesum dam near Washougal, WA. Prior to dam removal, 3 tributaries will need to be dammed and diverted to the nearby Texas creek. There will need to be 20 CFS of flow capability between the creeks. The flows from the 3 tributaries will gravity flow to a pump station on the SE Bank of the reservoir where flow can be pumped to Texas creek if needed. This quote should be used for budgetary purposes only at this time until a more formal job walk can be performed. Equipment in this quote provided based on customer request. Customer to verify suitability of this equipment for the desired application.

Reference Materials

Project is quoted based on applicable/customer provided reference materials noted below:
___x__ Plans
___x__ Job Walk(s)
___x__ Customer Meeting(s)
___x__ Verbal / Written Request

This quote should be used for budgetary purposes only at this time. Additional job walk(s) will be needed to provide a more formal quote for this project. Rain for Rent has not independently verified the site conditions for this project. Customer to verify suitability of this equipment for the desired application.

Operating Parameters

System is intended to be operated at a maximum flow rate of 20 CFS between all 3 tributaries.
Water source is 3 tributaries feeding Kwoneesum reservoir.
Suction lift: Flooded
Pipe Type: SDR17 HDPE
Size: 12", 18" and 24"
Material: Stream Water

Customer Responsibilities

It is the customer’s responsibility to inform RFR about prevailing wage at time of proposal. If RFR is informed after the quote is issued that

certified payroll is required, quote will be subject to additional charges.

Jobsite:

Customer is responsible for:

1. Informing RFR of any jobsite or general requirement(s) to perform work on location.
2. Securing permits, fees, bonding, right of ways, vehicular/pedestrian traffic control, and security.
3. Providing safe, secure access and egress to an adequate staging area throughout the job which could include brush clearing, grading, and removal or replacement of any landscape or hardscape in the temporary right of way for the equipment.
4. Any damage to the environment including trees, vegetation, stream banks, or any other part of the site caused by the installation, removal, construction, pulling or dragging of equipment, or operation of the equipment that would require site restoration or environmental countermeasures.
5. Any excavation, saw cutting, trench plating for the purpose of road crossings, backfilling, restoration, modification, or alteration of any permanent structure or site element including changes to pump pad preparation, suction, or discharge chambers during duration of job (including installation and removal).
6. Customer to provide equipment and operator(s) as needed during offloading and loading process as well as during the movement of equipment into place (pumps, fuel cells, generators, etc.) Customer to also provide equipment such as forklifts/excavators and barge with operators to facilitate movement of pipe during fusion process and removal of pipe at the end of the project. Additional equipment and operators provided by the contractor may be needed based on findings in additional job walk(s). All on water work to be performed by contractor. Customer to supply all rigging and any needed securement of pipe to anchor points.

System:

1. Customer __x___ RFR _____ will provide dedicated equipment with operator and fuel to perform all needed unloading, testing, operations, maintenance, relocating, cleaning, and reloading of provided equipment/system. Equipment must be capable of lifting 13,000 Lbs.
2. If installation provided by RFR and Customer is operating system, this Transfer of Operation form will need to be reviewed and signed by both parties upon completion of setup. (sample form only): **https://rainforrentcorp.box.com/v/systemtransferoperation**
3. Customer __x___ RFR _____ will provide fueling.
4. Customer __x___ RFR _____ will provide preventative maintenance as recommended by manufacturer or per the Rental Agreement. **https://rainforrentcorp.box.com/v/pumpmaintenance**
5. Customer will supply all needed water for the commissioning, startup, and system testing. Project specific criteria for hydrotesting can be provided at an additional charge.
6. By accepting this quotation, the customer has acknowledged that the equipment proposed herein is suitable for its intended application and accepts all liabilities associated with its use. Customer is responsible for compliance with appropriate liquid/material quality standards, regulations, and testing protocols to meet all federal, state, local and job location specific requirements. Customer is responsible for all waste materials associated with this equipment/system.

Customer is responsible for:

1. Any work in confined spaces.
2. Protecting system from damage including any freeze protection necessary to safeguard equipment from damage. Should equipment become frozen and damaged, customer is responsible for repair of equipment. RFR can provide necessary freeze protection at an additional charge per executed change order. Equipment stays on rent until it can be returned.
3. Using equipment in a safe and proper manner in accordance with manufacturers' recommendations, regulatory standards, and industry best practices. Improper usage may cause equipment/system failure, damage, possible incidents, injuries, and spills.
4. Customer is required to periodically start diesel back-up pumps and ensure batteries are fully charged, ready for operation.
5. Customer to identify high points for air vents.
6. Customer is responsible for any residual fluids in system once project is concluded to remove and properly dispose of.

Upon Pickup:

Contact the RFR office at 503-262-7246 to schedule pickup when equipment/system is cleaned and ready to be released.
Flushing and cleaning of equipment must be performed to RFR's standards prior to being called off rent. RFR personnel will perform a visual inspection. It is recommended to have a customer representative on-site during inspection. Equipment found not to be in "delivered condition" will not be picked up.

Project Scheduling & Billing

This quote is valid for 30 days. For the quoted items, RFR requires a signed quote not less than 30 days prior to delivery.

Estimated schedule durations:
Mobilization/Installation: Approx. 3.5 weeks
Operation: Based on 28 day rental period
Removal/Demobilization: Approx. 1.5 weeks
System Rental Duration: Based on 28 day rental cycle. Actual time rented will be billed.

Customer acknowledges that availability of equipment/system and/or media will be confirmed at time of order. Additional freight charges may apply subject to mutually agreed upon change order.

Billing
Delivery and labor for this project will be billed upon completion of the installation.

This is an estimate only. Actual Time and Material used for this job will be billed to the customer. Equipment to be placed on rent at the end of installation or after 3 weeks from beginning of installation whichever is sooner.

Any re-rented equipment may be billed according to the third party's billing period. All billing subject to our standard terms and conditions in the rental agreement.

Safety

Each employee is expected to adhere to the RFR Environmental, Health and Safety programs, which will protect the environment, the health and safety of the customer, employees, and others. RFR asks for your full cooperation to succeed in this expected outcome.

Rain for Rent proposes the following equipment for the Kwoneesum Dam 3 tributary diversion phase (Partial Gravity Option):

(4) DV200C SA Diesel Pumps (3 Primary and 1 Backup)
(4) 12'x16' spillguards for pump containment
10' of 12" suction hose off of each pump to pull from gravity header pipe
500' of 12" HDPE pipe for pumps to discharge back into 24" gravity line
Isolation valves on suction and discharge lines for each pump
(4) Air vents for the discharge side of pumps
(2) 24" gate valves
3,100' of 24" HDPE SDR17 discharge pipe
1,700' of 18" HDPE SDR17 discharge pipe
Misc. 12", 18", and 24" elbows, tees, and fittings to navigate changes in terrain and connections

Rental cost is for (1) 28 day rental cycle

Rain For Rent
11035 NE Marx St
Portland, OR, 97220
503-262-7246
rainforrent.com
BWIDING@rainforrent.com

Preliminary

Cowlitz Indian Tribe
Account: 7102408
1055 9th Ave Suite B
Longview, WA, 98632
Justin Isle

Dear Justin Isle,

Thank you for your inquiry. As requested, please find attached our proposal 1059-IND-2035723 for Initial 3 Creek Diversion. We value this opportunity to provide a solution for your liquid handling need and we are committed to partnering with you to ensure your project's safe execution and completion.

