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COORDINATOR OF NATURAL RESOURCES
STATE OF COLORADO

MORTON W. BITTINGER
AND ASSOCIATES
*Water Resources Engineers*

PRELIMINARY REPORT

# STUDY OF

# INTEGRATED WATER USE

# SOUTH PLATTE RIVER BASIN

WRIGHT WATER ENGINEERS
ENGINEERING CONSULTANTS
Denver, Colorado

December, 1967

MEMBER

WRIGHT WATER ENGINEERS
ENGINEERING CONSULTANTS
1240 WEST BAYAUD AVENUE
DENVER, COLORADO 80223

PHONE
744-6271

December 29, 1967

Mr. Richard Eckles
Coordinator of Natural Resources
Columbine Building
1845 Sherman
Denver, Colorado

Re: Integrated Water Use Study

Dear Mr. Eckles:

The water utilization study authorized under our contract with you dated August 1, 1967 has been completed. The attached report summarizes the findings of fact, and presents our preliminary conclusions and recommendations for new legislation which would permit more efficient, and better utilization, of the State's water resources.

As you directed, our Office concentrated its efforts in the Lower South Platte River Valley from Sterling to the State Line. During the course of our investigations we had the opportunity to meet with numerous water users in Water District 64. Meeting with these men made it evident that present methods of administering and distributing water is not satisfactory under the conditions as they exist today on the South Platte River. We concluded that the time is right for bringing about changes which will make the farmers' water delivery more dependable and timely as related to the crop demands.

The attached report presents basic conclusions which indicate that additional water exists in the South Platte Valley for beneficial use, the existing water uses are not efficient nor wholly effective, and that the opportunity exists for taking a major step towards the better utilization of our water resources.

The proposal presented would be the objective of new legislation. This proposal recommends the inclusion of all wells in the administrative system, the managing of the river basin so that these wells can be utilized beneficially, the protection of all vested water rights, the payment for water used outside of the priority system, and the formation of river basin authorities to develop and distribute water.

A second proposal, similar in nature but with a somewhat different emphasis, has been included in the Appendix of this report for your review. As you no doubt understand, various possible proposals leading to the better utilization of our water were prepared, and the two included in this report appear to us to be the most promising.

By definition in our Contract, investigation represented by this report was to be preliminary in nature because of the short time allowed for the work. It is our opinion that additional engineering work is required, of both a theoretical and practical nature, before final recommendations can be made as to the necessary legislation.

Very truly yours,

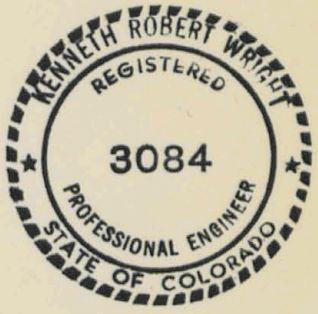
WRIGHT WATER ENGINEERS

By Kenneth R. Wright

Kenneth R. Wright

KRW:dld

Enclosure



COORDINATOR OF NATURAL RESOURCES
STATE OF COLORADO

Preliminary Report

# STUDY OF
# INTEGRATED WATER USE
# SOUTH PLATTE RIVER BASIN

WRIGHT WATER ENGINEERS
ENGINEERING CONSULTANTS
Denver, Colorado
December, 1967

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# SECTION I

# INTRODUCTION

The Coordinator of Natural Resources of the State of Colorado was authorized by Senate Bill No. 407, 46th General Assembly, to undertake, with the assistance of private engineers, a study leading to legislation providing for integrated use of surface and ground water. Thus empowered, the Coordinator of Natural Resources contracted with several engineering firms, of which Wright Water Engineers was one, to undertake the required study in cooperation with the Colorado Water Conservation Board.

## OBJECTIVES

The objectives of the study, in the language of the Bill, are: "to investigate relationships in the areas where intermingled surface and ground waters are commonly used in conjunction with each other on the same lands, or lands immediately adjoining, for the same purpose of irrigation; to determine the need for and content of legislation that would provide for integrated administration of all diversions and uses of water within the state, protect all vested water rights, conserve water resources for maximum beneficial use, and permit full utilization of all waters in the state; . . . ."

## PROCEDURE

For the preliminary phase of the study, leading to this report, each of the three groups working on the South Platte were assigned a particular reach of the river. The assignments were: C.W.C.B. Staff to Water District 2, the South Platte from Clear Creek to Kersey; Bittinger and Associates to Water District 1, the River from Kersey to Balzac; and Wright Water Engineers to Water District 64, the River from Balzac to Julesburg at the State line.

To avoid spending a great deal of time in collection of basic data, the instructions were to utilize work already done by various agencies, particularly by the C.W.C.B., the United States Bureau of Reclamation and the United States Geological Survey. This was done, and numerous discussions were held with personnel of these agencies, as well as with personnel of the State Engineer's Office in Denver and in the field. Several meetings were held with groups of water users in Water District 64. Two ditches, Sterling No. 1 and Harmony No. 2, were studied in detail. River operation was analyzed on a daily basis for several months of two years and the results confirmed by discussion with water officials and water users.

A variety of tentative proposals for legislation were formulated. One of these is discussed in Section III of this report. Another is in the Appendix. While the two proposals are similar in many respects, some variation in philosophy exists between the two, and emphasis of particular aspects differs. While the Section III proposal is preferred, both are presented for review.

A brief summary of the factual water situation in District 64 is presented in Sections IV, V, and VI of this report. This information is an outcome of the investigations made as a part of this assignment.

## SECTION II

## CONCLUSIONS

The investigations performed relative to water utilization and water availability in the Lower South Platte Valley have resulted in a number of basic conclusions, some of which would apply to all river basins of the State, and others which apply primarily to the study area. The conclusions are:

1. The present utilization of Colorado's water resources is neither as efficient nor as effective as it should be.

2. Additional water is available which can be put to beneficial use. Large quantities of transient ground water storage exist along several rivers which can be used to good advantage to help balance out seasonal surface supply variations.

3. The existing use of ground water by well owners has many uncertain aspects which presently make these supplies undependable.

4. A continued threat exists to owners of vested surface water rights because of uncontrolled and increased well pumping.

5. Water resources and the physical mechanisms for better utilization of our water resources exist, or could be constructed, which would provide for a more dependable water supply and/or increased water use.

6. Irrigation of additional lands will tend to decrease the quality of the river water downstream.

7. An opportunity exists for river basin authorities to provide more water for beneficial use, and to improve the dependability of that now being used.

## SECTION III

## TENTATIVE PROPOSAL FOR INCREASED WATER UTILIZATION

SUMMARY

1. A River Basin Authority shall be formed in each major river basin of the State, each authority being permitted to have sub-districts to facilitate administration and allocation of water.

2. The River Basin Authority shall have the power of condemnation, the power of taxation, and the authority to acquire direct flow rights and operate recharge ditches, the authority to acquire storage rights and to operate reservoirs for the purpose of increasing water availability, to drill and operate wells and pumping plants, and to acquire and to operate existing wells and pumping stations.

3. The River Basin Authority shall establish an office which is properly staffed and properly equipped. The office shall have the means available for computing the legal availability of water to the various decrees in the river basin.

4. All vested water rights shall be fully protected.

5. All tributary wells as herein defined shall be brought into the water administrative system.

6. The owners or board of directors of ditches shall acquire administrative control over all water wells located on lands under the ditches.

7. Wells located on lands not under ditches shall be permitted to associate with ditches for administrative control; however, groups of well owners at their option may form water well associations to provide for administration of wells.

8. The River Basin Authority may provide water from alternate sources to supply vested rights having a legal availability to such water. The extra cost of furnishing such water from alternate sources shall be at the expense of the Authority.

9. Vested water rights, both direct flow and storage, shall be quantified in terms of acre feet on the basis of beneficial use and historic diversions.

10. Water diverted from wells or under surface water rights whose priority is not in the river, or when such water is in addition to that legally available under the Appropriation Doctrine, shall be paid for on an acre foot basis to the River Basin Authority at a rate to be determined by the River Basin Authority. Industrial and municipal water use shall be provided with a higher dependability of delivery factor than agricultural water and charges for such water use shall be appropriately higher than for the agricultural use.

11. Ditches would acquire alternate points of diversion at well heads.

DISCUSSION

1. The River Basin Authority. A River Basin Authority would be formed in each river basin of the State. This Authority would be made up of water users and run by the water users. Appointments to the board of directors of the Authority must be made with great forethought and care so as to avoid any undue control by special interest groups.

   In order to provide for ease in administration and allocation of water, each Authority would be permitted to form sub-districts which could be conterminous with present water districts. In many cases, several water districts would be combined into an Authority Sub-District at the discretion of the Authority.

   For continuity between Authorities within the State, a representative from the Colorado Water Conservation Board would automatically become a member of each board of directors.

   In order to insure the administration of water under the laws of the State of Colorado, the State Engineer would continue to act in his present capacity and would thus not be represented in the River Basin Authority, except in an advisory manner.

2. River Basin Authority Powers. The River Basin Authority would be quasi-municipal in nature. In order to properly develop and allocate the water resources of the State, the Authorities would be given the power of condemnation. In only rare instances should actual condemnation be used, and in such cases it must be brought to bear only with great judiciousness. It is believed that condemnation proceedings would only be brought in such instances where specific well fields were required for the public good, where it was necessary to acquire specific junior water rights needed for ground water recharge, and where disputes arose over the quantification of water rights.

   The River Basin Authority would have the power of taxation, though taxation would be resorted to only in instances where it was absolutely necessary to retain fiscal integrity. An important purpose of having the power of taxation would be to permit advantageous interest rates should bonding become necessary to finance major works or acquisitions.

   The Authority would be given the power to acquire direct flow rights and operate recharge ditches along with the power to acquire storage rights and to operate reservoirs. Specifically, legislation would be passed in order that certain reservoirs might be acquired which are presently owned by districts and where bonds are still outstanding which had been issued to finance the construction of the reservoir. Acquisition of direct flow rights would be limited to those rights which are generally junior in nature and the use of which is both ineffective and inefficient. When acquiring junior direct flow rights, it is contemplated that alternate points of diversion would be set up for such water rights so that they might be used in the most effective manner for water conservation.

   It is necessary for the Authority to have the power to own and operate wells and pumping plants. These facilities would be obtained both by construction of new facilities and by the acquisition of existing facilities where necessary.

3. Offices. The River Basin Authority must have a properly staffed and equipped office. It is intended that such an office would be staffed by competent water operational personnel and that adequate equipment would include access to computers.

   It is necessary that the office maintain complete records of the water rights in the river basin, together with adequate hydrological reference data. In addition to the normal duties one might expect of such an office, it shall be equipped to determine water calls and to determine decrees in the river under historic conditions representing conditions prior to the major well impact.

4. Appropriation Doctrine. It is necessary that all vested water rights under the Appropriation Doctrine be fully protected. Minor modifications to the Appropriation Doctrine to permit quantification of water rights and to facilitate maximum water utilization would be made; however, compensation would be paid to those whose rights were materially adversely affected.

5. Adjudication of Wells. It is necessary to bring all tributary wells into the water administrative system that have a yield of over 25 gpm. The River Basin Authority would accept petitions from well owners, of which the Well Registration would form a part, and make whatever investigations were needed to verify the well data furnished. The petitions for adjudication of the wells would include data on the historic beneficial use in terms of rate of flow, quantity, and appropriation dates.

   The River Basin Authority would hold hearings and either verify the data furnished or determine new data relative to the correct volume, rate of flow, and appropriation date for each well. The hearings would primarily be to permit aggrieved well owners to be heard and present evidence in their behalf.

   Compensation as recommended by legal counsel would be offered those whose well rates and volumes of flow were reduced from apparent historic amounts. Where no agreement could be reached, the matter would be settled by the Court in a condemnation proceeding.

   Upon completion of the fact gathering, the petitions would be submitted to the Court by the Authority for adjudication without further testimony. Those disputed petitions would be submitted after settlement.

   Each well would be adjudicated with a volumetric limitation and a maximum rate of flow. Wells with appropriation dates prior to May 1, 1957, would be assigned the first adjudication date following the appropriation date for the Water District in which the adjudication is being held. Wells with appropriation dates subsequent to May 1, 1957, would be lumped together in a new general adjudication.

   Tributary wells must be adequately defined. It might include those wells having a 20 percent effect upon the river within a 12-month period as determined by the River Basin Authority. These remote alluvial or terrace material aquifers in the hydraulic system of the river are necessary for use by the River Basin Authority in order to properly manage the water resources.

6. Administrative Control of Wells. The thousands of individual wells cannot be effectively administered by a River Basin Authority, and for that reason it is considered necessary for all irrigation water wells situated on lands lying under a ditch to be administered by the ditch. Administrative control would not mean ownership of the wells by the ditch, but on the other hand such ownership would not be precluded.

