WATER POWER OF DESCHUTES RIVER GIGANTIC

Development of Energy, After Railroads Are Built and Irrigation Cared For, Would Represent Investment of \$100,000,000

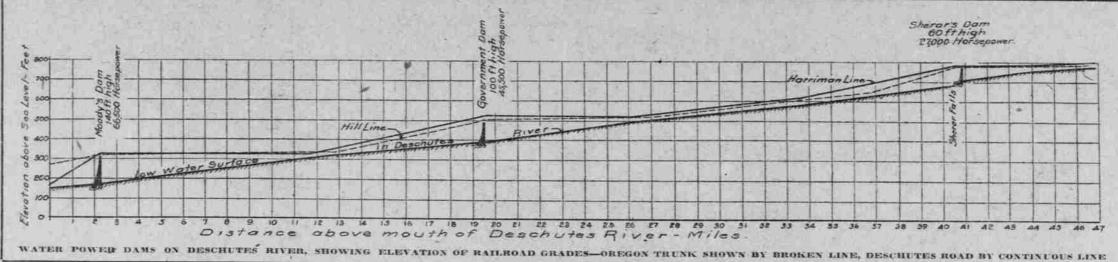
By J. C. Stevens, District Engineer, United States Geological Survey, Member of Oregon Conservation Committee.

rivers would serve us best if they were uniformly flowing streams, if their drainage area could absorb sufficient water to bridge entirely over the inequalities of rainfall and give us a continuous rate of flow. Then the improvement of inland waterways would be comparatively easy, irrigation of all contiguous lands be a water-power stream. Unfortunately for us, this condition is seldom reallzed, and but very few streams have this quality to any marked degree. We are, therefore, required in certain cases partially to remedy the deject by the construction of storage reservoirs. construction of storage reservoirs. Under present-day conditions, the value of a river for water power is directly measured by the volume of water it carries at its minimum stage. When, however, we do find a stream that possesses the unusual qualifications of uniformity of flow, its value as an industrial factor over rivers without it is almost presentable.

Desclutes River possesses this qual-fly to a greater degree, I think, than any stream of lis size in America. Or-dinary storms do not affect it to a nodinary storms do not affect it to a noticeable extent, and only when a large snowfall on frozen ground is suddenly melted by Chinook wind and heavy rain does the river respond. On Thanksgiving day of the present year the newspapers of the state heralded an unprecedented "flood" of 18 inches at Bend. Just think—13 inches! Willamette River at Portland must rise 18 feet before it reached the danger mark. This remarkable uniformity of flow of Deschutes River is readily accounted for. The rocks of the territory are lava flows, with a preponderance of

Even after the Government's work there is finished, the controlling system will not compare in point of perfection with the system nature has provided on Deschutes River. You have noticed the little spring that gushes from the side of the hill? Winter and Summer it flows the same. Well, Deschutes River is merely a big spring, nothing more. It drains over 2000 square miles of land surface, is 224 miles long and drops a vertical height of 4840 feet in that distance. Its flood discharge at Bend is only three times its minimum flow. The flood discharge of Williamette River is 65 times, and of Yakima River 200 times, the minimum. On account of these remarkable prop-

On account of these remarkable properties and the strategic position at holds as an entering route for railroads to that great field of undeveloped resources, Central Oregon, this river has been a fruitful source of contention within the past few months, and public interest in the situation has been exceptionally keen. Two masters of railway finance, James J. Hill and the Edward H. Harriman, contended by field stratagem and through the ma-chinery of the courts for this valuable right of way. The conservationists of the country have been greatly exer-cised over the possible loss of water powers that would attend the construction of railroads on a low-water grade.
The Central Oregonian has been in a frame of mind to "chuck" all the water powers on Deschutes or any other



gratifying indeed. The net results are The rallroads for Central Oregon—": consummation devoutly to be wished" there is water power enough left to supply all the Pacific Northwest, and

governs is the market for this power when developed. Evidently the physical features may be ever so favorable, yet the power be without value. The water power on Deschutes and other rivers of Central Oregon are today without value, tomorrow they may be worth without value, tomorrow they may be

cal features may be ever as favorable, seed for. The rocks of the territory are lava flows, with a preponderance of scoria, or "sponge rock." the solidified froth and foam on molten rock that welled up from subterranean depths during early geologic time. This porcus lava has disintegrated into a pumice soil that absorbs water like a sponge, and allows it to filter gradually into the river beds. No artificial control can be half so perfect.

