Controlling Factors

of

Complete Water Utilization

of

North Platte River

by

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January 15, 1921

Engineer for Wyoming on "North Platte Co-operative Investigation" with U. S. Reclamation Service.

1918.

Read before the Nebraska Irrigation Association at annual meeting,

January 18, 1921, Gering, Nebraska

"The day of complete water utilization of North Platte river lies a long way in the future and rests on heavy reservoir control on the lower end of the river. Patience between communities, states and government departments, like patience between individuals, will finally solve the problem."
CONTROLLING FACTORS OF COMPLETE WATER UTILIZATION OF NORTH PLATTE RIVER

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GENERAL STATEMENT.

The states of the arid and semi-arid West, where irrigation is essential to successful agriculture, are entering a period of greater development in water utilization. The smaller and more cheaply constructed ditch and reservoir opportunities have been developed to a large degree in the more arid of these states, and, to a considerable extent, in the semi-arid. In the semi-arid states opportunities exist for local development at low cost, benefits considered. Upon many western streams irrigation from direct flow (unsupported and unstabilized by storage water), has reached its limit in years of average flow, and in years of low, or poorly distributed flow, a shortage of water during the hot months of July and August results in reduced crop production. Additional development in such areas depends largely upon equalization in reservoirs of unused winter flow, or the peak flows of the spring floods from melting snows or heavy rains. While many opportunities are yet afforded for lesser reservoir development, it may be generally said that future economic projects will be of large size, and their water demands will affect the water supplies of interstate streams to a greater or less degree.

Under our form of Government we have a union of states separate in their sovereignty, except for those powers surrendered to the national government. Save for federal purposes, each state is, for general consideration, a separate state or nation. All attributes of sovereignty, not specifically or by necessary implication surrendered to the federal government, are still retained by the states, and these powers are, by the Constitution, the same in the newer states as with the original thirteen. The new states are in all respects equal in power and sovereignty with the original thirteen. Each of the original thirteen states retained full jurisdiction and sovereign control over the domain within its borders, including the streams and the waters thereof, except the control of navigation of its waters, which was specifically surrendered to the United States, and even as to such the states still exercise control over navigation, subject always to the superior power of the federal government. Each of the original thirteen states, and all of the states subsequently admitted (upon an equality with the original thirteen), has, from time to time, fixed its own methods of control of the use and enjoyment of the waters of its streams among its inhabitants. These methods have varied from legislature to legislature within each of the states in conformity with changing conditions and the progress of population and industry. While certain general doctrines, commonly designated as the riparian and appropriation doctrines, characterize these state methods of control and use of the waters of the streams, the methods in each of the states vary to a greater or less degree from those obtaining in neighboring states. No two methods of intra-state control are the same. Each method is but a means of local administration, which has changed from time to time in the past, and will necessarily change during the future, according to local conditions and necessities.
In view of these conditions it would be presumptuous to attempt to discuss the rule of policy or law which should prevail between neighboring states in the settlement of their interstate problems on rivers common to two or more thereof. As between nations, we are advised, such matters are determined on principles of international policy, and are settled by treaty (Orr. Atys. Genl., Vol. XXI, pp. 280-3). If carried to the extreme and not settled by diplomacy, complications might arise which would constitute a cause for war. No state can impose its doctrines or methods of administration upon any other state, and Congress cannot impose any doctrine upon one or more of the states (Kansas vs. Colorado, 206 U. S., 46). Under our form of government our interstate rivers are necessarily administered by the separate states without regard to the uses in other states until, by some convention between the states, or as a result of interstate litigation before the Supreme Court, the extent of the use by the separate states is limited or defined. Joint administrative compacts between the states appear essential to avoid friction and to encourage future use.

The more extended and larger use of the water supplies of western streams, and more complete regulation of flow by storage reservoirs, are well illustrated by the proposed Colorado River Basin and Columbia River Basin projects. Without regard to the settlement of the rights of the respective states to the use and benefits of the waters within their borders, which must necessarily in the end be settled as matters of policy by interstate compacts or agreements, with consent of Congress, or by resort to the United States Supreme Court in lieu of settlement by force, a brief reference to the practical problems presented may be profitable.

