Water Resources Survey

STATE OF MONTANA WATER RESOURCES BOARD

Part I:

WATER AND RELATED LAND RESOURCES

and

Part II:

IRRIGATION DEVELOPMENT WITH MAPS SHOWING IRRIGATED AREAS IN COLORS DESIGNATING SOURCES OF SUPPLY

Richland County, Montana

Published by
MONTANA WATER RESOURCES BOARD
Sam W. Mitchell Building
Helena, Montana 59601 — May, 1971
Telephone: 406/449-3648

WATER RESOURCES SURVEY

RICHLAND COUNTY, MONTANA

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MONTANA WATER RESOURCES BOARD

3 REPORTER PRTG. & SUPPLY CO

May 1, 1971

The Honorable Forrest H. Anderson
Governor of Montana
State Capitol Building
Helena, Montana

Dear Governor Anderson:

Submitted herewith is a consolidated report on a survey of Water Resources for Richland County, Montana.

The report is divided into two parts: Part I consists of history of land and water uses, and Part II contains the summary of water rights and irrigated lands, and the township maps in the County showing in colors the lands irrigated from each source of water supply.

Surveys have been made in the counties of Big Horn, Blaine, Broadwater, Carbon, Carter, Cascade, Chouteau, Custer, Dawson, Deer Lodge, Fallon, Flathead, Gallatin, Glacier, Golden Valley, Granite, Hill, Jefferson, Judith Basin, Lake, Lewis and Clark, Liberty, Lincoln, Madison, Meagher, Mineral, Missoula, Musselshell, Park, Phillips, Pondera, Powder River, Powell, Prairie, Ravalli, **Richland**, Rosebud, Sanders, Silver Bow, Stillwater, Sweet Grass, Teton, Toole, Treasure, Valley, Wibaux, Wheatland and Yellowstone. Reports are available for all of the counties except a few of the ones which were surveyed a number of years ago and are now out of print. However, reports will again be published on these counties sometime in the future after they have been updated. Copies of these Water Resources Survey reports are available upon request to the Montana Water Resources Board.

The office files contain minute descriptions and details of each individual water right and land use, which are too voluminous to be included herein. These office files are available for inspection to those who are interested.

The historical data on water rights contained in these reports can never become obsolete. If new information is added from time to time as new developments occur, the records can always be kept current and up-to-date.

Respectfully submitted,
DOUGLAS G. SMITH, DIRECTOR
Montana Water Resources Board

ACKNOWLEDGMENTS

A survey and study of water resources involves many phases of both field and office work in order to gather the necessary data to make the information complete and comprehensive. Appreciation of the splendid cooperation of various agencies and individuals who gave their time and assistance in aiding us in gathering the data for the preparation of this report is hereby acknowledged.

Hans L. Bille........Surface Water Rights Coordinator and Editor

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METHOD OF SURVEY

Water resources data contained in Part I and Part II of this report are obtained from courthouse records in conjunction with individual contacts with landowners. A survey of this type involves extensive detailed work in both the office and field to compile a comprehensive inventory of water rights as they apply to land and other uses.

The material of foremost importance used in conducting the survey is taken from the files of the county courthouse and the data required includes: landownership, water right records (decrees and appropriations), articles of incorporation of ditch companies and any other legal papers concerning the distribution and use of water. Deed records of landownership are reviewed and abstracts are checked for water right information when available.

Aerial photography is used by the survey to assure accuracy in mapping the land areas of water use and all the other detailed information which appears on the final colored township maps in Part II. Section and township locations are determined by the photogrammetric system, based on government land office survey plats, plane-table surveys, county maps and by "on-the-spot" location during the field survey. Noted on the photographs are the locations of each irrigation system, with the irrigated and irrigable land areas defined. All the information compiled on the aerial photo is transferred and drawn onto a final base map by means of aerial projection. From the base map, color separation maps are made and may include three to ten overlay separation plates, depending on the number of irrigation systems within the township.

Field forms are prepared for each landowner showing the name of the owner and operator, photo index number, a plat defining the ownership boundary, type of irrigation system, source of water supply and the total acreage irrigated and irrigable under each. All of the appropriated and decreed water rights that apply to each ownership are listed on the field forms with the description of intended place of use. During the field survey, all water rights listed on the field form are verified with the landowner. Whenever any doubt or complication exists in the use of a water right, deed records of the land are checked to determine the absolute right and use.

So far as known, this is the first survey of its kind ever attempted in the United States. The value of the work has become well substantiated in the counties completed to date by giving Montana its first accurate and verified information concerning its water rights and their use. New development of land for irrigation purposes by State and Federal agencies is not within the scope of this report. The facts presented are found at the time of completion of each survey and provide the items and figures from which a detailed analysis of water and land use can be made.

The historical data contained in these reports can never become obsolete. If new information is added from time to time as new developments occur, the records can always be kept current and up-to-date.

Complete data obtained from this survey cannot be included in this report as it would make the text too voluminous. However, if one should desire detailed information about any particular water right, lands irrigated, or the number and amount of water rights diverting from any particular stream, such information may be obtained by writing the Montana Water Resources Board in Helena.

Every effort is being made to ensure accuracy of the data collected rather than to speed up the work which might invite errors.

SURFACE WATER RIGHTS

Our concern over surface water rights in Montana is more than a century old. When the first Territorial Legislature, meeting in Bannack, adopted the common law of England on January 11, 1865, the Territory's legal profession assumed that it had adopted the Doctrine of Riparian Rights. This doctrine had evolved in England and in the eastern United States where the annual rainfall is generally more than twenty inches. It gave the owners of land bordering a stream the right to have that stream flow past their land undiminished in quantity and unaltered in quality and to use it for household and livestock purposes. The law restricted the use of water to riparian owners and forbade them to reduce appreciably the stream flow, but the early miners and ranchers in Montana favored the Doctrine of Prior Appropriation which permitted diversion and diminution of the streams. Consequently, the next day the legislature enacted another law which permitted diversion by both riparian and non-riparian owners. Whether or not this action provided Montana with one or two definitions of water rights was not settled until 1921 when the Montana Supreme Court in the Mettler vs. Ames Realty case declared the Doctrine of Prior Appropriation to be the valid Montana water right law. "Our conclusion," it said, "is that the common law doctrine of riparian rights has never prevailed in Montana since the enactment of the Bannack Statutes in 1865 and that it is unsuited to the conditions here . . ."

The appropriation right which originated in California was used by the forty-niners to divert water from the streams to placer mine gold. They applied to the water the same rules that they applied to their mining claims—first in time, first in right and limitation of the right by beneficial use. Those who came to Montana gulches brought with them these rules, applying them to agriculture as well as to mining.

The main points of consideration under the Doctrine of Prior Appropriation are:

1. The use of water may be acquired by both riparian and non-riparian landowners.

2. It allows diversion of water regardless of the reduction of the water supply in the stream.

3. The value of the right is determined by the priority of the appropriation; i.e., first in time is first in right.

4. The right is limited to the use of the water. Stream waters in Montana are the property of the State and the appropriator acquires only a right to their use. Moreover, this use must be beneficial.

5. A right to the use of water is considered property only in the sense that it can be bought or sold; its owner may not be deprived of it except by due process of law.

The State Legislature has provided methods for the acquisition, determination of priority and administration of the right. No right may be acquired on a stream without diversion of water and its application to a beneficial use. On unadjudicated streams, the Statutes stipulate that the diversion must be preceded by posting a notice at a point of intended diversion and by filing a copy of it within 20 days in the county clerk's office of the county in which the appropriation is being made. Construction of the means of diversion must begin within 40 days of the posting and continued with reasonable diligence to completion (Section 89-810 R.C.M. 1947). However, the Montana Supreme

Court has ruled that an appropriator who fails to comply with the Statutes may still acquire a right merely by digging a ditch and putting the water to beneficial use.

To obtain a water right on an adjudicated stream one must petition the District Court having jurisdiction over the stream for permission to make an appropriation. If the other appropriators do not object, the court gives its consent and issues a supplementary decree granting the right subject to the rights of the prior appropriators.

Montana laws do not require water users to file official records of the completion of their appropriations; therefore, it becomes advisable as soon as the demand for the waters of a stream becomes greater than its supply, to determine the rights and priorities of each user by means of an adjudication or water right suit. This action may be initiated by one or more of the appropriators who may make all the other claimants parties to the suit. The Judge of the District Court then examines all of the claims and issues a decree establishing priority of the right of each water user and the amount of water he is entitled to use. The court decree becomes in effect the deed of the appropriator to his water right.

Whenever scarcity of water in an adjudicated stream requires an allocation of the supply according to the priority of rights, the Judge, upon petition of the owners of at least 15 percent of the water rights affected, must appoint a water commissioner to distribute the water. Chapter No. 231, Montana Session Laws 1963, Senate Bill 55 amended Section 89-1001 R.C.M. 1947, to provide that a water commissioner be appointed to distribute decreed water rights by application of 15 percent of the owners of the water rights affected, or, under certain circumstances at the discretion of the Judge of the District Court—**"provided that when petitioners make proper showing they are not able to obtain the application of the owners of at least 15 percent of the water rights affected, and they are unable to obtain the water to which they are entitled, the Judge of the District Court having jurisdiction may, in his discretion, appoint a water commissioner."** After the Commissioner has been appointed the Judge gives his instructions on how the water is to be apportioned and distributed in accordance with the full terms of the decree.

