Surface Water Use in Nebraska's Platte River Valley

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Cover shot is of trumpeter swans on the North Platte River with Chimney Rock in the background. This and several other photos courtesy of the Nebraska Game and Parks Commission.

Platte River with sand bars

Introduction

Within the Platte River Valley is Nebraska's most abundant supply of surface water. In the western part of the state (between the Colorado and Wyoming borders and Kearney), it stretches for 500 miles along the North Platte, the South Platte and the Platte Rivers. From this plentiful water supply, over 567,000 acres of land are irrigated from surface water sources. Nearly two million acre-feet of water are diverted by 40 canals and 25 stream bank pumps.

This comprehensive water system has been evolving over a period of 100 years. Since the first settlers arrived in western Nebraska, sufficient water supplies were thought to be essential to the area's continued economic growth.

Just how the water should be apportioned among various users has been a controversial subject since the late 1800's. Back then, anyone whose land bordered a stream assumed a right to use water that passed his property. No permit was issued and the landowner used as much water as he needed without regard for other users.

As more and more farmers began to receive additional economic benefits from increased irrigation, and as competition for available supplies intensified, disputes arose over the diversion of water from a stream. It became clear that a more systematic means of water distribution was needed.

So, in 1895, the Nebraska Legislature established the system of prior appropriation based on the concept "first in time is first in right. Fundamentally, that system remains in operation today. Under this system, anyone who wants to use water must apply to the Department of Water Resources for a permit. Users must specify where the water will be diverted, for what purpose, the quantity to be used and the location of its use.

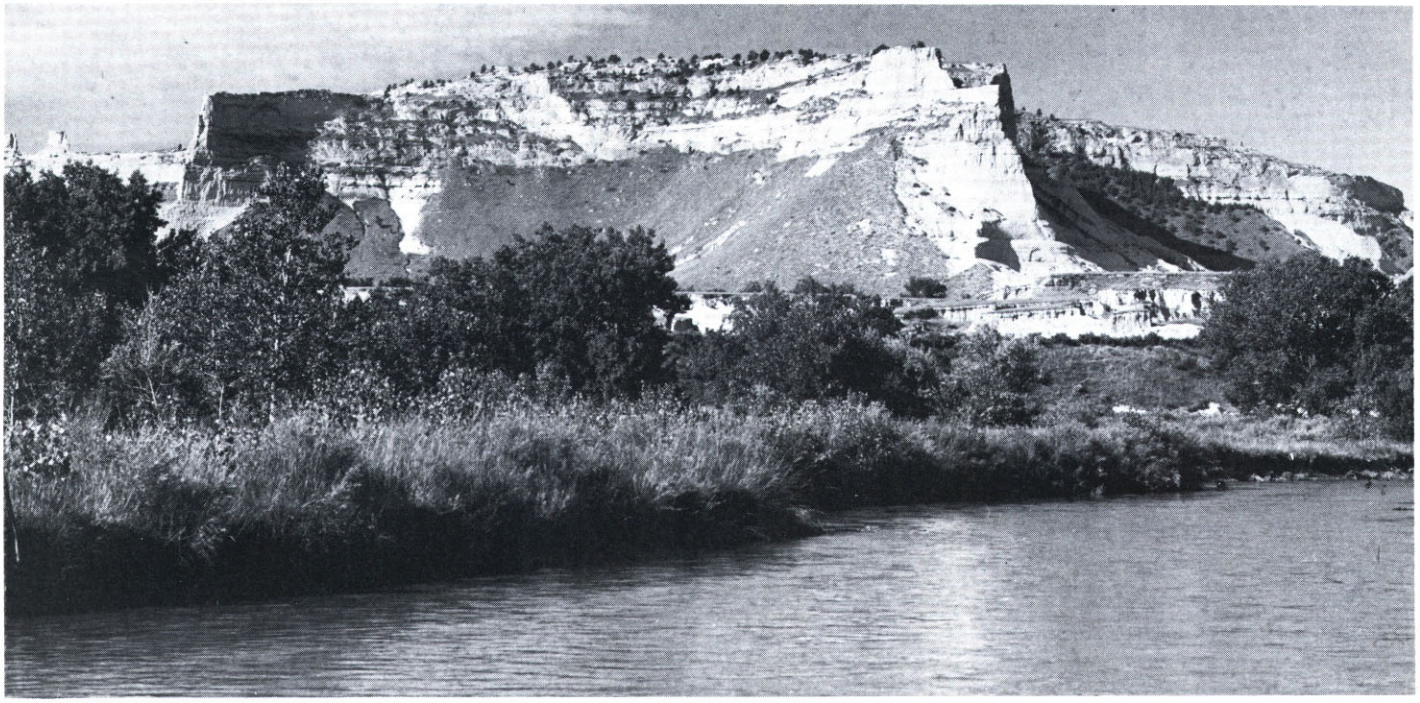
Within the Platte River Valley this legal system alone was not enough.

Under natural conditions, water users had traditionally experienced flooding in the late spring or early summer, as a result of upstream snowmelt. During July and August, when natural flows were minimal and the demand was the greatest, users were frequently left without sufficient supplies of water.

To ensure that water users all along the Platte River system get an adequate supply of water, a series of reservoirs has been built to impound or store water from snowmelt and flood flows during the period of minimal use — October through April. During these months, water is transferred frequently from upstream to downstream impoundments to satisfy 1-anticipated stream runoff, 2-later water demands and, 3-hydroelectric power generation at several locations.