To convert this proposal into a confirmed order WITHOUT ANY CHANGES, please click the "Start Signing" button to begin the electronic signature process.

If you would like to CHANGE anything in this proposal or discuss anything further, please call Brian Widing at 503-262-7246.

Thank you, and I look forward to working with you.

Regards,

Brian Widing
BWIDING@rainforrent.com
Mobile: 503-969-8951
Branch: 503-262-7246
11035 NE Marx St
Portland, OR, 97220

Proposal #	1059-IND-2035723	Project Name	Initial 3 Creek Diversion
Date Prepared	8/18/2022	Est. Delivery Date	6/1/2023
Prevailing Wage	No	Est. Completion Date	6/28/2023

Project Location

Camp Kwoneesum Dam
Washougal, WA, 98671

Project Summary

Cowlitz Tribe is planning work to remove the Kwoneesum dam near Washougal, WA. Prior to dam removal, 3 tributaries will need to be dammed and diverted to the nearby Texas creek. 12" HDPE pipe has been requested as the conveyance piping for the discharge lines and will cumulatively provide 20 CFS of flow capability between the 3 systems. This quote should be used for budgetary purposes only at this time until a more formal job walk can be performed.

STATEMENT OF WORK

RFR Responsibilities & Scope of Work

Rain for Rent (RFR) will provide the following:
__x___ Delivery, installation, removal, pickup of all quoted materials/equipment with assistance from contractor during loading, unloading, and movement of equipment into place on site.
_____ Delivery/pickup of equipment only, no installation/removal or onsite labor
_____ Delivery/pickup of equipment and RFR technician(s) to work with Customer's crew
__x___ Customer _____ RFR will operate system
_____ Will Call: RFR will gather & prepare equipment for customer pickup
_____ Equipment Sale

Cowlitz Tribe is planning work to remove the Kwoneesum dam near Washougal, WA. Prior to dam removal, 3 tributaries will need to be dammed and diverted to the nearby Texas creek. 12" HDPE pipe has been requested as the conveyance piping for the discharge lines and will cumulatively provide 20 CFS of flow capability between the 3 systems. A total of approx. 7,000 ft. of discharge pipe will be needed to take flows to nearby Texas creek. Pumps to be electric 12" suction and 8" discharge centrifugal pumps. This quote should be used for budgetary purposes only at this time until a more formal job walk can be performed.

Reference Materials

Project is quoted based on applicable/customer provided reference materials noted below:
Plans __x___
Bid Specifications __x___
Job Walk __x___
Customer Meeting(s) __x___
Verbal / Written Request __x___

This quote should be used for budgetary purposes only at this time. Additional job walk(s) will be needed to provide a more formal quote for this project. Rain for Rent has not independently verified the site conditions for this project. Customer to verify suitability of this equipment for the desired application.

Operating Parameters

System is intended to be operated at a maximum flow rate of 20 CFS between all 3 systems.
Water source is 3 tributaries feeding Kwoneesum reservoir.
Suction lift: Under 10 ft.
Pipe Type: SDR17 HDPE
Size: 12"
Material: Stream Water
Total pipe length estimated at under 7,000 ft.

Customer Responsibilities

It is the customer's responsibility to inform RFR about prevailing wage at time of proposal. If RFR is informed after the quote is issued that certified payroll is required, quote will be subject to additional charges.

Jobsite:

Customer is responsible for:

1. Informing RFR of any jobsite or general requirement(s) to perform work on location.
2. Securing permits, fees, bonding, right of ways, vehicular/pedestrian traffic control, and security.
3. Providing safe, secure access and egress to an adequate staging area throughout the job which could include brush clearing, grading, and removal or replacement of any landscape or hardscape in the temporary right of way for the equipment.
4. Any damage to the environment including trees, vegetation, stream banks, or any other part of the site caused by the installation, removal, construction, pulling or dragging of equipment, or operation of the equipment that would require site restoration or environmental countermeasures.
5. Any excavation, saw cutting, trench plating for the purpose of road crossings, backfilling, restoration, modification, or alteration of any permanent structure or site element including changes to pump pad preparation, suction, or discharge chambers during duration of job (including installation and removal).
6. Customer to provide equipment and operator(s) as needed during offloading and loading process as well as during the movement of equipment into place (pumps, fuel cells, generators, etc.) Customer to also provide equipment such as forklifts/excavators and barge with operators to facilitate movement of pipe during fusion process and removal of pipe at the end of the project. Additional equipment and operators provided by the contractor may be needed based on findings in additional job walk(s). All on water work to be performed by contractor. Customer to supply all rigging and any needed securement of pipe to anchor points.

System:

1. Customer __x___ RFR _____ will provide dedicated equipment with operator and fuel to perform all needed unloading, testing, operations, maintenance, relocating, cleaning, and reloading of provided equipment/system. Equipment must be capable of lifting 13,000 Lbs.
2. If installation provided by RFR and Customer is operating system, this Transfer of Operation form will need to be reviewed and signed by both parties upon completion of setup. (sample form only): **https://rainforrentcorp.box.com/v/systemtransferoperation**
3. Customer __x___ RFR _____ will provide fueling.
4. Customer __x___ RFR _____ will provide preventative maintenance as recommended by manufacturer or per the Rental Agreement. **https://rainforrentcorp.box.com/v/pumpmaintenance**
5. Customer will supply all needed water for the commissioning, startup, and system testing. Project-specific criteria for hydrotesting can be provided at an additional charge.
6. By accepting this quotation, the customer has acknowledged that the equipment proposed herein is suitable for its intended application and accepts all liabilities associated with its use. Customer is responsible for compliance with appropriate liquid/material quality standards, regulations, and testing protocols to meet all federal, state, local and job location specific requirements. Customer is responsible for all waste materials associated with this equipment/system.

Customer is responsible for:

1. Any work in confined spaces.
2. Protecting system from damage including any freeze protection necessary to safeguard equipment from damage. Should equipment become frozen and damaged, customer is responsible for repair of equipment. RFR can provide necessary freeze protection at an additional charge per executed change order. Equipment stays on rent until it can be returned.
3. Using equipment in a safe and proper manner in accordance with manufacturers' recommendations, regulatory standards, and industry best practices. Improper usage may cause equipment/system failure, damage, possible incidents, injuries, and spills.