The administrative control of the wells by the ditch must be adequate enough so that the ditch could exercise the control for the Authority as to wells which were to be pumped under the decrees of the ditch and so that the ditch would have adequate knowledge and records of the rate and amount pumped from all individual wells. Data relative to the pumping of wells would be submitted at periodic intervals to the River Basin Authority by the ditch organization. Wells which are located on lands adjacent to a ditch which were constructed to serve lands supplied water by the ditch would be treated as if they were located on lands under the ditch.

7. Wells Not Under Ditches. It will be determined that numerous tributary wells exist which are not located under active ditches. These wells would be permitted by the River Basin Authority to associate with ditches for administrative control, or groups of well owners might form well associations to provide for the administration of wells in a manner similar to that by the ditches.

The primary reason for grouping of wells either under ditches or in their own associations is to eliminate costly detailed work by the Authority and to provide a responsible organization which would administer the use of wells and the payments, where required, for such water used by the wells.

In Water District 64 it is to the advantage of the State to shelter as many wells as is possible under ditch decrees having appropriation dates earlier than June 14, 1897. The protective wing of such ditches should be extended to these wells with the encouragement of the Authority. The volumetric limitation based on historic conditions would preclude expanded use of decrees without payment for the water, but Nebraska water demands on junior wells would be at least partially eliminated as a potential problem. It is presumed that the water rights not now fully exercised would be used for this purpose.

8. Alternate Water Sources. The River Basin Authority would be permitted to supply vested water rights from alternate sources which would include exchange water, water from wells, releases from reservoirs, and other sources deemed suitable by the Authority. The extra cost of furnishing such water, where such supply would be available to the owner of the water right under the Appropriation Doctrine, and under historic conditions, would be covered by the River Basin Authority funds.

In Water District 64 it is presumed that the Authority would acquire Prewitt Reservoir and use this reservoir, along with releases from North Sterling and Julesburg, to furnish a portion of the replacement water needed to permit junior diversions by wells and ditches below Sterling in order not to be in violation of the compact.

9. Quantification of Water Rights. In order to provide for increased effective use of the natural water resources, and to provide better administration, all water rights would be quantified in terms of acre feet. The River Basin Authority would act as a referee in this matter in a manner similar to that for adjudication of wells. The power of condemnation of the Authority would be used to help overcome constitutional problems which might arise. The quantification would be based upon beneficial use as well as the historic diversions. The quantification of the water rights would not negate the rate of flow limitations established in the decrees for the water rights.

At times the Authority would recommend diversions by ditches for aquifer recharge purposes. Such water use would not be charged to the quantity limit.

10. Water Payment. Water diverted under water rights which are adequately senior, so that at any given time water would have been legally and physically available under historic conditions, would be diverted with no payment being made to the River Basin Authority.

Water taken by direct flow diverters from wells or by ditches, which would not be available under strict administration under the Appropriation Doctrine, would be paid for by the diverter to the Authority at rates set by the River Basin Authority adequate to cover budgetary requirements. Such rates would be flat rates for all agricultural water users, except that the Authority may establish different rates for sub-districts where it is shown that area-wide consumptive use requirements are significantly different from the average. It is contemplated that in the South Platte valley only those water users in South Park and in other high mountainous basins would be charged a lower rate because of their significantly smaller depletions per acre foot of water diverted.

It is mandatory that industrial and municipal water use, where such water supplies are not legally available under the Appropriation Doctrine at any given time, would be charged a significantly higher acre foot amount than the agricultural user. With this higher rate per acre foot would also go a higher dependability factor as to allocation of water by the River Basin Authority.

It is believed that agricultural water use rates would be in the range of $5.00 per acre foot, while industrial and municipal water would be in the range of $10.00 to $20.00 per acre foot. These figures are presented only for generalized purposes and are not based upon the necessary studies and cost estimates which would be required prior to the settling of rates by the River Basin Authority.

11. Alternate Points of Diversion. Designation of wells as alternate points of diversion for ditch decrees shall be encouraged and facilitated. In such matters the River Basin Authority would act as a referee in a manner similar to that for the adjudication of wells. Alternate points of diversion would provide the shelter of surface decrees to well pumping, though they would not permit ditches to increase their burden on the stream utilizing the new and additional diversion facilities made available without payment to the Authority. Increased diversions over the historic conditions would be handled as new water being made available by the River Basin Authority.

IN CONCLUSION, the intent of the proposal presented is to make more water legally available, when needed, under an organized and properly managed Appropriation Doctrine system. Those water users benefiting from the efforts of the River Basin Authority would pay for value received. In making more water available and providing for better distribution of the water, certain vested rights may be shorted. The River Basin Authority would make up these shortages or provide compensation.

Wells being pumped under a ditch in excess of the ditch decree, or in excess of that rate or volume historically available to the ditch, may continue to pump water as such water is determined to be available without injury to the system; however, payment for such water would be made to the River Basin Authority.

It is believed that the River Basin Authority can make general water supply projections prior to the irrigation season as to how much water is available for the irrigation season, taking into consideration all sources. It is believed fairly reliable estimates can be made as to which water users can take their full amount of water volumetrically decreed, or additional water, without further detailed regulation during the irrigation season. The effort of the River Basin Authority during the irrigation season would be aimed at recording water used, for management and payment purposes, and not at the distribution of water, except for supplying water from alternate sources to leave users with vested rights whole.

In general, at least initially, the development of new and alternate sources of water by the River Basin Authority would be limited to furnishing make-up water to those with vested water rights who are shorted as a result of the additional water taken by those with means to make such additional diversions, though new wells would not be discouraged.

The River Basin Authority shall have the opportunity to intercept a water call and to make alternate water available to satisfy the call, or to pay compensation, prior to the call being put on the river. In lieu of the water being supplied, or compensation being paid, the call will be placed on the river by the State Engineer and appropriate wells and ditches shut down to supply the water.

## SECTION IV

## WATER REQUIREMENTS AND SUPPLY

The annual stream flow in Water District 64 plus the magnitude of the ground water reservoir is ample in general and on an annual basis to provide an adequate water supply to today's irrigation requirements. However, the seasonal distribution of the surface flow does not correspond with seasonal water requirements. Also, under present law the ground water aquifer cannot be properly utilized on a firm basis. Furthermore, the aquifer is not available physically to all water users. While one farmer is able to pump, for example, three cubic feet per second from a well adjoining his fields, another man may have no ground water available at all.

### WATER REQUIREMENTS

Irrigated acreage in Water District 64 by classes of land is shown in Table IVA. Water use in the District is predominantly agricultural.

Overall irrigation water requirements have been computed based upon consumptive use studies made by the U. S. Bureau of Reclamation. These are tabulated in Table IVB. As noted on the Table, the figures assume a 60 percent farm headgate efficiency for all lands, a 30 percent reservoir outlet loss for North Sterling, and a 20 percent canal loss for all river diversions within the district. Actual farm headgate efficiency, of course, is not a uniform 60 percent, but will vary appreciably. Also, the 20 percent canal loss factor for diversions within the District is an estimated overall figure, and the loss for any particular canal could vary appreciably from this. The figures do, however, give an approximate dimension of the water requirement.

In order to approximate water requirements for individual ditches, Table IVC has been prepared, based upon the U. S. Bureau of Reclamation study of the area of the South Platte below the Narrows Dam site for the 1947 to 1961 period. Crop consumptive use, both gross and net, are shown on an annual basis and for each month, April through October, of the irrigation season. High, average and low values are given. The Bureau's figures are based upon a combination of the Thornthwaite and Lowry-Johnson methods. The acre feet of water required per acre of crop land as consumptive use given here are general for an overall crop pattern. The requirements of particular crops will vary somewhat from the figures shown.

The Bureau of Reclamation and the Agricultural Research Service are currently preparing a more refined method of computing crop consumptive use, known as the Jensen-Haise method. Any future water management of the river which might seek to apportion water more or less on the basis of current crop requirement would probably utilize Jensen-Haise or one of the other contemporary methods. We have briefly tested the Bureau figures shown in Table IVC by computations based upon the Jensen-Haise method. We found that for gross, overall purposes the Bureau's figures are adequate. Table IVC also uses an irrigation efficiency of 60 percent and provides alternate values for river headgate requirements based upon varying canal losses.

## WATER SUPPLY

A summary of annual irrigation water supply is shown in Table IVD. Total water supply, Column 6, averages 292,000 acre feet per year. This is less than the average annual river headgate requirement as seen on Table IVB of 326,000 acre feet per year. It should be noted that during the early years, 1947 - 1956, there were many fewer wells than today. The ground water aquifer was less well utilized. The ground water pumping figure shown in Column 5 and also included in Column 6, for 1962 - 1966, was projected from the Bureau's work rather conservatively. That is, pumping in the last five years of the table may be somewhat higher than shown. The gap between total water supply and total water requirement can be overcome upon paper rather easily. However, the actual gap when looking at periods shorter than one year is greater than given in these two tables. Total water supply in Column 6 includes diversions in May and June that are frequently in excess of water requirements in those months. Figure IV-1, made from Table 3, shows ground water pumping, direct flow surface diversions, combined ground water and surface diversions, and total water supply as well as annual discharge of the South Platte at Balzac for the 20 year period. There has been a slight downward trend in surface diversions, a pronounced upward trend in ground water pumping, and a slight upward trend to combined diversions. A more detailed study might shift the lines somewhat, particularly as regards pumping which we believe may be higher than shown here.

The peaks in the curve of Balzac flows represent water that generally is excess to diversion capabilities within Colorado. The monthly distribution of Balzac flows is shown in Table IVE for the irrigation year, November through October.

These peak flows or a portion of them might be retained within Colorado by a major storage project such as Narrows Reservoir. The Bureau of Reclamation's calculations show that the average annual flow at Julesburg would be reduced from 315,000 acre feet to 230,000 acre feet by operation of Narrows Reservoir. A smaller portion of the excess might also be retained within Colorado within the ground water storage reservoir. That is, greater pumping from the aquifer in low flow months would lower water levels in the aquifer and make room for additional storage. To make use of such alluvial storage capacity, it will be necessary to follow a program of active recharge rather than depend upon natural recharge from stream flow.

The foregoing discussion has dealt with averages and with overall figures for the water district. However, the district is not a large project which can be dealt with as a whole. The problems encountered, although sometimes general, relate to specific farms, ditches, and water rights. It should also be noted that Water District 64, the subject of this preliminary report, is not an entity in itself, but will be greatly influenced by what occurs upstream. Thus, it is necessary to look both at details and at the entire basin. The preliminary study did go into considerable detail. The subsequent study will focus upon the basin as a whole.

TABLE IV-A

PRODUCTIVE ACREAGE HISTORICALLY IRRIGATED BY DITCHES & RESERVOIRS*
Water District 64

| | | Historically Irrigated | | | Non-Irrigated Irrigable**** | Total All |
|---|---|---|---|---|---|---|
| | | Classes 1,2,3 acres | Class 6W acres | Total acres | Classes 1,2,3 acres | Classes acres |
| **1. | Within Water District | 93,000 | 25,000 | 117,000 | 20,000 | 137,000 |
| **2. | North Sterling Irrigation District. Lands are located within Water District 64. Diversions to North Sterling Reservoir are made out of South Platte River in Water District No. 1. | 30,000 | 4,000 | 34,000*** | 14,000 | 48,000 |
| **3. | Lands irrigated by diversions within Water District 64 | 63,000 | 21,000 | 83,000 | 6,000 | 89,000 |

*Includes pump irrigated land lying under ditches. Excludes pump irrigated land lying above & outside the historic ditch system.

**Land classification figures are based upon U.S.B.R. study of "Productive" or "Net Irrigable" acreage which is about 94% of "Gross Irrigable" acreage.

***Lands taxed within North Sterling Irrigation District total 41,000 acres.

****This category is not "new land" that has never been irrigated. It has received irrigation water so infrequently that it is considered to be non-irrigated.