During the irrigation season (May through September), instream natural flow and storage reservoir releases are apportioned by the Department to the

Inlet area to Johnson Reservoir south of Lexington



Scotts Bluff National Monument

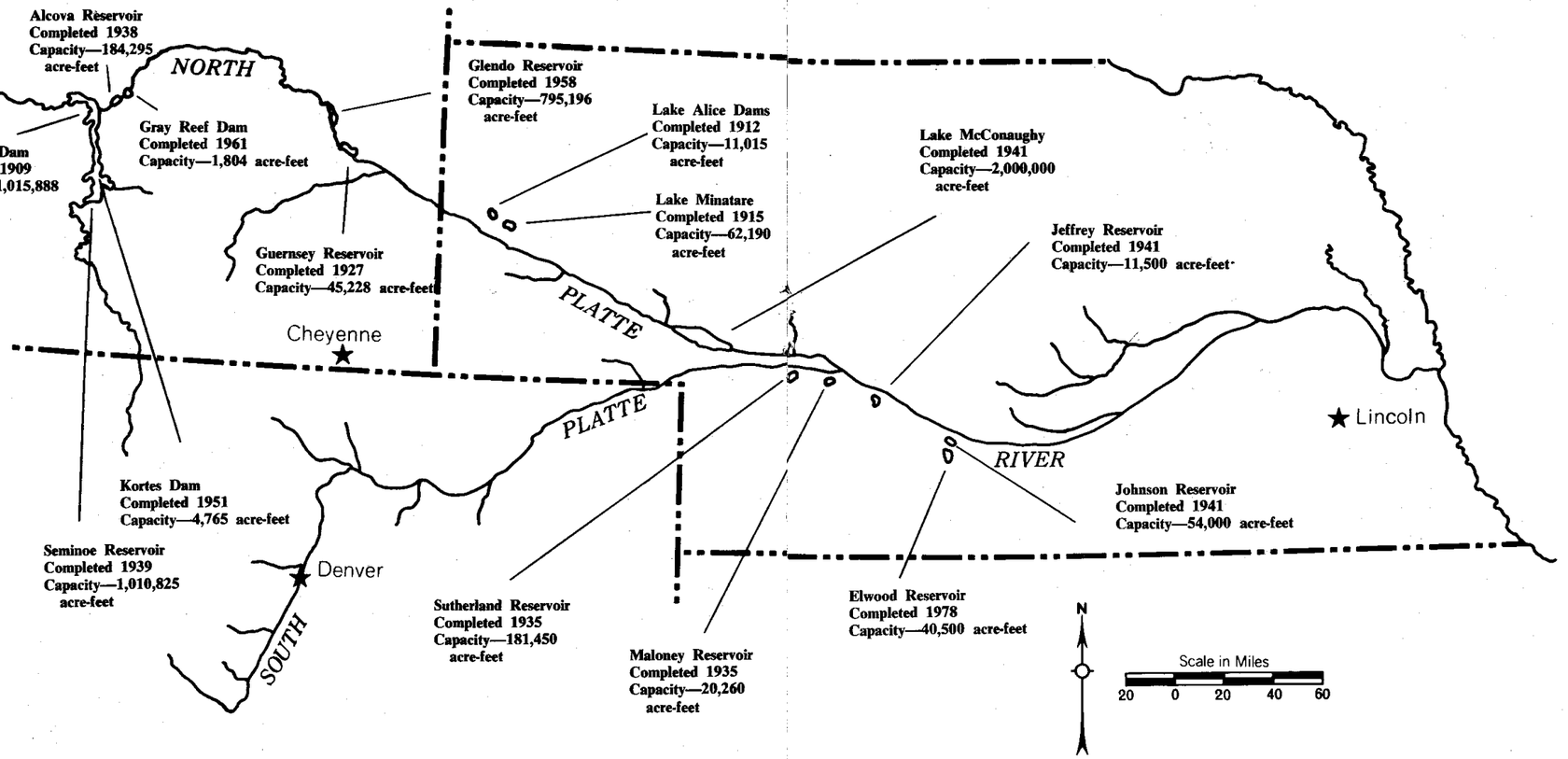
various irrigation districts, canal companies and individual appropriators. Natural flow is the term applied to the virgin or natural waters arising in the basin, while storage water pertains to those waters impounded and later released from reservoirs for downstream users. For administrative purposes, a storage release necessitates reservoir outflow exceeding a reservoir's natural flow inflow.

During the irrigation season, continual regulation and enforcement (administration) is required for orderly allocation and distribution to the numerous users. Data collection is a fundamental and necessary input to administration. Key administrative stream gaging stations are equipped with clock driven, continuous recording equipment which monitors flows in the river and its tributaries. Water commissioners (field investigators) gather this data on a daily basis. This information, together with similar data for each canal, is transmitted to the Department's Bridgeport office where daily allocations are computed. Following computation, appropriate orders are issued to various project managers. This entire process demands a daily accounting of water ownership, deliveries and segregation of natural flow and storage water.

Of the water diverted for irrigation, a considerable portion is return flow (at least once having been diverted) from upstream projects. Once applied to the land for irrigation purposes, return flow is excess irrigation water returning to the river as overland flow (that not absorbed by the land) or as sub-surface drainage from the ground water reservoir underlying project lands. For example, summertime inflow to Lake McConaughy is often 80 percent return flow from upstream developments. Also, in the twelve years prior to construction of Kingsley Dam, the key measuring station on the Platte River at Overton was dry for a portion of each year. Since that construction and application of water to the land, return flows to the Platte at this point have contributed to a constant flowing stream.