Upon Pickup:

Contact the RFR office at 503-262-7246 to schedule pickup when equipment/system is cleaned and ready to be released.
Flushing and cleaning of equipment must be performed to RFR's standards prior to being called off rent. RFR personnel will perform a visual inspection. It is recommended to have a customer representative on-site during inspection. Equipment found not to be in "delivered condition" will not be picked up.

Project Scheduling & Billing

This quote is valid for 30 days. For the quoted items, RFR requires a signed quote not less than 30 days prior to delivery.

Estimated schedule durations:

Mobilization and Installation: Approx. 3 weeks
Operation: Based on a 28 day rental period
Removal and Demobilization: Approx. 1 week
System Rental Duration: Based on a 28 day rental period. Actual time rented will be billed.

Customer acknowledges that availability of equipment/system and/or media will be confirmed at time of order. Additional freight charges may apply subject to mutually agreed upon change order.

Billing

1. Delivery and labor for this project will be billed upon completion of the installation.
2. This is an estimate only. Actual Time and Material used for this job will be billed to the customer. Equipment to be placed on rent at the end of installation or after 3 weeks from beginning of installation whichever is sooner.

Any re-rented equipment may be billed according to the third party's billing period. All billing subject to our standard terms and conditions in the rental agreement.

Rental rates for gensets (if applicable) are for normal and reasonable use of equipment not exceeding 8 hours per day, five days per week (one shift basis). 9-16 hrs. a day and or 41-80 hrs. a week is billed at 1.5 times rate. 17+ hrs. a day and or 81+ hours a week billed at 2.0 times rate.

Safety

Each employee is expected to adhere to the RFR Environmental, Health and Safety programs, which will protect the environment, the health and safety of the customer, employees, and others. RFR asks for your full cooperation to succeed in this expected outcome.

Product availability, pricing and services are subject to change based on factors out side of Rain For Rents control ie, possible shut downs in manufacturing, shipping, and available work force due to developing Covid-19 health crisis.

Rain for Rent proposes the following equipment for the Kwoneesum Dam 3 tributary diversion phase:

(6) DV200CE electric pumps (3 primary and 3 backups)
(6) Variable frequency drives for pumps
(6) 500 gallon+ fuel cells
(6) Floats for backup pump operation
(2) 10'x50' spillguards for fuel cell containment
20' of 12" suction hose off of each pump
8" discharge hoses directly off of the pumps connecting each set of pumps to a common 12" tee
7,000' of 12" HDPE SDR17 discharge pipe
Air vents at the pump stations and every 1,000' of pipe run
Isolation valves off of each pump
Misc. 12" elbows to navigate changes in terrain

Rental cost is for (1) 28 day rental cycle

Rain For Rent
11035 NE Marx St
Portland, OR, 97220
503-262-7246
rainforrent.com
BWIDING@rainforrent.com

Preliminary

Cowlitz Indian Tribe
Account: 7102408
1055 9th Ave Suite B
Longview, WA, 98632
Justin Isle

Dear Justin Isle,

Thank you for your inquiry. As requested, please find attached our proposal 1059-IND-2036300 for Per Sprayer Budgetary. We value this opportunity to provide a solution for your liquid handling need and we are committed to partnering with you to ensure your project's safe execution and completion.

To convert this proposal into a confirmed order WITHOUT ANY CHANGES, please click the "Start Signing" button to begin the electronic signature process.

If you would like to CHANGE anything in this proposal or discuss anything further, please call Brian Widing at 503-262-7246.

Thank you, and I look forward to working with you.

Regards,

Brian Widing
BWIDING@rainforrent.com
Mobile: 503-969-8951
Branch: 503-262-7246
11035 NE Marx St
Portland, OR, 97220

Proposal #	1059-IND-2036300	Project Name	Per Sprayer Budgetary
Date Prepared	8/17/2022	Est. Delivery Date	6/1/2023
Prevailing Wage	No	Est. Completion Date	6/28/2023

Project Location

Camp Kwoneesum Dam
Washougal, WA, 98671

Project Summary

Cowlitz Tribe is planning work to remove the Kwoneesum dam near Washougal, WA. During dam removal, customer has expressed the desire to use sprinklers to land apply some of the water to reduce the volume in the reservoir. Rain for Rent has provided budgetary pricing to transfer water being provided to the high head pump to a location approx. 3,500 feet away to a sprinkler for land application. This quote should be used for budgetary purposes only at this time until a more formal job walk can be performed.

STATEMENT OF WORK

RFR Responsibilities & Scope of Work

Rain for Rent (RFR) will provide the following:
__x___ Delivery, installation, removal, pickup of all quoted materials/equipment with assistance from contractor during loading, unloading, and movement of equipment into place on site.
_____ Delivery/pickup of equipment only, no installation/removal or onsite labor
_____ Delivery/pickup of equipment and RFR technician(s) to work with Customer's crew
__x___ Customer _____ RFR will operate system
_____ Will Call: RFR will gather & prepare equipment for customer pickup
_____ Equipment Sale

Cowlitz Tribe is planning work to remove the Kwoneesum dam near Washougal, WA. During dam removal, customer has expressed the desire to use sprinklers to land apply some of the water to reduce the volume in the reservoir. Rain for Rent has provided budgetary pricing to transfer water being provided to the high head pump by others. The high head pump will then pump water to a location approx. 3,500 feet away to a sprinkler for land application. Contractor to supply sump pumps that feed HH pump and provide at least 380 GPM of flow to the high head pump at at least 10 PSI of pressure. Additional or alternate equipment may be needed for this project and will be billed for. This quote covers (1) high head pump and sprinkler setup. This quote should be used for budgetary purposes only at this time until a more formal job walk can be performed.

Reference Materials

Project is quoted based on applicable/customer provided reference materials noted below:
Plans __x___
Bid Specifications __x___
Job Walk __x___
Customer Meeting(s) __x___
Verbal / Written Request __x___

This quote should be used for budgetary purposes only at this time. Additional job walk(s) will be needed to provide a more formal quote for this project. Rain for Rent has not independently verified the site conditions for this project. Customer to verify suitability of this equipment for the desired application.

Operating Parameters

System is intended to be operated at a flow rate of 380 GPM given the distance of the discharge run.
Water source is Kwoneesum reservoir.
Suction lift: Flooded suction from contractor owned pumps.
Pipe Type: SDR11 HDPE
Size: 6"
Material: Reservoir water
Pipe length estimated at 3,500 ft. for this run.

Customer Responsibilities

It is the customer's responsibility to inform RFR about prevailing wage at time of proposal. If RFR is informed after the quote is issued that certified payroll is required, quote will be subject to additional charges.