A plan is now on foot for the complete regulation of the Colorado River by large storage reservoirs. This general plan affects the water resources of seven states of the Southwest. The annual flow of the Colorado River at Yuma, Arizona, is 17,000,000 acre-feet, or about nine times the total average annual flow of the North Platte River at North Platte, Nebraska. Several storage sites of from 1,000,000 to 25,000,000 acre-feet capacity are being investigated and seriously considered. Hydro-electric power development of 2,500,000 h.p. is being discussed. During December, 1920, one California electrical corporation, alone, made application to the Federal Water Commission for a permit to develop 2,500,000 h.p. on the Colorado River. All these large developments contemplate flood control. The irrigation of lands at the headwaters of the stream necessarily aids in flood control by equalization of the flow thru return seepage, permitting the re-use on the lower reaches of the stream. At present 2,000,000 acres are irrigated in the Colorado River Basin; 4,000,000 acres additional may feasibly be irrigated according to present cost standards and irrigation practice.

All these combined enterprises and methods of reclamation, use and flood control, present one great problem which must ultimately be considered as a whole, but without doing violence to the sovereign rights of any of the seven states involved. Each state has a right to develop its territory and control its domain as its future necessities may demand, whatever they may be, without at the same time violating like
rights of other states. Just what those rights will be must necessarily depend upon the present and future facts prevailing in each interstate problem. No two are alike, and no two can be held to the same rule of treatment. Conditions of today may change tomorrow. Policies sufficient for the present may be abandoned in whole or in part during the future, and new orders of things and new rules of administration may be adopted as conditions require.

The State of Washington has just expended $100,000 on an engineering investigation of a large irrigation project on the Columbia River Basin, which contemplates the reclamation of 1,750,000 acres at a cost of $300,000,000. The water supply for this project originates in Montana, Idaho and Washington, and such a project is interstate in character, and must be developed without doing violence to the rights and future requirements of the States of Montana and Idaho.

The above mentioned projects are cited as examples of the general interstate character of future irrigation development. Projects of such extent should be studied in a co-operative manner by the various states involved, in order that a safe foundation may be provided for the expenditure of the enormous amounts of money, and the security of water supplies be assured. Irrigation development is outgrowing its original limits. Laws of individual states, under whatever general doctrine they may be cassed, are at best but rules of local administration of public property. Even those laws are ever changing and adapting themselves to local conditions and needs. California, for example, originally proceeded upon one rule of law, changed to a combine doctrine, and is fast gravitating back to the original rule, but may change from generation to generation as her necessities may require. New laws are needed to meet new conditions; rules of local administration, whether under the riparian doctrine, appropriation doctrine, or any other doctrine, cannot apply between states. No state can fasten an interstate servitude upon an interstate stream without the consent of the other state involved.

No lower state should expect non-impairment of stream-flow by upper states, although this is the false hope or absurd desire of many water users, and interstate litigation is, in part, largely the formal expression of such desire. On the other hand, the upper state should not expect to wholly monopolize all the waters within its confines. Fortunately, the latter condition is impossible by reason of the return flow from irrigation upon the upper areas. Whether the use is confined to the narrow limits of the drainage area of some tributary, or extended from one tributary to the drainage area of another, in the end return of water inures to the benefit of the entire stream.

Between the two extreme positions which might be taken by the lower state upon the one hand, and the upper state upon the other, policy between the states will eventually dictate a middle ground. Irrespective of the method adopted, in arriving at a balance of equitable distribution between the states (varying in each particular case), the most vital need of the present is an accurate and well digested knowledge of physical conditions on interstate river basins, followed by co-operative negotiation and subsequent administration between
the states. Physical conditions, such as topography and the seasonal distribution of stream-flow throughout the calendar year, are large controlling factors in river utilization. While these conditions will change with irrigation development by reason largely of return flow of water from lands already irrigated, the change of conditions can only be ascertained by first investigating present facts. State laws, or rules of local and intra-state administration, may have little to do with the control of the use of the waters of the river as a whole. Even these laws are but a crystallized public sentiment, varying with changing conditions and developing with the areas. Public dissemination of physical facts, accompanying comprehensive plans for the use of the river as a whole, and other like undertakings will first produce a greater comity between the states, and later react upon local administration, and finally embody themselves in a change of legal fabric.