In some locations, return flows are sufficient enough alone to support irrigation developments. The Alliance Canal near Bayard abandoned its river diversion facility and relies entirely upon return flows accruing in Red Willow Creek and the Bayard Sugar Factory Drain. Other examples include the Northport Canal, where as much as half of the total demand of the canal is met by interception of five drains located north of the North Platte river between Scottsbluff and the Wyoming-Nebraska state line. Tri-State, Winter Creek and Enterprise Canals in the locality also benefit by augmenting their river diversions with return flows. Likewise, the Sheridan-Wilson Canal in Keith County diverts its entire demand from the Sarben Slough.

Reservoir Operations



As mentioned earlier, reservoirs play an important role in meeting water user's needs and in the overall administration of water in the Platte River valley. The 15 reservoirs within this water system are located on the North Platte channel and within the valley at several off-channel locations between Sutherland and Lexington and near Scottsbluff. With few exceptions, year to year operation of the reservoirs follows an established pattern.

For Seminoe Reservoir (in Wyoming) the usual practice is to retain as much water in storage as possible during the summer and evacuate the reservoir during fall and winter. This serves three purposes: (1) to have ample reservoir capacity to control spring and summer runoff from the upper drainage, (2) to generate power during the fall and winter and, (3) to retain the reservoir at its fullest storage for fishing and recreation during summer months.

In the operation of Pathfinder Reservoir, the usual practice is to lower its content to a minimum by the end of September and then increase the storage during the fall and winter until approximately 100,000 acre-feet of storage capacity are available for spring runoff. Releases from Pathfinder Reservoir are used to the maximum extent possible to generate power and to meet downstream water demands in coordination with Glendo and Guernsey Reservoir releases.

The water level in Alcova Reservoir is more rigidly controlled than the two upstream reservoirs. The inflow is dependent on Pathfinder Reservoir releases. It is necessary to have water in the top 10 feet of the reservoir to make deliveries to Wyoming's Casper Canal. Therefore, during the summer, the reservoir is maintained at a nearly constant high level. During the fall and winter, reservoir storage levels are lowered.

The operation of Glendo Reservoir usually involves the transfer of about half of the storage water ownership from Pathfinder Reservoir (North Platte Project ownership) to Glendo Reservoir during the fall and winter. Releases from Glendo Reservoir during the irrigation season generate power and meet downstream water demands. By the end of the irrigation season, the reservoir content is usually down to its minimum storage of about 65,000 acre-feet.

Guernsey Reservoir operations are basically for the re-regulation of releases made from upstream reservoirs to meet irrigation requirements within the North Platte Project service area. Periodically, since 1936, water in the reservoir has been evacuated rapidly during July and early August to flush accumulations of sediment into the irrigation distribution system as this is believed to stabilize canal banks and reduce canal and lateral seepage losses.

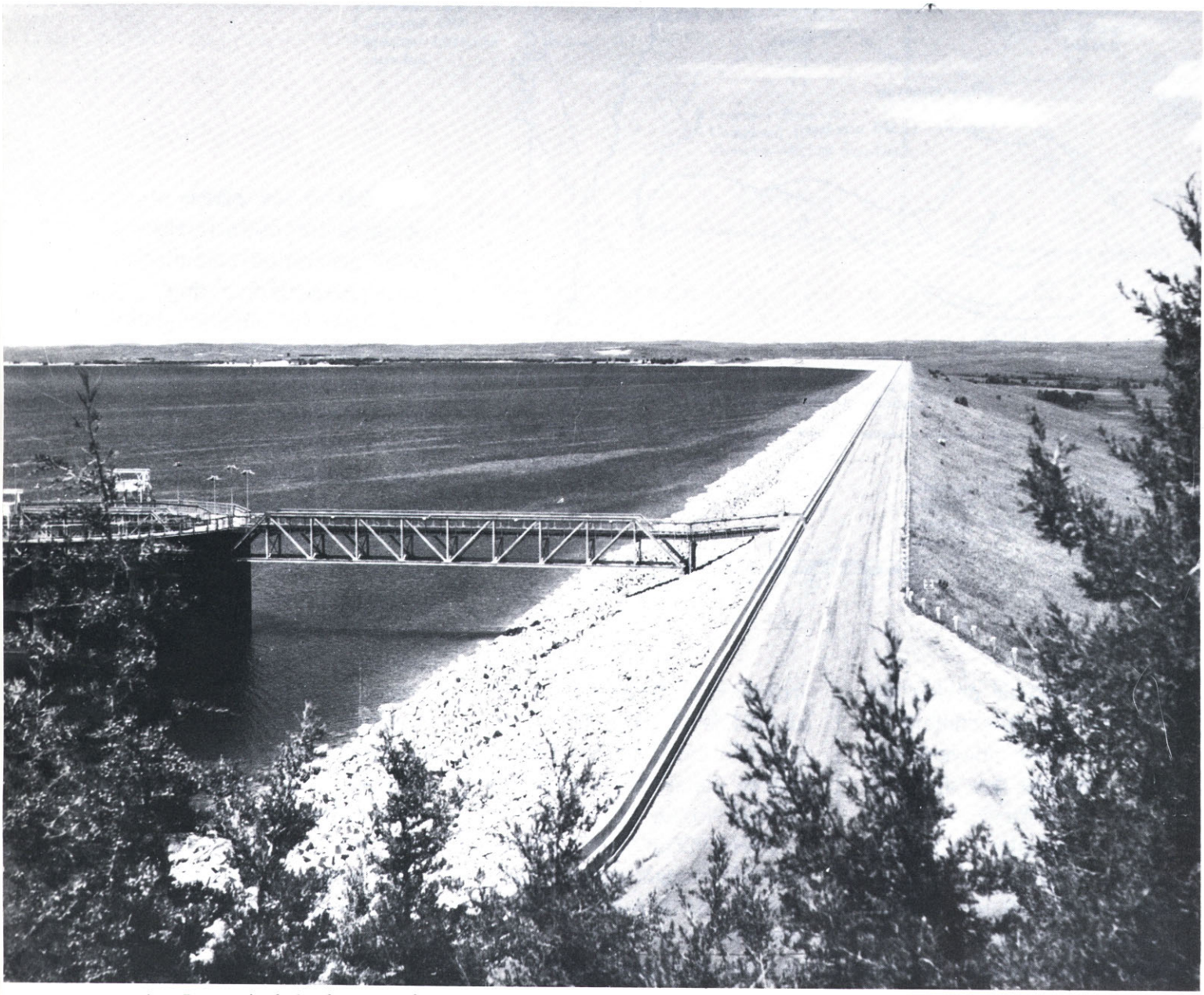
Kortes Dam impounds a relatively small quantity of water. The purpose of the structure is primarily hydroelectric generation.