The Federal Government is spending \$6,000,000 in constructing reservoirs on the headwaters of Yakima River, in Washington, merely to render the flow of that river a little more uniform. Even after the Government's work there is finished, the controlling sysmens of transportation. But this incan power plants be built if machinery and materials cannot be taken to the power sites? Heretofore only sheep and horses and cattle have been profitable, for they are provided with means of transportation. But this industry does not tend to increase a country's population or develop its resources. Therefore these great water powers have been without value, and today their value is only potential—based on prospects.

The wisest conservation policy that can be adopted with reference to this enormous aggregation of water power is, therefore, one that allows a same and reasonable adjustment between the

enormous aggregation of water power is, therefore, one that allows a sane and reasonable adjustment between the commercial desire to hold for private or corporate exploitation and the extremists' desire to preserve in public ownership for future generations. With this in mind, a study has been made along these lines.

made along three lines.

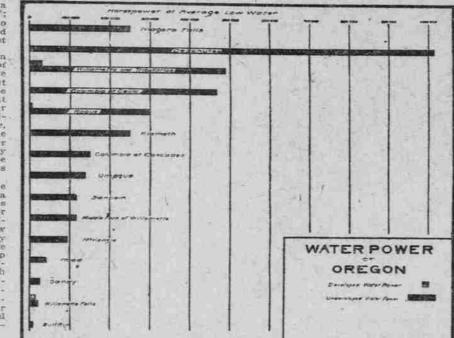
1. What amount of water-power originally existed on Deschutes River be-

remaining by reason thereof?

physical features are involved. The river and its tributaries have been considered in sections of from two to 20 miles each.

The total fall and the quantity of water available at the average minimum stage civer if he could only get a railroad.

But now affairs appear to be shaping themselves satisfactorily to all concerned, and the present outlook is very cal horsepower, which expresses the rate



WATER POWER OF OREGON RIVERS COMPARED WITH THAT OF NIAGARA FALLS.

fore the territory was settled?

2. How much will this power be reduced by the construction of railroads original amount of waterpower in and what increased value will attach to Deschutes draining area at the mini-

3. What effect will irrigation, when fully developed, have on the power situation both as to reducing the amount and as to furnishing increased market facilities for that remaining?

In answering the first question, only physical features are involved. The star physical features are involved. The star physical features are involved. The star physical features are involved.

at which the energy is developed. This From this table we see that today the theoretical energy has been reduced 30 total energy of the Deschutes sysper cent because it is not possible to tem reaches the enormous figure of 1.utilize more than 30 per cent of the to-tal fall and only about 80 per cent of the theoretical power can be realized on water wheels. The following condensed tabular statement gives the result of the amount of energy here represented. 115,000 horsepower. Only by comparison gram is useful It compares the power on Deschute. River with other streams and recognized power sites in Oregon and with that developed and epower. under construction at Niagara Falls.

60.800 A faint conception is also conveyed by
the fact that all developed water powers 484,000 in Oregon. Washington and Idaho today 404,000 do not exceed 150,000 harsepower, or only 3,000 about one-seventh of this amount. This enormous energy is today expending itself in wearing down the hills and mountains of the drainage area and has had no value unless it be that as an agent in carving a canyon through which railreads may be built to develop the country be-

1t is comparatively simple to obtain a railroad.

1.115.600 fairly reliable answer to the first part Water

the next question. How much will drainage area at the minimum stage after this power be reduced by the construction of railroads? Quite contrary to the popular conception, the rallroad, strictly speaking, does not destroy any waterpower at all. It simply changes the manner of development. The canyon of Deschutes River lends itself admirably to development under low heads using the large volume of water available. The canyon is narrow, the sides precipitous and composed largely of basaltic rock. Every section is a dam site. Thus it is physically possible by a succession of dams to develop practically the entire head from Cline Falls to the mouth of the river, a distance of 134 miles. Of course, this method is not possible if railroads are built in the bottom of the canyon, for the tracks would be submerged.