Jobsite:

Customer is responsible for:

1. Informing RFR of any jobsite or general requirement(s) to perform work on location.
2. Securing permits, fees, bonding, right of ways, vehicular/pedestrian traffic control, and security.
3. Providing safe, secure access and egress to an adequate staging area throughout the job which could include brush clearing, grading, and removal or replacement of any landscape or hardscape in the temporary right of way for the equipment.
4. Any damage to the environment including trees, vegetation, stream banks, or any other part of the site caused by the installation, removal, construction, pulling or dragging of equipment, or operation of the equipment that would require site restoration or environmental countermeasures.
5. Any excavation, saw cutting, trench plating for the purpose of road crossings, backfilling, restoration, modification, or alteration of any permanent structure or site element including changes to pump pad preparation, suction, or discharge chambers during duration of job (including installation and removal).
6. Customer to provide equipment and operator(s) as needed during offloading and loading process as well as during the movement of equipment into place (pump, generator, etc.) Customer to also provide equipment such as forklifts/excavators and potentially barge with operators to facilitate movement of pipe during fusion process if needed and removal of pipe at the end of the project. Additional equipment and operators provided by the contractor may be needed based on findings in additional job walk(s). All on water work to be performed by contractor. Customer to supply all rigging and any needed securement of pipe to anchor points.

System:

1. Customer __x___ RFR _____ will provide dedicated equipment with operator and fuel to perform all needed unloading, testing, operations, maintenance, relocating, cleaning, and reloading of provided equipment/system. Equipment must be capable of lifting 11,000 Lbs.
2. If installation provided by RFR and Customer is operating system, this Transfer of Operation form will need to be reviewed and signed by both parties upon completion of setup. (sample form only): **https://rainforrentcorp.box.com/v/systemtransferoperation**
3. Customer __x___ RFR _____ will provide fueling.
4. Customer __x___ RFR _____ will provide preventative maintenance as recommended by manufacturer or per the Rental Agreement. **https://rainforrentcorp.box.com/v/pumpmaintenance**
5. Customer will supply all needed water for the commissioning, startup, and system testing. Project-specific criteria for hydrotesting can be provided at an additional charge.
6. By accepting this quotation, the customer has acknowledged that the equipment proposed herein is suitable for its intended application and accepts all liabilities associated with its use. Customer is responsible for compliance with appropriate liquid/material quality standards, regulations, and testing protocols to meet all federal, state, local and job location specific requirements. Customer is responsible for all waste materials associated with this equipment/system.

Customer is responsible for:

1. Any work in confined spaces.
2. Protecting system from damage including any freeze protection necessary to safeguard equipment from damage. Should equipment become frozen and damaged, customer is responsible for repair of equipment. RFR can provide necessary freeze protection at an additional charge per executed change order. Equipment stays on rent until it can be returned.
3. Using equipment in a safe and proper manner in accordance with manufacturers' recommendations, regulatory standards, and industry best practices. Improper usage may cause equipment/system failure, damage, possible incidents, injuries, and spills.

Upon Pickup:

Contact the RFR office at 503-262-7246 to schedule pickup when equipment/system is cleaned and ready to be released.
Flushing and cleaning of equipment must be performed to RFR's standards prior to being called off rent. RFR personnel will perform a visual inspection. It is recommended to have a customer representative on-site during inspection. Equipment found not to be in "delivered condition" will not be picked up.

Project Scheduling & Billing

This quote is valid for 30 days. For the quoted items, RFR requires a signed quote not less than 30 days prior to delivery.

Estimated schedule durations:

Mobilization and Installation: Approx. 3 days
Operation: Based on a 28 day rental period
Removal and Demobilization: Approx. 1.5 days
System Rental Duration: Based on a 28 day rental period. Actual time rented will be billed.

Customer acknowledges that availability of equipment/system and/or media will be confirmed at time of order. Additional freight charges may apply subject to mutually agreed upon change order.

Billing

1. Delivery and labor for this project will be billed upon completion of the installation.
2. This is an estimate only. Actual Time and Material used for this job will be billed to the customer. Equipment to be placed on rent at the end of installation or after 3 days from beginning of installation whichever is sooner.

Any re-rented equipment may be billed according to the third party's billing period. All billing subject to our standard terms and conditions in the rental agreement.
Rental rates for gensets (if applicable) are for normal and reasonable use of equipment not exceeding 8 hours per day, five days per week (one shift basis). 9-16 hrs. a day and or 41-80 hrs. a week is billed at 1.5 times rate. 17+ hrs. a day and or 81+ hours a week billed at 2.0 times rate.

Safety

Each employee is expected to adhere to the RFR Environmental, Health and Safety programs, which will protect the environment, the health and safety of the customer, employees, and others. RFR asks for your full cooperation to succeed in this expected outcome.

Product availability, pricing and services are subject to change based on factors out side of Rain For Rents control ie, possible shut downs in manufacturing, shipping, and available work force due to developing Covid-19 health crisis.

Rain for Rent proposes the following equipment for the Kwoneesum Dam land application sprayer phase:

(3) 10' 6" Suction and discharge hoses for connections
(1) HH125CE high head pump
(1) 75HP Variable frequency drive
3,500' of 6" SDR11 HDPE pipe
(1) SR200 Sprayer with stand
(4) Air vents
(1) Isolation valve on discharge line

Rental cost is for (1) 28 day rental cycle

Rain For Rent
11035 NE Marx St
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rainforrent.com
BWIDING@rainforrent.com

Preliminary

Cowlitz Indian Tribe
Account: 7102408
1055 9th Ave Suite B
Longview, WA, 98632
Justin Isle

Dear Justin Isle,

Thank you for your inquiry. As requested, please find attached our proposal 1059-IND-2036156 for Siphon System Kwomeesum. We value this opportunity to provide a solution for your liquid handling need and we are committed to partnering with you to ensure your project's safe execution and completion.

To convert this proposal into a confirmed order WITHOUT ANY CHANGES, please click the "Start Signing" button to begin the electronic signature process.

If you would like to CHANGE anything in this proposal or discuss anything further, please call Brian Widing at 503-262-7246.

Thank you, and I look forward to working with you.

Regards,

Brian Widing
BWIDING@rainforrent.com
Mobile: 503-969-8951
Branch: 503-262-7246
11035 NE Marx St
Portland, OR, 97220

Proposal #	1059-IND-2036156	Project Name	Siphon System Kwomeesum
Date Prepared	8/17/2022	Est. Delivery Date	6/1/2023
Prevailing Wage	No	Est. Completion Date	6/28/2023

Project Location

Camp Kwoneesum Dam
Washougal, WA, 98671

Project Summary

Cowlitz Tribe is planning work to remove the Kwoneesum dam near Washougal, WA. Prior to dam removal, the water in the reservoir must be initially drawn down approx. 10 feet from OHW to allow for deconstruction to begin. Rain for Rent is providing the following pricing for a siphon system to accommodate initial draw down at a total rate of UP TO 20 CFS.