Gray Reef Dam serves merely to re-regulate releases from upstream facilities.

Downstream in Nebraska normal operation of Lake McConaughy results in a minimum reservoir level at the conclusion of the irrigation season. Releases are usually curtailed in early fall to the extent necessary for downstream power generation commitments. Present operating procedures (in an attempt to reduce potential hazards to the dam) call for maximizing storage accumulations only after mid-May.

Storage levels in the Platte Valley Lakes are not highly variable. Fluctuations in storage at Lake Maloney (actually a hydroelectric generation forebay) are considerably less than Sutherland Reservoir. Maximum utilization is made of the South Platte flow available to the reservoirs. This arrangement thus allows for more water to be stored within Lake McConaughy.

Within the Tri-County system, the newly constructed Elwood Reservoir is designed to augment the capacity of the system's delivery facilities. The reservoir is filled by pumping from the system's off season returns. Storage is also provided in other reservoirs; Jeffrey and Johnson being the largest. Both of these sites also provide for hydroelectric genenration.



Kingsley Dam which backs up Lake McConaughy at Ogallala

North Platte Valley Administration

Nearly 1.4 million acre-feet of water is administered to users in the North Platte valley to irrigate 325,000 acres via 30 canals.* Ground water sources alone provide supplies for approximately 30,000 additional acres.

Natural flow entering Nebraska during the summer is an entitlement provided by a U. S. Supreme Court decree first implemented in 1946. Generally, the decree provides that Nebraska water users under the North Platte project and those served by the so-called state line canals, be guaranteed 75 percent of the natural flow in the upper North Platte drainage basin during the period May 1st through September 30th. The North Platte projects includes the Ft. Laramie, Interstate and Northport canals. The state line canals are: Tri-State (Farmers Irrigation District), Mitchell (Mitchell Irrigation District) and Gering (Gering Irrigation District). Diversions below the state line section with the exception of the Ramshorn Canal (which gets its water from Wyoming) are dependent upon local and return flows under terms of the decree. Two canals, the Interstate and the Ft. Laramie, withdraw water from the river at Whalen Dam some 40 miles into Wyoming. Both canals supply water to lands in the two states. In addition eight private canals also divert water for use in Wyoming within the Whalen Dam-site line reach.

During the irrigation season, the North Platte River is administered in a series of "runs" or sections. The procedure allows periodic, quantitative analysis for the main stem gages at the Whalen Diversion Dam (Wyoming), the Wyoming-Nebraska state line, Mitchell, Minatare, Bridgeport, Lewellen, Keystone, Sutherland and North Platte.

From late June until early September natural flow is usually insufficient to satisfy the demands of many canals, and supplemental storage water is ordered to meet their needs. In addition to the state line canals, the table at the end of this brochure summarizes average natural flow and storage water use by all canals over the past ten years. Quantities listed for the Ft. Laramie and Interstate Canals are the average for water actually used in Nebraska.