Two alternatives present themselves:
(1) to build the railroads on the canyon sides above the possible height of dams, or (2) to adopt the method of development by means of flumes or pipe lines along the sides of the canyon. The first greatly increases the expense of rallroad construction, the second that of power development. What has actually happened is this: Both railroads, one on each bank of the bank of the river, have clevated their tracks at three distinct points in the lower 40 miles of river to permit the erection of three dams, (1) two miles above the mouth known as Moody's dam, (2) at the Government dam site, 20 miles above the mouth and (3) at Sherar's bridge, 40 miles above the mouth. These three dams will ultimately develop-129.three dams will ultimately develops 127, 000 horsepower. The elevation of the tracks will cost both lines about one and one-half million deliars more than a low line would have cost. Below each by reason of railroad grade requirements it will be possible to build other dams, from 10 to 10 feet in height by which 27,200 be possible to build other dams, from 20 to 40 feet in height, by which 37,200 additional horsepower can be developed. At intermediate points and along the 40at intermediate points and along the 40-mile stretch from Sherar's bridge to the mouth of Trout Creek, near which latter point both railroads leave the Deschutes canyon, the method of flume or pressure pipe construction will have to be followed. Above Trout Creek as far as Cline Pails the river is in its primeval state and 392,500 horsepower can be developed here whenever tutture conditions. veloped here whenever future conditions

that flumes and pressure pipes cannot be economically made to carry large vol-umes of water, the following condensed table shows that in the aggregate 924,-200 horsepower will be left in Deschutes 200 horsepower will be left in Destruction River after present railroad construction is complete and that 199,800 horsepower has been sacrificed between Trout Creek and Columbia River for the sake of a

Deschutes, from Crescent Lake to Warm Springs River White River Minor tributaries

What increased value will attach to that remaining by reason of the railroads? is not so easily answered. The railroad companies may some day decide to use electrical energy for operating trains. Their construction will undoubtedly increase the population of the country and the cities and towns will afford a market. They will also encourage lumbering, mining, and extensive irrigation development and an additional market will be afforded. But when we realize that the energy capable of being developed at the lower dams is almost enough to supply all the present waterpower reapprements of Oregon, Washington and Idaho combined, we see that new fields must be opened to afford markets for even these projected plants. But present even these projected plants. But present day conditions are changing rapidly and cannot be taken as a rigid criterion of future needs. Before construction of the railroads, this 1.115,000 horsepower had only a potential value that depended en-tirely on future probability of a railroad that would make their construction pos-sible and evadually change the potential sible, and gradually change the potential to actual value as the country developed. Of course only arbitrary money values could be assigned under these conditions and the best we can say is that before the railroad, the 1.115,000 horsepower was worth practically nothing, but since the railroad, 50 per cent of the remaining 924,200 horsepower may some day be worth \$50 per horsepower per year to the owners and afford an annual income to the state of say \$2 per horsepower.

The third problem: What effect will irrigation when fully developed have on the power situation both as to reducing the amount and as to furnishing increased.

power situation both as to reducing the amount and as to furnishing increased market facilities for that remaining? Is very difficult of solution, both from the physical and economic side. A rigid solution of the physical problem falls for lack of physical data concerning the flow of the streams and seepage conditions of the lands to be irrigated. Some 5. 1 as been sacrificed between Trout Creek assumptions were necessary: (1) that all the Summer flow of the river above allroad.

Water-power remaining in Deschutes (2) that from 10 to 30 per cent of this

amount, depending on the distance below the intake of proposed canals, will
gradually filter back into the stream;
(a) that storgae reservoirs will be built
at Crane Prairie and on Crescent, Davis
and Odell Lakes and at the proposed
sites on Crooked River, These will be
filled during the Winter, for Summer
use; (4) that the water powers survive
on what is left.

At the storage reservoirs and above the intake of irrigation canals additional power may be developed for part of the year and this has been taken into account. No discussion of the very interesting phases of this problem will be indulged in. The final results are given in the following table which shows that there will still be left 630,000 horsenower er the country has been fully de-oped through irrigation and after the

railroads are in operation. Water-power remaining in Deschutes River drainage area at minimum stage after construction of railroads and after full development of irrigation, and construction of proposed reservoirs.

Deschutes, from Crescent Lake to Deschutes, from Crescent Lake to 12,100
Bend Bend Creek 170,000
Beschutes, from Bend to Trout Creek 170,000
Beschutes, from Bend to Trout Creek 170,000
Bendin River 153,000
West Fork, from Lake to Davis Creek 28,800
Turnalo Creek
Squaw Creek
Crooked Brow 45,000
Metolius River 77,200
Wain Springs River 18,400
White Rive 21,800
Minor cributaties 5,000

These three tables deserve careful study. They show that the reduction of water-power by the railroads alone is 17 cent; by irrigation alone the reduc .024,200 tion is 26 per cent. If the atorage reser The next part of the second question: voirs are not built but irrigation be otherwise fully developed half the waterpower of Deschutes River will be de-stroyed. The increase through reservoir construction will balance the loss through railroad construction. Bear in mind that the reservoirs are being built for irriga-tion requirements alone, the increases water-power is morely incidental—a by-