The recording of appropriations in local courthouses provides an incomplete record of the water rights on unadjudicated streams. In fact, the county records often bear little relation to the existing situation. Since the law places no restriction on the number or extent of the filings which may be made on an unadjudicated stream, the total amount of water claimed is frequently many times the available flow. There are numerous examples of streams becoming over appropriated. Once six appropriators each claimed all the water in Lyman Creek near Bozeman. Before the adjudication of claims to the waters of Prickley Pear Creek, 68 parties claimed thirty times its average flow of about 50 cfs. Today, the Big Hole River with an average flow of about 1,000 cfs has filings totaling 173,912 cfs. One is unable to distinguish in the county courthouse the perfected rights from the unperfected ones since the law requires no official recording of the completion of an appropriation. Recognition by the courts of unrecorded appropriations adds to the incompleteness of these records. To further complicate the situation, appropriators have used different names for the same stream in their filings. In Montana, many of the streams flow through several counties; consequently, water right filings on those inter-county streams are found distributed in two or more county courthouses. Anyone desirous of determining appropriations on a certain river or creek finds it difficult and expensive to examine records in several places. In addition, the records are sometimes scattered because the original nine counties of 1865 have now increased to 56. As the original counties have been divided and subdivided, the water right filings have frequently not been transcribed from the records of one county to the other. Thus, a record of an early appropriation in what is at present Powell County may be found in the courthouse of the original Deer Lodge County.

It can readily be seen that this system of recording offers little protection to rights in the use of water until they are determined by adjudication. In other words, an appropriator does not gain clear title to his water right until after adjudication, and then the title may not be clear because the Montana system of determining rights is also faulty. In the first place, adjudications are costly, sometimes extremely costly when they are prolonged for years. It is estimated that litigation over the Beaverhead River, which has lasted more than twenty years, has cost the residents of the valley nearly one-half million dollars. In the second place, unless the court seeks the advice of a competent irrigation engineer, the adjudication may be based upon inaccurate evidence; in the third place, if some claimant has been inadvertently left out of the action, the decree is not final and may be reopened for consideration by the aggrieved party. Another difficulty arises in determining the ownership of a water right when land under an adjudicated stream becomes subdivided in later years and the water is not apportioned to the land by deed or otherwise. There are no provisions made by law requiring the recording of specific water right ownership on deeds and abstracts.

The Legislative Session of 1957 passed Chapter 114 providing for the policing of water released from storage to be transmitted through a natural stream bed to the place of use. The owner of the storage must petition the court for the right to have the water policed from the storage reservoir to his place of use. If there are no objections the court may issue the right and appoint a water commissioner to distribute the water in accordance therewith. This law applies only to unadjudicated streams.

Administration of water on adjudicated streams is done by the District Court, but it has its drawbacks. The appointment of a water commissioner is often delayed until the shortage of water is acute and the court frequently finds it difficult to obtain a competent appointee for so temporary a position. The present administration of adjudicated streams which cross the county boundaries of judicial districts creates problems. Many of the water decrees stipulate head gates and measuring devices for proper water distribution, but in many instances the stipulation is not enforced, causing disagreement among water users.

Since a water right is considered property and may be bought and sold, the nature of water requires certain limitations in its use. One of the major difficulties encountered after an adjudication of a stream is the failure of the District Court to have control over the transfer of water rights from their designated places of use. The sale and leasing of water is becoming a common practice on many adjudicated streams and has created serious complications. By changing the water use to a different location, many of the remaining rights along the stream are disrupted, resulting in a complete breakdown of the purpose intended by the adjudication. Legal action necessary to correct this situation must be initiated by the injured parties as it is their responsibility and not that of the court.

In 1967, the Montana Legislative Assembly passed Section (89-813) Water Laws of Montana which states: "From and after July 1, 1967, the county clerk and recorder shall forward to the Montana Water Resources Board a copy of any instrument of water appropriation or any instrument transferring any water appropriation which is filed as provided in this section."

This means that copies of **all surface water filings** (appropriations) and copies of **all deed transfers** of water appropriations filed in the office of the county clerk and recorder on or after July 1, 1967 are to be forwarded to the Montana Water Resources Board, Sam W. Mitchell Building, Helena, Montana 59601.

At one time or another all of the Western Reclamation States have used similar methods of local regulation of water rights. Now all of them, except Montana, have more or less abandoned these practices and replaced them by a system of centralized state control such as the one adopted by the State of Wyoming. The key characteristics of the Wyoming system are the registration of both the initiation and completion of an appropriation in the State Engineer's office, the determination of rights and administration by a State Board of Control headed by the State Engineer. These methods give the Wyoming water users title to the use of water as definite and defensible as those which they have to their land.

When Montana began to negotiate the Yellowstone River Compact with Wyoming and North Dakota in 1939, the need for some definite information concerning our water and its use became apparent. The Legislature in 1939 passed a bill (Ch. 185) authorizing the collection of data pertaining to our uses of water and it is under this authority that the Water Resources Survey is being carried on. The purpose of this survey is: (1) to catalogue by counties in the office of the Montana Water Resources Board, all recorded, appropriated, and decreed water rights including the use rights as they are found; (2) to map the lands upon which the water is being used; (3) to provide the public with pertinent water right information on any stream, thereby assisting in any transaction involving water; (4) to help State and Federal agencies in pertinent matters; (5) to eliminate unnecessary court action in water right disputes; and (6) to have a complete inventory of our perfected water rights in case of need to defend these rights against the encroachments of downstream states, or Wyoming or Canada.

GROUNDWATER RIGHTS

Groundwater and surface water are often intimately related. In fact, it is difficult in some cases to consider one without the other. In times of heavy precipitation and surface runoff, water seeps below the land surface to recharge underground reservoirs which, in turn, discharge groundwater to streams and maintain their flow during dry periods. The amount of water stored underground is far greater than the amount of surface water in Montana, and, without seepage from underground sources it is probable that nearly all the streams in the state would cease to flow during dry periods.

It is believed that Montana's groundwater resources are vast and only partly developed. Yet, this resource is now undergoing accelerated development as the need for its use increases and economical energy for pumping becomes available. Continued rapid development without some regulation of its use would cause a depletion of groundwater in areas where the recharge is less than the withdrawal. Experience in other states has shown that once excessive use of groundwater in a specific area has started, it is nearly impossible to stop, and may result in painful economic readjustments for the inhabitants of the affected area.

Practical steps aimed at conserving groundwater resources as well as correcting related deficiencies in surface water laws became necessary in Montana. Prior to the Legislative Session of 1961, there was no legal method of appropriating groundwater. Proposed groundwater codes were introduced and rejected in four biennial sessions of the Montana Legislative Assembly — 1951, 1953, 1955 and 1959.

In 1961, during the 37th Legislative Session, a bill was introduced and passed creating a Groundwater Code in Montana (Chapter 237, Session Laws of Montana, 1961.) This bill became effective as a law on January 1, 1962, with the State Engineer of Montana designated as "Administrator" to carry out provisions of the Act. However, the 1965 Legislature abolished the office of the State Engineer and transfered his duties to the State Water Conservation Board, effective July 1, 1965. On July 1, 1967, the name of the State Water Conservation Board was changed to the Montana Water Resources Board. Therefore, the Montana Water Resources Board became the "Administrator" of this Act.

Some of the important provisions contained in Montana's Groundwater Law are:

Section 1. DEFINITIONS OR REGULATIONS AS USED IN THE ACT.

(a) "Groundwater" means any fresh water under the surface of the land including the water under the bed of any stream, lake, reservoir, or other body of surface water. Fresh water shall be deemed to be the water fit for domestic, livestock, or agricultural use. The Administrator, after a notice of hearing, is authorized to fix definite standards for determining fresh water in any controlled groundwater area or subarea of the State.

(b) "Aquifer" means any underground geological structure or formation which is capable of yielding water or is capable of recharge.

(c) "Well" means any artificial opening or excavation in the ground, however made, by which groundwater can be obtained or through which it flows under natural pressures or is artificially withdrawn.

(d) "Beneficial use" means any economically or socially justifiable withdrawal or utilization of water.

(e) "Person" means any natural person, association, partnership, corporation, municipality, irrigation district, the State of Montana, or any political subdivision or agency thereof, and the United States or any agency thereof.

(f) "Administrator" means the Montana Water Resources Board of the State of Montana.

(g) "Groundwater area" means an area which, as nearly as known facts permit, may be designated so as to enclose a single distinct body of groundwater, which shall be described horizontally by surface description in all cases and which may be limited vertically by describing known geological formations, should conditions dictate this to be desirable. For purpose of administration, large groundwater areas may be divided into convenient administrative units known as "subareas."

Section 2. RIGHT TO USE.

Rights to surface water where the date of appropriation precedes January 1, 1962, shall take priority over all prior or subsequent groundwater rights. The application of groundwater to a beneficial use prior to January 1, 1962, is hereby recognized as a water right. Beneficial use shall be the extent and limit of the appropriative right. As to appropriations of groundwater completed on and after January 1, 1962, any and all rights must be based upon the filing provisions hereinafter set forth, and as between all appropriators of surface water or groundwater on and after January 1, 1962, the first in time is first in right.

Montana's Groundwater Code now provides for three different types of forms available for filing water rights, depending upon the nature of the groundwater development. The use of GW-4, Declaration of Vested Groundwater Rights, expired January 1, 1966.

Form GW-1, **"Notice of Appropriation of Groundwater"** — shall require answers to such questions as (1) the name and address of the appropriator; (2) the beneficial use for which the appropriation is made, including a description of the lands to be benefited if for irrigation; (3) the rate of use in gallons per minute of groundwater claimed; (4) the annual period (inclusive dates) of intended use; (5) the probable or intended date of first beneficial use; (6) the probable or intended date of commencement and completion of the well or wells; (7) the location, type, size, and depth of the well or wells contemplated; (8) the probable or estimated depth of the water table or artesian aquifer; (9) the name, address and license number of the driller engaged; and (10) such other similar information as may be useful in carrying out the policy of this Act. This form is optional but it has an advantage in that after filing the Notice of Appropriation, a person has 90 days in which to commence actual excavation and diligently prosecute construction of the well. Otherwise, failure to file the Notice of Appropriation deprives the appropriator of his right to relate the date of the appropriation back upon filing the Notice of Completion.