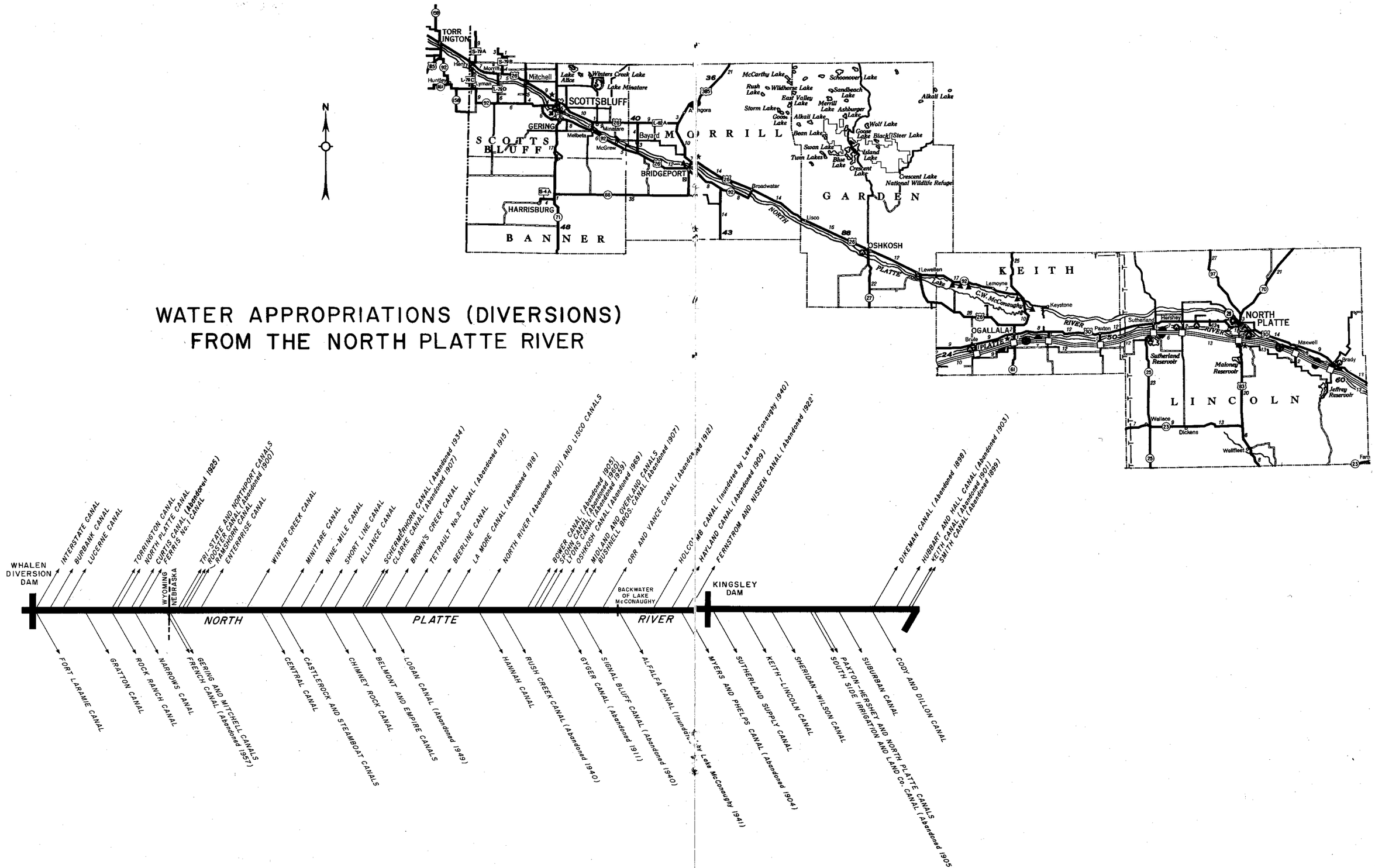
Storage water is impounded and supplied from the seven reservoir system located on the North Platte River in Wyoming and from Lake McConaughy in Nebraska. Also in Nebraska two other reservoirs, Lake Alice and Lake Minatare, essentially augment the carriage capacity of the Interstate Canal during periods of peak demand. Recreation, hydro-electric generation and flood control are other benefits derived from this entire Bureau of Reclamation development.

At times storage contractors do not divert all storage quantities ordered. Any excess amount is administratively converted to natural flow as it passes their headgate. Hence, the entire flow of the North Platte River entering Lake McConaughy is treated as natural flow. This quantity is carried through the reservoir to the North Platte River gage at Keystone, thus establishing the natural flow amount in the Keystone-Sutherland section.

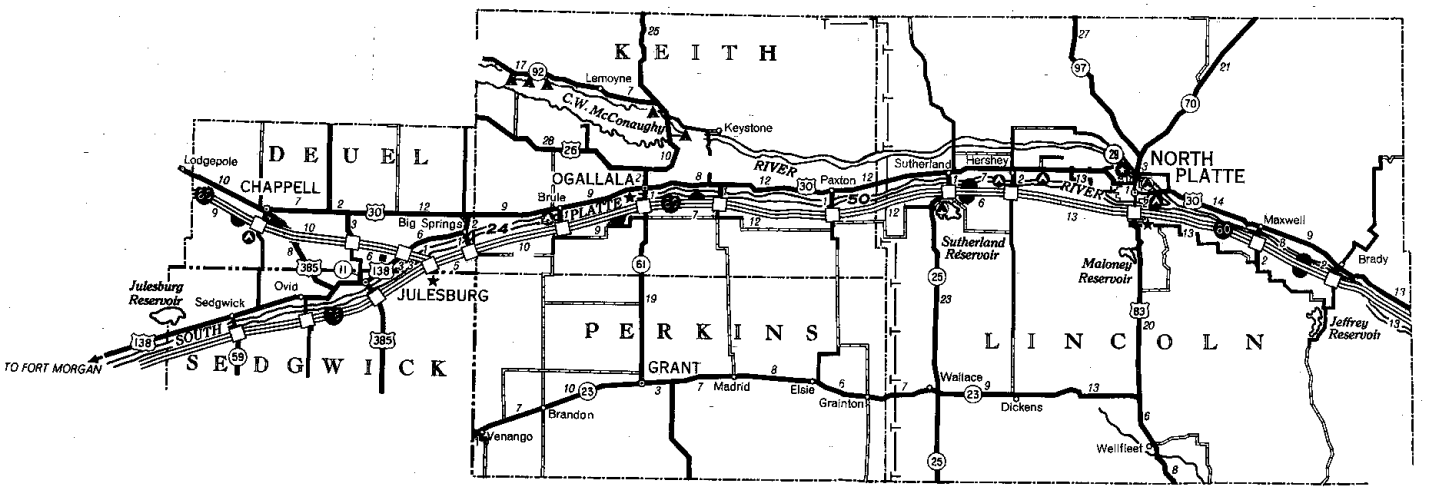
In the section between Kingsley Dam and North Platte, seven canals divert from the river for irrigation. Four of them — North Platte, Keith/Lincoln, Paxton/Hershey and Suburban — contract for McConaughy storage water.

