Herb Jenkins
Grant County PUD
April 26, 1963

TO ALL NEWSPAPER, RADIO AND TV EDITORS:

FILLING OF WANAPUM RESERVOIR

We will let you know just as soon as we have a fairly definite date for filling of the reservoir. Tentative dates are between May 4 and 20, but it could be even later, it all depends upon the river flow, temperature and precipitation.

In the meantime, we have prepared the enclosed information sheets for your feature writers to play with.

I will be back East from April 27 through May 3, but if you need any information during that period call C. E. Bagnall, Director of Generating Plants, Grant County PUD, Phone SKyline 4-3541, Ephrata.

I'll be back the night of May 3 and will try to pick up from there. My office phone number is the same as Bagnall's. Home phone is SKyline 4-3814.

We hope you can be on hand for the pool filling operation.

Herb Jenkins
Information Officer
Grant County PUD

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April 26, 1963



FOR YOUR INFORMATION

# NOTES ON WANAPUM RESERVOIR

Date of filling will depend upon river flow, temperature and precipitation. Tentative dates are between May 4th and 20th, 1963.

Reservoir will be filled within a 48-hour period because upstream migration of fish cannot be delayed for a longer period.

Fish are now going upstream through future intake units, located between powerhouse and spillway section at Wanapum.

Reservoir will be filled to level of 560 feet above sea level. Elevation of river on April 22 was 491 feet, which means water must be raised 69 feet.

Reservoir is 38 miles long, extending from Wanapum upstream to Rock Island dam. It will cover 23 square miles.

Reservoir is from 3/4 of a mile to two miles wide.

Old town of Vantage had to be removed to make way for reservoir. Also, about 35 homes, a small school and a community hall had to be removed from Crescent Bar, where about 600 acres of orchard and farm land were involved.

New elevation of reservoir will be a height equal to four feet above the floorboards of the main span of the old Vantage Bridge, now dismantled. New Vantage Bridge will be 75 feet above the reservoir surface.

The Grant County PUD contributed $4,200,000 toward the construction of the new four-lane Vantage Bridge (Old bridge was 2-lane) and the relocation of the highway on the east side of the river.

All water not required for downstream power use will be stored in the Grand Coulee Reservoir for use in filling the Wanapum pool.

This is believed to be the first time any large reservoir has been filled in such a short time.

It will require approximately 330,000 acre feet of water to bring the Wanapum pool up to elevation 560 feet above sea level. Elevation of the river behind the dam on April 24 was 491 feet. The depth of the water is 24 feet at the dam.

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At present the water is flowing through the six future intake units. These units will be closed off with steel bulkheads and concrete stop logs when the filling of the pool starts, and the water required for downstream power operations will be regulated by the spillway gates.

For those of you who like statistics, here they are:

330,000 acre feet will be required to bring the pool up from the 491-foot level to the 560 foot level, (at an average of 17 inches an hour).

1 acre foot = 325,850 gallons of water.

330,000 acre feet X 325,850 gallons = 107,530,500,000 gallons

107 billion 530 million gallons divided by the 48 hour period equals 2,240,000,000 gallons of water an hour to be impounded in the pool.

This 2,240,000,000 gallons an hour equals 37,333,000 gallons a minute, or 622,000 gallons a second.

or

1 acre foot of water weighs 1359 tons

Water will be impounded at the rate of 6,875 acre feet per hour for 48 hours.

6,875 acre feet per hour X 1359 tons per acre foot equals 9,320,000 tons of water per hour.

or

155,332 tons of water a minute

or

2590 tons of water a second.

Any way you figure it--it's a heckuva lot of water.

Herb Jenkins

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Herb Jenkins
Grant County PUD
May 9, 1963

WANAPUM POOL FILLING
WILL DRIVE OUT SNAKES

EPHRATA --- Not since St. Patrick drove the snakes out of Ireland has there been a prospect of such a mass exodus of reptiles from an area as probably will take place with the filling of the reservoir behind the Wanapum dam some time in May, possibly around May 17 and 18, E. B. Gibbons, manager of the Grant County PUD, owner of Wanapum dam, said today. A definite date will be announced as soon as it is determined.

Filling of the 38-mile-long reservoir will be accomplished within a 48-hour period because the upstream migration of fish cannot be delayed for a longer time, Gibbons said. The elevation of the water will be brought up from its present elevation of 491 feet above sea level to 560 feet, which means the water will be raised 69 feet at the rate of approximately 17 inches an hour.