Form GW-2, **"Notice of Completion of Groundwater Appropriation by Means of Well"** — this form shall require answers to the same sort of questions as required by Form GW-1 (Notice of Appropriation of Groundwater), except that for the most part it shall inquire into accomplished facts concerning the well or means of withdrawal, including (a) information as to the static level of water in the casing or the shut-in pressure if the well flows naturally; (b) the capacity of the well in gallons per minute by pumping or natural flow; (c) the approximate drawdown or pumping level of the well; (d) the approximate surface elevation at the well head; (e) the casing record of the well; (f) the drilling log showing the character and thickness of all formations penetrated; (g) the depth to which the well is drilled and similar information.

It shall be the responsibility of the driller of each well to fill out the Form GW-2, "Notice of Completion of Groundwater Appropriation by Means of Well," for the appropriator, and the latter shall be responsible for its filing.

Form GW-3, **"Notice of Completion of Groundwater Appropriation Without Well"** — is for the benefit of persons obtaining (or desiring to obtain) groundwater without a well, such as by subirrigation or other natural processes so as to enable such persons to describe the means of using groundwater; to estimate the amount of water so used; and requiring such other information pertinent to this particular type of groundwater appropriation.

Montana's Groundwater Code provided for a period of four (4) years after January 1, 1962, for filing vested groundwater rights. The deadline for filing was December 31, 1965. A person did not automatically lose his vested groundwater rights by failure to file within the four-year period, but in the event of a future groundwater dispute, he would bear the burden of proving his rights in court.

It shall be recognized that all persons who have filed a Water Well Log Form as provided for under Sections 1 and 2 of Chapter 58, Session Laws of Montana, 1957, shall be considered as having complied with the requirements of this Act.

It is important to note that the groundwater law states, "UNTIL A NOTICE OF COMPLETION (Form GW-2 or GW-3) is FILED WITH RESPECT TO ANY USE OF GROUNDWATER INSTITUTED AFTER JANUARY 1, 1962, NO RIGHT TO THAT USE OF WATER SHALL BE RECOGNIZED."

Copies of the forms used in filing on groundwater are available in the County Clerk and Recorder's Office in each of Montana's 56 counties. It shall be the duty of the County Clerk in every instance to record and file the original copy of the appropriation, transmit the second copy to the Administrator (Montana Water Resources Board) and the third copy to the Montana Bureau of Mines and Geology. A fourth copy is to be retained by the appropriator (person making the filing).

An accurate method of compiling data on the amount of water being used and the amount of water available for future use is essential in the administration and investigation of water resources. In areas where the water supply becomes critical, the groundwater law provides that the Administrator may define the boundaries of the aquifer and employ inspectors to enforce rules and regulations regarding withdrawals for the purpose of safeguarding the water supply and the rights of the appropriators. (See wording of the law for establishing a "controlled area.")

The filing of water right records in a central office under control of a responsible State agency provides an efficient means for the orderly development and preservation of our water supplies while protecting all appropriators.

HISTORY AND ORGANIZATION

To have a better understanding of the origin of Richland County, it is necessary to go back and start from the early days of the 19th century. The French were in possession of this territory which included the area now contained in Richland County.

The first human residents of the Richland County area were Arikaree Indians, but they were eventually driven out by the Sioux tribe. The Arikaree were probably a part of the Crow Nation because their favorite hunting and camping grounds were located along the Yellowstone River. However, the Sioux Indians were in possession of these fabulous hunting grounds when the early explorers began to arrive in the Yellowstone country.

Among the earliest adventurers in the area were Larocque, Colter, LeRaye and the Lewis and Clark Expedition. It was during this time that President Jefferson was negotiating with France to obtain possession of the Louisiana Territory for the United States.

This area was governed under the Territory of Missouri until 1821, when it was designated "Indian Country." During the next 30 years this "Indian Country" of eastern Montana history began to take form. Some of the toughest hunters, trappers and desperadoes poured into the country to reap their harvest of riches obtained from the fur-bearing animals. It was during this period of organized fur trading that the field headquarters post of Fort Floyd was established. This post, a short distance from the Montana boundary line in North Dakota played an important part in the history of Montana, especially that area now known as Richland County. Fort Floyd was also known as Fort Union, Fort Williams, Fort Mortimer and, lastly, Fort Buford.

During the era of fur trade, the American Fur Company founded a post at Fort Floyd and called it Fort Union. This fort was considered the most important trading post on the upper Missouri River and the hub of other fur trading posts in the Territory. One noted authority thought Fort Union was the best built trading post in the Northwest and that it was ideally located to defend, if attacked by warring Indian tribes.

Kenneth MacKenzie, the manager of the American Fur Company, tried to establish friendly relations between the Indian tribes. Although the Blackfeet and Assiniboines were at that time the worst of enemies, MacKenzie succeeded in having these two tribes sign a treaty of friendship and establish a boundary line between them in the northern part of the Territory.

The Indians, during the fur trading period, soon became convinced of the dishonesty of all fur traders, suspicious of the whites and a resentment of intrusion of all of the foreigners in the area of their great hunting grounds. Finally, the tribes decided that the Great Plains between the Yellowstone and Missouri Rivers would be the common hunting grounds for all of the tribes. At this time the whites considered this area the Great American Desert and no permanent settlements were established there. Any development in the area was discouraged because it interfered with the fur bearing animals located there.

It was during this period that the Richland County area had some culture introduced into its history. George Catlin, an American artist, came to Fort Union looking for the opportunity to paint pictures of the American Indians in their natural state. Maximilian, the Prince of Weid and a scientist, also came during this period seeking adventure. Accompanying the Prince was the German artist, Karl Bodmer, who painted a picture of Fort Union while residing there. In 1843, Audubon came to study bird life, and he also made drawings of the Three Buttes, a well known landmark north of Sidney.

In 1854, the Nebraska Territory was given supervision over these Northern Plains for a period of 7 years. It was during this time in history that the first steamboats were introduced to Montana. Steven Long was the first person to attempt to take a steamboat to the Upper Missouri. The introduction of steamboat travel into the Territory hastened the slaughter and extermination of the huge herds of buffalo on our Great Plains. The era of the steamboat lasted from about 1859 to 1888 when the railroad was introduced by Jim Hill and replaced the river as a means of transportation.

The year 1861 brought another change in the Territory when the Dakota Territory was formed and included Eastern Montana. Two years later the Territory was included in the Territory of Idaho along with the rest of the area which now composes the State of Montana. Finally, in 1864 the Montana Territory was formed and Governor Edgerton was appointed by President Lincoln. About this time gold was being discovered in the southwestern part of the Territory, while the buffalo were being killed by the thousands in the northeastern part of the Territory.

Captain Grant Marsh, an important pioneer in the steamboat era, entered into the history of the Territory in 1864 while the fur trade flourished; during the Indian Wars; and again in 1903 when he became a prominent personality in the area now known as Richland County.

Another noted early day character of this period was Luther S. Kelly, better known at that time as "Yellowstone Kelly." Kelly was the son of a prosperous family in New York State. Until he was fifteen years of age he attended a good elementary school. During the Civil War he served as a boy soldier for two years and was discharged from the Army at a fort in Dakota in 1867. Instead of returning to his home in New York, he secured a pony and went into Manitoba, Canada. He left there enroute to the Missouri River where he joined up with a party of halfbreeds on a buffalo hunt and eventually he arrived at Fort Buford. It was during his stay at Fort Buford that Sioux Indians became hostile to all whites and it became necessary for mail to be escorted by mounted troops in order to get it through from Fort Stevenson to Fort Buford. It was during one of the times when the mail failed to make it through that Kelly proved his courage by taking it through the hostile Indian country. After this feat of courage, the Fort Berthold Indians named him "The-Little-Man-With-A-Strong-Heart." For a while Kelly continued carrying the mail, but he soon tired of this occupation and desired to do something more exciting. Finally he set out alone, trapping along the Yellowstone River during the summer season, and returning each fall to the vicinity of Fort Buford where he established his winter headquarters.

Kelly was also a good friend of Captain Marsh and once accompanied him and General Forsyth on an expedition up the Yellowstone River as a scout and guide. He was a scout and guide for General Miles when he made the trip to the Tongue River during the final battles of the Indian Wars in that area.

"Yellowstone Kelly" continued as a scout until 1883 when he joined the Army and became commissioned a Captain. After serving in the U.S. Army he was appointed to a post in the Philippines for four years. His last days were spent at San Carlos, Arizona, as a United States Indian Agent.

Another scout and guide of the same era (1860's) was "Lonesome" Charlie Reynolds. Reynolds like Kelly, had served in the Civil War and craving adventure he joined a party bound for California. The trip was interrupted by an Indian attack and Reynolds stayed on in this Northwest region to gain a reputation as a frontiersman and exceptional hunter.

The Indians called Reynolds "The-White-Hunter-Who-Never-Goes-Out-For-Nothing." One severe winter when Berthold Agency Indians were suffering from hunger and their hunters were unable to procure any wild game, Lonesome Charlie went on a hunting trip with a halfbreed Arikaree and returned with eight elk for them; thus, he was given this name among the Indians.

In 1875, Reynolds made a trip with Captain Marsh on the steamer Josephine. He also served as a scout for General Custer. His skill as a hunter was of great value to any expedition, and the slaughter he wrought among the wild animals caused continual astonishment to the soldiers. Reynolds last assignment was as a scout with the ill-fated expedition of General Custer; he never returned.

Prior to the year 1876, Indians still roamed at will along the Yellowstone River and in the valley near its mouth. Few trappers and early explorers came up the river and none tarried very long.