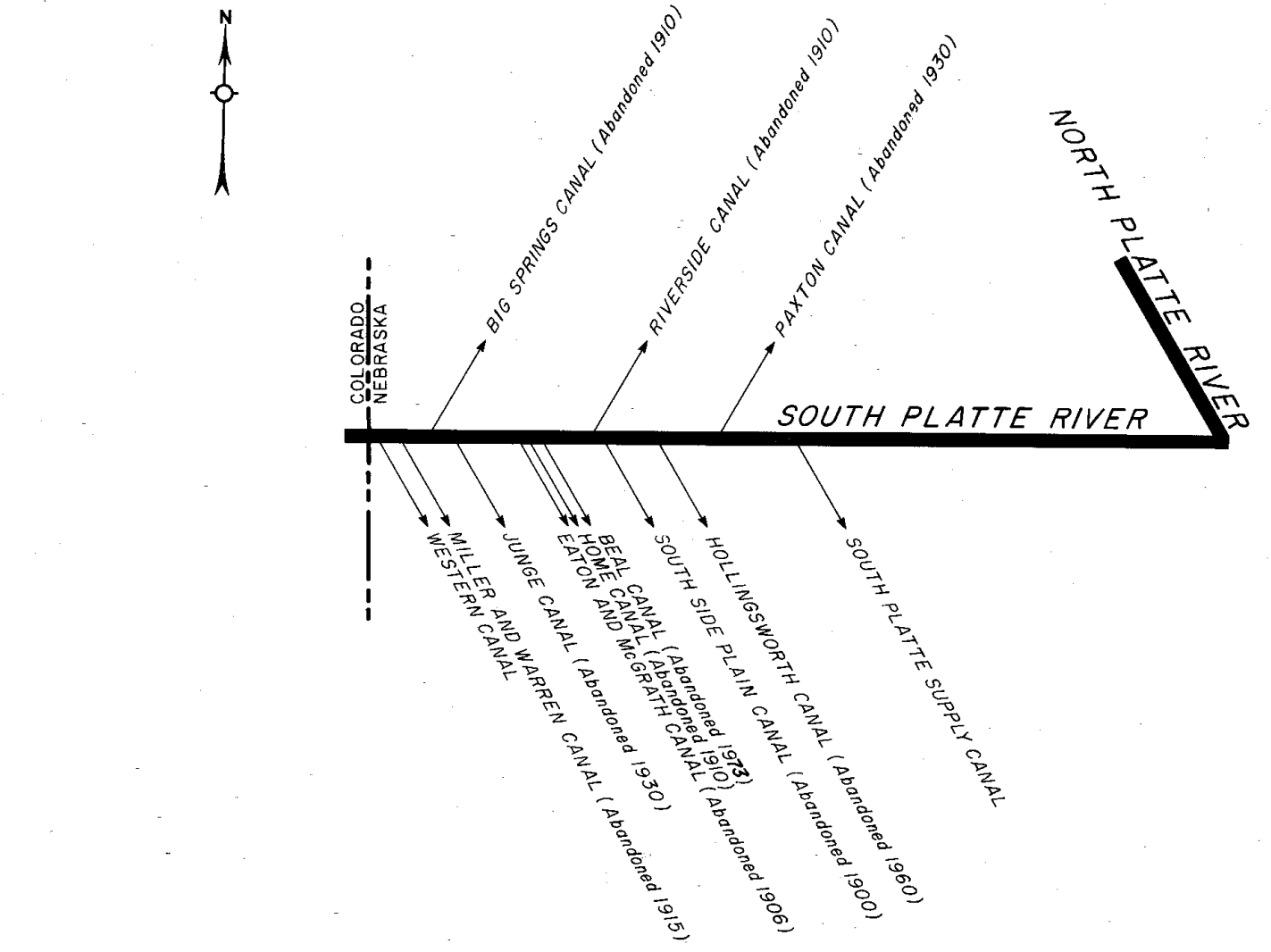
* *A statistical table of individual water diversions is located on page 15.*

WATER APPROPRIATIONS (DIVERSIONS) FROM THE NORTH PLATTE RIVER



WATER APPROPRIATIONS (DIVERSIONS) FROM THE SOUTH PLATTE RIVER





South Platte Valley Administration

Only 22,230 acre-feet of water is diverted to 9,700 acres for irrigation in the South Platte valley. Ground water wells satisfy the irrigation requirements of approximately 118,000 acres.

Of the 12 canals at one time on the South Platte River, only two are still in use. The Western Canal near the Colorado border supplies water to most of the irrigators in the area. The Nebraska Public Power District's South Platte Supply Canal (near Korty) joins the Sutherland Supply Canal to provide flow for hydro-electric generation at the North Platte facility and for cooling at the Gerald Gentleman Station.