TABLE IV-B

TOTAL IRRIGATION WATER REQUIREMENTS
Water District 64
Based upon U.S.B.R. Crop Consumptive Use Figures,
60% Farm Headgate Efficiency,
a 30% Reservoir Outlet Loss for North Sterling, and
a 20% Canal Loss for Diversions within the District

| Category | Productive Acreage acres | Farm Headgate Irrigation Water Requirement | | | | River Headgate or Reservoir Outlet Irrigation Water Requirement | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Annual Average ac.ft. | Annual High ac.ft. | July Average ac.ft. | July High ac.ft. | Annual Average ac.ft. | Annual High ac.ft. | July Average ac.ft. | July High ac.ft. |
| Historically Irrigated Class 1, 2, 3 & 6W land within W.D. 64 | 118,000 | 250,000 | 303,000 | 66,000 | 86,000 | 326,000 | 394,000 | 86,000 | 112,000 |
| North Sterling Irrigation District | 34,000 | 72,000 | 87,000 | 19,000 | 25,000 | 103,000 | 124,000 | 27,000 | 36,000 |
| Lands Irrigated by Diversions within W.D. 64 | 84,000 | 178,000 | 216,000 | 47,000 | 61,000 | 223,000 | 270,000 | 59,000 | 76,000 |

TABLE IV-C

AGRICULTURAL WATER REQUIREMENTS PER ACRE
Water District 64
Based upon U.S.B.R. Study of 1947-61 Period

| | Crop Consumptive Use | | Farm Headgate Irrig. Water Requirement | River Headgate Requirement | | | | |
|---|---|---|---|---|---|---|---|---|
| | Gross | Net | 60% Effic. | *U.S.B.R. Canal Loss Pattern | 10% Canal Loss | 20% Canal Loss | 30% Canal Loss | 40% Canal Loss |
| | acre feet/acre | | ac.ft./acre | - - - - - | acre feet/acre | | | |
| Annual | | | | | | | | |
| High | 2.34 | 1.54 | 2.58 | | 2.87 | 3.23 | 3.69 | 4.30 |
| Average | 2.18 | 1.27 | 2.12 | 3.07 | 2.36 | 2.65 | 3.03 | 3.53 |
| Low | 2.06 | 0.88 | 1.46 | | 1.62 | 1.83 | 2.09 | 2.43 |
| April | | | | | | | | |
| High | 0.15 | 0.10 | 0.18 | | 0.20 | 0.23 | 0.26 | 0.30 |
| Average | 0.14 | 0.05 | 0.08 | 0.14 | 0.09 | 0.10 | 0.11 | 0.13 |
| Low | 0.13 | 0.00 | 0.00 | | 0.00 | 0.00 | 0.00 | 0.00 |
| May | | | | | | | | |
| High | 0.29 | 0.20 | 0.33 | | 0.37 | 0.41 | 0.47 | 0.55 |
| Average | 0.27 | 0.06 | 0.11 | 0.20 | 0.12 | 0.14 | 0.16 | 0.18 |
| Low | 0.25 | 0.00 | 0.00 | | 0.00 | 0.00 | 0.00 | 0.00 |
| June | | | | | | | | |
| High | 0.43 | 0.35 | 0.59 | | 0.66 | 0.74 | 0.84 | 0.98 |
| Average | 0.40 | 0.22 | 0.36 | 0.55 | 0.40 | 0.45 | 0.51 | 0.60 |
| Low | 0.38 | 0.09 | 0.15 | | 0.17 | 0.19 | 0.21 | 0.25 |
| July | | | | | | | | |
| High | 0.54 | 0.44 | 0.74 | | 0.82 | 0.93 | 1.06 | 1.23 |
| Average | 0.50 | 0.34 | 0.56 | 0.77 | 0.62 | 0.70 | 0.80 | 0.93 |
| Low | 0.48 | 0.20 | 0.34 | | 0.38 | 0.43 | 0.49 | 0.57 |
| August | | | | | | | | |
| High | 0.48 | 0.43 | 0.72 | | 0.80 | 0.90 | 1.03 | 1.20 |
| Average | 0.44 | 0.33 | 0.54 | 0.70 | 0.60 | 0.68 | 0.77 | 0.90 |
| Low | 0.42 | 0.25 | 0.41 | | 0.46 | 0.51 | 0.59 | 0.68 |
| September | | | | | | | | |
| High | 0.30 | 0.28 | 0.47 | | 0.52 | 0.59 | 0.67 | 0.78 |
| Average | 0.28 | 0.20 | 0.33 | 0.45 | 0.37 | 0.41 | 0.47 | 0.55 |
| Low | 0.27 | 0.10 | 0.16 | | 0.18 | 0.20 | 0.23 | 0.27 |
| October | | | | | | | | |
| High | 0.16 | 0.13 | 0.22 | | 0.24 | 0.28 | 0.31 | 0.37 |
| Average | 0.15 | 0.09 | 0.14 | 0.26 | 0.16 | 0.18 | 0.20 | 0.23 |
| Low | 0.14 | 0.00 | 0.00 | | 0.00 | 0.00 | 0.00 | 0.00 |

*April 42%, May 44%, June 34%, July 27%, August 23%, September 26%, October 38%

TABLE IV-D

SUMMARY OF ANNUAL IRRIGATION WATER SUPPLY 1947-1966
Water District 64
All values rounded to the nearest 1000 acre feet

| Year | 1 Direct Flow Surface Diversions Below Balzac | 2 Prewitt Reservoir Releases | 3 North Sterling Reservoir Releases | 4 Julesburg Reservoir Storage Under Storage Decree | 5 Ground Water Pumping | 6 Total Water Supply | 7 Annual Discharge South Platte at Balzac Oct.-Sept. |
|---|---|---|---|---|---|---|---|
| 1947 | 153 | 12 | 72 | 15 | 14 | 266 | 478 |
| 48 | 197 | 14 | 92 | 13 | 16 | 332 | 350 |
| 49 | 160 | 10 | 75 | 12 | 21 | 278 | 514 |
| 1950 | 190 | 15 | 65 | 14 | 24 | 308 | 88 |
| 51 | 174 | 8 | 63 | 6 | 24 | 275 | 116 |
| 52 | 171 | 16 | 79 | 13 | 29 | 308 | 221 |
| 53 | 179 | 15 | 68 | 5 | 28 | 295 | 82 |
| 54 | 164 | 5 | 57 | 10 | 52 | 288 | 60 |
| 55 | 150 | 2 | 44 | 22 | 55 | 273 | 71 |
| 56 | 161 | 0 | 43 | 18 | 72 | 294 | 80 |
| 57 | 165 | 9 | 82 | 24 | 33 | 313 | 376 |
| 58 | 136 | 14 | 75 | 16 | 35 | 276 | 608 |
| 59 | 122 | 17 | 73 | 15 | 57 | 284 | 173 |
| 1960 | 142 | 21 | 78 | 14 | 62 | 317 | 147 |
| 61 | 108 | 12 | 75 | 18 | 44 | 257 | 307 |
| 62 | 155 | 13 | 79 | 11 | 55 | 313 | 539 |
| 63 | 156 | 15 | 72 | 13 | 74 | 330 | 129 |
| 64 | 140 | 5 | 53 | 3 | 84 | 285 | 71 |
| 65 | 100 | 3 | 61 | 28 | 63 | 255 | 433 |
| 66 | 107 | 19 | 69 | 12 | 80 | 287 | 279 |
| 20-Year Averages | 152 | 11 | 69 | 14 | 46 | 292 | 256 |

Notes:
Column 2 Because of high seepage loss, Prewitt contributes much more water than shown.
Column 3 Reservoir & outlet canal losses are included in these figures.
Column 4 Water stored or passed through Julesburg Reservoir under Harmony No. 1 decree is not included here, but is included in Column 1.
Column 5 Figures for 1947-1961 are from U.S.B.R. study. Figures for 1962-66 are projections by W.W.E.
Column 6 This is the sum of Columns 1 through 5. No adjustment has been made for changes in Julesburg Reservoir year-end storage levels.

TABLE IV-E

SURFACE FLOWS AT BALZAC GAGE IN ACRE FEET

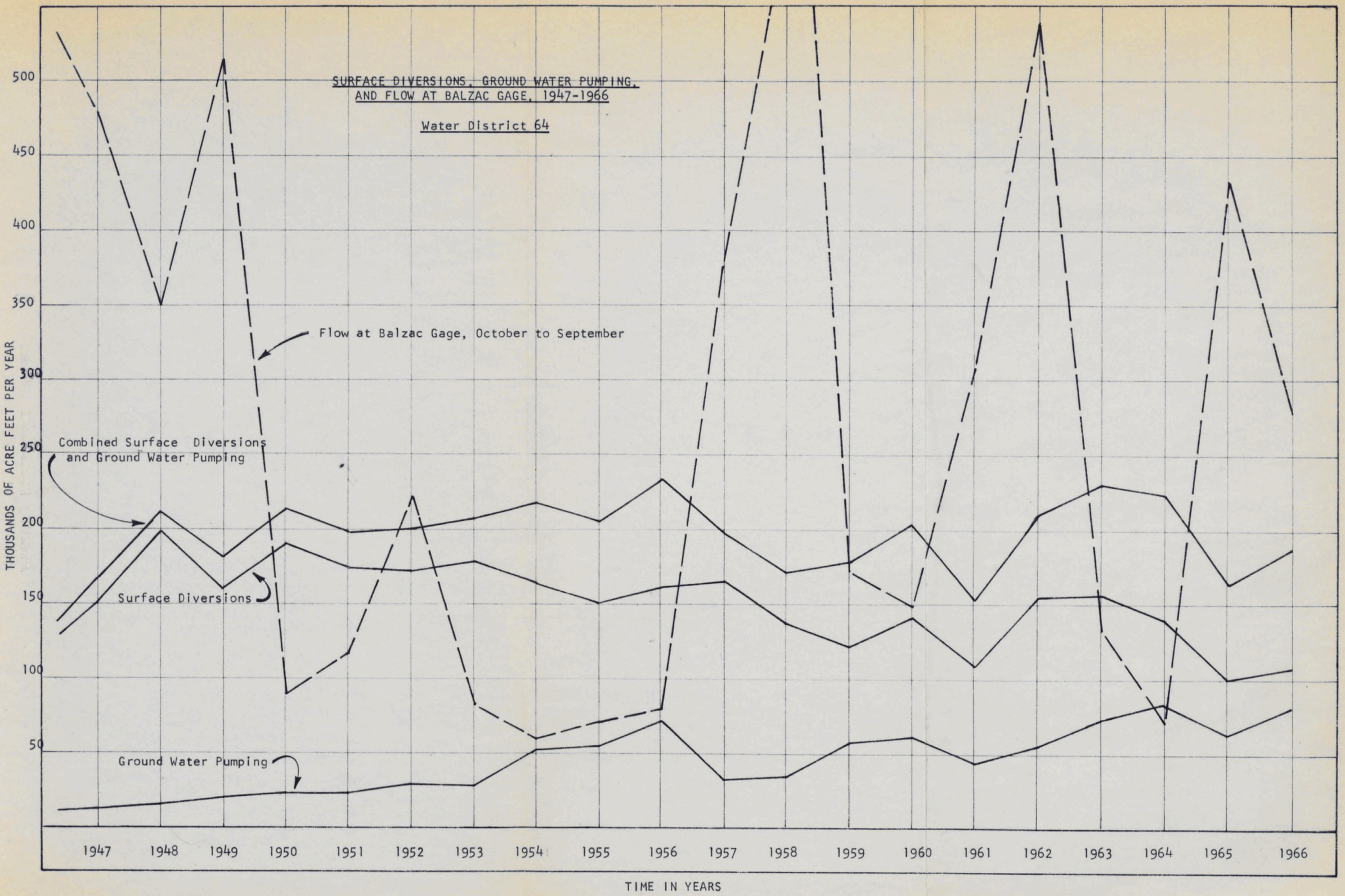
Irrigation Year, November - October

| Year | Nov. | Dec. | Jan. | Feb. | March | April | May | June | July | Aug. | Sept. | Oct. | Annual Irrigation Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1961 | 700 | 700 | 800 | 800 | 1,600 | 4,800 | 58,400 | 182,900 | 14,200 | 14,600 | 22,600 | 75,400 | 377,500 |
| 1966 | 41,400 | 38,000 | 42,000 | 41,500 | 8,800 | 3,200 | 5,400 | 6,000 | 8,700 | 9,300 | 17,700 | 17,000 Est. | 239,000 |
| 1947-61 15-year Average | 2,000 | 2,500 | 8,000 | 10,100 | 17,100 | 17,500 | 54,600 | 80,600 | 17,800 | 15,800 | 13,300 | 5,300 | 244,600 |

Figure IV-1

SURFACE DIVERSIONS, GROUND WATER PUMPING, AND FLOW AT BALZAC GAGE, 1947-1966

Water District 64



## SECTION V

## DITCH AND RESERVOIR SYSTEM.

The historic irrigation water supply system in Water District 64 consists of: mainstem ditches, reservoir irrigation districts, individually owned farm pumps, and tributary and seepage ditches. A relatively recent addition to this historic system is a number of wells serving individual farms that lie outside of and above the historic ditch-reservoir system.

### MAINSTEM DITCHES

The 80-mile length of the South Platte River in Water District 64 from Balzac to the Nebraska line contains 34 decreed mainstem ditches of which three appear to have been out of existence for many years. About 20 of the 34 divert from the river more or less regularly. The remainder divert occasionally or not at all from the surface flow of the mainstem. Some of these ditches are inactive, but others are in existence and are used to carry inflow from higher ground, and in some cases to carry pump water. Because of inadequate river flow during much of the irrigation season, these junior ditches have given up the effort and expense required to maintain sand diversion dams at their river headgates. Farmers under these ditches have apparently found that it is convenient and economic to install pumps for a physically, though not legally, dependable supply than to rely upon the river's surface flow which is an undependable physical supply.