Touching Nebraska, you have larger water problems on the North Platte River which demand constructive treatment and co-operation by the many interests involved. This brings us to the subject—

WHAT ARE THE CONTROLLING FACTORS OF COMPLETE WATER UTILIZATION OF THE NORTH PLATTE RIVER?

The ultimate destiny of all natural resources is economic and complete use. At the present time our greatest resource, water, is given less economic consideration than any other commodity. When hay is sold it is usually measured or weighed (even tho crudely); grain, potatoes, sugar beets, all are weighed; land is sold by the acre; but water, the greatest public resource, which is the basic source of all the above, is crudely and wastefully distributed, and as carelessly and unscientifically applied. Careless measurement, of course, is the usual treatment of any commodity which is under-valued. Therefore,

(1) MEASUREMENT OF IRRIGATION WATER, together with equitable distribution, is placed as the most important controlling factor of economical and complete use. It is much cheaper for a community to distribute its water by careful measurement than to use it wastefully and build reservoirs for a supplemental supply. Not until the lack of water, by seasonal shortage, a canal break, or other causes, compels the average irrigator to use sparingly, does he so use it. Many irrigators use two to three times as much water as is required. Too much water is just as bad for growing crops as too little. Furthermore, too much water saturates and alkalizes the land, and eventually the additional cost of drainage is a too frequent burden to irrigated land.

(2) CONTINUOUS ENGINEERING STUDY is another factor of complete water utilization. On large rivers like the North Platte, where vast areas of land are being irrigated, developed, and constantly increasing areas served with water, conditions of river flow are constantly changing. Seepage water, drainage water, reservoir water, direct flow, all become intermingled and their identity frequently lost, and only when their effect is cumulative is it noticed. River flow and distribution are becoming more complex, and the relation of the
new projects to old ditches and old projects along a river must be studied and their relation determined. Continuous engineering investigation, therefore, becomes an important factor in development.

(3) CO-OPERATION: Another controlling factor in future development is co-operation. Co-operation is essential because projects of the future will be large, will have far-reaching effects on the North Platte River, and because individual ideas, community aims and state laws must be merged to a common end. As previously indicated, conditions surrounding irrigation development are outgrowing independent administration by states and communities, and there must be a general readjustment of ideas to fit conditions of future use. While physical conditions are controlling factors in the development of river basins, co-operative efforts are likewise controlling, because, without such efforts, utilization cannot occur. It will take years to formulate plans and finance projects of the future because the value and need must first be shown to many communities before the necessary support can be secured. The biggest and hardest problems engineers have to contend with in organizing, constructing and operating irrigation projects are not engineering problems, but financial ones, and matters of human contact. Your association is doing a valuable, tho not fully appreciated, work in fostering irrigation advancement, investigational studies, community spirit and publicity.

(4) RESERVOIR EQUALIZATION: Complete use of the North Platte River can only come thru control, and control can only come thru heavy reservoir construction, a large amount of which should be on the lower river, because the upper river is fairly well controlled by the Pathfinder Reservoir, or will be upon the completion of the Fort Laramie Unit and Bridgeport Extension. In average years the total unused flow of the North Platte River at North Platte is about 1,800,000 acre-feet, or more than the average yearly flow at Pathfinder Reservoir. The North Platte River has the same general characteristics common to streams of the arid west, rising in mountainous areas. The winter flow is small and the spring flow is heavy. At Pathfinder but 8 per cent of the total yearly flow occurs during the period of November to February, inclusive. During the eight-month period of August to March, inclusive, only 21 per cent of the annual flow occurs. Another way of expressing what should be brought out is that the stream-flow of the year chiefly occurs in four months, viz., April to July, inclusive, and amounts to 79 per cent of the year's flow. The month of greatest flow is June, when one-third of the year's flow occurs.

