WEST UMATILLA PROJECT ONE OF BEST IN THE ENTIRE UNITED STATES

Irrigation is the golden key which alone can unlock the door of civilization to wide areas in Oregon. This applies paricularly to that portion of the state east of the Cascade mountains.

Irrigation may be said to antedate the white man, as much of the land in Oregon now classed under irrigation is that which yields a crop of wild hay after having been watered in the primitive way by the natural overflow of streams. From this crude beginning the present system of irrigation has developed, first by the construction of temporary dikes to force this natural overflow over a greater area; later by ditches to divert even the low water of the streams, sometimes causing them to go almost dry during the summer months, as in the case of the Umatilla; now by the conservation of winter flood water by storage to be used during the hot summer months.

The first irrigation by the consruction of canals began about 60 years ago along the Walla Walla river. Since that time the land in that valley has become highly developeu through irrigation. In the Malheur valley irrigation began about thirty years ago, and about 50,000 acres have been reclaimed. In Harney county the land is irrigated at the present time by the natural overflow of streams aided by primitive diversion works.

The cost of the first irrigation in the state was only about five dollars per acre, because it was employed where easiest to divert the water from streams. Now a portion of the irrigation development of the state is carried on by the government, and as expensive canals and structures have been built it has resulted in the cost of water on some projects being raised to sixty dollars an acre.

In 1890 irrigation was regarded as the most important factor in the future development of the state. Now, in some of the southwestern counties, it is even considered necessary for the proper cultivation of the soil. In 1902 there was an area of 439,981 acres in the state irrigated by private corporations.

Investigations were first begun in Oregon by the United States reclamation service in 1903, and work commenced in 1904 on the Umatilla and Klamath projects. The Umatilla project consists of 22,000 acres of comparatively level land lying east of the junction of the Umatilla river and the Columbia river.

The soil in its original state is covered with sagebrush, but being of basaltic origin it will, when irrigated, be well adapted to the production of alfalfa, fruit and vegetables.

Under this project there are public and private lands on which the construction cost of sixty dollars per acre must be paid in ten annual insallments. Where private lands are purchased residence within the vicinity must be established before water can be secured.

All the structures on the project have been built of permanent material. The diversion dam near Echo is of concrete, and much of the 25 mile feed canal of 300 cubic feet per second capacity is concrete lined A storage reservoir of 50,000 acre-feet has been provided by the construction of an earth embankment 98 feet in height with a top length of 3500 feet. In the distribution system there will be eight miles of canals of from 50 to 225 cubic feet per second capacity, 50 miles with from 10 to 50 cubic feet per second capacity, and 100 miles with less than 10 cubic feet per second capacity. Instead of constructing wooden flumes across depressions, reinforced concrete pipe, some as large as forty-six inches in diameter, has been constructed and imbedded in the ground, forming an inverted siphon.

The Klamath project, which is divided into two projects, the upper and lower contemplates the reclamation of 172,000 acres of fertile land located largely in Klamath county, Oregon, and partly in Modoc and Siskiyou counties, California.

Construction work was authorized on May 17, 1905, and by June, 1909, thirty-one per cent of the entire project was completed, and water was delivered to about 7000 acres.

The water supply of the lower project is derived from Upper Klamath lake, which has an area of 60,000 acres and serves as a natural reservoir. The plan of the upper project provided a sorage dam 35 feet high and 940 feet long at the outlet of Clear lake; a diversion dam on Lost river about twelve miles below the storage dam; and canals on either side of the river for the irrigation of lands in the upper valley of Lost river.

The principal industry of this country has been stockraising, but alfalfa, grain, fruit and vegetables may be grown as soon as the land is irrigated.

Some of the most important preliminary surveys that have been made by the reclamation service during and since 1903 are the Malheum project, involving 90,000 acres, for which $2,000,000 was set aside provisionally at one time; Silver creek project in Harney county, where about 20,000 acres can be reclaimed by the construction of a ninety-foot dam; and in 1909 investigations were carried on for the west extension of the Umatilla project.