It does not require much imagination to visualize what this rapid encroachment of water will do to the many rattlesnake dens along the foot of the cliffs and in other areas. High water periods in the past have resulted in many snakes floating down the river on driftwood and clumps of weeds and debris, while others hastily migrated to higher ground. However, these former high water levels developed at a relatively slow rate and were nothing to compare with the rapid rise of water that will take place this spring.

"Anyone standing along the edge of the reservoir during the filling period may be well advised to wear stovepipe leggings to protect himself from the snakes seeking higher ground," Gibbons said smilingly.

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The filling of the Wanapum reservoir within a 48-hour period is believed to be the first time any large reservoir has been filled in such a short time. Commenting again on the need for haste in the operation, Gibbons explained that at present the fish are migrating upstream through the future intake units at Wanapum. These intake units will be closed off with steel bulkheads and concrete stop logs when the filling operation starts. Enough water to meet downstream power generation requirements will be released continuously over the spillway during the 48 hours. The remainder will be used to bring the water up to the desired level of 560 feet above sea level.

More than 330,000 acre feet of water will be impounded in the reservoir, which will cover an area of 23 square miles when filled.

Migrating fish will use the two fish ladders at Wanapum dam after the pool is filled.

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Herb Jenkins
Grant County PUD
May 17, 1963

EPHRATA --- The filling of the Wanapum reservoir will be accomplished during a 48-hour period on Wednesday and Thursday, May 22 and 23, it was announced today by the Public Utility District of Grant County, owner of the Wanapum Development. The river will start to rise following the final closing of the intake units some time Tuesday, but the main operation will take place during Wednesday and Thursday.

The water will be brought up from about 491 feet to 560 feet above sea level, a rise of 69 feet, at an average rate of 17 inches an hour. More than 330,000 acre feet of water will be used to fill the 38-mile-long pool.

Because the water in the reservoir area will rise rapidly, fishermen, visitors and sightseers are cautioned to stay out of the pool area during the filling operation. The possible crumbling of banks and rock slides could create a hazard for persons standing too close to the edge of the pool. Rattlesnakes migrating to higher land to escape the rising waters also could cause a real danger to the unwary visitor.

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Herb Jenkins
Grant County PUD
May 21, 1963

EPHRATA --- The filling of the Wanapum reservoir on Wednesday and Thursday, May 22 and 23, may be compared to filling a bathtub with the drain plug about half open. About 750,000 gallons of water a second will be continuously released for downstream power generating requirements, says Herb Jenkins, information officer for the Grant County PUD, owner of the Wanapum dam. An additional 622,000 gallons a second will be impounded to fill the 38-mile-long reservoir, for a total rise in elevation of 69 feet above the former river level.

During construction of the dam the river has been flowing through the future intake units, located between the powerhouse and the spillway section. These future intake units provide space for six additional generating units which can be added later when additional upstream storage is available.

In preparation for the filling operation, work was started Monday on closing off the intake units with steel bulkheads and concrete stop logs. This closure was scheduled to be complete by late Tuesday evening. After the intake units have been closed off to a certain level the water starts flowing over the spillway section, and more and more water flows over the spillway as the closure of the intakes proceed. All of which means that a continuous flow of water is maintained downstream either through the intake units or over the spillway, as the spillway gates will never be completely closed during the filling operation.

The closing of the future intake units is a sizeable job in itself. Each of the six units has three openings. When the generating units are installed, the three openings in each unit will converge into one scroll cage which carries the water to drive the turbine.

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Steel bulkheads are first used to close off a bottom portion of each opening. Then, one by one, four massive concrete stop logs are placed one on top of the other like bricks in a wall. Each stop log is approximately 2 feet 7 inches wide, 4 feet 6 inches high and 21 feet 4 inches long. Each log weighs about 20 tons and is lowered into place by a crane. A narrow rubber gasket around the edge of the logs helps seal off the water.

Sightseers who expect to see spectacular walls of water flowing down the reservoir will be disappointed, as the water will come up at the rate of about 15 inches an hour during the main part of the filling operation. Nevertheless, the reservoir will not be a safe place for boats during this time, as floating debris and even rattlesnakes clinging to logs and brush can create a hazard.

The Grant County Public Utility District urges all persons to stay out of the reservoir area during the filling period, and to stay away from the edges of banks which may crumble as the water rises.

The PUD will fly over the area each evening, Monday, Tuesday and Wednesday in a plane equipped with a loudspeaker to warn persons to stay out of the pool area. Grant County Sheriff Ralph Hall also will have several deputies in the vicinity to issue warnings on the dangers.