However, in 1876, two trappers, both bachelors of indefinite age, took a fancy to the lower Yellowstone valley. These trappers were James "Jimmie" Crane and Joseph "French Joe" Seymore who settled on Fox Creek where they built a log cabin and decided to make it their home, the first settlement in the valley. In 1888, they sold their place to John O'Brien who was married in September of that year. The O'Brien place became well-known as a stage stop, restaurant, store and general headquarters for many early settlers in the valley.

Some of the early pioneer settlers in the area during the years of 1877 and 1878 were William Shadwell, Andy Ruhl, Scott and Tom Courshane. In 1879 and 1880 the early residents there included W. W. Newlon, T. J. Chestnut, A. P. Ayotte, Bill Cheney, the Dunlaps, George Grant, the Hursts, Charles Adams, Sartins, Tilyous, H. W. Otis, O. D. Polly, the Bickfords, Jarvises, Youngs, Townes, Martins, Dave Stewart, Lawsons, Kelleys, Armstrongs, George Morgan, Tilcome and Jordan Lightner. In 1882 there were the Oberfells, the Sterlies, George McCone, Lovering brothers, Si Bean, N. W. Comfort, Steve Marmon, Ferris, Iva Allen and Charles Crossin came and were among the well-known settlers in the valley. By now, the little settlement along the Yellowstone had grown to a total of sixty inhabitants. These were some of the earliest settlers to come into the Yellowstone valley of which Richland is now a part.

When the cowboys ruled the plains, the Richland County area was regarded as one of the premium stock ranges of the great cattle country of eastern Montana. There were acres and acres of free grass in the country and the range was merely commandeered. The cattlemen had their own range law, and the first there had the right to graze his cattle in that area. However, they did have problems in holding their range from the grass pirates who sought to edge their stock into another cattleman's territory. There was always Indian trouble, especially with the Crows, who preyed upon the white man's cattle herds. The cattle rustlers became an organized company of renegades that included ex-buffalo hunters, ex-wolfers, fugitives and murderers who had established headquarters in the Missouri badlands. In these badlands, you could find such notorious rustlers as Rattlesnake Jake, Fallon and Long-haired Owens. These outlaws eventually met their death in an encounter with the Stuart Stranglers, a vigilance committee which was formed to protect the stockmen in this eastern part of the state. These were the days of the great cattle drives from Texas which lasted until the severe winter of 1886-1887 when many of the cattlemen lost all their livestock and were forced to leave the country. Those cattlemen who did remain changed to a more diversified ranch operation, with fewer cattle, a limited but better range that included a supplemental supply of hay to carry them through the winter months.

The building of the railroads opened up the Richland County area for settlement. The Northern Pacific branch line from Glendive to Sidney was built in 1912 and the Great Northern branch line was completed to Richey in 1914. When the great influx of homesteaders came into the area after the Northern Pacific branch line reached Sidney in 1912, there became a need for some type of local government.

On May 16, 1914, the question of a division from Dawson County was presented to the Legislature and by popular vote Richland County was created, with the town of Sidney designated as the county seat.

That area of Richland County located along the west bank of the Yellowstone River that grew only sagebrush and short sparse grass soon became an oasis of alfalfa, sugar beets and other forage crops as a result of the construction of the Lower Yellowstone Irrigation Project.

The Reclamation Act of 1902 enacted by the United States Congress provided for the development of the arid lands of the west. Construction activities of the Lower Yellowstone Project began in June 1905 (see write-up of Project in Part II of this report), and by April 1909 irrigation facilities were completed for approximately 40,000 acres. About 7,000 acres were irrigated the first year. At later dates additional acreages were developed, bringing the total irrigable area to approximately 60,000 acres.

During the 1930's and early 1940's an irrigation economy became well established in Richland County, and the Lower Yellowstone Project exerted an influence in the economy far beyond the project area. Sheep and cattlemen within a radius of hundreds of miles depend upon the project for the sale of feeder cattle and sheep and for feed in drought years to retain their foundation herds.

The success of the Lower Yellowstone Project can be seen in the highly intensified crop production, the well established farms and farm homes, and the progressive towns that serve the projects.

Due to the efforts of local Sidney and Fairview men, a sugar refinery was constructed at Sidney in 1924-25, under the name of the Midland Sugar Company, a subsidiary of the Holly Sugar Corporation, and later it became a part of the Holly Sugar Corporation.

Factory production, which started at 58,115 tons of sugar beets and 127,433 bags of sugar in 1925 increased to 290,000 tons of sugar beets and 700,000 bags of sugar in 1961. These figures show that progress is being made by the farmers in raising sugar beets, and the factory in processing them. The sugar beet pulp, tops and molasses provides highly nutritional feed when combined with alfalfa, corn, barley, oats and other crops grown in the county for fattening sheep and cattle.

In 1943, the Yellowstone Livestock Commission was started by Ingvard Svarre and Chris Hansen. The Yellowstone Livestock Commission, located in Sidney has an average sale of 1,500 and 2,000 head of cattle each week (Wednesday) representing 150 to 200 consigners and 40 to 60 different buyers. The Commission also cooperates with the S and H Cattle Company in keeping 1,000 to 2,000 head of cattle in feed lots at the stockyards to fatten for market. The Yellowstone Livestock

Commission is one of the State's leading auction markets, usually ranking second in the State in volume of sales each year. There are from 65,000 to 90,000 head of cattle marketed through the auction each year in addition to 20,000 head of sheep and 10,000 head of hogs.

Sidney, which is situated midway between Glendive and Williston, is halfway between the flourishing oil fields at Beaver Lodge and Toga on the North Dakota side of the Williston Basin and the oil fields at Poplar, Richey and Glendive on the Montana side.

So far oil development in Richland County is not very extensive. There are a few producing wells near Sidney and in the western part of the county. Much of Richland County's acreage has been leased to oil companies. The leading leaseholders of mineral rights are the Shell, Standard and Sun Oil Companies. If the oil industry develops fully in the potential area, Richland County will no doubt be in the center of an "oil boom." Sidney, which is served by Frontier Airlines, the Northern Pacific and Great Northern Railroads, and a highway system connecting Glendive, Williston, Richey and Poplar has a future of rapid growth if oil becomes a leading industry in the area.

Sidney, the county seat, and Fairview are the only towns of any size in Richland County.

The town of Sidney has a population of 6,000 people and was named after a small boy named Sidney Walter. Justice Otis, when verifying some legal papers, had the question arise as to what name he would use for the town as the place of location. Being a bachelor, and a friend of the Walter's family, Mr. Otis insisted on using the name of Sidney, the name of their five-year old son to whom he was greatly attached. Thus, Sidney became the name of the largest town in Richland County.

Fairview, a small town of 2,000 persons, is located 13 miles north of Sidney and was started in the late 1890's by L. E. Newlon. The townsite is now on his old homestead and was named because of the fair view of the Lower Yellowstone Valley that could be seen from his homestead location.

Topographically, Richland County is mostly plains and rolling hills. The hills, running in a northeasterly direction divide the watersheds between the Missouri and Yellowstone Rivers.

Richland County contains a land area of 2,103 square miles and in 1970 had a population of 10,600 people.

CLIMATE

Located in northeastern Montana, Richland County lies just west of the confluence of the Missouri and Yellowstone Rivers. The Missouri River, which flows eastward through this portion of the State, forms the northern boundary of the county. The Yellowstone River flows northeastward through the southeastern portion of the county and empties into the Missouri River just east of the Montana border. Topography varies from the flat river bottom of the Yellowstone Valley to hilly terrain that is fairly rugged in places. The land slopes upward from the Yellowstone River into hilly country paralleling the River's northeastward course on both sides. South of the Missouri River, the land slopes upward to the crest of the hills paralleling the Yellowstone River.

The crests of the hills about 25 miles west of the Yellowstone River rise approximately 500 to 1,500 feet above the floor of the Yellowstone Valley. East of the Yellowstone River the terrain is slightly lower with the crests of the hills lying east of the Montana Border. Richland County contains the lowest point in northeastern Montana, the Missouri River at the North Dakota Border, with an elevation of less than 1,800 feet. The highest terrain in the county lies in the hilly country about 30 miles west of Sidney where several hills rise to more than 2,700 feet.

The area is drained by numerous small creeks, most of which become dry in the late summer. The Yellowstone River is the principal drainage in the southeastern portion of the county. The northwestern portion is drained by the Missouri River and East Redwater Creek. East Redwater Creek flows northwestward into the Redwater River, which in turn flows northward into the Missouri River just west of the county boundary.

Richland County is within an area having climate generally described as Continental, with cold winters, warm summers and marked variation in seasonal precipitation. During a normal year about 80 percent of the annual precipitation will fall during the April-September growing season. June is usually the wettest month by quite a margin, followed by May and July with both of these months having about equal rainfall. Practically all of the county averages 13 to 14 inches of precipitation a year ,with some of the higher terrain undoubtedly averaging slightly more. Winter snowfall is usually not heavy, averaging about 25 inches annually in the Yellowstone Valley with heavier amounts in the hills.

While annual snowfall averages are not large compared to the rest of the State, heavy snows do occur infrequently, usually in late winter or early spring. Summer precipitation normally occurs as showers, but steady, gentle rains can occur in May, June, and September. Summer thundershowers are fairly frequent, and occasionally produce hail locally heavy enough to damage crops. Hail will fall somewhere within the county just about every year.

Winters are quite cold, although not as severe as is thought by many. Some very cold weather can occur each winter, but these cold spells do not ordinarily last for an extended period of time. About once every 9 to 10 years the January or February temperature will average below zero. Relatively mild winter weather is not uncommon. However, periods of mild weather do not occur as frequently during the winter in Richland County as in the counties to the west nearer the Rocky Mountains. In the spring the change from wintry to warmer weather is quite rapid, and the progressive cooling of the fall season is very noticeable during October and November.