Probably more money has been spent in Malheur county in the development of irrigation by private enterprise than in any other county in the state. There are about 50,000 acres under irrigation now and with storage of water in the reservoir sites along the Malheur and Owyhee rivers, Bully creek and Willow creek 100,000 acres in addition to this may be reclaimed. A lage ditch twenty-five miles in length and with a capacity of 200 cubic feet per second takes water from the Owyhee river. Twenty-two ditches divert water from Bully creek, and eleven from the Malheur river.

In Baker county twenty-five per cent of the Powder river valley is irrigaed by the regular summer flow of the Powder river, and is almost entirely in private ownership. The largest storage development in he valley is that of the Baker Irrigation company. A dam 2000 feet in length and fifty feet high is now under consruction, and will when completed, store enough water to reclaim 10,000 acres.

In Umatilla county several large ditches have been built where the crops depend on the flood water during the spring overflow. Nineteen of these ditches divert water from the Umatilla river. There has been no irrigation development in the state west of the Umatilla project except in Hood River county, and there irrigation is also necessary for the highest development of the soil.

Methods of Applying Water.

Whatever the source or supply of the water, a large number of ditches to convey it to all parts of the country is necessary.

The form of these ditches depends on the implements used in excavating and the size determined by the crops to be grown, the method to be adopted in watering them and the regulations governing the delivery of water to the ditch. The capacity of a ditch depends as much on the fall or grade as on its size. Having obtained a suitable grade, the chief points to be remembered are the volume to be carried and the nature of the soil. The smaller the volume the greater the grade required. In a fine sand there must be a flat grade to prevent scouring, while in a hard soil a velocity of three feet per second may be used without eroding the bottom. When excessive grades cannot be avoided by windink around the high places, the speed of the water may be checked by the insertion of drops at the proper intervals.

In laying out permanent ditches an effort should be made to locate them in the right place. Sufficient water should be conveyed from the source of supply to the highest point of the farm, and from there distributed to the various subdivisions. Where depressions occur, the water may be carried across in a cement pipe laid in the form of an inverted siphon. Every farmer must have a headgate to contol the water from the main canal into his private ditch and a weir to measure it. After his supply ditches have been built, the fields should be graded and leveled, then the laterals should be located and constructed for the distribution of the water.

The field may be watered from the laterals by placing a temporary dam in the channel, which stops the flow in that direction, and causes it to flow over the low places in the bank. This system, called the "flooding system," may be used where the soil is heavy; where grain and forage crops are to be raised and when a rotation of crops is desired.

Nearly all crops that are planted in rows and cultivated are irrigated by means of furrows. Head-ditches that are fed from the main supply ditch of the farm are made after the field is leveled and graded. The distance between any two consecutive head-ditches depends on the soil, for in sandy soils they should not be more than 300 feet apart, and in a hard soil they may be from 400 to 600 feet apart. Each furrow is fed by a wooden spout placed two or three inches below the surface of the water. The cost of irrigating by this method is about the same as by flooding from the field laterals.

The check method of irrigation, confined mainly to alfalfa, consists in dividing up a field into rectangular checks, each comprising from one-half an acre to one and one-half acres. Around the margin of each check a low embankment is formed which retains the water until it has been absorbed by the soil. A ditch with a capacity equal to the head used is built to carry water to each check or pair of checks. Each check should be provided with a wooden or concrete box controlled by a gate. A large head of water is turned into a check by raising the gate, and when sufficient has been admitted, a gate to the second check is opened and the first one closed. The labor and expense of irrigating is much reduced when this sysem is used.

In the border method of irrigation a large head ditch is built across the highest boundary of the field. After being plowed the field is marked off into parallel strips of land from 75 to 125 feet wide, which extend down the steepest slope from the head ditch. These are then leveled and a low embankment built along the border of each. Care should be used to obtain an even slope between the borders, so that the water which is admitted through a box in the head ditch may flow in a thin sheet from top to bottom of each strip.

Value of Irrigation to State as Whole.

Many people do not realize the value of water in running streams when viewed from a commercial standpoint. It has been estimated that the yearly income from all the water power in this state will sometime exceed the wealth produced by the mines and forests. The value of irrigated lands is based on the right to use the necessary water, and such lands increase from pracically nothing to as much as $1000 per acre.