STATEMENT OF WORK

RFR Responsibilities & Scope of Work

Rain for Rent (RFR) will provide the following:
__x___ Delivery, installation, removal, pickup of all quoted materials/equipment with assistance from contractor during loading, unloading, and movement of equipment into place on site.
_____ Delivery/pickup of equipment only, no installation/removal or onsite labor
_____ Delivery/pickup of equipment and RFR technician(s) to work with Customer's crew
__x___ Customer _____ RFR will operate system
_____ Will Call: RFR will gather & prepare equipment for customer pickup
_____ Equipment Sale

Cowlitz Tribe is planning work to remove the Kwoneesum dam near Washougal, WA. Prior to dam removal, the water in the reservoir must be initially drawn down approx. 10 feet from OHW to allow for deconstruction to begin. Rain for Rent is providing the following pricing for a siphon system to accommodate initial draw down at a total rate of UP TO 20 CFS. The siphon system will consist of (3) 12" HDPE siphons. For the purpose of this quote, Rain for Rent has estimated that the suction ends of the siphons shall extend approx. 150' out into the reservoir to reach a deep enough area to achieve initial drawdown. The suction ends of the siphons shall have an elbow that points an additional section of pipe upwards to avoid bypassing sediment downstream. The siphons will go over the existing dam where the HDPE lines will each have their own saddle tap and port to pull prime from, as well as a valve to control flow. The siphons will then extend down the back of the dam. For the purpose of this quote the distance down the back of the dam has been estimated to be 225' for each line. Upon reaching the base of the dam, the siphon lines will again be elbowed "up" to avoid air entering the lines and breaking siphon. Rain for Rent anticipates the majority of the fusion taking place along one of the future access points to the reservoir and each of the 3 siphon systems being floated to the dam face by the contractor in "halves". From this point, the contractor would position each of the "halves" in position to be bolted together. Contractor responsible for movement of pipe into position and during breakdown as well as securing equipment to dam/stabilization and weighting the suction end of the siphons to avoid floatation. This quote should be used for budgetary purposes only at this time until a more formal job walk can be performed.

Reference Materials

Project is quoted based on applicable/customer provided reference materials noted below:
Plans __x___
Bid Specifications __x___
Job Walk __x___
Customer Meeting(s) __x___
Verbal / Written Request __x___

This quote should be used for budgetary purposes only at this time. Additional job walk(s) will be needed to provide a more formal quote for this project. Rain for Rent has not independently verified the site conditions for this project. Customer to verify suitability of this equipment for the desired application.

Operating Parameters

System is intended to be operated at a maximum flow rate of 20 CFS between all 3 lines.
Water source is 3 tributaries feeding Kwoneesum reservoir.

Pipe Type: 12" HDPE
Material: Reservoir Water
Total pipe length estimated at 1,215 ft.

Customer Responsibilities

It is the customer's responsibility to inform RFR about prevailing wage at time of proposal. If RFR is informed after the quote is issued that certified payroll is required, quote will be subject to additional charges.

Jobsite:
Customer is responsible for:
1. Informing RFR of any jobsite or general requirement(s) to perform work on location.
2. Securing permits, fees, bonding, right of ways, vehicular/pedestrian traffic control, and security.
3. Providing safe, secure access and egress to an adequate staging area throughout the job which could include brush clearing, grading, and removal or replacement of any landscape or hardscape in the temporary right of way for the equipment.
4. Any damage to the environment including trees, vegetation, stream banks, or any other part of the site caused by the installation, removal, construction, pulling or dragging of equipment, or operation of the equipment that would require site restoration or environmental countermeasures.
5. Any excavation, saw cutting, trench plating for the purpose of road crossings, backfilling, restoration, modification, or alteration of any permanent structure or site element including changes to pump pad preparation, suction, or discharge chambers during duration of job (including installation and removal).
6. Customer to provide equipment and operator(s) as needed during offloading and loading process as well as during the movement of equipment into place (pump, pipe). Customer to also provide equipment such as forklifts/excavators and barge with operators to facilitate movement of pipe during fusion process and removal of pipe at the end of the project. Customer to also weigh down suction side of the siphon lines and secure pipe to the dam as needed. Additional equipment and operators provided by the contractor may be needed based on findings in additional job walk(s). Customer responsible for all on water work and all rigging.

System:
1. Customer __x___ RFR _____ will provide dedicated equipment with operator and fuel to perform all needed unloading, testing, operations, maintenance, relocating, cleaning, and reloading of provided equipment/system. Equipment must be capable of lifting 10,000 Lbs.
2. If installation provided by RFR and Customer is operating system, this Transfer of Operation form will need to be reviewed and signed by both parties upon completion of setup. (sample form only): **https://rainforrentcorp.box.com/v/systemtransferoperation**
3. Customer __x___ RFR _____ will provide fueling.
4. Customer __x___ RFR _____ will provide preventative maintenance as recommended by manufacturer or per the Rental Agreement. **https://rainforrentcorp.box.com/v/pumpmaintenance**
5. Customer will supply all needed water for the commissioning, startup, and system testing. Project-specific criteria for hydrotesting can be provided at an additional charge.
6. By accepting this quotation, the customer has acknowledged that the equipment proposed herein is suitable for its intended application and accepts all liabilities associated with its use. Customer is responsible for compliance with appropriate liquid/material quality standards, regulations, and testing protocols to meet all federal, state, local and job location specific requirements. Customer is responsible for all waste materials associated with this equipment/system.

Customer is responsible for:
1. Any work in confined spaces.
2. Protecting system from damage including any freeze protection necessary to safeguard equipment from damage. Should equipment become frozen and damaged, customer is responsible for repair of equipment. RFR can provide necessary freeze protection at an additional charge per executed change order. Equipment stays on rent until it can be returned.
3. Using equipment in a safe and proper manner in accordance with manufacturers' recommendations, regulatory standards, and industry best practices. Improper usage may cause equipment/system failure, damage, possible incidents, injuries, and spills.

Upon Pickup:
Contact the RFR office at 503-262-7246 to schedule pickup when equipment/system is cleaned and ready to be released.
Flushing and cleaning of equipment must be performed to RFR's standards prior to being called off rent. RFR personnel will perform a visual inspection. It is recommended to have a customer representative on-site during inspection. Equipment found not to be in "delivered condition" will not be picked up.

Project Scheduling & Billing

This quote is valid for 30 days. For the quoted items, RFR requires a signed quote not less than 30 days prior to delivery.

Estimated schedule durations:
Mobilization and Installation: Approx. 4 days

Operation: Based on a 28 day rental period
Removal and Demobilization: Approx. 2 days
System Rental Duration: Based on a 28 day rental period. Actual time rented will be billed.

Customer acknowledges that availability of equipment/system and/or media will be confirmed at time of order. Additional freight charges may apply subject to mutually agreed upon change order.