Summers are characterized by warm weather which often lasts for weeks at a time. Sunny weather prevails 70 to 80 percent of the summer with interruptions mostly during the afternoons from occasional showers and thundershowers. A few days of hot weather occur almost every year, but hot spells seldom last more than a few days, and the hot weather seldom occurs with high humidity. Temperatures can reach highs of 90° or more during any month May-September, and on about half of the afternoons in July and August temperatures will reach 90° or warmer.

With cold winters and warm summers, the length of the growing season assumes importance, particularly as far as vegetative growth and harvest are concerned. The average length of season between spring and fall occurrences of 32° F. varies greatly in the county, from about 110 days in the hills up to near 130 days in the Yellowstone Valley.

Local flashflooding caused by sudden heavy thunderstorms can occur somewhere in the county about every two or three years. A more general type flood can develop during the late winter, following a cold spell, caused by ice jams when thawing begins upstream while freezing continues downstream. Here again this condition tends to localize itself and to recur at bridges, shallows and other places where ice can become lodged and begin to pile up.

PRECIPITATION

Station	Years of Record	Elevation	Yearly Average Total	Growing Season Average Total	Percent Falling in Growing Season	Wettest Year	Driest Year
Lambert	1957-1967	2335	13.16	11.10	84	20.61 (1965)	9.18 (1966)
Nohly 3WNW	1951-1968	1920	13.25	10.90	82	19.67 (1965)	8.73 (1951)
Savage	1905-1968	1985	13.92*	11.54*	83	27.08 (1906)	5.93 (1934)
Sidney	1911-1922 1949-1966	1920	13.50	10.83	80	20.58 (1953)	8.46 (1952)

*1939-1968

TEMPERATURE

Station	Years of Record	Elevation	Highest and Year of Record	Lowest and Year of Record	January Average	July Average	Annual Average
Nohly 3WNW	1951-1968	1920	108 (1958)	−49 (1954)	9.0	69.7	41.2
Savage	1905-1968	1985	111 (1936)	−53 (1936)	13.3*	71.0*	43.4*
Sidney	1911-1922 1949-1966	1920	110 (1917)	−47 (1913)	9.3	68.7	41.3

*1939-1968

POTENTIAL IRRIGATION DEVELOPMENT

Glenn R. Smith, Soil Scientist

David R. Cawlfield, Consulting Soil Scientist

INTRODUCTION

The major features that determine the desirability of an area for irrigation development are the type of soil, topography, availability and quality of irrigation water, the climate and markets. Soils and topography, together with frost free season and mean temperature largely determine the ability of an area to produce, assuming that a dependable water supply is available, and finally a market is necessary to obtain a profit from crops that are produced. This article is based on a long range projection which disregards the present available water supply for irrigation and market factors of crops produced.

Land classification is the process by which soils, relief and climate are systematically appraised and lands are placed in categories based on similarity of characteristics. Land classification surveys made by the Montana Water Resources Board are specifically designed to establish the degree of suitability of land for sustained irrigation farming. The objective is to outline the land areas that have a potential for irrigated agriculture. Because technological advances in irrigation are taken into account, slope and surface topography become less important as rapid expansion of sprinkler irrigation takes place.

The land classification system used in the water resources survey separates the land areas into (1) lands having potential for irrigation termed "irrigable" in contrast to (2) the inferior "non-irrigable" lands which are unsuited for present or future irrigation because of unfavorable characteristics. The term "irrigable land" as used in this classification, includes land with soils topography and drainage features that are suitable for irrigation by gravity or sprinkler methods. Lands classed as "irrigable" have soil, topography and climate that will support sustained irrigated agriculture with proper water management, drainage and other necessary conservation practices.

Lands which are classified as "irrigable" are divided into classes on the basis of their relative suitability for irrigation farming. Class 1 represents irrigable land with potentially high productive value; class 2 represents land of intermediate value, and class 3 includes land of the lowest value that may be suitable for irrigation.

The intensity of this land classification is a general reconnaissance survey. **Any future project development should be based on a detailed study** to pinpoint the exact location and limits of the land best suited for irrigation.

PHYSIOGRAPHIC FEATURES

Richland County covers 2,013 square miles of the Northern Great Plains, which has been dissected by the down-cutting of streams. The divide between the Missouri and Yellowstone Rivers, known as Mountain Sheep Bluffs, in Dawson and McCone Counties extends northeast through the central part of Richland County. This divide, terminating near Sioux Pass consists mainly of broken ridges, buttes and mesas, locally capped with gravel in Richland County. Nearly all the county below the main divide has been glaciated and is included in the area known as the glaciated plains of Northern Montana. The mantle of till in the southcentral and southwestern parts and east of the Yellowstone River is comparatively shallow, for nearly all of it has been removed by erosion since the time of glaciation. The physical features of the county may be divided into several physiographic areas according to the nature of the exposed geologic material, the character of erosion of these materials, and the degree of dissection of the different parts of the county.

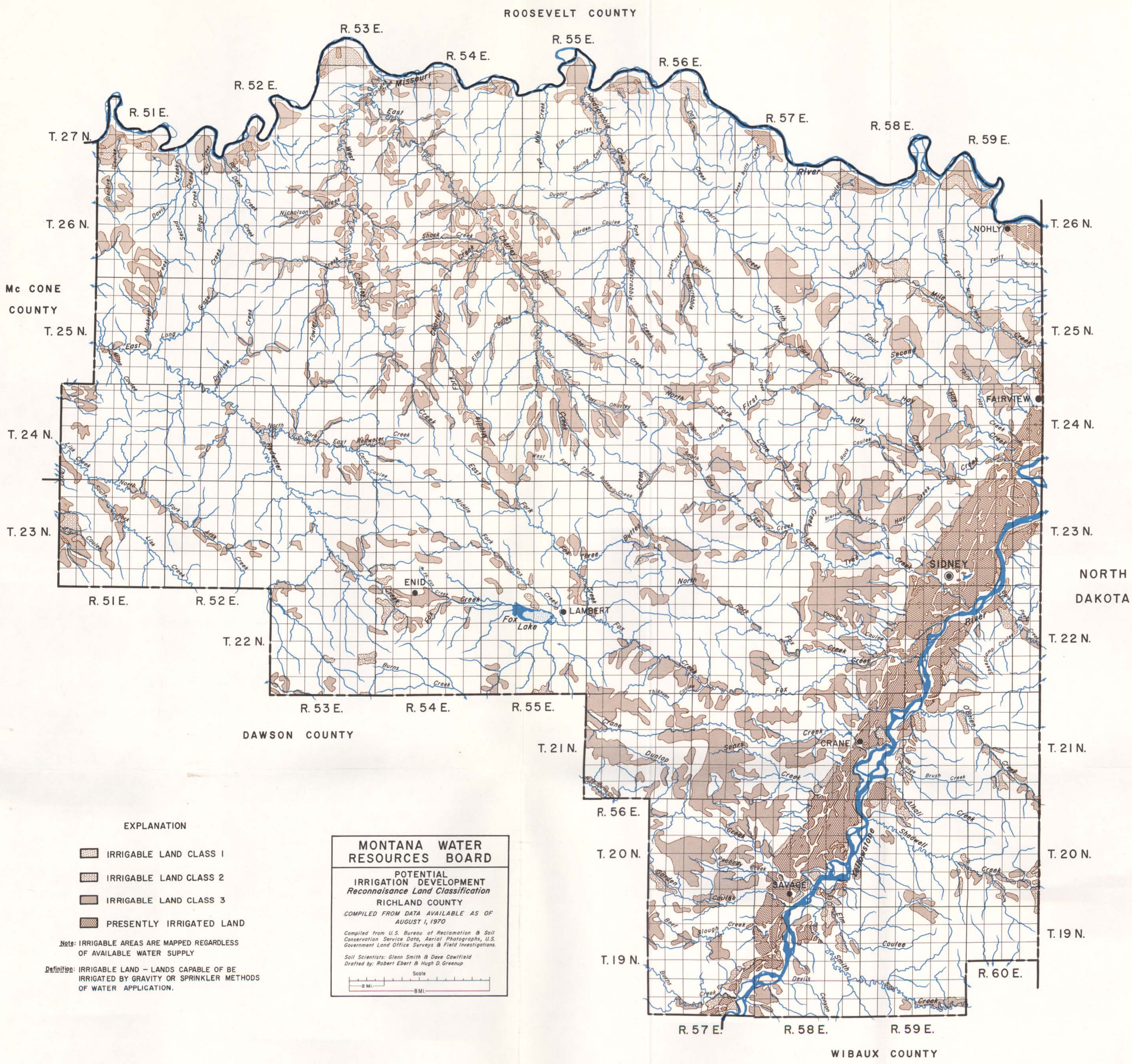
The local physiographic features for consideration of potentially irrigable land are:

(1) flood plains, low terraces, and fans of the Yellowstone and Missouri Rivers;

(2) high benchlands of the divide, known as Mountain Sheep Bluffs;

(3) smooth sloping uplands (mostly glaciated); and

(4) strongly rolling to dissected residual uplands.