Since present irrigation developments demand, in ordinary years, all July, August and September flow, it is evident that those ditches with a poor water right, or any new developments, must supplement direct flow by storage water if they are to have a reliable water right. This applies generally throughout the entire river basin, altho there may be a few minor exceptions.

There is one modifying influence which may postpone the day of reservoir need for some areas, viz., return-flow. While
return-flow from irrigation will improve the late summer flow in many communities, its precise future for the lower river (below North Platte), is more or less conjectural. Such waters should not be considered a general remedy for future river shortages, especially in dry years. It should also be remembered that only about one-half the return flow occurs during the irrigation season.

Since additional growth of agriculture is inevitable along the North Platte, a careful, systematic study should be made of reservoir opportunities along the lower river, and their relation to water supply and future areas to be served, in order that the cheapest and most strategic sites may be developed first and according to some comprehensive plan. This will require co-operation of the various communities along the main river.

The possibilities in this direction are well illustrated by a cursory examination of the area along the South Platte River between Julesburg and North Platte. Several natural reservoir sites have been examined which may be utilized by expenditures far less, per acre-foot, than has been required in the construction of numerous reservoirs along that stream in Colorado by the citizens of that state without government or state aid. A considerable volume of water passes annually down that stream in average years thru Nebraska to the Gulf of Mexico after Colorado diversions have been fully supplied. This water could be economically stored by citizens of Nebraska in the available reservoir sites. The present intensive agricultural development of the lower South Platte in Colorado is the result primarily of the conservation of the winter flow of that stream in reservoirs constructed at great expense by the irrigators themselves. The Nebraska lands should receive the benefit of the water now going to waste, by conservation through similar agencies.

(5) INTERSTATE COMITY: There is a great need for legal and administrative co-operation between adjacent states on water matters. The constant litigation brought against Colorado during an eighteen-year period has failed to successfully settle interstate water problems, although the decision in Kansas vs. Colorado (206 U. S., 46) resulted in the clear announcement by the U. S. Supreme Court of the principles of interstate law governing such controversies and a definition of the extent of federal powers in such matters. The largest water problem facing the states is that of equitable apportionment between the states of the waters of interstate streams. As previously cited, on interstate rivers, each state naturally uses the water of its portion of the river basin regardless of the effect it may have on the lower state. This condition cannot continue indefinitely. But adjoining states can adjust and solve these difficulties in a friendly way much easier than by prolonged litigation, just as ditch disputes are frequently settled by mutual agreement.

National treatment of similar problems by the United States Government on international rivers has pointed a way and established a precedent on three rivers which originate in the United States but pass into adjoining countries. Such affairs are settled by treaty as matters of international policy. By a treaty agreement between the Republic of
Mexico and the United States the waters of the Rio Grande were apportioned in 1906. In 1909 an agreement was reached and treaty entered into between the United States and Canada concerning the use of water from the St. Mary and Milk Rivers. Both streams originate in Montana and descend into Canada, the St. Mary water eventually draining into Hudson Bay, the Milk River returning to the United States after a 216-mile ramble, discharging finally into the Missouri River. Water agreements have also been entered into between some of the Australian states. Unless similar agreements are made between the states concerning the larger interstate rivers where irrigation is practiced, future development will encounter difficulties and litigation, and will be delayed. By an apportionment of the water of an interstate river, based in part on existing rights and in part on potential needs, taken in consideration with the economic relation of the various parts of a river basin, a sound basis for development would be provided in certainty of water supply. As far back as fifteen years ago Elwood Mead, now of international irrigation fame, called attention to interstate water problems and the need of constructive action in their treatment as opposed of wasteful litigation.