Billing

1. Delivery and labor for this project will be billed upon completion of the installation.
2. This is an estimate only. Actual Time and Material used for this job will be billed to the customer. Equipment will go on rent after completion of installation or after 4 days from beginning of installation whichever comes first.

Any re-rented equipment may be billed according to the third party's billing period. All billing subject to our standard terms and conditions in the rental agreement.

Safety

Each employee is expected to adhere to the RFR Environmental, Health and Safety programs, which will protect the environment, the health and safety of the customer, employees, and others. RFR asks for your full cooperation to succeed in this expected outcome.

Product availability, pricing and services are subject to change based on factors out side of Rain For Rents control ie, possible shut downs in manufacturing, shipping, and available work force due to developing Covid-19 health crisis.

Rain for Rent proposes the following equipment for the Kwoneesum Dam 3 siphon phase:

(3) 150' 12" HDPE "suction" lines w/ 90 degree elbows and approx. 10' of pipe vertically angled
(3) 3" saddle taps w/ gate valves for priming lines
(3) 12" butterfly valves to control flow
(3) 225' 12" HDPE "discharge" lines w/ 90 degree elbows and approx. 5' of vertical pipe to avoid air from breaking siphon
(1) VMX Wellpoint pump and hose for priming of system
(1) spillguard

Rental cost is for (1) 28 day rental cycle

Preliminary

To whom it may concern,

Rain for Rent has reviewed the Kwoneesum Dam Removal project plans and has identified 3 distinct "phases" of the project that will require considerable liquids handling efforts. 1) Tributary diversion 2) Reservoir draw down and 3) Land application of water.

1) Regarding the 3 tributary diversions, Rain for Rent was informed that a total flow rate of up to 20 CFS would be needed to be conveyed (approx. 3,000 GPM per tributary) from the tributaries to nearby Texas Creek. In order to facilitate easier movement of equipment during installation and removal, Rain for Rent confirmed the most feasible discharge material for these pipes would be individual 12" HDPE SDR17 pipes. Because of the winding waterline and changes in elevation around the reservoir, Rain for Rent has proposed floating the discharge pipes on top of the reservoir during bypassing. Multiple lengths of hose will be connected off of the bypass pumps and connecting to the discharge pipes to allow for movement of the pipe as water levels recede and the pipe comes to rest in spots along the shoreline. Customer has requested electric pumps for this application, and each diversion shall have a primary pump as well as a backup pump. All pumps will be equipped with variable frequency drives to adapt to changing flow conditions. Due to potential losses along power cable, Rain for Rent recommends placement of generators no more than 300' from pumps if possible. Placement of generators at distances over 300' is possible, but will likely incur much higher cable costs.

Rain for Rent proposes the following equipment for the Kwoneesum Dam 3 tributary diversion phase:

(6) DV200CE electric pumps (3 primary and 3 backups)
(6) Variable frequency drives for pumps
(6) 500 gallon+ fuel cells
(6) Floats for backup pump operation
(2) 10'x50' spillguards for fuel cell containment
20' of 12" suction hose off of each pump
Discharge hoses directly off of the pumps connecting each set of pumps to a common 12" tee
7,000' of 12" HDPE SDR17 discharge pipe
Air vents at the pump stations and every 1,000' of pipe run
Isolation valves off of each pump
Misc. 12" elbows to navigate changes in terrain

2) Regarding the draw down of the reservoir level, Rain for Rent believes a siphon system would be suitable for this application. Prior to dam removal, the water in the reservoir must be initially drawn down approx. 10 feet from OHW to allow for deconstruction to begin. The system we propose would consist of (3) 12" HDPE siphons that would, combined, provide a flow rate of up to 20 CFS. This flow rate can be adjusted to a lower rate with valves on the lines if needed. Rain for Rent has estimated that the "suction" ends of the siphons shall extend approx. 150' out into the reservoir to reach a deep enough area to achieve initial drawdown. The suction ends of the siphons shall have an elbow that points an additional section of pipe upwards to avoid bypassing sediment downstream. The siphons will go to the top of the existing dam where the HDPE lines will each have their own saddle tap and port to pull prime from, as well as a valve to control flow. The siphons will then extend down the back of the dam. Rain for Rent estimates the distance down the back of the dam to be 225' for each line. (This length may be able to be shortened based on conversation with the owner and general contractor.) Upon reaching the

base of the dam, the siphon lines will again be elbowed "up" to avoid air entering the lines and breaking siphon. Rain for Rent anticipates the majority of the fusion taking place along one of the future access points to the reservoir and each of the 3 siphon systems being floated to the dam face by the contractor in "halves". From this point, the contractor would position each of the "halves" in position to be bolted together.

Rain for Rent proposes the following equipment for the Kwoneesum Dam 3 siphon phase:

(3) 150' 12" HDPE "suction" lines w/ 90 degree elbows and approx. 10' of pipe (vertically angled)
(3) 3" saddle taps w/ gate valves for priming lines
(3) 12" butterfly valves to control flow
(3) 225' 12" HDPE "discharge" lines w/ 90 degree elbows and approx. 5' of vertical pipe to avoid air from breaking siphon
(1) VMX Wellpoint pump and hose for priming of system
(1) Spillguard

3) Regarding the land application sprayers, the customer has expressed the desire to use sprinklers to land apply some of the water to reduce the volume in the reservoir and avoid sending turbid water downstream. Rain for Rent has provided an equipment estimate to transfer water being provided to the high head pump by others. For the purpose of this illustration, Rain for Rent is estimating equipment needed for (1) of the several sprayers that may be needed for this project. In this scenario, the high head pump will take the water that is supplied by the contractor and pump water to a location approx. 3,500 feet away to a sprinkler for land application. Contractor to supply sump pumps that feed HH pump and provide at least 380 GPM of flow to the high head pump at at least 10 PSI of pressure. Due to the possibility of oversaturating particular areas with such a large volume of water, it may be more feasible to have a higher number of more “mobile” setups using lower flows and shorter discharge lines that can be moved as needed during the spraying process.

   Rain for Rent proposes the following equipment for the Kwoneesum Dam land application sprayer phase:

   (3) 10' 6" Suction and discharge hoses for connections
   (1) HH125CE high head pump
   (1) 75HP Variable frequency drive
   3,500' of 6" SDR11 HDPE pipe
   (1) SR200 Sprayer with stand
   (4) Air vents
   (1) Isolation valve on discharge line

Rain for Rent appreciates the opportunity to review this project. Please feel free to contact the Portland, OR office with questions any time at (503) 262-7246. We wish you good luck on this project.