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Herb Jenkins
Grant County PUD

(Photo No. 8426. Aerial view of Wanapum dam)

The sunlight sparkles on the water entering Wanapum dam from the upstream (right) side and again as the water is discharged (left) after passing through the turbines. The ten generators at Wanapum, with a total nameplate rating of 831,250 KW are now in production. The dam, which is being built for the Public Utility District of Grant County, will be completed in 1964.

(Grant County PUD Photo)

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Herb Jenkins
Grant County PUD
January 20, 1964

EPHRATA --- When the tenth generator went into production at Wanapum dam at 12:01 Saturday morning, January 18, the Grant County Public Utility District became the third largest non-federal producer of hydroelectric power in the nation. Grant County PUD officials said the ten generators at Wanapum with their total nameplate rating of 831,250 KW, added to the 788,500 KW nameplate rating of the ten units at Priest Rapids, gave the Grant County PUD 20 generators with a total nameplate rating of 1,619,750 KW. However, the machines are capable of producing at 115 percent of their nameplate rating.

With the hydroelectric production from the two dams, only 18 miles apart, the Grant County PUD is exceeded only by the New York State Power Authority and Pacific Gas and Electric Company, San Francisco, as a non-federal producer of hydroelectric power.

Construction of Priest Rapids dam started July 9, 1956. The first generator went on the line on October 19, 1959, and all generators were in production in the fall of 1961. Construction started on Wanapum on July 16, 1959, with the first three generating units going into production September 1, 1963.

The construction contract calls for completion of Wanapum by the end of 1964. However, the contractor is well ahead of schedule. The dam is being built by Grant County Constructors, a five-firm combine with Morrison-Knudsen as the sponsoring contractor.

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Herb Jenkins
Grant County PUD

Seaward Journey of Young Salmon
In Columbia River
By: Dr. F.A. Davidson

EPHRATA: The seaward journey of young salmon and some of the hazards they encounter in going over the dams and through the reservoirs in the Columbia River are told in a recent publication by Dr. F. A. Davidson, consulting biologist for the Grant County PUD. The publication also points out some of the physical and biological changes occurring in the river because of the construction of dams and reservoirs.

Dr. Davidson says the hazards encountered by the young fish at the dams are few in number but there is one that under some conditions can be very troublesome and cause injury to the fish. This hazard is encountered by the fish in passing through the turbines and is known as cavitation or the formation of vacuum pockets at the trailing edges of the turbine blades. When these pockets break up they create a force great enough to pit the under sides of the turbine blades hence, since the young salmon are not equipped with armor plate, they can be severely injured if they come in contact with one of them. Fortunately, the occurrence of these vacuum pockets is at a minimum when the turbines are operating under full load and maximum efficiency, and under such conditions the young fish can pass through them with only a small loss in their numbers. The U. S. Bureau of Commercial Fisheries is studying a means of removing the salmon migrants as they collect in the gate wells above the turbines and by-passing them around the powerhouses of the dams.

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Not all of the hazards and pitfalls encountered by the migrant salmon occur at the dams. Many exist in the reservoirs and are equally as deleterious to the young fish.

## Physical Hazards

The salmon like all fish are cold blooded and their temperature and metabolism vary directly with the temperature of the water in which they live. In other words, the salmon are very much under the control of their environment and depend upon directions received from it through their sense organs for survival and guidance on their migrations. The Pacific salmon began their evolutionary development several million years ago and through mutations, i.e. chance variations in their inherited characters, became adapted to life in the oceans and in the fast flowing cold water streams. This adaptation involved changes in their body structure and the conditioning of their physiological and sensory systems that enable them to live in both fresh and salt water and unerringly find their way to and from the sea.

## Effect of Impoundment

The impoundment of the Columbia River is changing it from a fast flowing cool water stream into a series of slack water pools whose temperature is approaching the critical point for the survival of the young salmon. In the past the young migrants received a lift downstream on their journey to the sea by drifting with the river's current but the slow moving waters of the reservoirs are now forcing them to swim downstream to a greater and greater extent under their own power. This is causing a delay in their seaward migration that can completely disrupt their life cycle.

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The internal urge that turns the young salmon towards the salt water lasts only a brief period and if they do not find ready access to the ocean and are detained in the lakes and rivers they may remain in them and become land-locked, i.e. grow to maturity in fresh water. Furthermore, those that do finally reach the ocean after a long delay in the river may be matured to such an extent that they will spend only one year and not the usual two or three years in salt water and return to the river as under developed jack salmon. There is good evidence at the present time that the longer period of migration in the reservoirs is causing an increase in the number of jacks in both the chinook and blueback runs to the upper river and land-locking an appreciable number of the young blueback migrants.