MONTANA WATER RESOURCES BOARD
POTENTIAL IRRIGATION DEVELOPMENT
Reconnaisance Land Classification
RICHLAND COUNTY
COMPILED FROM DATA AVAILABLE AS OF AUGUST 1, 1970
Compiled from U.S. Bureau of Reclamation & Soil Conservation Service Data, Aerial Photographs, U.S. Government Land Office Surveys & Field Investigations.
Soil Scientists: Glenn Smith & Dave Cawlfield
Drafted by: Robert Ebert & Hugh D. Greenup
Scale
2 Mi.
8 Mi.
EXPLANATION
IRRIGABLE LAND CLASS 1
IRRIGABLE LAND CLASS 2
IRRIGABLE LAND CLASS 3
PRESENTLY IRRIGATED LAND
Note: IRRIGABLE AREAS ARE MAPPED REGARDLESS OF AVAILABLE WATER SUPPLY
Definition: IRRIGABLE LAND – LANDS CAPABLE OF BE IRRIGATED BY GRAVITY OR SPRINKLER METHODS OF WATER APPLICATION.
ROOSEVELT COUNTY
Mc CONE COUNTY
DAWSON COUNTY
WIBAUX COUNTY
NORTH DAKOTA
N
R. 51 E.
R. 52 E.
R. 53 E.
R. 54 E.
R. 55 E.
R. 56 E.
R. 57 E.
R. 58 E.
R. 59 E.
R. 60 E.
T. 27 N.
T. 26 N.
T. 25 N.
T. 24 N.
T. 23 N.
T. 22 N.
T. 21 N.
T. 20 N.
T. 19 N.
Missouri
River
Yellowstone
River
SIDNEY
FAIRVIEW
NOHLY
LAMBERT
ENID
CRANE
SAVAGE
Fox Lake

The last two are intermingled in places and both contain flood plains and alluvial fans associated with tributary streams that flow through them.

Flood Plain, Low Terraces, and Fans of the Yellowstone River and Tributaries

The lower or more recent alluvial bottoms of the river valley are, in general, fairly flat, but actually many miniature terraces and low swales indicate former overflow channels of the river. The main vegetation of existing undeveloped land consists primarily of cottonwood trees. There are very few acres of bottomland left for irrigation development.

An outstanding characteristic of the Yellowstone Valley is the presence of benches or terraces, which border the recent alluvial bottoms on each side of the river. The highly productive irrigated lands generally appear on the larger high terraces which are the results of successive cutting of the river in a past geologic age. The high terraces invariably face the river with steep fronts. The irrigable land consists principally of alluvial soils on the low and high terraces. The terrace soils are well-drained, moderately complex, and to a degree dependent upon effect of colluvial material from the surrounding high uplands. Construction of a few subsurface drains will be required to correct minor drainage problems. Most of the irrigable land is underlain by gravelly alluvial deposits.

About 93 percent of the presently irrigated acres in Richland County is on the flood plains, low terraces and fans of the Yellowstone River. The total acreage which is potentially suitable for irrigation in this physiographic area is 66,300 acres. Yearly average irrigated crop yields and acres for 1968 and 1969 are: sugar beets, 16.4 tons per acre from 12,000 acres harvested; corn silage, 16.4 tons per acre from 3,350 acres; and alfalfa hay, 2.8 tons per acre from 8,000 acres. The yields of these major irrigated crops are among the highest in Montana. A high management level of irrigation, fertilizing, and crop management should increase these yields on newly developed irrigated lands.

The 65,000 acres of irrigable land within this physiographic area are terraces and alluvial-colluvial fans. The irrigable land will vary from a small to large acreage. The development of water distribution systems for irrigation of the larger remaining irrigable land areas should be within a feasible cost range. The pump lifts from either the high line canals or river are within 150 to 450 foot range. Reconnaissance and detailed potential project investigations of the Bureau of Reclamation show the Sidney Unit (south of Sidney and on the east side of the Yellowstone River), Seven Sisters Unit (east side of river and upstream from the Sidney Unit), and Elm Coulee Unit (east side of river, across from the small town of Savage) having a favorable benefit/cost ratio. The irrigable land areas in these units total 6,211 acres.

The larger acreages of this physiographic area appear on the west side of the Yellowstone River. Reconnaissance plans show these areas are not presently feasible, however, up to date sprinkler irrigation with pipeline laterals, and demand for food and fiber could change this.

Significant acreages within this physiographic area are unsuited for sustained irrigation because of a combination of unfavorable soil characteristics (salinity or alkalinity or coarse texture resulting in low water holding capacity), broken or uneven topography and poor soil drainage.

The major western tributaries of the Yellowstone River are Burns, Fox, Lone Tree, First Hay, Second Hay, and Four Mile Creeks. Burns Creek heads on the slopes of Mountain Sheep Bluffs and is a small stream meandering through a broad, saline flood plain bordered by badlands. The North and South Forks of Fox Creek unite in the uplands to form Fox Creek, which flows east and joins the river a few miles south of Sidney. The forks of this stream drain a rolling glaciated area. The flood plain is narrow and saline in places. The soil is generally heavy textured with poor internal drainage, however, there are several terraces along the south side of upper Fox Creek and small alluvial bottomlands with irrigable land that could be intermittently irrigated from Fox Creek. In the vicinity of the town of Lambert, lacustrine and alluvial deposits cover the broad bottom lands in the valley of streams draining into Fox Lake from the south, west and north. In most places the soils of these bottom lands are heavy and poorly drained. Lone Tree Creek and its tributaries head on the main divide in the central part of the county and drain a rolling residual and glaciated area. There are small acreages of irrigable land on the glacial uplands near the creek. The bottom lands near the stream are generally saline soil, which has poor drainability.

The larger perennial streams entering the Yellowstone River from the east are Smith, Shadwell, O'Brien and Bonnie Peer Creeks. These streams head on the divide east of the Yellowstone River in North Dakota and flow northwest. They are of the cutbank type and drain an area of rough, broken land, much of which is eroded into badlands. The streams flow through narrow flood plains which are bordered by long smooth valley slopes. The smooth slopes have 5,000 acres of irrigable land with soil, topography and drainage characteristics similar to the terraces and fans on the west side of the Yellowstone River. The elevation of the irrigable area generally limits the irrigation water supply to local intermittent streams.

Flood Plains and Low Terraces of the Missouri River and Tributaries

The Missouri River begins in southwestern Montana, flows in an easterly direction through Richland County and is joined by the Yellowstone River near the western edge of North Dakota.

The Missouri River Valley, which has eroded to a depth of about 200 feet below the floor of the preglacial valley, forms a distinct break between two types of topography. North of the river valley in Roosevelt County, the terrain is characterized by gently sloping till-covered benchlands. To the south in Richland County, the majority of the rough terrain gives away to gently rolling uplands, marked here and there with rounded buttes. There are several badland areas that are severely eroded near the mouths of the tributary streams.

The Missouri River and several of its larger tributaries are characterized by extended meanders and wide terraced flood plains. There are 17,000 acres of irrigable land in Richland County on the broad terraced flood plains of the Missouri River. The soils of the irrigable areas are predominantly composed of porous, well-drained medium textured material, however, the textures may vary from loamy sand to clay. The terraces next to the present river channel are of more recent alluvium, which is generally light textured soil of loamy sands, sandy loams, and loam. The areas farthest from the river channel are generally alluvial soils of a heavy to medium textured surface and subsoil. The clays have stratified layers of sandy loams, and loamy sands within the profile. The Bureau of Reclamation land classification surveys in 1964 to 1965 included field testing the clay, and clay loam soils for infiltration and permeability. These tests generally showed adequate water movement through the heavy textured soils for maintaining correct leaching and salt balance requirements for irrigated crop growth.

There are 8,870 irrigable acres on seven flood plain terraces that could be irrigated by pump lifts of 25-50 foot elevation from the Missouri River. Scattered tracts of the bottom lands are now being irrigated by a few private landowners. The present private investments in pumping factilities for irrigation are generally limited; irrigated acreages are relatively small, and optimum development and productivity of the land is not accomplished. Comprehensive irrigation development of the area would better utilize the irrigable land. The increased crop production through irrigation would obtain maximum development of the Missouri River Valley area by: (1) better roads; (2) expanded agricultural land value; and (3) provide a more stabilized agricultural economy of northern Richland County.

The terraced areas next to the rough breaks and the alluvial soils near the mouth of small stream tributaries may have soils high in sodium and soluble salts and may be too heavy textured for irrigation. These areas were considered non-irrigable in this survey. The colluvial slopes near the shale badlands east of the mouth of Redwater Creek are an example of clay soil areas with high sodium, soluble salts and dispersed colloids.

The larger perennial streams joining the Missouri River from the south in Richland County are Charlie and Hardscrabble Creeks which are of a cut-bank type that meander in wide open valleys. These streams and their tributaries drain a rolling, glaciated area from which much of the till has been stripped by erosion. This condition occurs just above the Missouri River Valley to within 6 to 8 miles of the main divide in the central part of the county.

The largest alluvial bottom land area along a perennial stream extends approximately 5½ miles upstream from the mouth of Hardscrabble Creek. The 2,200 acres from the creek mouth to the Missouri Valley breaks is a broad area which could receive water by pumping from the Missouri River. The remaining 3,000 acres are predominantly class 2 land which full water supply irrigation is doubtful due to the inadequate supply from the creek and the high elevations preventing pumping from the Missouri River. A partial water supply may be available from Hardscrabble Creek for a very limited acreage. The possibility of ground water pumping should be investigated.

There are small areas of irrigable alluvial bottom land and smooth sloping fans along Charlie Creek and its tributaries that can be irrigated. Approximately 800 acres of broad terraces can be irrigated from the Missouri River by a pumping lift of 40 to 50 feet. The water supply for the remaining irrigable land has not been investigated.

The tributaries of the Redwater Creek head on the western slopes of the Mountain Sheep Bluffs and flow northeast across the county line. The irrigable lands within these tributaries are intermingled glacial till soils and bottom land alluvial soils which are washed in alluvium from the uplands. There are 16,000 acres of potentially irrigable land located at an average elevation of 2,600 feet. The alluvial bottoms are generally saline, with the sodium content high in many areas. The bottom lands area may be a quarter of a mile wide. The low terraces adjacent to the bottom lands are generally irrigable soil of a medium texture. The long smooth slopes adjacent to the valley are glacial soils from which the till has been eroded away in many places. The valley bottom lands, low terraces, and slopes have serious drainage problems that must be considered in future irrigation planning.