The mainstem ditches have appropriation dates ranging from 1872, at the most senior, to 1904. There is seldom water available to a 1904 decree during the irrigation season. For most purposes, the date which serves as a lower limit to legal diversions is that contained in the South Platte River Compact, which is June 14, 1897. The Compact is discussed in Section VII of this report.

A list of mainstem ditch decrees appears in Table V-A.

Several ditches are what are called "early and late" ditches. This means that the physical flow available at their headgates during the irrigation season, in conjunction with their appropriation dates, is such that they can in most years divert only early or late in the season and frequently not late, if the demand by senior ditches is sustained through the late summer. These early and late ditches have gone heavily to pumping for a dependable supply. However, not only these junior ditches have gone to pumps for a physically dependable supply of water. Under all but a few mainstem ditches, most farmers rely on pumping to provide adequate water in mid-summer when crop requirements are the highest. One noteworthy exception to the general rule of the dependency upon pumps is the Sterling Irrigation Company Ditch, or Sterling No. 1. There are relatively few pumps under this ditch, and the explanation can be seen in the surface water decree. Sterling No. 1 has a 7-15-73 decree for 113.9 cfs which is satisfied most of the time. The contrast between Sterling No. 1 and Farmers Pawnee Ditch is instructive. Both ditches are at the upper end of the Water District on the north bank of the river. The total amount of the water decreed to both ditches is approximately the same per acre irrigated. Both have decrees that are able to call water down from Water District 1. However,

Farmers Pawnee has 14.4 cfs of 1873 water, and 126 cfs of 1882 water. The 1882 water is not firm in low flow periods. Almost every farmer under the Pawnee has one or more pumps. Well pumping is discussed further in Section VI of this report.

The location of a decreed right along the stream influences the extent to which a right of a given date is able to divert water. Here again the Farmers Pawnee 1882 right illustrates the point. Although it is upstream and senior to the Iliff and Platte Valley's 1883 decree, the Iliff 1883 is able to divert more water in a dry August than Pawnee's 1882. Another example is Peterson Ditch at the lower end of the District with an 1895 right, which is frequently able to take water when upstream ditches senior to it are out. The explanation is that a large part of the diversions made within the Water District are dependent upon return flow to the stream within the District. Farmers Pawnee has to pass water down to the Sterling No. 1 which pretty well dries up the stream in low flow months. However, the stream gains below the Sterling No. 1 headgate so that Iliff can take water on its 1883 decree. Furthermore, Iliff is not required to pass water downstream to anyone. Similarly although the stream has dried up at several headgates upstream of Peterson, there is sufficient gain so that the Peterson 1895 right is able to divert 50-70 cfs when the river upstream will not support smaller diversions by more senior ditches.

Although flow at Julesburg is generally less than at Balzac, the river gains a great deal of water between the two points when diversions are taken into account. Water enters the District via:

a. Surface flows in the River measured at the Balzac gage.
b. Subsurface river flows that are not measured.
c. Storage in Prewitt Reservoir, measured as recorded releases or as changes in reservoir storage level, but not as inlet canal diversions.
d. Storage in North Sterling Reservoir, measured as recorded releases or as changes in reservoir storage level, but not as inlet canal diversions.
e. Return flow from Prewitt and North Sterling inlet canals and irrigation return flow from the direct flow ditches which divert above the Balzac gage.

Measured inflow and outflow for July, 1961, is shown in Table V-B. The sum of surface diversions between Balzac and Julesburg was 40,500 acre feet. Surface flow at Balzac plus Prewitt releases to the River were 17,000 acre feet. Thus the apparent gain to river flow was 23,500 acre feet and this does not include losses to river flow from phreatophyte growth or ground water pumping. The gain of 23,500 acre feet is based upon diversions, but there was also 8,200 acre feet flowing out of the District at the Julesburg gage. The total apparent gain was 31,700 acre feet. Of this, perhaps 4,200 acre feet was water lost to Prewitt Reservoir by seepage. Another source was return flow from the 19,500 acre feet released by North Sterling. Return flow from Julesburg Reservoir releases would account for a portion, as would return flow from irrigation under direct flow diversions. There is also natural inflow to the basin.

The ditches in Water District 64 sufficiently senior to the Fort Morgan and Weldon Valley ditches in Water District 1 are all at the upper end from Sterling west. It is possible for one of the downstream ditches, such as Harmony No. 1, to place a call on Juniors in the upstream water district, but this is an unusual circumstance. Thus, while there are calls upon Water District 1 downstream as far as Sterling No. 1, there are, with a rare exception, no calls from the lower end of the river in Colorado. This comment refers to direct flow calls. Julesburg Reservoir's 1904 storage decree is in a position to make calls extending far upstream upon other storage rights and upon wells, however, it is primarily supplied by winter return flow.

Up until 1966, there were few calls from Water District 64 to Water District 1 that went through the Denver office of the Division Engineer. See Table V-C. This is because the calls were handled by the respective water commissioners in an informal manner. Sufficient water was passed downstream to give the seniors in Water District 64 what they had coming, given the current condition of the river, without placing a formal call on the river. It is likely that this kind of river management reduced futile calls. A futile call is defined as one which requires a much larger amount of water to pass the headgate of an upstream junior than is received by the downstream senior.

All of the direct flow ditches junior to the Compact have over the years adjusted to the fact by giving up river diversions in favor of pumping. The active impact of the Compact today is upon Julesburg Reservoir. The Reservoir is not able to store between April 1 and October 15 when the Compact requirement of 120 cfs at the gauge is not met. There are times when the demands of direct flow ditches downstream of Harmony No. 1 headgate are met and Julesburg could store except for the Compact requirement.

The physical arrangements of the mainstem ditches is characterized by a great deal of over-lapping. Much of the irrigated ground lies under more than one ditch and on the north side of the river. Almost all of the irrigated ground lies below the canals of the Julesburg and North Sterling Irrigation Districts. The North Sterling inlet canal and outlet canal, Harmony No. 1 and Julesburg Highline Canal are, geographically, highline ditches extending the full length of the Water District on the north bank. The extreme example of over-lapping is in the vicinity of the Town of Sterling. Here, in descending order, are the North Sterling Inlet, Pawnee, Springdale, Sterling No. 1, Sterling No. 2, and the Lowline. This over-lapping provides the physical basis for possible ditch consolidation or transfer of downstream rights to headgates upstream to serve the same grounds.

## IRRIGATION DISTRICTS

In addition to the mainstem ditches in the Water District, there are three irrigation districts, each of which has its own reservoir. They are Prewitt Irrigation District, North Sterling Irrigation District, and Julesburg Irrigation District.

The Prewitt District provides supplemental water to individual right owners located under 14 of the mainstem ditches. With one exception, releases from Prewitt are made to the river and the water is then re-diverted at the ditch headgate. The one exception is the release to the South Platte Ditch which

does not reach the river. Mainstem ditches which are included within the Prewitt Irrigation District are the South Platte, Farmers Pawnee, Davis, Schneider, Springdale, Sterling No. 2, Bravo, Farmers, Iliff and Platte Valley, Lone Tree, Powell, Harmony No. 2, Ramsey, and Harmony No. 1. Most releases to these ditches are made in July and August.

Prewitt Reservoir, although physically located in Water District 64, is decreed in Water District 1 since the headgate of its inlet canal takes water out of the river in Water District 1. The active capacity of the reservoir is about 27,000 acre feet. The recorded releases that benefit the right owners are usually appreciably less than 27,000 acre feet a year, as can be seen in Table IV-D. This is because the reservoir leaks at a high rate. This seepage is diverted as stream flow by Davis Brothers Ditch up to its entitlement, the balance reaches the River, where it is available to other ditches according to their priority. Sterling No. 1, which is not included within the irrigation district, receives a large portion.

The North Sterling Irrigation District lies entirely on the north side of the River and the lands within the District are above the mainstem ditches. This District does not provide supplemental water, but is the sole source of water to the land within it. It should be pointed out, however, that North Sterling does provide supplemental water in a sense to lands lying outside the District insofar as mainstem ditches lying under the outlet canal receive an appreciable amount of inflow from North Sterling return flow. Both the inlet and the outlet canals probably contribute to ground water recharge as well as to seepage water intercepted by ditches below them. The North Sterling Irrigation District comprises some 41,000 acres for tax purposes. The District is served by water stored in North Sterling Reservoir, also known as Point of Rocks Reservoir. The Reservoir's decrees are tabulated in Table V-D. Capacity of the reservoir is approximately 71,000 acre feet. The North Sterling System has a direct flow right as well as storage rights. However, the direct flow right was adjudicated in 1936 with a 1914 appropriation date. Although direct flow water enters into the District's internal administration, the decree is sufficiently junior so that the water commissioners disregard it. Releases from the reservoir for the use of irrigators under the outlet canal are made in proportion to the number of acre rights held by the irrigator. As can be seen in Table IV-B, irrigated acreage under North Sterling comprises 29 percent of the total irrigated acreage in the Water District.

There are 30 odd wells under the North Sterling on record in the State Engineer's office. The land irrigated by North Sterling is on the high ground north of the river and does not lie over the South Platte alluvium. These lands, therefore, do not have available to them the ground water supply that many of the direct flow ditches do. Many of the wells are relatively low yielding. Thus, almost the entire irrigated acreage is dependent upon a reservoir storage decree that is junior to all the mainstem ditches in the area. For an adequate supply of summer irrigation water, it is necessary that the reservoir fill in the early spring, and even with a full reservoir the capacity does not provide as full a water supply as that available to many of the mainstem ditches in high flow years. This marginal irrigation water supply is due both to the late appropriation date and to the high losses experienced in the long outlet canal. The canal losses, of course, improve the supply of other ditches. Filling of North Sterling Reservoir,

as well as of the other reservoirs, is dependent upon the magnitude of winter and early spring flows in the river. As can be seen in Table IV-E, winter flows vary over a very wide range. High winter flows in this reach of the river are largely a function of upstream reservoirs having been filled relatively early. The adequacy of spring flows to fill the downstream reservoirs is a function both of stream flow and the extent to which direct flow rights are taking water.

The third reservoir system serving this area is Julesburg Irrigation District. Julesburg Reservoir, sometimes known as Jumbo Reservoir, has a 1904 storage right for 28,000 acre feet which is also the capacity of the reservoir. Whereas Prewitt Irrigation District supplies supplemental water and North Sterling Irrigation District supplies the entire requirement of its users, Julesburg is a mixed system. The reservoir supplies water to irrigators under the Julesburg Highline who have no other water source, but also supplies users under the Peterson and the Settlers ditches which do have direct flow rights. Furthermore, some users under the Harmony No. 1, the feeder for Julesburg Reservoir, are within the District. Water diverted under the Harmony No. 1 direct flow right not utilized under the ditch are available for users downstream from the reservoir. The direct flow rights in Settlers ditch are junior to the Compact and do not provide any significant quantity of water. The Peterson ditch, however, has an 1895 right which is able, in its reach of the river, to divert appreciable quantities. The Harmony No. 1 and Peterson direct flow rights account for roughly one half of the District's water supply. There are 21,000 acres taxed within the District. Net irrigable acreage is less than this.

The Julesburg Reservoir storage decree is junior to the South Platte Compact. Thus, storage in Julesburg is dependent on the factors discussed above for North Sterling and also upon the river flow at the Julesburg gage downstream of the Reservoir's feeder headgate.

The significance of storage water and the dependency of storage upon winter and early spring flows point up the fact that the South Platte River must be viewed as a 12-month stream. That is, water administration today and any future water management must regard the stream not as a source of water during the irrigation season alone, but as a source of water the year around. With the relatively new factor of the ground water pumping, the old concept of a summer irrigation season and a winter storage season becomes obsolete. Furthermore, future river management integrating ground water and surface water uses would find the division of the year into storage and irrigation seasons to be an impediment.

In this connection it might also be remarked that the present water district boundaries, although necessary for administrative purposes, may not be suitable for water management. The South Platte River is presently broken up into five mainstem districts. Under any scheme of water management, we believe, the river will have fewer parts than it does now. Actually, for many years, the statutory distinction between water districts has in some measure been blurred by informal arrangements between adjoining water commissioners for the management of their reach of the river. The division engineer serves as the supervisor for the entire river, and plays a major role, but there are many day-to-day details which need not go up to the division engineer's level. As between Districts 1 and 64, the effect of this informal river management has been to satisfy the demands of the senior ditches of the upper end of Water District 64 and, at the same time, keeping futile calls to a minimum.