It is generally known that the most productive and highest priced lands are in those portions of the west where irrigation is practiced. Irrigation bonds are in such great demand, and irrigation projects are being so eagerly sought for that new capital and settlers are being continually brought into the state.

It is difficult to estimate what the value of irrigation will be to the state, as it is now a practically new undertaking, but the results already evident give us an inkling of what wonderful undeveloped resources the state possesses in this regard. The vast territory that now lies idle, supporting all told but a few thousand people, may be transformed into a wonderfully productive country thickly populated with desirable, progressive citizens.

There is perhaps no state in the west in which the natural resources are so undeveloped as in Oregon. This may be accounted for by the lack of railroads, and consequently the country has not been settled as it would otherwise have been.

The development of irrigation has been retarded not only by a deficiency of capital on the part of most of the country on the part of those who possessed the capital. Oregon has not knowledge of the conditions of the settlers, but also by the lack of received her just proportion of the reclamaion fund, it having been expended in other states. This was caused to some extent by the lack of harmony on the part of the land holders on certain areas capable of reclamaion, particularly in the Malheur district.

Practically all the waters that are used for irrigation are drawn from the flowing streams. Although a portion of the water in the streams is taken up by evaporation and also wasted by floods, a large quantity rushes on to the sea, and its usefulness is lost.

The amount of water precipitated in the form of rain, snow and fog, upon the watershed may be said to be used in three different ways, as it were, namely: For evaporation and plant life; for seepage into the earth and then collecting into surface streams, subterranean streams and gravel beds; for storm run-off and run-off during the irrigation season.

The amount of water which is taken up by evaporation and also as nutriment necessary to sustain plant life varies with the conditions of the watershed and atmosphere.

It is impossible to estimate the amount of water which seeps into the ground and finds its way into underground channels that saturate the gravel beds of the valleys and fill the strata that carries the artesian supply.

The storm run-off is the water which flows from the surface of the watershed after the upper crust of earth has been saturated and no more water can be absorbed by it. The saturation depends upon the amount of rainfall and character of the watershed. If the rainfall is heavy the surface will soon become saturated and the runoff will be much greater than if a portion of it was allowed to seep into the ground. Also it may be seen that on a water-shed denuded of plant life the storm run-off will be much larger than where the underbrush forms a resistance to and retains the water longer upon the surface, giving it more time to penetrate into the pores of the earth and subsequently into the underground channels and reservoirs which retain the water and give it up gradually during the summer into the streams.

The more water we are able to save from the storm run-off and to turn into reservoirs, the more we increase the amount that may be used in irrigation. Therefore in order that irrigation may be developed further, some means must be provided to store sufficient water.

How far are the principles and methods of irrigation as practiced in the arid portions of the state applicable to the Willamette valley and other so-called humid portions of the state, and the difficulties peculiar to these sections severally:

The Willamette valley at the present time is the most undeveloped section of Oregon when its natural advantages are compared with those of the other sections. It has the longest growing season of any section of the state; rich and deep soil; no long and severe winter; access to the local markets and is convenient to railway and water transportation.

Few people realize the fact that the rainfall during the summer months is less than that which occurs in the arid sections of the state. Thus the need of irrigation is not determined by the total amount of rainfall, but by its distribution throughout the year. From October to March about seventy-five per cent of the annual rainfall occurs and during the summer period from June to September less han five per cent.

Since a greater amount of water is available in the streams of the Willamette valley and other humid portions of the state than in the arid districts (on account of the heavy winter rainfall), irrigation systems there would not need to be elaborate or extensive as in the arid regions; nevertheless, the same mehods might be carried on to good advantage, though on a smaller scale.

Investigations have been carried on by the office of experiment stations of the U. S. department of agriculture during the past three years. These investigations have demonstrated that irrigation in the Willamette valley is profitable—four crops of clover and alfalfa having been grown in a season where only one was produced before. Such crops as these were unheard of before irrigation was practiced.

More investigations and study will be required to further the development in the Willamette valley.