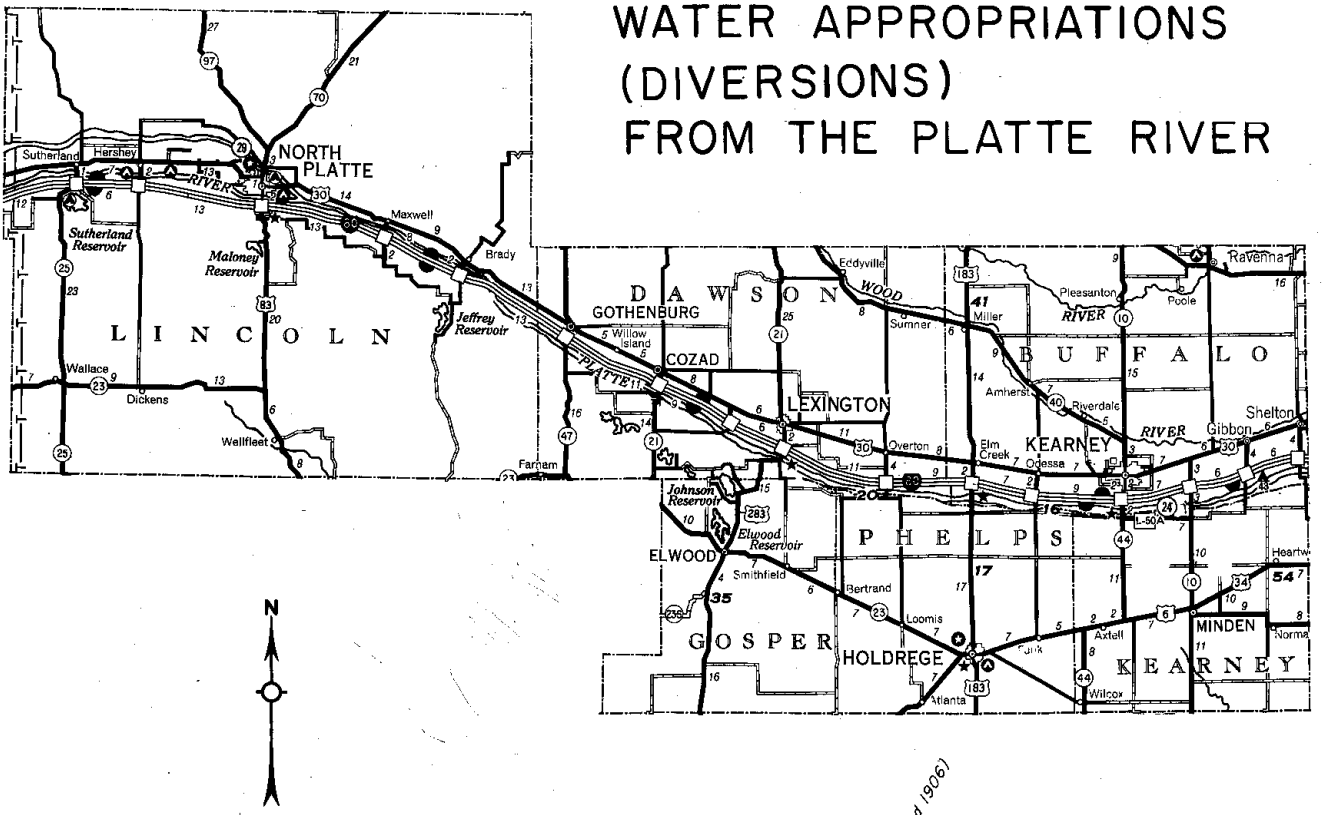
Of the three rivers, administration of the South Platte River is minimal. The river has only two gaging stations (one at Julesburg, Colorado and the other at North Platte) and receives no storage water. Under terms of the 1923 South Platte Compact, Nebraska's Western Canal is placed in priority with Colorado's more downstream canals. When river flow at Julesburg drops below 120 cubic feet per second, the State of Colorado is obligated to close down certain of its more downstream water users for the benefit of the Western Canal.

Platte Valley Administration

Within the Platte River valley (downstream from the confluence of the North and South Platte Rivers east of North Platte) approximately 175,000 acres are irrigated from 504,330 acre-feet of water. Of the 17 original canals, only eight remain in use. The Tri-County Canal alone uses more than half of the available water. Ground water sources provide water to over a million additional acres. Also, several off-river hydro-electric facilities are located within the valley.

The river is administered in sections with key gaging stations located at North Platte, Brady, Cozad, Overton and Odessa. Lake McConaughy provides storage water to all of the canals along the Platte River, though the Kearney Canal seldom uses a significant amount as natural flow usually satisfies its demands.