Thank you,

Brian Widing

Rain for Rent, Portland OR

(503) 969-8951

bwiding@rainforrent.com

2023 Summer Spillway Flow Record

Purpose: This document is intended to provide reference information on the flow conditions based on the Kwoneesum dam spillway during the summer of 2023. Contractors are encouraged to conduct independent research about past and predicted watershed conditions to assess how project implementation will be affected. The provided information are snapshots in time during one season which may or may not accurately represent construction conditions. The intent of this addenda is to provide visual references to various conditions. All numerical values are taken in the lower portion of the Washougal basin representing whole watershed response to seasonal conditions that cannot be directly translate to subwatershed conditions at the Kwoneesum Dam Removal Site during the upcoming construction season.

Contractor Resources

Washington Department of Ecology— Washougal River @ Hathaway Park station

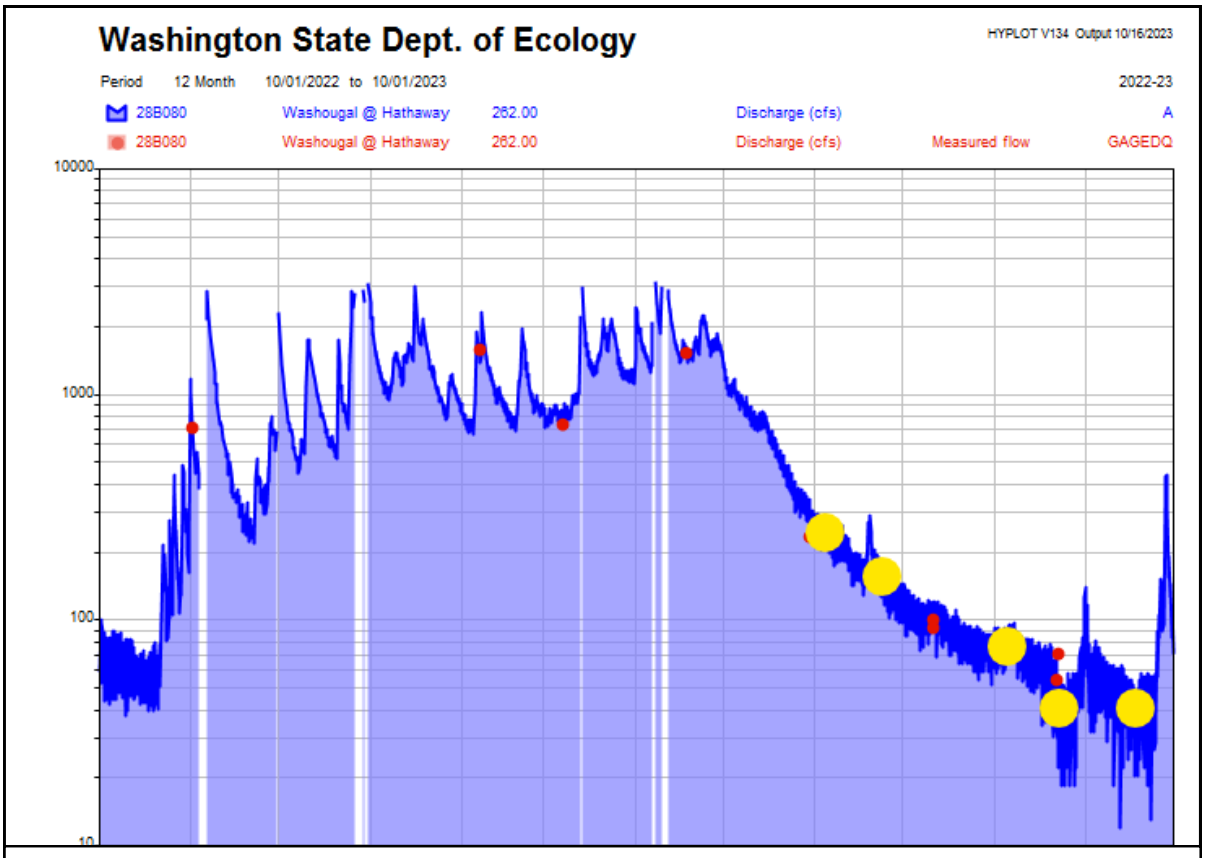
http://apps.ecology.wa.gov/continuousflowandwq/stationdetails?sta=28B080

Natural Resources Conservation Service— National Water and Climate Center

http://www.nrcs.usda.gov/wps/portal/wcc/home

National Oceanic & Atmospheric Agency— Climate Prediction Center

http://cpc.ncep.noaa.gov/products/prediction/90day/



Washougal River Discharge; yellow corresponds with photos provided below

June 8,2023: Washougal River at 220 cfs and 4.8ft from DOE gage at Hathaway Park

June 8,2023: Washougal River at 220 cfs and 4.8ft from DOE gage at Hathaway Park

June 16,2023: Washougal River at 165 cfs and 4.7ft from DOE gage at Hathaway Park

June 16,2023: Washougal River at 165 cfs and 4.7ft from DOE gage at Hathaway Park

August 3,2023: Washougal River at 76.6 cfs and 4.44ft from DOE gage at Hathaway Park

August 3,2023: Washougal River at 76.6 cfs and 4.44ft from DOE gage at Hathaway Park

August 30,2023: Washougal River at 64.9cfs and 4.4ft from DOE gage at Hathaway Park

August 30,2023: Washougal River at 64.9cfs and 4.4ft from DOE gage at Hathaway Park

September 21,2023: Washougal R. at 45.4cfs and 4.3ft from DOE gage at Hathaway Park

September 21,2023: Washougal R. at 45.4cfs and 4.3ft from DOE gage at Hathaway Park

October 16,2023: Washougal River at 225cfs and 4.8ft from DOE gage at Hathaway Park

October 16,2023: Washougal River at 225cfs and 4.8ft from DOE gage at Hathaway Park

June 8,2023: Washougal River at 220 cfs and 4.8ft from DOE gage at Hathaway Park

June 16,2023: Washougal River at 165 cfs and 4.7ft from DOE gage at Hathaway Park

August 3,2023: Washougal River at 76.6 cfs and 4.44ft from DOE gage at Hathaway Park

August 30,2023: Washougal River at 64.9cfs and 4.4ft from DOE gage at Hathaway Park

October 16,2023: Washougal River at 225cfs and 4.8ft from DOE gage at Hathaway Park