As this development will increase the population of the country to nearly 200, 600 the actual value of the remaining power will so far outdistance the potential value of the original 1,115,000 horse-power that there is no comparison. It is all very well to talk of so many millions of horsepower bringing \$50 or more per year and capitalize this at 5 year goal. per year and capitalize this at 5 per ceat and obtain a valuation for undeveloped river energy that requires nine or ten figures to express, but unless there is some ultimate prospect of use, the value is purely fictitious. It's like the gold in sea water. The gold is there in enorm-ous quantities, but it has no value because it cannot be profitably extracted.
In conclusion, let us summarize briefly the various points brought out in this inquiry into the water-power situation on Deschutes River.

Deschutes River is the most unl formly flowing stream in America and as such is of inestimable economic value for both power and irrigation. omena is readily accounted for by the ex-ceptional porosity of the rocks and soil forming its drainage area.

In its primeval state, Deschutes Biver afforded 1,250,000 horsepower at its

imum stage.

The railroads under construction will reduce this to 924,000 and irrigation development under way and proposed w still farther reduce it to 630,000 horse-

The development of this ren power at \$150 per horsepower would represent an investment of nearly \$100,000

5. It is likely that 40 years will see half of this developed, bringing an an-nual income of \$12,000,000 to the operators and to the state \$650,000 annually

DESCHUTES LINES WILL TAP KLAMATH REGION IN SOUTHERN PART OF STATE

Vast Timber Belt Near California Line, Fine Stock Country, and Irrigated Farm Land Will Be Penetrated by Hill and Harriman Railroads Now Under Construction.

By Frank Ira White. *RANSPORTATION is the essential to commercial greatness in Oregon at this time, as it is in every other part of America. Kind and qual-

in the market will be 10 times as great. Sawmills are now established, and others projected to begin the gigantic Industrial task of converting this timber into lumber. It will be largely devoted to the manufacture of boxes in the early stages of the industry. See all the lines of the time of t

has undergone the gradual change from

districts even though closely paratteling the Harriman system line. The entrance to Klamath Palis has not yet
been definitely fixed.

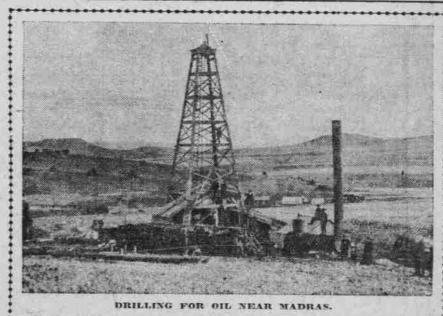
The Southern Pacific has acquired 55
acres of land adjacent to the depot
yards for shop and roundhouse purposes. That extensive car shops will
be built is conjectured, but with the
usual demeanor of railroad officials, no
promises are being made, and plans of
improvement are being worked out withimprovement are being worked out with-out publicity. It is understood that work will begin on certain of these division shop buildings early next Spring.

The plant of the Long Lake Lumber

INDICATIONS OF OIL ARE DISCOVERED AND WELLS ARE NOW BEING BORED

Prospecting Is Going On in Several Places in Interior Oregon and Properties Being Developed Are Expected to Yield Paying Quantities of Petroleum.

PROMISING indications of oil are found in several localities of Central



The topography of the Harney valley is oil in Southeastern Oregon it will be

FEDERAL CANALS SERVE LARGE AREAS

Thirty-Five Thousand Acres Are Now Watered by Completed Ditches of Umatilla and Klamath Projects, Upon Which Only Beginning Has Been Made.

N OREGON, outside of the central propriated for this work and water Government lands in Oregon now in

has been delivered to about 15,000 progress as the result of new rallroad development within a few years will begin to have its effect on the the Malheur, a proposed Government Government reclamation fund, for this fund is derived from the sales of Gov-One of these is the Umatilia project, private enterprise. This district was ernment lands. In addition, the money visited by Secretary Ballinger, in the paid to the Government in the reclamation projects is to be turned over to new projects. Under the Hitchcock interpretation of the law there should now he \$2,500,000 more available for Government reclamation work in Oregon than has been expended. This fund will increase to vast proportions and it can only be a question of time until other feasible projects are undertaken in this state by the Reclamation

Service.

The interior Department is not overlooking the possibilities of other sections, for where permission has been
granted to Carey Act projects to impound waters of lakes the Government
has reserved the right to take over
such projects and gaise the dams built
if deemed advisable in the future.