TABLE V-A

CANAL AND RESERVOIR DECREES
MAINSTEM SOUTH PLATTE RIVER
Water District No. 64, Irrigation Division No. 1
Compiled from the Records of the State Engineer's Office of Colorado

| Date of Issue | Name of Ditch | No. | Priority Date | | Amount Sec.Ft. | Remarks |
|---|---|---|---|---|---|---|
| 2-24-03* | South Platte | 1 | 5- 1-72 | P1 | 22.50 | |
| 5-29-97 | Schneider | 2 | 4-10-73 | | 9.00 | Limit. from 4-10 to 7-10 |
| " | Schneider | 2 | 4-10-73 | | 2.00 | " " " " " |
| 3-17-05* | Sterling Irrig. Co. | 3 | 7-15-73 | P1 | 113.90 | |
| 3-29-12 | Pawnee Ditch | 4 | 9-17-73 | P1 | 14.40 | Injunction against Dist. 1 |
| 5-29-97 | Davis Bros. | 5 | 4-10-74 | | 2.00 | Sub-irr. app. 4-10 to 7-10 |
| 7-25-03* | Schneider | 6 | 7-15-75 | P1 | 18.10 | |
| " | Davis Bros. | 6 | 7-15-75 | P1 | 6.90 | Tr. from Schneider & So. Platte Extension |
| 2-24-03* | So. Platte 1st Enl. | 6½ | 2-15-76 | P2 | 7.50 | |
| 7-25-03* | Schneider 1st Enl. | 7 | 10-20-80 | P2 | 15.93 | |
| " | Davis Bros. | 7 | 10-20-80 | P2 | 6.07 | Tr. from Schneider & So. Platte Extension |
| 5-29-97 | Henderson & Smith | 8 | 11-30-80 | P1 | 12.50 | Prior. changed from No. 6 to No. 8 |
| 3-29-12* | Pawnee 1st Enl. | 9 | 6-22-82 | P2 | 126.0 | Injunction against Dist. 1 |
| 11-15-94 | Low Line | 8 | 10-14-82 | P1 | 39.90 | |
| 2-24-03* | South Platte 2nd Enl. | | 4-21-83 | P3 | 20.00 | |
| 5-29-97 | Iliff & Platte Valley | 11 | 10- 1-83 | P1 | 150.00 | Prior. changed from 9 to 11, 5-29-97 |

*Former decree modified - Properly placed in series

TABLE V-A (Continued)

CANAL AND RESERVOIR DECREES DISTRICT 64

| Date of Issue | Name of Ditch | No. | Priority Date | | Amount Sec.Ft. | Remarks |
|---|---|---|---|---|---|---|
| 5-29-97 | Sterling No. 2 | 12 | 6- 7-84 | P1 | 50.00 | Prior. changed from 10 to 12, 5-29-97 |
| " | Springdale | 13 | 7-19-86 | P1 | 62.50 | Prior. changed from 11 to 13, 5-29-97 |
| 2-24-03* | South Platte 3rd Enl. | | 5- 1-90 | P4 | 37.50 | |
| 5-29-97 | Davis Bros. | 15 | 12- 1-90 | P3 | 3.00 | |
| " | South Reservation | 16 | 9-14-92 | P1 | 25.00 | |
| " | Bravo | 17 | 2-21-93 | P1 | 40.00 | Prior. changed from 13 to 17, 5-29-97 |
| 5-29-97 | Powell & Dillon | 18 | 12-12-93 | P1 | 45.00 | Prior. changed from 14 to 18, 5-29-97 |
| 11-10-98 | Ramsey | 19 | 8- 3-94 | P1 | 12.00 | |
| " | Huston | 20 | 9-17-94 | X | 0.00 | All trans. to Lone Tree |
| " | Lone Tree | 20 | 9-17-94 | P1 | 10.00 | Trans. from Huston |
| " | Davis Bros. 1st Enl. | 21 | 9-20-94 | P4 | 20.00 | Prior. changed from 20 to 21, 11-10-98 |
| 7-10-99* | Powell | 23 | 2-19-95 | P2 | 40.00 | Decree of 11-10-98 modified from 34 to 40 sf |
| 9-29-02* | J. B. (Jud Brush) | 24 | 3-11-95 | P1 | 10.00 | |
| " | Harmony No. 1 | 25 | 4-28-95 | P1 | 252.00 | Prior. changed from 24 to 25, 9-29-02 |
| " | Chambers | 26 | 5- 4-95 | P1 | 30.00 | Prior. changed from 25 to 26, 9-29-02 |
| " | Farmers | 27 | 7-11-95 | P1 | 16.00 | |
| " | Lone Tree | 28 | 7-15-95 | P2 | 82.00 | Prior. changed from 26 to 28, 9-29-02 |

*Former decree modified - Properly placed in series

TABLE V-A (Continued)

CANAL AND RESERVOIR DECREES DISTRICT 64

| Date of Issue | Name of Ditch | No. | Priority Date | Amount Sec.Ft. | Remarks |
|---|---|---|---|---|---|
| 9-29-02* | South Platte Ext. | 29 | 4- 1-96 | P5 50.00 | Prior. changed from 27 to 29, 9-29-02 |
| " | Harmony No. 2 | 30 | 5- 3-97 | P1 50.00 | Prior. changed from 28 to 30, 9-29-02 |
| 12- 8-08 | Russel & Sidebotham | 18A | 10-22-90 | 12.00 | 9 sf may be diverted thru Liddle Ditch |
| 12- 8-08 | Liddle | 18B | 10-21-91 | P1 10.00 | |
| 1- 5-11* | Peterson | 23 | 3- 1-95 | P1 184.00 | Subject to 1908 decree |
| 1- 5-11* | Peterson 1st Enl. | 31 | 10-11-97 | P2 350.00 | " " " " |
| 10-23-07 | Red Lion Supply | 29 | 10-31-95 | P1 52.00 | |
| 1-5-11* | Settlers | 32 | 12-13-97 | P1 89.00 | Subject to decree of '08 |
| " * | Settlers 1st Enl. | 34 | 11-10-98 | P2 288.00 | " " " " " |
| " * | Harmony #2, 1st Enl. | 35 | 11- 9-00 | P2 162.00 | " " " " " |
| " * | Pawnee Extension | 36 | 12-16-01 | | No am't specified, system incomplete |
| 6-26-07 | Tamarack | 37 | 4-23-02 | P1 134.00 | |
| 1- 5-11* | Harmony No. 3 | 38 | 5-13-03 | P2 219.00 | Subject to dec. 11-10-08 |
| 3-11-09* | Harmony #1 Ext. & Enl. | 39 | 2-12-04 | P3 450.00 | When diversion does not interfere with prior rights |
| 12- 8-08 | Julesburg Res. | 1 | 2-12-04 | 28,178 | Acre feet Storage |
| 4-23-10 | Batten | 23 | 9-30-94 | P1 25.00 | |

*Former decree modified - Properly placed in series

TABLE V-A (Continued)

CANAL AND RESERVOIR DECREES DISTRICT 64

| Date of Issue | Name of Ditch | No. | Priority Date | Amount Sec.Ft. | Remarks |
|---|---|---|---|---|---|
| 4-23-10 | Sterling-Hereford Cattle Co. | 24 | 11-15-94 | 21.00 | |
| " | Carlson | 25 | 12- 1-94 | P1 16.00 | Court injunction favor of Peterson & Settlers |
| " | Davis Bros. 2nd Enl. | 41 | 5-25-03 | P5 102.00 | |
| " | Cox | 42 | 3-20-07 | 42.50 | |
| 6-11-13 | Hemming House | 38 | 1-22-97 | 10.00 | Jr. to Harmony #1 & #2 |
| " | Long Island | 39 | 2-10-97 | P1 14.50 | " " " " " " |
| " | Long Island 1st Enl. | 51A | 9-20-06 | P2 20.0 | |
| 7- 5-28 | Henderson & Smith Cole Ext. | 106 | 2-17-02 | P2 24.00 | |
| " | Rice | 110 | 4-28-04 | P1 35.00 | |
| " | Bravo Extension | 112 | 4- 1-06 | P2 20.00 | Claim made by ext. of ditch |

TABLE V-B

GAIN IN SOUTH PLATTE RIVER FLOW

Balzac to Julesburg, July, 1961

| | Acre Feet | Acre Feet |
|---|---|---|
| Total Headgate Diversions including rediversion of Prewitt releases | | 40,500 |
| Flow at Balzac Gage | 14,300 | |
| Prewitt Releases | 2,700 | |
| Total, recorded water in River at upper end | | 17,000 |
| Gain in River at last downstream headgate | | 23,500 |
| Flow at Julesburg Gage | | 8,200 |
| Total Gain in River, Balzac to Julesburg | | 31,700 |
| Estimated Contribution to River Gain by Prewitt seepage | | 4,200 |
| North Sterling Reservoir releases | | 19,500 |
| Net reduction in Julesburg Reservoir storage | | 1,100 |
| Estimated well pumping, Balzac to Julesburg | | 13,000 |

TABLE V-C

DIVISIONAL RIVER CALLS ORIGINATING IN W.D. 64
From Division Engineers Call Cards

| Year | Date | Call | |
|---|---|---|---|
| | | Date | Ditch |
| 1950 | 5-27 | 4-28-95 | Harmony No. 1 |
| | 6-18 | 6-14-97 | Compact |
| 1951 | 5-7 | 6-22-82 | Pawnee |
| 1952 | None | | |
| 1953 | None | | |
| 1954 | 4-12 | 6-22-82 | Pawnee |
| 1955 | 10-10 | 4-28-95 | Harmony No. 1 |
| 1956 | None | | |
| 1957 | 5-7 | 4-28-95 | Harmony No. 1 |
| 1958 | None | | |
| 1959 | None | | |
| 1960 | None | | |
| 1961 | None | | |
| 1962 | None | | |
| 1963 | 5-13 | 6-22-82 | Pawnee |
| 1964 | 7-29 | 2-15-76 | South Platte |
| | 8-17 | 10-20-80 | Schneider |
| 1965 | None | | |
| 1966 | 7-4 | 9-17-73 | Pawnee |
| | 7-6 | 7-15-73 | Sterling No. 1 |
| | 7-15 | 7-15-75 | Schneider |
| | 7-23 | 10-20-80 | Schneider |
| | 8-2 | 7-15-75 | Schneider |
| | 8-3 | 9-17-73 | Pawnee |
| | 8-7 | 10-20-80 | Schneider |

TABLE V-D

DECREES OF RESERVOIRS SERVING WATER DISTRICT 64
Listed in Downstream Order

| Date of Issue | Name of Reservoir | Priority No. | Priority Date | Amount Ac.Ft. | Remarks |
|---|---|---|---|---|---|
| 1-5-1922 | North Sterling (Point-of-Rocks) | 53A | 6-15-1908 ② | 69,446 | Decreed in Water District 1 |
| 1-5-1922 | North Sterling | 79 | 8- 1-1915 ④ | 81,400 | The amount shown is accumulative |
| 1-13-1936 | North Sterling | | ⑤ | 84,000 | The amount shown is accumulative, conditional decree |
| 1- 5-1922 | Prewitt | 75A | 5-25-1910 ③ | 32,300 | Decreed in Water District 1 |
| 12- 8-1908 | Julesburg Reservoir. | 1 | 2-12-1904 ① | 28,178 | Decreed in Water District 64, Reservoir feeder canal is Harmony No. 1 ditch. |

# SECTION VI

## GROUND WATER RESOURCE AND PUMPING

### GROUND WATER PUMPING

Ground water pumping plays a major irrigation role in Water District 64. In 1966 pumping diversions were an estimated 80,000 acre feet, as compared to 107,000 acre feet of surface diversions and 19,000 acre feet of releases from Prewitt Reservoir. In July and August of 1966 the volume pumped probably exceeded the volume of surface diversions. 1966 was a year of low surface flows.

Not all irrigators have pumps and among those that do there are differences in the use of well water. The possible categories of availability and use of well water are as follows:

a) Irrigators under junior ditches that have given up direct surface diversions from the River. Some of these ditches pick up return flow or tail water from irrigation above them. Pumping supplies the balance which ranges from 50% to 100% of the water used. Most farms in this situation have pumps, but a few do not.

b) Irrigators under junior ditches that divert through their surface headgate only in periods of relatively high river flow. These are the "early and late" ditches. Except for intercepted return flow, these irrigators take their entire irrigation supply by pumps during most of the irrigation season. Most farms have pumps.

c) Irrigators under ditches that divert all season. Some of these ditches will be called out completely at times during the season. Others will divert constantly but at reduced rates of flow. The percent of farms that have pumps varies over a considerable range from ditch to ditch. Many farms do not lie over the aquifer and hence do not have well water available at the farm.

d) Irrigators under the North Sterling Outlet Canal and the Julesburg Highline Canal. Few of these farms lie over the aquifer and few have pumps.