Reduced stream flow estimates based on DOE gage at Hathaway Park

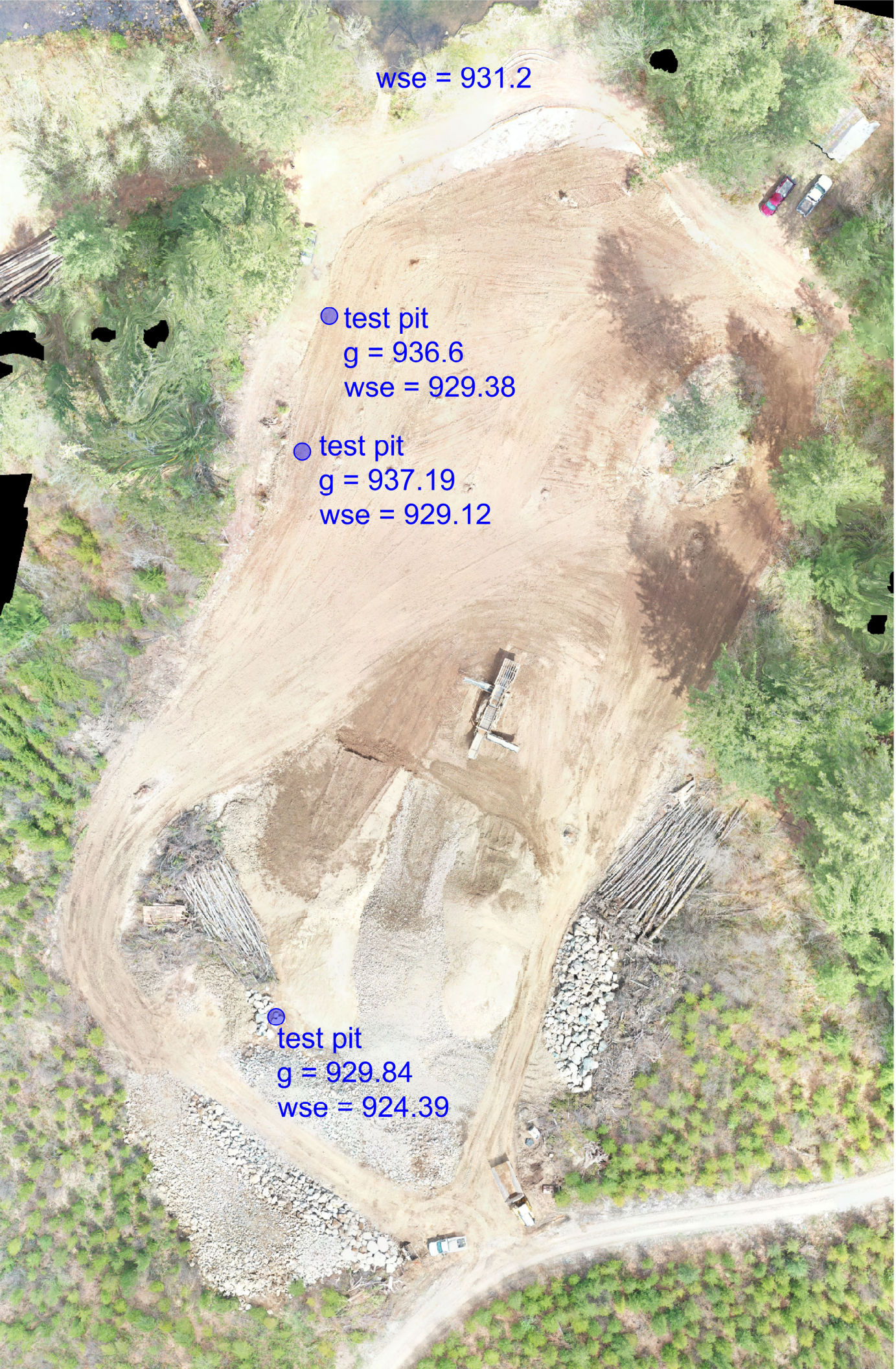
The following tables are derived from DOE gage data on the Washougal River at Hathaway Park. The flows measured at the gage have been reduced according to basin area ratios. These are the maximum flows recorded from 15-minute measurements. They show that the maximum flow recorded at the dam in the last 16 years during July 15-Sept 15, is approximately 16 cfs. That is the combined bypass design flow.
These reduced flow values were generated and used by project engineers to design the Temporary Stream Diversion for the tributaries and Initial Drawdown of the reservoir. This chart is intended to demonstrate the change in flow values from year to year in order to give contractors a broader scope of potential water diversion needs.

Maximum Discharge at dam																
Month	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
July 15-31	4.4	3.0	2.7	6.3	3.7	4.8	6.6	4.5	3.1	8.2	2.0	3.1	3.7	1.7	2.5	4.1
August	3.0	2.3	4.1	12.0	7.4	3.6	3.6	3.2	2.8	3.4	4.6	2.5	2.9	3.3	2.7	2.7
Sep 1-15	2.2	3.3	2.3	3.5	3.9	10.8	3.6	1.9	14.2	2.5	2.6	3.3	2.0	3.3	16.1	1.9
Max	4.4	3.3	4.1	12.0	7.4	10.8	6.6	4.5	14.2	8.2	4.6	3.3	3.7	3.3	16.1	4.1

Maximum Discharge East Tributary																
Month	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
July 15-31	1.5	1.0	0.9	2.1	1.2	1.6	2.2	1.5	1.0	2.7	0.7	1.0	1.2	0.6	0.8	1.4
August	1.0	0.8	1.4	4.0	2.5	1.2	1.2	1.1	0.9	1.1	1.5	0.8	1.0	1.1	0.9	0.9
Sep 1-15	0.7	1.1	0.8	1.2	1.3	3.6	1.2	0.6	4.7	0.8	0.9	1.1	0.7	1.1	5.4	0.6
Max	1.5	1.1	1.4	4.0	2.5	3.6	2.2	1.5	4.7	2.7	1.5	1.1	1.2	1.1	5.4	1.4

Maximum Discharge North Tributary																
Month	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
July 15-31	1.8	1.2	1.1	2.5	1.5	1.9	2.6	1.8	1.3	3.3	0.8	1.2	1.5	0.7	1.0	1.6
August	1.2	0.9	1.6	4.8	3.0	1.5	1.5	1.3	1.1	1.4	1.8	1.0	1.2	1.3	1.1	1.1
Sep 1-15	0.9	1.3	0.9	1.4	1.6	4.3	1.5	0.8	5.7	1.0	1.0	1.3	0.8	1.3	6.5	0.8
Max	1.8	1.3	1.6	4.8	3.0	4.3	2.6	1.8	5.7	3.3	1.8	1.3	1.5	1.3	6.5	1.6

Maximum Discharge West Tributary																
Month	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
July 15-31	1.1	0.7	0.7	1.6	0.9	1.2	1.7	1.1	0.8	2.1	0.5	0.8	0.9	0.4	0.6	1.0
August	0.8	0.6	1.0	3.0	1.9	0.9	0.9	0.8	0.7	0.9	1.2	0.6	0.7	0.8	0.7	0.7
Sep 1-15	0.6	0.8	0.6	0.9	1.0	2.7	0.9	0.5	3.6	0.6	0.6	0.8	0.5	0.8	4.1	0.5
Max	1.1	0.8	1.0	3.0	1.9	2.7	1.7	1.1	3.6	2.1	1.2	0.8	0.9	0.8	4.1	1.0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