The fact that most of the arid states have followed, to a greater of less degree, a rule of local administration based upon priority according to time, has caused many irrigators and others to assume that all that is needed on interstate streams is an enforcement of priorities according to dates regardless of state lines. This erroneous doctrine is quite plausible on first thought, but mature reflection and consideration bring home the fact that this is mainly a rule of local administration, varying in its application in each state, and changing from time to time according to necessity. It is but a method of distribution of a public resource, temporary in its final relation to the state. As between water within the state it furnishes a convenient rule of property users, but at best it is a mere passing phase as regards the ultimate benefit to the commonwealth. It ceases with abandonment, and public necessity may extinguish it through eminent domain in order that the natural resource, the water, may be devoted to other or higher uses. To apply such administration beyond the borders of the state would be to deprive the state of its control of a natural resource, and to vest in citizens of another state a perpetual claim upon the natural resources of the adjoining state. A direct application shows that enforcement along such lines would disturb rights which have become vested as between individual citizens and property values incident thereto in an entire river basin. The reason for this is plain. Using the North Platte River as an illustration—the North Platte River traverses three states—Colorado, Wyoming and Nebraska. In each state the oldest water rights date back to the period 1870 to 1880. Now, if a complete list of all the water rights on the main stream and its tributaries in the three states were prepared and arranged according to priority dates, the relation of the various water rights within a single state would be greatly changed by the interposition of water rights from adjoining states. This change in relation would mean a change in the amount of water divertible. On a river basin priority basis, some ditches that formerly had an excellent right would
receive little or no water; other ditches that heretofore had received but little water, would receive all the water they could use, and in some instances such changes in interstate relation would be practically confiscatory of vested rights and attached property values. In irrigated areas property values are almost wholly dependent upon water rights, and based upon water procurable. Eliminate or impair water rights and you impair the attached property values.

It would appear that a literal enforcement of water priorities, regardless of state lines throughout a river basin, is impracticable because it would disturb and impair the vested water rights of individuals and attached property values over an entire river basin. This is one reason why pending suits on interstate streams have been unsuccessful. They have attempted to disturb, not only water rights generally, but the attached property values. Some other solution must be found. One has been suggested that gives hope of accomplishing its object.

Elsewhere has been mentioned the fact that international controversies are settled and adjusted as a matter of policy and diplomacy, through treaties or by war. The states still have the treaty power with each other, upon consent of Congress. A suit in the United States Supreme Court is but the substitute for war between the states. Such a suit should never be resorted to until diplomacy has been exhausted; in fact, some of the closest students of the subject suggest that the Supreme Court should lay down the rule that no suit between states in that court will be entertained until it has been found that the disputant states have exhausted every reasonable effort to arrive at an amicable adjustment of their controversy. Such a suggestion was made by that court in the boundary suit between Washington and Oregon (217 U. S., 18).

War, or its substitute, an interstate suit, always being a last resort, settlement should be made by treaty, or, as expressed in the Constitution, by “Interstate Compacts or Agreements.”

INTERSTATE COMPACTS OR AGREEMENTS: Under this program the various states interested would make a thorough co-operative engineering study and investigation of the water supply of the entire river basin and everything touching thereon, such as present water rights, undeveloped irrigable areas, reservoir sites, power, drainage and flood control. This investigation would be the basis of a comprehensive plan for protection of vested private rights, apportionment of unused waters, future development, and administration between the states. The comprehensive plan would in turn then be the foundation of a water agreement or compact between the states which would provide a sound basis for future development, protection of present development, and be economic in the final analysis. Upon approval by Congress such a contract would be binding upon the states.