The increase in ground water pumping in recent years was shown in Table IV-D and on Figure IV-1. Table VI-A lists the number of irrigation wells drilled by year and their reported yield. Table VI-B presents similar information by periods of years for wells of all uses and for irrigation use by periods of years. Figures VI-1 and VI-2 show in graphic form the growth of irrigation wells and their reported yield in the past 40 years. The jump in 1954-1956 is apparently due to the fact that that was a very dry period, and the jump in the early 1960's probably represents both the relatively low flow years of 1963-64, plus an increasing acceptance by irrigators of well pumping costs as a normal cost of farming. The second period shown in Table VI-B is 1954-April 31, 1957. This period starts with a low flow year and terminates in mid-57 because of the well registration law which took affect on May 1, 1957. The next period is May 1, 1957, to 1965. Legislation which authorized the

State Engineer to limit the issuing of well permits went into effect on May 17, 1965. However, because applications received by the State Engineer prior to May 17 were treated under the earlier law regardless of when the well was actually drilled, in most cases later in 1965, no attempt was made to distinguish which wells were drilled early and late in 1965.

## GROUND WATER RESOURCE

Ground water resources in the Lower South Platte Valley are extensive. In Water District 64 it is estimated that the alluvium holds some 2.2 million acre feet of water. The alluvium of the river ranges in width from 3 to 5 miles, and has a thickness up to about 300 feet. Drawdowns in wells generally vary from 6 to 30 feet.

Depth to water ranges from less than a foot to about 50 feet. Water levels often rise during the irrigation season and decline in the winter, though this varies from area to area depending upon pumping and surface irrigation. Only minor use has been made of the aquifer storage to provide carry-over water through dry periods. That is, while pumping has taken place, it has not really tapped the storage potential. It has primarily been limited to date to only detracting from surface stream flow.

A one-foot drawdown in the water table in the river alluvium between Sterling and the State line would yield approximately 30,000 acre feet. Substantial potential exists in Water District 64 for ground water management benefits.

TABLE VI-A

NUMBER AND REPORTED YIELD OF IRRIGATION WELLS
Water District 64
Based upon State Engineer's Records of Well Permits & Registrations

| | Number of Irrigation Wells Drilled | Accumulative Number of Irrigation Wells | Accumulative Reported Yield cfs |
|---|---|---|---|
| 1886 to 1929 | 13 | 13 | 28 |
| 1930 | 2 | 15 | 33 |
| 31 | 1 | 16 | 37 |
| 32 | 1 | 17 | 41 |
| 33 | 4 | 21 | 58 |
| 34 | 7 | 28 | 83 |
| 35 | 17 | 45 | 140 |
| 36 | 11 | 56 | 175 |
| 37 | 6 | 62 | 190 |
| 38 | 6 | 68 | 210 |
| 39 | 3 | 71 | 220 |
| 1940 | 10 | 81 | 250 |
| 41 | 9 | 90 | 280 |
| 42 | 12 | 102 | 320 |
| 43 | 3 | 105 | 330 |
| 44 | 0 | 105 | 330 |
| 45 | 13 | 118 | 360 |
| 46 | 15 | 133 | 410 |
| 47 | 14 | 147 | 460 |
| 48 | 14 | 161 | 490 |
| 49 | 4 | 165 | 500 |
| 1950 | 9 | 174 | 530 |
| 51 | 8 | 182 | 560 |
| 52 | 12 | 194 | 590 |
| 53 | 11 | 205 | 620 |
| 54 | 96 | 301 | 940 |
| 55 | 56 | 357 | 1100 |
| 56 | 45 | 402 | 1230 |
| 57 | 28 | 430 | 1320 |
| 58 | 9 | 439 | 1340 |
| 59 | 16 | 455 | 1400 |
| 1960 | 14 | 469 | 1440 |
| 61 | 23 | 492 | 1520 |
| 62 | 18 | 510 | 1570 |
| 63 | 43 | 553 | 1690 |
| 64 | 80 | 633 | 1930 |
| 65 | 78 | 711 | 2170 |
| 66 | 17 | 728 | 2210 |

Notes: The number of wells shown here are those recorded as having been drilled. There may be other wells that are not on record in the State Engineer's office. Not all recorded wells may be in use.

The accumulated yield shown is probably high as the figures are based upon the well driller's report to the State Engineer. Driller's pump tests are usually quite brief & the results are frequently thought to be optimistic.

TABLE VI-B

NUMBER AND REPORTED YIELD OF WELLS BY PERIOD
Water District 64

| Period | All Uses | | Irrigation Use | |
|---|---|---|---|---|
| | Number | Reported Yield cfs | Number | Reported Yield cfs |
| 1886-1953 | 240 | 660 | 205 | 620 |
| 1954-4/31/1957 | 221 | 672 | 211 | 657 |
| 5/1/1957-1965 | 1419 | 978 | 295 | 893 |
| 1966-5/1/1967 | 149 | 100 | 26 | 80 |
| Totals | 2029 | 2410 | 737 | 2250 |

Figure VI-1

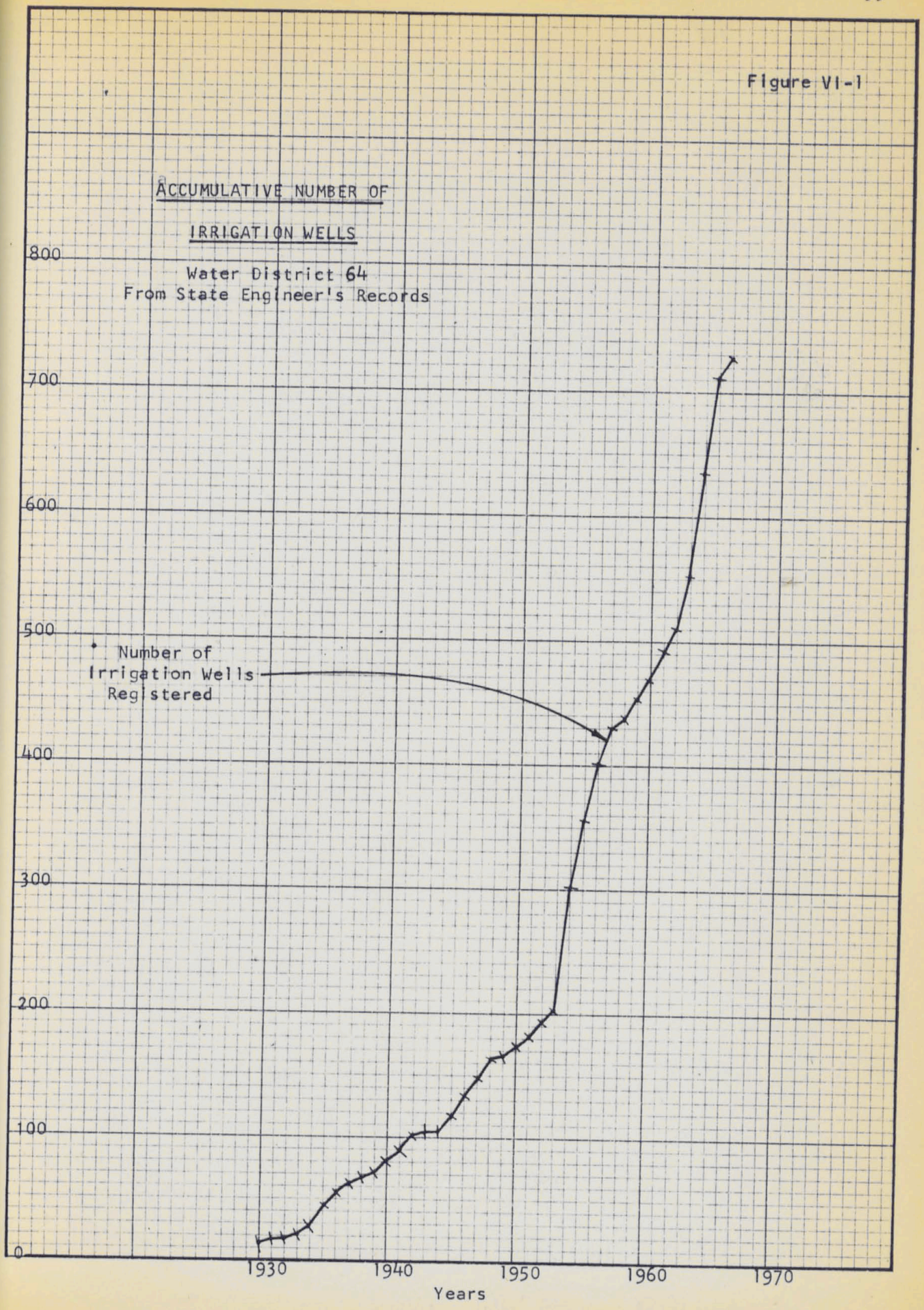
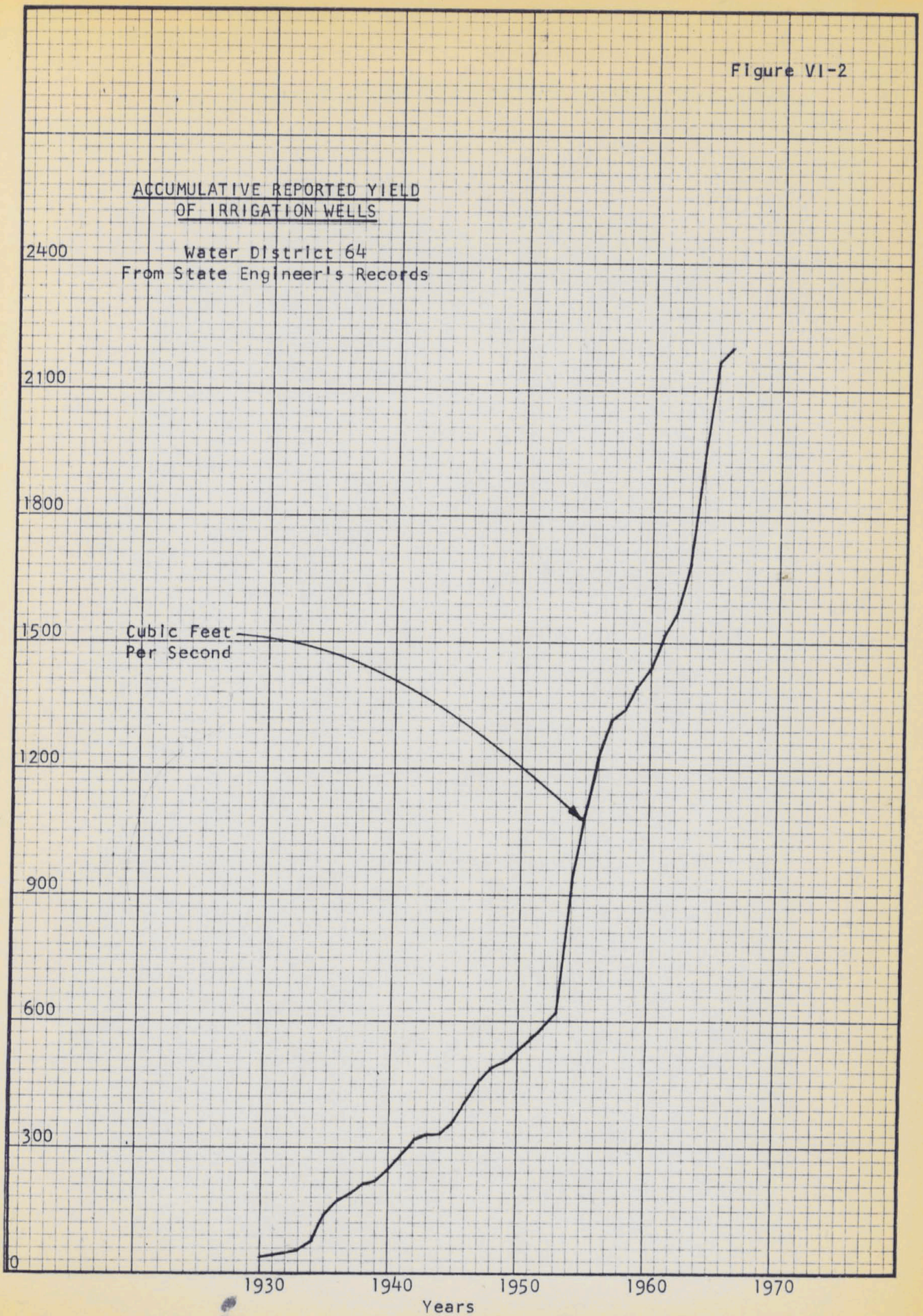

ACCUMULATIVE NUMBER OF
IRRIGATION WELLS
Water District 64
From State Engineer's Records
800
700
600
500
400
300
200
100
0
Number of
Irrigation Wells
Registered
1930
1940
1950
1960
1970
Years

Figure VI-2


ACCUMULATIVE REPORTED YIELD
OF IRRIGATION WELLS
Water District 64
From State Engineer's Records
2400
2100
1800
1500
1200
900
600
300
0
Cubic Feet
Per Second
1930
1940
1950
1960
1970
Years

## SECTION VII

## SOUTH PLATTE RIVER COMPACT

The South Platte River Compact was signed on April 27, 1923. The signatory states are Colorado and Nebraska.