Biological Hazards

The attacks of both predatory fish and birds on the young salmon during passage through the reservoirs is one of the greatest biological hazards to their survival. In the natural river the fingerling salmon moved downstream in the fast turbulent waters in a relatively short time and the mortality imposed upon them by their predators did not greatly affect their numbers. The slow moving and warmer waters of the reservoirs provide an environment inducive to the production of the predatory species and scrap fish in general and their rapidly increasing numbers is becoming a serious threat to the young salmon.

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The impounded river also provides a better opportunity for the predatory fish and birds to attack the young salmon. Squawfish and sea gulls collect by the hundreds at the dams when the fingerlings are passing downstream. They attack the schools of fingerlings that collect in the forebays in search of passage over the dams and pick up individuals in the tailraces that have been stunned in passing through the turbines.

The organisms that cause disease in the young salmon are common to all fresh waters. They differ to some extent with the geographic regions but their virulences, i.e. their ability to infect the fish, all vary with the temperature of the water. The salmon of the coastal rivers are all vulnerable to a number of disease organisms the most virulent and destructive of which is Chondrococcus columnaris. This organism is active in water of $56^{o}$ F. and becomes critical to the survival of the fish at $68^{o}$ F. and above. It has been found that the most virulent strains of this organism are common to the waters of the upper Columbia River. Hence, since the temperature of the upper Columbia will vary from $55^{o}$ to $80^{o}$ F. during the migratory season under complete impoundment, the chinook and blueback seaward migrants from the upper reaches will be exposed to the most destructive strains of this disease during the early part of their migration.

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Natural Stream Bed

The natural stream bed of the Columbia River consisted mainly of coarse gravel 3 to 6 inches in diameter interspersed with rocky boulder-strewn stretches and sandy areas. The fast cool water flowing over the gravel provided a favorable environment for a horde of insect larvae and nymphs that lived upon the microscopic animals and plants that drifted with the current. The newly hatched salmon first fed upon the microscopic forms but as they approached migrant age turned to forage on the insect forms in the gravel. The fast cool water contained an abundance of oxygen so essential to fish life and was practically free of pollution and the products of decomposing organic matter that are so frequently found in warm sluggish rivers. In short, the natural river provided an ideal environment for the reproduction and early existence of the salmon.

The impoundment of the river has all but destroyed its natural environment. The original velocity of its flow is maintained only for a short distance below the dams and is reduced to a fraction of a foot per second as it approaches them. The impoundment of the river has also altered its course and in some localities has more than doubled its surface area. Both of these marked changes in the river have made possible a greater effect of the weather upon its physical and biological complex. They have provided for a greater absorption of heat by the river during the spring and summer and likewise a greater loss of heat during the fall and winter.

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Strong Winds on River

Strong westerly winds that occasionally attain hurricane force occur at all times of the year in the upper Columbia River Basin. These winds in blowing across the reservoirs frequently create waves 3 feet high that pound the shorelines relentlessly. This causes large quantities of silt and sand from the newly submerged lands to drift into the reservoirs which during calm periods settle to the bottom. The silting of the reservoirs is a process that will continue with their aging and is covering the natural stream bed with a layer of impervious sediment and destroying the insect populations and other small aquatic forms that live in the gravel. The loss of this abundant fish forage is being replaced in part by an increase in the plankton forms that usually occurs in a newly formed reservoir, but this is not permanent and decreases with time.

Owing to the continuous flow through the reservoirs it is doubtful if they will have any direct effect on the chemical composition of the river. However, insecticides and herbecides, phosphates and nitrates that enter the river with the drainage from the irrigated lands are causing a change in both its chemical and biological balance. The insecticides and herbecides are toxic to animal aquatic life and especially to the eggs and young of fish. The phosphates and nitrates cause mass production of algae and other microscopic plants in the reservoirs. The recent unseasonable increase in algae in the river may be the result of a concentration of these chemicals in the reservoirs.

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The impoundment of the river may have an effect on its gaseous content. Water supersaturated with gaseous nitrogen is very harmful to fish in that it causes a gas bubble disease in them known as the bends. Adult salmon have been observed recently in the river suffering with this disease and an analysis of the river's water shows that its nitrogen content is dangerously high. Its origin is believed to be associated with the passage of the river over the spillways of the dams.

There may be other physical and biological hazards in the reservoirs that affect the young salmon but which are not of sufficient severity to be recognized at the present time. These, however, may increase in intensity and become critical in effect on the fish with the aging of the impounded river. In short, all information available on the physical and biological complex of the river points to a continuous change in it with the aging of the reservoirs and it may remain in a state of biotic imbalance for many years.

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