High Benchlands, Terraces, and Upland Areas of Richland County

The glaciated plains of Northern Montana extended south into Richland County. During the Pleistocene Age, one or more lobes of the continental ice sheet moved up the valleys of the Yellowstone River, Redwater Creek and their tributaries and deposited a mantle of till on the uplands along those streams. One of the deeper and less rolling hummocky deposits of soil is found in the northeastern part of the county. Nearly all of the till has been removed from the Missouri River breaks and also from the tops of many of the hills. Surface drainage has developed in all the till covered uplands except for a few local tracts east of Sioux Pass.

The present tributary streams of the Missouri River drain the rolling upland areas in forms of cut-bank channeling. The narrow alluvial bottom lands of the streams are generally saline soils, which leave only a few scattered areas of irrigable land within the bottom lands. There are smoothly sloping terraces of light to medium textured irrigable soil bordering the narrow valleys. Also, the glacial upland areas with rolling topography are generally irrigable unless the till, underlying sandstone, or siltstone is within 36-42 inches of the ground surface. The combination of the smooth terraces, glacial uplands and scattered irrigable bottom lands total 41,800 irrigable acres within the upper drainages of the Missouri tributaries. The rolling glacial uplands are limited in irrigation development due to the elevation of the land above the Missouri River. The increase in irrigation will be limited to small developments by private reservoirs on the tributaries or early spring irrigation by water spreading dike systems. The spreader dikes have increased the water supply for hay production. The hay yields have increased from .5 ton to 1.5 tons per acre. Careful water management of the dike system is necessary to prevent drowning of alfalfa and also to obtain maximum use of the limited water supply.

The irrigable areas shown on the high benchlands, terraces, and upland area of the county would be greatly reduced by a detailed land classification and drainage survey. The glacial till has eroded in many places leaving shallow soils over sandstone, siltstone and shale substratums. The soil conditions vary within short distances, which makes a detailed drainage and land classification survey necessary for proper delineation of the irrigable land.

The sharply rolling topography covers large areas of Richland County. The rough glacial moraine around Fox Lake and within the upper portion of the Redwater Creek drainage has only small scattered irrigable areas. These irrigable areas are too small for irrigation development. The sharp, rough badland areas in the southeastern part of the county have irrigable alluvial bottom lands consisting of small tracts that are limited to spreader dike irrigation systems. The scattered small irrigable areas of Richland County total approximately 18,000 acres which are limited to local irrigation development.

SUMMARY

Livestock grazing is the principle agricultural use for most of the land in Richland County. There was a yearly average of 63,000 head of cattle, 20,000 head of sheep and 4,000 head of hogs recorded in the agricultural statistics for years 1968 and 1969. The use of the grazing land will continue with the range and pasture acreage showing very little change.

Dryland wheat and other small grains account for an average of 200,000 acres of cropland, plus a sizable acreage of fallow land. The estimated value of these dryland crops will average 5,550,000 dollars for the years of 1968 and 1969.

Irrigation is the main economic stabilizer for Richland County. There was a yearly average of 31,300 acres of harvested irrigated crops in 1968 and 1969. The yearly average estimated values of these crops was 3,950,000 dollars for 1968 and 1969. The main crop was sugar beets, with a yearly average of 12,000 acres harvested for 1968 and 1969 at 2,800,000 dollars per year. The value of irrigation in this county shows an additional average of $98.76 per acre of crop harvested in comparing dryland and irrigated crop returns for the years 1968 and 1969. The net return was not calculated, however, most of the production costs for crops contributes to the economy of Richland County.

The expansion of irrigation can be accomplished in several areas, the largest being the dryland terraces and slopes above the presently irrigated land of the Yellowstone Valley. There are an estimated 66,000 irrigable acres of land within an area of a maximum of 500 feet elevation above the Yellowstone River. The smaller terraces, benchlands, and alluvial slopes may not be economically feasible to develop, however, the large areas could be feasible within the near future especially when the acreages necessary for food and fiber needs shows additional planning necessary for production, projecting into the years 1980, 2000, and 2020. This expansion will warrant development in areas that are not presently feasible.

The flood plain terraces of the Missouri River have an estimated 17,000 irrigable acres with irrigation development possible by low pumplifts of 30-50 feet from the river. Private irrigation development is progressing slowly since this type of development does not provide maximum development of the irrigable land. The broad terraces could be irrigated by one pump at the upper end of each terrace and these areas should be developed as soon as possible.

The glacial uplands, high benchlands, and small alluvial bottom land areas of tributary streams have an estimated total of 93,000 acres of irrigable land. The future irrigation development of the small acreages will be by private reservoirs or water spreading dike systems.

The irrigable land acreage will change as areas are studied with detailed drainage and land classification surveys. The drainage investigations will establish the cost of minimizing seepage and salinization of the soil. The detailed land classification investigations will establish the land areas, that will sustain irrigated agriculture and give an economic standard for evaluating repayment of irrigation costs to the sponsoring agency.

Whenever irrigation development becomes a reality it should be remembered, that soil that has become seeped and strongly alkaline to the point where crop production is curtailed, is a waste of arable cropland and also a pollutant due to man's negligence.

The local, federal and state agricultural agencies have soil surveys and experimental information available that help determine areas for future irrigation and management of presently irrigated land within Richland County. Contacting these agencies will save individual farmers money and labor, and will also assist in conserving the land for future use.

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Acknowledgments

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Ward, Harold B., Soil Scientist, Upper Projects Office, Bureau of Reclamation, United States Department of the Interior, Great Falls, Montana. Contribution of land classification information in Richland County, 1968 and 1969.

CROPS AND LIVESTOCK

Richland County is located in the northeastern part of Montana on the eastern boundary. It is bordered on the north by Roosevelt County, on the south by Wibaux County and Dawson County, on the west by Dawson and McCone Counties, and on the east by the State of North Dakota.

The Missouri River runs along the northern boundary of the county and the Yellowstone River enters the county at the southern border running north to the northeastern part of the county. The Yellowstone joins the Missouri just across the border in North Dakota near the proximity of the northeastern corner of Richland County. Tributaries feed into these two major rivers providing the drainage for the rest of the land. Approximately half of the county drains into the Missouri and the other half into the Yellowstone River.

The topography is typical of the great plains with the rolling hills and valleys. The area contains approximately 1,321,600 acres of which 91.8 percent is in farms. The average size of farms in Richland County is 1,584.6 acres. The 1964 census indicates 776 farms of which 18.8 percent of the farms were tenant operated. Richland County has 36,490 acres of irrigated crop land, 369,522 acres dry crop land, 11,607 acres of woodland, which includes shelterbelts, 885,156 acres of range and pasture land, and 16,639 acres are in cities, towns, roads, railroads, water, and etc.

The residents of the area enjoy a relatively mild climate. The outstanding feature of the lower Yellowstone is its low altitude of less than 2,000 feet above sea level. This low altitude from the standpoint of climate compensates for the northern location. The climate is similar to that of the western plains states east of the Rocky Mountains, 200 to 500 miles further south.

The average growing season for the valley area is approximately 129 days with the growing season somewhat less for the hills area. The average annual rainfall is approximately 11 inches with the majority of this precipitation falling during the growing season. Agriculture is one of Richland County's leading economic activities. Because of the development of irrigation facilities, rich fertile valley soils, and the favorable climate, the agriculture has been more diversified than in many other counties in the same general area of the northern great plains. The lower Yellowstone valley is noted for its lamb feeding enterprises.

From Montana Agricultural Statistics — Volume XII, December, 1968.

CROP PRODUCTION—1967 HARVESTED ACRES

Crop	Irrigated		Non-Irrigated		Total	
	Acres	Yield/A	Acres	Yield/A	Acres	Value
Winter Wheat	300	34	77,500	35.5	77,800	$2,962,800
Duram Wheat	400	47	3,100	20	3,500	126,500
Spring Wheat	2,900	44	60,600	23	63,500	1,521,400
Rye	----	----	200	35	200	5,300
Corn Silage	3,900	18	4,100	5.5	----	----
Corn Green	600	65	100	14	700	52,600
Forage & Grazed						
Corn Harvested for	----	----	----	----	1,000	----
Flax	----	----	600	11	600	17,400
Oats	1,900	63	5,200	33	7,100	291,300
Barley	2,600	48	24,200	33	26,800	749,000
Sugar Beets	10,500	16.8	----	----	10,500	2,528,200
Dry Beans	1,600	17.5	----	----	1,600	217,400
Potatoes	106	150 cwt.	11	50 cwt.	117	52,800
Alfalfa Hay	8,300	2.90	9,700	1.25	18,000	----
Wild Hay	1,100	1.20	13,600	.80	14,700	----
Alfalfa Seed	400	120	200	70	600	24,300

LIVESTOCK ON FARMS—1967

All Cattle and Calves	Milk Cows	Sheep and Lambs	Hogs and Pigs	Chickens
61,000	1,200	22,000	4,000	27,000

STREAM GAGING STATIONS

The U. S. Geological Survey measures the flow of streams, cooperating with funds supplied by several state and federal agencies. The results have been published yearly in book form by drainage basins in Water-Supply Papers through the year 1960. Beginning with 1961, the streamflow records have been published annually by the U. S. Geological Survey for the entire state under the title, "Surface Water Records of Montana." Data for 1961-65 and subsequent five-year periods will be published in Water-Supply Papers. Prior to general issuance, advance copies of station records may be obtained from the U. S. Geological Survey. That agency's records and reports have been used in the preparation of this resumé.