The major provisions affecting Colorado are:

1. Between April 1 and October 15 of each year, diversions downstream of Balzac under appropriations junior to June 14, 1897, shall not diminish mean daily flow at the Julesburg gage below 120 cfs.

   In other words, the compact calls out appropriators in Water District 64 junior to June 14, 1897, when the gage drops below 120 cfs on a mean daily basis from April 1 to October 15.

2. Between October 15 and April 1, Colorado has full use of the river, except if Nebraska constructs a proposed canal which would divert from the South Platte River in Colorado to carry into Nebraska. The canal has not yet been constructed.

   When and if the canal does exist, then Nebraska has claim to 500 cfs remaining in the river after:

   a. decrees in Water District 64 senior to December 17, 1921, are satisfied, and
   b. decrees junior to December 17, 1921, are satisfied to the extent of 35,000 acre feet of diversions. Such diversions specifically include storage for later use.

The Compact places no burden on diversions upstream of Water District 64 except insofar as diverters called out by the Compact may, in turn, call out still more junior rights upstream of Water District 64. The Division Engineer's records show that the last time this occurred was in 1950. Such calls are futile, but are possible with strict application of the priority system.

The Compact's provision has not been applied to ground water pumping.

Mainstem Ditch decrees junior to the Compact are listed in Table VII-A. Tributary stream decrees senior to the Compact are listed in Table VII-B. The number of days on which mean daily flow at the Julesburg gage was less than 120 cfs is shown in Table VII-C for several recent years. A complete list of pertinent District No. 64 decrees have been presented in an earlier table.

TABLE VII-A

MAINSTEM CANAL AND RESERVOIR DECREES
JUNIOR TO SOUTH PLATTE COMPACT
Water District 64

| Date of Issue | Name of Ditch | No. | Priority Date | Amount Sec.Ft. | Remarks |
|---|---|---|---|---|---|
| 1- 5-11* | Peterson 1st Enl. | 31 | 10-11-97 | 350.00 | |
| 1- 5-11* | Settlers | 32 | 12-13-97 | 89.00 | |
| 1- 5-11* | Settlers 1st Enl. | 34 | 11-10-98 | 288.00 | |
| 1- 5-11* | Harmony #2, 1st Enl. | 35 | 11- 9-00 | 162.00 | |
| 1- 5-11* | Pawnee Extension | 36 | 12-16-01 | | |
| 6-26-07 | Tamarack | 37 | 4-23-02 | 134.00 | |
| 1- 5-11* | Harmony No. 3 | 38 | 5-13-03 | 219.00 | |
| 3-11-09* | Harmony #1 Ext. & Enl. | 39 | 2-12-04 | 450.00 | |
| 12- 8-08 | Julesburg Res. | 1 | 2-12-04 | 28,178 Acre feet | |
| 4-23-10 | Batten | 23 | 9-30-94 | 25.00 | |
| 4-23-10 | Davis Bros. 2nd Enl. | 41 | 5-25-03 | 102.00 | |
| 4-23-10 | Cox | 42 | 3-20-07 | 42.50 | |
| 6-11-13 | Long Island 1st Enl. | 51A | 9-20-06 | 20.00 | |
| 7-5-28 | Henderson & Smith Cole Ext. | 106 | 2-17-02 | 24.00 | |
| 7-5-28 | Rice | 110 | 4-28-04 | 35.00 | |
| 7-5-28 | Bravo Extension | 112 | 4- 1-06 | 20.00 | |

*Former decree modified - Properly placed in series

TABLE VII-B

DITCH DECREES SENIOR TO JUNE 14, 1897, & ADJUDICATED PRIOR TO 1923
ON TRIBUTARIES OF SOUTH PLATTE RIVER IN WATER DISTRICT 64

| Prior. | Name of Ditch | Adj. Date | Appr. Date | Amount cfs. | Location Sec. | Tn. No. | Rge. West | Source |
|---|---|---|---|---|---|---|---|---|
| | Red Lion | 11-15-1894 | 2-21-1891 | 3.50 | 35 | 11 | 48 | Spring Creek |
| | Red Lion, 1st Enlg. | " | 8-22-1894 | 2.00 | 35 | 11 | 48 | " " |
| 22 | Knowles Spring No. 1 | 11-10-1898 | 1- 1-1895 | 0.78 | | | | |
| | " " " " | " | " | 60.00 | | | | Tributary flood water |
| 19 | McWilliams Canal | 10-26-1907 | 6-19-1894 | 8.00 | | | | Cottonwood Creek |
| 37 | Thomas D. Crain | 6-11-1913 | 4-15-1895 | 18.00 | 16 | 10 | 55 | Two Mile Creek |

TABLE VII-C

NUMBER OF DAYS ON WHICH MEAN DAILY FLOW
OF SOUTH PLATTE RIVER AT JULESBURG
GAGE WAS LESS THAN 120 CFS

| | 1961 | 1962 | 1963 | 1964 | 1965 |
|---|---|---|---|---|---|
| April | 1 | 6 | 14 | 0 | 30 |
| May | 14 | 16 | 30 | 27 | 28 |
| June | 0 | 0 | 27 | 29 | 4 |
| July | 15 | 11 | 30 | 29 | 4 |
| August | 23 | 20 | 31 | 31 | 10 |
| September | 8 | 27 | 24 | 30 | 3 |
| October 1-15 | 0 | 0 | 0 | 31 | 0 |

# APPENDIX

## SECOND PROPOSAL FOR

## INCREASED WATER UTILIZATION

# APPENDIX

## INCREASED WATER UTILIZATION - A LEGISLATIVE PROGRAM

The suggestions which follow are based on studies conducted by Wright Water Engineers in the South Platte River Basin, and particularly on the Primary Conclusions set out in the foregoing Wright Report. This Appendix is designed to suggest one program, from a legal perspective, which might implement the Primary Conclusions, and provide a starting point for considering the content of necessary legislation. This suggested program does not always correspond with the specific Proposals of the Wright Report, but, where it differs, offers alternatives for consideration.

## SUMMARY

Certain premises underline the approach set out here.

1. All water rights should be measured and defined in the same terms, to permit their being administered together.

2. A water right should give a water user the right to some annual amount of water of a certain priority, based on historic beneficial use and obtainable from different sources, rather than a right to a rate of flow from one particular source.

3. Water rights should be integrated into a single system, based on priorities, and administered so as to facilitate the maximum and wisest use of all water sources while satisfying priority demands.

4. River Basin Authorities should be employed to develop water sources, to supply quantified water rights and give them certainty and to promote effective and efficient use of all available water.

These premises are based, in turn, on the belief that the State has a paramount interest in maximizing the use of the critical water resource and a responsibility to implement that interest through its police power while protecting vested rights to the extent of their historic beneficial use. Serious consideration should be given to the desirability of a constitutional amendment declaring this State interest and providing a basis from which to implement it.

A. Quantification of All Existing Uses

Water rights are presently measured and decreed in terms of rates of flow. Since the rate of stream flow varies drastically over a season, decrees for stream rights do not

necessarily reflect the quantity of water which a water user may be able to divert and put to beneficial use during a year. In fact, since each decree is based on the maximum flow which a water user can divert to beneficial use through his facility, the sum of the decrees usually exceeds greatly the amount of water in the stream.

1. Advantages of Quantification

It is submitted that there are significant advantages in translating water rights into annual quantities with a certain priority, based on historic beneficial use, rather than continuing to define and measure them in terms of rates of flow.

a. It will meet the irrigator's primary concern that he get a sufficient amount of water. He would be best served if he could be assured of receiving a firm annual amount of water and could take it during the season at the times he needed it most, rather than at times the stream happens to be high.

b. It will make rights correspond with the water which is actually available annually within the system.

c. It will implement the beneficial use limitation of present law that a water user may take only the amount which he can apply to beneficial use, regardless of the rate at which he is capable of diverting.

d. It will provide a basis for administering stream and well rights within a single system. There will be little problem in quantifying well rights. They are less subject to variations in rate of flow during a season than are stream diversions and therefore are often now considered on an annual quantity basis. In order to administer wells with stream rights, it will be necessary to determine appropriate priorities for the wells, a subject which is discussed hereafter.

e. It will implement the thought that is basic to this program: a water user should have a right to an annual quantity and quality of water with a certain priority, provided when needed, without regard for its source, rather than a right to a particular rate of flow or means of diversion.

2. Implementation of the Quantification Concept

a. Historic water uses, whether from a stream or wells,

should be translated into annual acre-foot figures. In the case of irrigation rights, these quantities should be ascertained for each irrigated tract.

b. Since a water user has a vested right under present law to divert and apply the maximum rate of flow permitted by his decree whenever it is available to him for beneficial use, the starting point in quantifying rights for each tract should be the maximum annual amount ever diverted for use on that tract.

c. This amount should then be limited by the requirement of beneficial use, perhaps applied to catch only cases of clear excess. In applying the beneficial use limitation to each tract, consideration should be given to the acreage irrigated, either the maximum ever irrigated or the maximum irrigated within a recent period, perhaps fifteen years, together with maximum crop needs and the maximum length irrigation season.

d. The quantity derived for each tract ("Determined

Amount") would represent the amount of water historically applied to beneficial use on that tract, from all available sources. Ditch decrees would be quantified as the sum of the Determined Amounts for all tracts historically irrigated by the ditch. This sum would, of course, reflect well diversions on these tracts as well as ditch diversions which have served the tracts.

e. The quantification procedure might work hardship on some water users, and they must be afforded the possibility of judicial review and compensation to protect their vested rights and avoid constitutional objections, as discussed hereafter. Even with the possibility of judicial review and adequate compensation, it may be advisable to propose a constitutional amendment providing for the quantification of water rights and their measurement in terms of an annual acre-foot allotment rather than in rates of flow.

f. The legislation implementing this concept should spell out as clearly as possible the standards to

be used in ascertaining the Determined Amounts. It also would be helpful to have a legislative clarification of the beneficial use limitation.

3. A Suggested Procedure

All existing alluvial water uses would be quantified. The initial determination should be administrative, subject to a limited judicial review and the possibility of compensation. This would be far less costly in time and money for water users than requiring them to join in new adjudication proceedings in which each would have to present evidence. This administrative determination might best be made by the River Basin Authorities described herein rather than within the existing administrative structure. Undoubtedly, the total process would take a significant amount of time. The determination would have to be made for each irrigated tract, probably ditch by ditch, then for irrigated tracts not under ditches.

a. There are bound to be questions whether particular wells should be subject to this determination and it would be wise for the legislation to provide adequate

standards. A well user who felt aggrieved at being included within the determination could challenge the jurisdiction of the Authority administratively, and failing at that, seek judicial review in the same fashion as if he were challenging a Determined Amount.

b. Determinations previously made by the Gound Water Commission concerning amounts and priorities of wells should be conclusive and not open to collateral challenge.

c. Diversion decrees and storage decrees could be quantified by the same process. It is contemplated that flood decrees could be handled in the same way also.

d. The determination procedure would apply only to existing uses. However, a procedure similar to that in use under the Ground Water Management Act profitably could be used for future determination of well rights, eliminating the need for future wells to enter adjudications. A conditional well permit would be a prerequisite to drilling and a final

permit, establishing the amount and date of beneficial use as administratively determined, could define the completed water right. Future stream rights could be handled in standard adjudications, but a representative of the River Basin Authority should be included as an interested adversary party.

e. Conditional decrees would remain subject to present standards. They would be made absolute only to the extent that water is applied to beneficial use with due diligence.

f. The following procedure is suggested for consideration:

(1) There would be a study by the administrative staff to make tentative determinations of the Determined Amounts. The staff should be authorized by legislation to make a variety of investigations and to seek cooperation and information from water users.

(2) Tentative findings, together with the basis for the findings, would be published, and personal notice would be given to those whose water rights were being quantified.

(3) Those whose water rights were being quantified could file petitions, setting forth the particulars in which they disagreed with the tentative findings. Matters on which they did not disagree would be taken as final.

(4) An administrative hearing would be held under appropriate evidentiary rules, in which a water user would have the burden to prove the particulars in which he alleged the staff findings were erroneous. The staff should be required to introduce evidence in order to make a reviewable record. Junior water users within the water district would be allowed to appear and present evidence or to cross-examine.

(5) For protection of the constitutional rights of existing appropriators, procedures such as follow should be established for compensating those who are injured by changes in the character of historic rights and in the regimen of stream supplies that result from administrative determinations and actions.

(a) Any person who feels aggrieved by an action of the River Basin Authority or its subdistricts can file an objection with the Basin Authority or subdistrict.