FUTURE DEVELOPMENT: Request was made to touch upon the future development of North Platte River in Wyoming and Nebraska, the effect that development in either state might have upon the other, etc. In order to approach this subject properly, a concise review of present irrigated areas and undeveloped irrigable areas in the North Platte
Basin and water supply, is necessary. In round figures we then have—

<table>
<thead>
<tr>
<th>Areas</th>
<th>825,000</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigated Colorado</td>
<td>145,000</td>
<td>18</td>
</tr>
<tr>
<td>Irrigated Wyoming</td>
<td>355,000</td>
<td>43</td>
</tr>
<tr>
<td>Irrigated Nebraska</td>
<td>325,000</td>
<td>39</td>
</tr>
<tr>
<td>Undeveloped, Irrigable Colorado</td>
<td>150,000</td>
<td>13</td>
</tr>
<tr>
<td>Undeveloped, Irrigable Wyoming</td>
<td>510,000</td>
<td>43</td>
</tr>
<tr>
<td>Undeveloped, Irrigable Nebraska</td>
<td>515,000</td>
<td>44</td>
</tr>
<tr>
<td>Total</td>
<td>1,175,000</td>
<td>100</td>
</tr>
</tbody>
</table>

*Includes trans-mountain diversions of but 21,000 acre-feet yearly in Colorado to Poudre Basin.

NOTE:—These figures include all tributaries above North Platte and the Platte River to Kearney, Nebraska.

Application of water to lands under canals from the North Platte River now being constructed will increase the per cent in Nebraska, and within six years put Nebraska in the lead.

Now, comparing the run-off or water supply originating in each state, we have the following table, approximate figures only:

<table>
<thead>
<tr>
<th>Estimated Gross Run-off Acre-feet</th>
<th>Appr. Net Run-off Acre-feet</th>
<th>Con-sumptive Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colorado 800,000</td>
<td>650,000</td>
<td>150,000</td>
</tr>
<tr>
<td>Wyoming 1,800,000</td>
<td>1,350,000</td>
<td>450,000</td>
</tr>
<tr>
<td>Nebraska 400,000</td>
<td>100,000</td>
<td>500,000</td>
</tr>
<tr>
<td>Total 3,000,000</td>
<td>1,900,000</td>
<td>1,100,000</td>
</tr>
</tbody>
</table>

NOTE:—Does not include South Platte run-off or below North Platte. Includes acreage irrigated to Kearney.

Summarising, we then have the present area irrigated in the North Platte Basin, about 825,000 acres, consuming roughly 1,100,000 acre-feet, or approximately one-third of the total original annual run-off of the North Platte Basin of 3,000,000 acre-feet. The undeveloped irrigable area, according to present standards of cost, is approximately 1,200,000 acres or 1½ times the present area and the unused water, 1,900,000 acre-feet, if fully controlled, with which to irrigate it. Applying a general consumptive use of 1.5 acre-feet to 1,200,000 acres, we have a net demand for 1,800,000 acre-feet of water annually. Of course it may not be economic to completely control the North Platte River by reservoirs, so that less than 1,000,000 acres additional area will ultimately be served. In round figures then, ultimately probably about 1,500,000 acres will be irrigated with North Platte water, or almost twice the present area.

EFFECT OF ADDITIONAL DEVELOPMENT IN COLORADO ON NORTH PLATTE WATER SUPPLY AVAILABLE TO WYOMING AND NEBRASKA: The ultimate maximum reduction of water supply by Colorado through projected diversions is estimated at 150,000 acre-feet annually; 100,000 acre-feet in North Park and 50,000 acre-feet from the Laramie
River through diversion into the Poudre River. Reduction of water supply in Colorado will be a gradual occurrence by new developments, and will involve reservoir construction. No large immediate reduction in water supply can come from use in Colorado. The present water supply by the Laramie River to the North Platte River is quite variable, uncertain and erratic, so no great loss will occur from this source. To offset this reduction of water from the headwaters of the North Platte there will doubtless result an increase in the annual flow of the South Platte across the Colorado-Nebraska State Line from return flow from present irrigated and future irrigated lands in Colorado, in small part served by North Platte water. This will, in the end, result in benefit to Nebraska by reason of the fact that the diversions from the South Platte for irrigation of Nebraska lands in Perkins County and easterly must necessarily be made above points where North Platte water would be available.