WATER APPROPRIATIONS (DIVERSIONS) FROM THE PLATTE RIVER



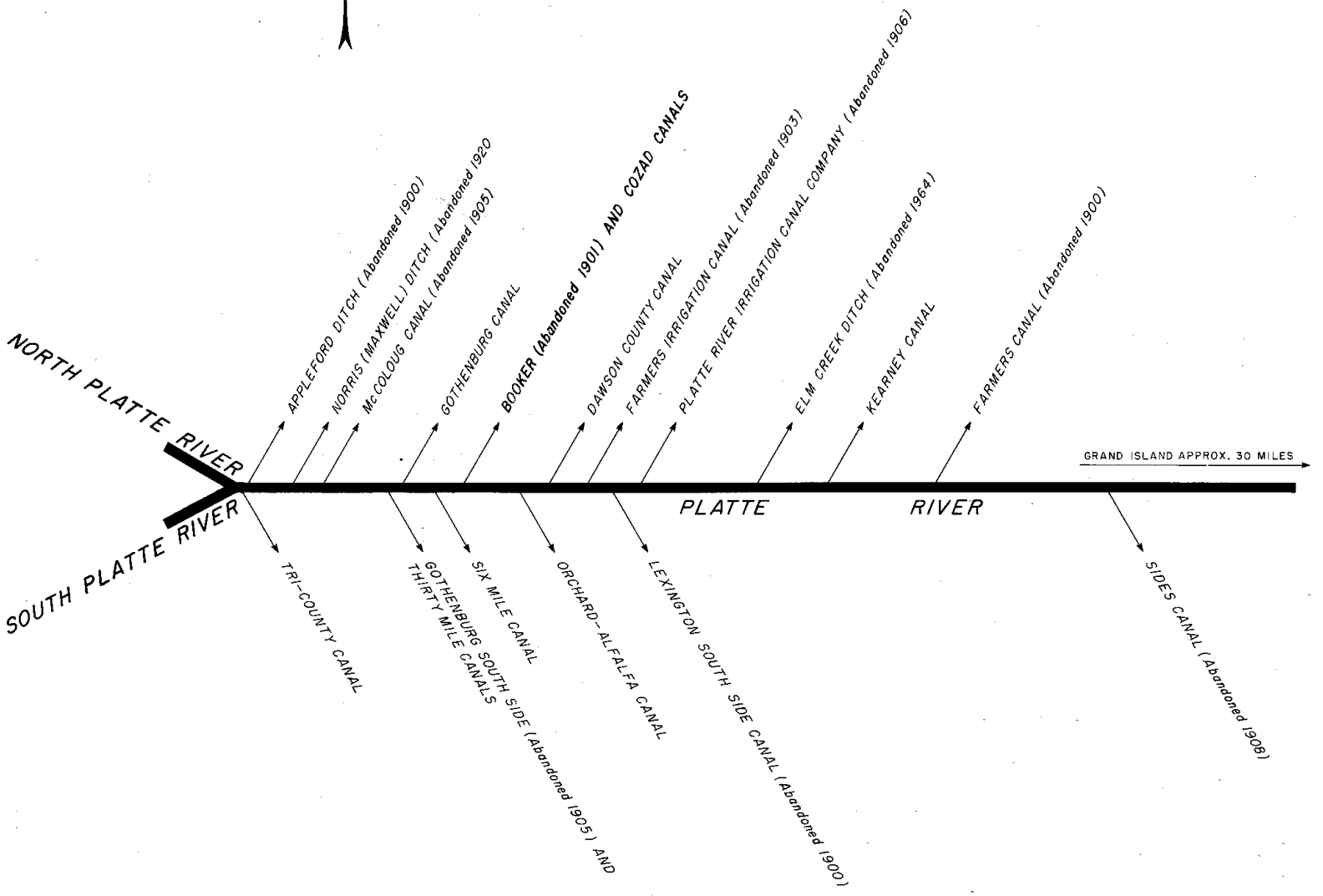


Table of Water Diversions from the Platte River System

10-Year Average (Acre-Feet)

Canal	Storage Release Diverted	Natural Flow	Total
North Platte River			
Alliance	30	19,090	19,120
Beerline	280	2,070	2,350
Belmont	300	29,590	29,890
Browns Creek	640	13,970	14,610
Castlerock & Steamboat		20,740	20,740
Central	310	5,360	5,670
Chimney Rock	1,490	17,110	18,600
Cody-Dillon		6,010	6,010
Empire		6,760	6,760
Enterprise	450	22,380	22,830
Ft. Laramie	104,990	75,450	180,440
Gering	14,160	30,970	45,130
Hannah /1			
Interstate	316,380	173,230	489,610
Keith-Lincoln	890	19,380	20,270
Lisco		8,500	8,500
Midland-Overland		2,060	2,060
Minatare		20,130	20,130
Mitchell	4,300	18,920	23,220
Nine Mile		18,510	18,510
North Platte	3,640	49,800	53,440
Northport	19,730	60,790	80,520
Paxton-Hershey	660	19,460	20,120
Ramshorn		1,500	1,500
Sheridan-Wilson		2,200	2,200
Shortline		7,290	7,290
Suburban	1,610	21,660	23,270
Sutherland Supply	Power Generation		724,730
Tri-State	27,150	180,840	207,990
Winters Creek		15,120	15,120
South Platte River			
South Platte Supply	Power Generation		212,370
Western		22,230	22,230
Platte River			
Cozad	4,200	26,450	30,650
Dawson County	1,820	60,590	62,410
Gothenburg /2	3,460	40,220	43,680
Kearney /2		14,390	14,390
Orchard-Alfalfa	2,120	7,820	9,940
Six Mile	560	1,740	2,300
Thirty Mile	11,410	27,140	38,550
Tri-County /2	212,390	91,020	303,410

/1 Hannah Canal resumed operation in 1978 after several years of non-use.
/2 Quantities are for irrigation exclusive of power.

Glossary

Acre-foot—quantity of water which will cover one acre of land to a depth of one foot. This equals 43,560 cubic feet or 325,851 gallons.

Administration—regulation and enforcement.

Canal Company—corporation suppling water to its stockholders.

Channel—bed where a natural stream of water runs.

Divert—to withdraw water (as in diversion canal).

Ground water—water located below surface of the earth.

Impound—to store water in a reservoir.

Irrigation District—political subdivision supplying water to users within its boundaries.

Natural Flow—water in a stream which originates from natural causes such as rainfall or snowmelt, except that which comes from storage water releases.

Percolation—movement of the ground water in the pore spaces between grains of earth materials.

Project Manager—person in charge of operating a canal company or irrigation district.

Recharge—to replenish ground water supplies.

Reservoir—artifical impoundment created by construction of a dam.

Return Flow—excess irrigation water returning to the river after being diverted to upstream projects.

Storage Water—water impounded in a reservoir and later released.

Stream Bank Pumps—mechanical pumps generally used by individuals to divert water.

Stream Gaging—monitoring/measurement of water flow and storage in impoundments.

Surface Water—water located on the surface of the earth in streams or reservoirs.

Water Appropriation—state permit authorizing diversion or impoundment of surface water.

Water Commissioners—individuals employed to monitor (measure) water and administer water appropriations.

Tri-County Supply Canal

The Platte River Valley has seen many changes over the past century. The North Platte, South Platte and Platte River's still provide Nebraska with a plentiful supply of water. But now, their method of delivery is monitored and water is legally allocated to various users.

The entire water system has become much more complex; but, at the same time more efficient, in order to serve the ever-changing needs of its users.