(b) An investigation of the objection will be made by a board of appraisers, designated in advance by the district court with jurisdiction for adjudications within the water district, and composed of three real estate and water right appraisers. The amount of the detriment and offsetting benefits will be determined by appraisal. The appraisal will be reported to the River Basin Authority.

(c) The Authority shall determine whether to compensate an aggrieved party in money or in water, as appropriate, and will offer a settlement to the objecting party.

(d) An objecting party may decline to accept the settlement proposal by filing an action in the district court. In the district

court proceeding the only question for determination shall be the sufficiency of compensation.

(e) Funds necessary for payment of claims of objectors may be procured by the Authority or its subdistricts by general taxation within limits prescribed and by assessments.

(6) Alternatively, a water user might be allowed to appeal from the administrative quantification to the district court, alleging that particular administrative findings lacked a basis of substantial evidence. If a finding did lack a basis of substantial evidence in the record, or if the Authority had made an error of law, the district court would have discretion to hold a de novo evidentiary hearing and to make its own specific findings. The protesting water user, affected juniors, and the Authority all could present evidence at such a de novo hearing. The judicial proceeding would be subject to the right of the Authority to turn it into an inverse condemnation suit.

B. Integrating Water Rights

1. Integrating Determined Amounts into Existing Decrees

a. The administrative bodies would certify their findings and the resulting Determined Amounts to the district court. These findings and Determined Amounts, if unchallenged or upheld, or the findings of the district court in the de novo proceeding, would be adopted by the court as an amendment to its adjudication decrees.

b. Priority dates under existing decrees would not be affected. Unadjudicated wells would be assigned priorities administratively. The Wright Report suggests one way in which priorities for unadjudicated wells might be determined. An alternative which deserves serious consideration is assigning these wells a priority based on the date of first beneficial use. Water rights are obtained in Colorado by diversion and application of water to beneficial use; adjudication decrees merely confirm the rights previously obtained. If wells are not required to be adjudicated under existing law,

under penalty of losing priority, there may be constitutional objections to assigning well rights priorities junior to their dates of first beneficial use.

c. A ditch's Determined Amount would be allocated among its priority dates. Its stream diversions would be allocated to its most senior decrees. The wells on tracts under the ditch, whether owned by the ditch or not, then would be allocated, according to their priorities, to the more junior ditch decrees.

d. If the Determined Amount, considering all stream diversions and well diversions, was less than the amounts decreed to a particular ditch, its decrees would be cut back, in reverse order of priority, to the Determined Amount. If the Determined Amount exceeded the total decrees of the ditch, the excess uses (which probably would be relatively junior wells under the ditch) would take their own priorities.

2. Integrating Rights Within the System

a. Ditches and Wells Under Ditches.

(1) Under present law, a ditch itself has the decree, not the tracts under the ditch; the ditch company

diverts the water available at its headgate and distributes it to consumers. However, the ditch's Determined Amount under the proposed program would be the sum of the Determined Amounts for each tract historically served by the ditch. It would include water from all sources available to the tracts, including wells not owned by the ditch. It seems desirable to retain the ditch as the basic administrative unit, to let the water officials regulate the water available to it under its Determined Amount and to allow it to continue to distribute stream water to its consumers.

A ditch company could allocate its Determined Amount by contract among users under the ditch who would not have a right to share the ditch's priority date absent such a contract. It is contemplated that a ditch might contract to furnish a well owner with a certain amount of high priority water and gain, in return, some

right to use the well. Well owners who pumped in excess of the contract amount would have to do so without the protection of the ditch's priority. However, such diversions would be charged to the ditch's Determined Amount and the ditch company might be assessed for any resulting excess.

(2) This system would provide administrative simplicity for the state water officials, would guarantee water users under ditches a firm amount of high priority water by contract and would offer ditch companies flexibility in obtaining and allocating water from different sources. The ditch would have a right to take its Determined Amount from any sources available to it. The ditch should be free either to enter arrangements with owners of existing wells under the ditch (or on lands not under the ditch but close enough to the ditch so that the ditch might utilize the wells) or to sink new wells and take part of the

Determined Amount there.

(a) Transfers of part of the Determined Amount to existing wells (providing multiple points of diversion) should be simple and flexible. The ditch company should be free to take its Determined Amount through such sources and at such times as seem most desirable. Therefore, it should not have to transfer a specific amount to an existing wellhead, but might simply file evidence of its relationship with the well with the Authority.

(b) Perhaps it should be more difficult to transfer to a new wellhead, but this again should be a relatively simple matter. Transfer might be permitted except when there was a material impact upon some specific other water user or when the new well would be hydrologically unsound.

(c) If the ditch company chose to transfer to a new well rather than to an existing well,

diversions from the new well should be charged against the ditch decree, while a corresponding amount from the most junior existing well not contractually related to the ditch would no longer be charged to the ditch decree.

b. Wells Unsheltered by Ditch Decrees. Unsheltered wells would have rights to a given annual quantity of water, just as a ditch, but they would not have the advantage of an early priority. Ideally, tracts with unsheltered wells whose priority would not allow them to pump could be supplied by the River Basin Authority at a price. Administration of unsheltered wells is essential. Some might logically be assigned to ditches or to well associations for administrative purposes, as the Wright Report suggests. Others may have to be regulated individually by the state water officials.

C. Administering the Integrated System

1. Administrative Responsibility

The State Engineer's office and the local water officials

should retain basic responsibility for administering priorities, but work in close cooperation with the River Basin Authorities and the ditch companies. The River Basin Authorities should have power to determine the source from which users could take their Determined Amounts in order to promote the most efficient use of water within the system, for example, by providing wells or reservoir water in lieu of stream diversions, and the ditch companies would have the responsibility outlined above for allocating their Determined Amounts among water users.

2. Administering Determined Amounts

a. Stream diversions still would be regulated on a basis of priority, but water rights defined in terms of an annual quantity, available from various sources, do not admit of easy day-to-day regulation. Measuring devices would be required on all wells and records kept of all diversions chargeable to each ditch or other water user. When a ditch had taken its Determined Amount for a year, it could divert no more without payment unless there were sufficient water

for it to do so with a most junior priority. The ditch company would have to police water uses under it in order to avoid exceeding its Determined Amount. Well owners who diverted more than their Determined Amounts might be assessed at the end of the season for the excess diversions, instead of being prevented from pumping.

b. Decreed rights would be subjected to periodic examination, perhaps every five or ten years, and cut back to the amount of the largest annual diversions within the period. Perhaps such a cutback should be made only if the largest annual amount diverted for beneficial use during the period was 10 per cent or more below the Determined Amount, to allow for precipitation variation.

c. Defining and administering water rights in terms of annual quantities should encourage ditches to leave excess water in the stream in times of high flow and to space out diversions through the year by means of wells. The excess flow left in the stream might be available to the River Basin Authority.

3. Administering Priorities

a. The present system of denying water to junior stream and well appropriators in order to meet calls on the river tends to be wasteful since junior stream users may be forced to pass a large volume of water in order to meet relatively small downstream calls or junior well users may be forced to pass water which would not reach the calling senior at the time he needs it.

b. No call should be allowed until the water user had used all existing facilities available to him and still could not meet his present needs. Then the call might be made to the River Basin Authority rather than to the state water officials. The Authority should have broad discretion on how to meet the call and could adopt such measures as releasing reservoir water, drilling new wells for the calling senior or supplying substitute water to other stream appropriators to free the surface stream of their demands.

c. Alternatively, after a water user had exhausted the facilities available to him he might be allowed to place a call through the state water officials on

the surface stream only. Affected juniors could elect either to pass stream water or to supply other water through the River Basin Authority to the calling senior. If this approach were employed:

(1) ditches would be encouraged to take so much of their water as possible by wells since their stream diversions would be vulnerable to call. As more users took their water rights by wells, the burden upon the surface stream, at least during the irrigation season, should be lessened, reducing the possibility of a call.

(2) Futile calls against wells would be eliminated. Ditches which were so junior that they could call out no stream use could make their call to the River Basin Authority.

(3) The burden on the River Basin Authority would be lessened under this alternative, but there might be a corresponding loss of flexibility in the Authority to implement a comprehensive program of water allocation.

d. Under either approach, a senior appropriator still should be able to obtain an injunction against a particular junior well which was interfering significantly with his obtaining water.

e. Unsheltered wells present a special regulatory problem. When there is water available within the system, perhaps these wells could pump out of priority after paying the charge determined by the River Basin Authority. However, the possibility exists that some senior appropriators cannot be satisfied, simply because there is inadequate water available within the system. This might be true particularly before the River Basin Authorities develop water sources, but could occur on occasion thereafter. In such a situation, it would seem equitable to regulate unsheltered wells in order to regenerate the system. Perhaps wells initiated after the 1957 Ground Water Act could be regulated as a class and all cut back or restricted according to some uniform standard. Treating post-1957 wells as a class might be justified

on the theory that 1957 was the first year in which wells were exposed to regulation. If the system were still in need of regeneration, pre-1957 rights could be restricted in reverse order of their priority.

f. The relationship among wells when there is water available in the system should not be governed by strict priority, but by a modified appropriation system such as that found in the 1965 Ground Water Management Act.

(1) A senior well should be required to take reasonably economic steps to obtain water before demanding water from junior wells.

(2) A call against junior wells might be futile, as well as wasteful, because of the relative position of the wells within the alluvium aquifer.

(3) Junior wells could be required to supply the senior well owner (after he has taken reasonably economic steps to better his own lot) through the Authority.

D. <u>The Role of the River Basin Authorities</u>

1. The Purposes of a River Basin Authority

a. A River Basin Authority, established as a basin-wide consenancy district would provide a vehicle for:

(1) Constructing new storage, diversion and conservation projects to enlarge usable water supplies from the surface and underflows of the river drains.

(2) Allocation of water among historic and new water users on a flexible basis, utilizing priority guidelines, contracts regulating use, police power regulations for prevention of waste and inefficient uses, and condemnation of inefficient rights, to accomplish these purposes.

(3) Compensating those whose property rights in water may be impaired by quantification that is necessary for sound administration and full utilization of water supplies.

(4) Financing the acquisition of water rights, construction of new facilities, administration of priorities and compensation of parties injured,

by use of a combination of property taxation, assessments for new water supplies and sale of revenue bonds.

b. The conservancy district is a better vehicle to achieve these objectives than the State Engineer's office on the one hand or the existing ditches or other private entities on the other because the district can provide necessary flexibility to meet the peculiar needs of individual basins, can utilize subdistricts for local administration and financing purposes and can provide the public authority for modifying the character of existing property rights, as necessary, by payment of just compensation. The district will be needed to help administer existing stream and ground water rights as provided above, to conserve water, enlarge the supplies available for beneficial use from the ground water aquifers, provide storage to meet compact calls and provide security of water rights for historic and new beneficial uses.

2. The Characteristics of a River Basin Authority

a. It should be basin-wide in extent in order to minimize the administration problems that arise between individual water districts on a stream system.

b. It should be established by legislation, in the manner of the Colorado River Water Conservation District, rather than by petition and court decree, for the reasons that the districts must be mandatory, not discretionary; no land should be excluded therefrom; and their jurisdiction will extend in all cases beyond the court of any judicial district.

c. Their governing body should be active, not advisory, representative of the water consumers of the district, regardless of number and location, and professionally qualified for water administration work. To meet these objectives, the board should probably be rather small in size and be compensated adequately for the duties required (Ohio districts have 3-man boards). One approach to attainment of a board that represents basin-wide interests, rather than vested interests within the basin, is to select part of the representa-

tives from the divergent territorial population interest groups and require those selected to select the balance of control from persons acceptable to existing appointees.

d. Subdistricts may be created to perform the functions of the district on various reaches of the stream and to finance construction of facilities in the manner contemplated by the Colorado River Water Conservation District Act. Administrative activities of the subdistrict would be subject to the control of the district board.

3. The powers of a River Basin Authority

Aside from the powers mentioned earlier, a River Basin Authority and its subdistricts should have power to:

a. Appropriate water that it has developed or conserved or water which has not theretofore been appropriated, and to sell uses therein to projects within the district.

b. Condemn uneconomic water rights and facilities needed for the full utilization of the water resources of the basin.

c. Finance operations by a small ad valorem tax on the real property within the district subject to limitations similar to those contained in the Colorado River Water Conservation District Act, by assessments upon water users for enlargements of use and dependability of supply beyond that held by water users under historic appropriations; and by sale of revenue bonds for construction of new facilities within the district. Such funds should be subject to primary call, to the extent needed, by subdistricts encompassing the land and uses from which the revenues are derived.

d. Alter priority relationships by contracts of the kind provided for in the Montana Water Conservation Board Act (Art. 89-1 of the Montana Revised Codes) and provide state water commissioners with priority schedules based upon the quantitative determinations of district board, contracts and district appropriations for administration by such water commissioners.