EFFECT OF ADDITIONAL DEVELOPMENT IN WYOMING ON NEBRASKA: While there is a large undeveloped irrigable area in Wyoming, the greater part of this area lies at a high altitude, requires reservoir construction, and the cost per acre is not attractive. The development of the Wyoming area will be a slow, gradual process. The ultimate consumptive use by this area should not exceed 300,000 acre-feet. It would then appear that the greatest reduction in water supply to the lower river will occur upon completion of the Federal Project, Fort Laramie Unit, which, however, has ample storage rights in Pathfinder Reservoir. Irrigation development in the basin above Whalen will have a beneficial effect upon equalizing the late summer flow by return water from irrigation. No heavy immediate reduction in water supply can come from use in Wyoming above Whalen.

The Government Embargo against the granting of rights-of-way over public lands at the headwaters of the North Platte River has served no useful purpose and has retarded the development in those areas. Had this development been completed it would have aided in the flood control of the river, and the benefits from return waters would have been apparent by this time. These embargoes simply tend to leave an impression of want of fair play as regards the upper states, and have a tendency to destroy the comity between the states which will be necessary for the proper final solution of the water problems of the North Platte. If the Federal Government wishes to encourage an early solution of these water supply problems, it should lift its right-of-way embargoes at an early date.

Nebraska opportunities for future irrigation development of any size from the North Platte River in Nebraska lie below Bridgeport and extend as far east as Kearney on the Platte. This area has had an improved water supply in recent years due to unused water from Pathfinder Reservoir being turned down the river. When the Fort Laramie and Bridgeport Units are completed and exert their total demand on the water supply of the river, this extra reservoir water will all be absorbed, also a large amount of now unused direct flow, and river flow on the lower river will be uncertain and similar to the years prior to 1909 when the Pathfinder Reservoir was completed.
There will be one compensating feature, however, viz.: return flow or seepage water from irrigation. The present return flow between Whalen and Bridgeport, over a 100-mile stretch, approximates 400,000 acre-feet annually; approximately 50 per cent of this flow occurs during the irrigation season. In time the return in this area will be almost doubled from the Fort Laramie Unit and Bridgeport Extension. Return flow will then be a considerable factor in furnishing late summer water to the lands between Bridgeport and North Platte. In turn the area lying east of North Platte may receive benefits from return water, but to what degree is more or less uncertain on account of the wide sandy channel and heavy percolation and evaporation losses during July and August. A marked example of return flow from irrigation occurs between La Salle, Colorado and Julesburg, on the South Platte River, where, on a 150-mile stretch, the measured seepage returns, in addition to the natural river flow, now approximately 800,000 acre-feet annually, a large increase over fifteen years ago, and showing yearly increases. The above figures are based on careful seepage measurements.

The up-stream location and extent of the North Platte Project, the Tri-State Canal and adjacent irrigated areas are of great value to the North Platte ditches between Bridgeport and North Platte, Nebraska, and return flow from irrigation of about 450,000 acres will play a vital part in enriching their water rights.

Irrigated lands below North Platte will have need of storage assistance since years of low precipitation will recur, and dry cycles of several years' extent will also occur again, resulting in low stream flow. Reservoir water is just so much "insurance," and should be provided to lands now having a so-called 50 per cent water right.

In this discussion small consideration has been given to the water contributed annually to the Platte River at North Platte by the South Platte River, which amounts to about 300,000 acre-feet annually. Favorable reservoir sites exist above North Platte for control of this water for use below North Platte. Reservoir possibilities also occur on the North Platte and tributaries, between Bridgeport and North Platte, which, in time, will be used for controlling some of the 1,800,000 acre-feet now passing North Platte in average years.

The day of complete water utilization of North Platte lies a long way in the future and rests on heavy reservoir control on the lower end of the river. Patience between communities, states and government departments, like patience between individuals, will finally solve the problem.

Summarizing, we then have the following factors of direct importance to irrigation development of North Platte River, both present and future:

2. Continuous Engineering Study.
3. Co-operation of River Interests.
4. Reservoir Equilization and Up-Stream Development.
5. Interstate Comity.