Data given below cover the stream gaging records, which are available for Richland County from the beginning of measurements through the water year 1969. The water year begins October 1 and ends September 30 of the following year.

Following are equivalents useful in converting from one unit of measurement to another:

(a) In Montana, one cubic foot per second equals 40 miner's inches.

(b) One acre-foot is the amount of water required to cover an acre one-foot deep.

(c) One cubic foot per second will nearly equal two acre-feet (1.983) in 24 hours.

(d) A flow of 100 miner's inches will equal five acre-feet in 24 hours.

(e) One miner's inch flowing continuously for 30 days will cover one acre 1½ feet deep.

For reference purposes, the stream gaging stations are listed in downstream order.

Missouri River near Culbertson*

The water-stage recorder is at the downstream side of bridge on State Highway 16, 3 miles southeast of Culbertson, 9.6 miles downstream from Big Muddy Creek, and at mile 1,620.76. The drainage area is 91,557 square miles. Records are available from July 1941 to December 1951, April 1958 to date (1970). The maximum discharge was 78,200 cfs (March 26, 1943) and the minimum daily discharge, 575 cfs (November 22, 1941). The average discharge for 19 years (1943-51, 1958-69, after operational level at Fort Peck Reservoir was reached) was 9,942 cfs or 7,203,000 acre-feet per year. The highest annual runoff was 10,540,000 acre-feet (1948) and the lowest, 2,956,000 acre-feet (1942). The flow is partly regulated by Fort Peck Reservoir and many other reservoirs above the station. There are diversions for the irrigation of about 1,029,700 acres above the station.

Burns Creek near Savage

The water-stage recorder was 1,000 feet upstream from the bridge on Highway 16, 1 mile upstream from the mouth, and 7 miles southwest of Savage. The drainage area is 233 square miles. Records are available from October 1957 to September 1967. The maximum discharge was 2,100 cfs (March 20, 1960) and the minimum, no flow at times in each year. The average discharge for 10 years was 5.90 cfs or 4,270 acre-feet per year. The highest annual runoff was 14,440 acre-feet (1967) and the lowest, 383 acre-feet (1961). There are minor diversions for irrigation upstream.

Yellowstone River near Sidney*

The water-stage recorder is at the Montana-Dakota Utilities powerplant, a quarter of a mile downstream from bridge on State Highway 23, 2 miles south of Sidney, and 30 miles upstream from mouth. The drainage area is 69,103 square miles. Records are available from October 1910 to September 1931 and October 1933 to present (1969). If monthly figures of diversion (acre-feet) to Lower Yellowstone Canal at Intake are added to records at this site, records equivalent to those published as Yellowstone River at Glendive in Dawson County (1898-1910, 1931-34) can be obtained. The maximum discharge was 159,000 cfs (June 21, 1921) and the minimum, 470 cfs (May 17, 1961). The average discharge for 56 years was 12,880 cfs or 9,325,000 acre-feet per year. The highest annual runoff was 13,800,000 acre-feet, (1917) and the lowest, 4,209,000 acre-feet (1934). There is some regulation on tributary streams. There are diversions above station for irrigation of about 1,250,000 acres. Records of chemical analyses and water temperatures are available since 1950.

Partial Record Stations and Miscellaneous Discharge Measurements

In order to provide information on more streams than are covered by stream gaging stations, the U. S. Geological Survey has for several years been collecting some partial records. These are in addition to the miscellaneous discharge measurements which have always been reported. These partial records, when correlated with simultaneous discharges of nearby continuous-record stations give fair indications of available flow.

There are two crest-stage partial-record stations in the Missouri and Yellowstone River basins in Richland County. Stations are now (1969) being operated on Missouri River tributary No. 3 near Culbertson, and First Hay Creek near Sidney.

The partial-record stations as well as the miscellaneous discharge measurements are listed at the end of each U. S. Geological Survey Water-Supply Paper or Surface Water Records report.

*This gaging station is now in operation (1969).

RESERVOIRS

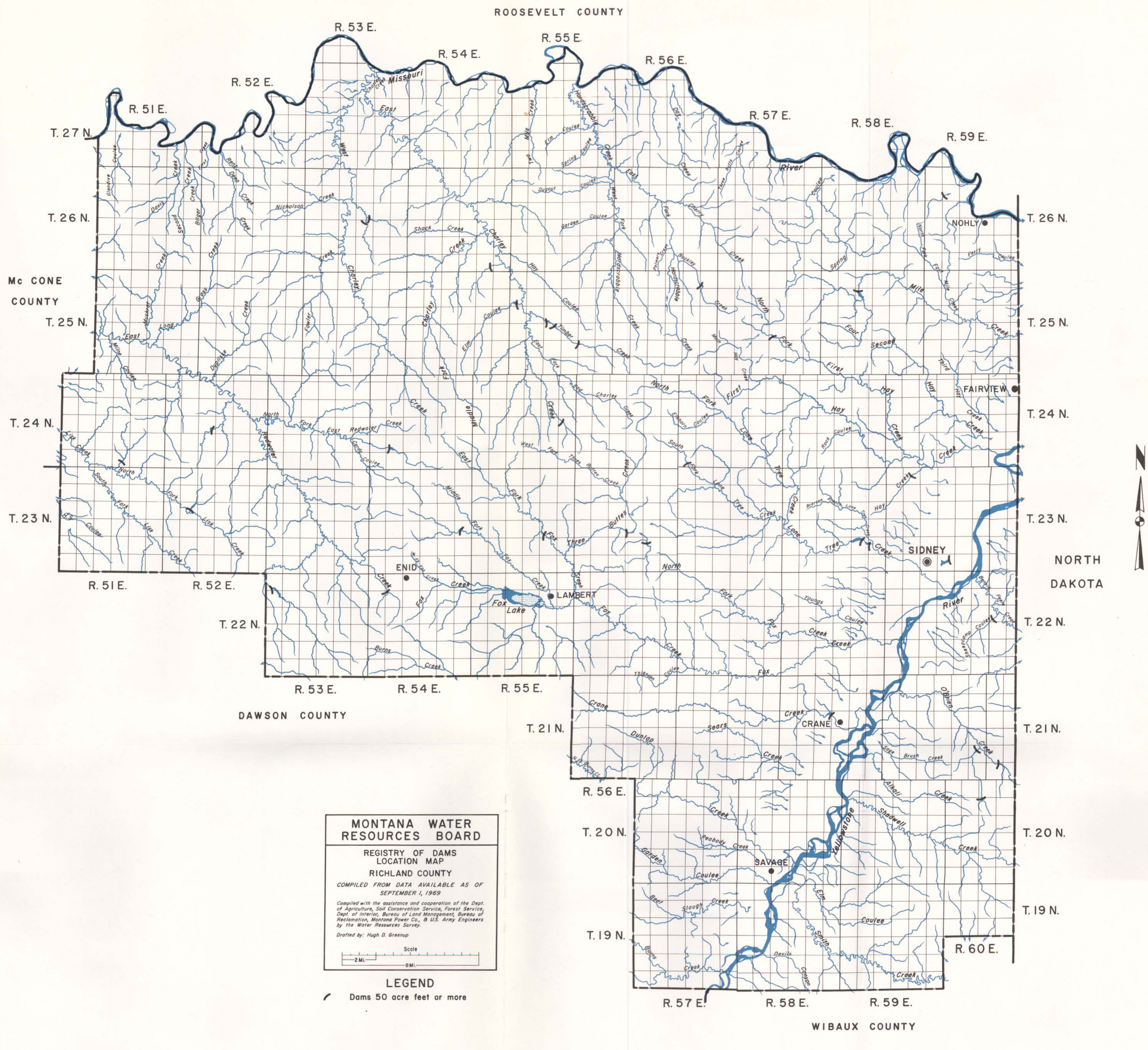
There are no records published by the U. S. Geological Survey for reservoirs in Richland County.

DAMS AND RESERVOIRS

The State of Montana has no statutes governing the design or construction of dams and, except for projects which the Montana Water Resources Board has constructed, the Board has no means of automatically obtaining information concerning design specifications, storage, capacities, locations, or ownerships of dams and reservoirs built throughout the State. Consequently, steps have been taken to make this information available for use by the State, the Federal Government, and private citizens.

By means of a questionnaire, the Montana Water Resources Board recently obtained from the various federal agencies who design structures, the basic engineering data, locations, and ownerships of dams and reservoirs for which they either have, or had, responsibility and which have storage capacities of 50 acre-feet or more. The contributing federal agencies were the Soil Conservation Service, the Forest Service, the Bureau of Reclamation, and the Bureau of Land Management. The Montana Power Company also participated in the study.

Information on numerous dams and reservoirs constructed by private individuals in Montana is not available and is, therefore, omitted. However, the Board's Water Resources Survey crew, while working in Richland County, obtained information on private dams and reservoirs within this county. The available information obtained from all sources was compiled by the Board for each county in the State and a list of dams and reservoirs which store 50 acre-feet or more of water was published.



ROOSEVELT COUNTY
Mc CONE COUNTY
DAWSON COUNTY
WIBAUX COUNTY
NORTH DAKOTA
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R. 52 E.
R. 53 E.
R. 54 E.
R. 55 E.
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T. 19 N.
Missouri River
Yellowstone River
NOHLY
FAIRVIEW
SIDNEY
ENID
LAMBERT
Fox Lake
CRANE
SAVAGE
N
MONTANA WATER RESOURCES BOARD
REGISTRY OF DAMS LOCATION MAP
RICHLAND COUNTY
COMPILED FROM DATA AVAILABLE AS OF SEPTEMBER 1, 1969
Compiled with the assistance and cooperation of the Dept. of Agriculture, Soil Conservation Service, Forest Service, Dept. of Interior, Bureau of Land Management, Bureau of Reclamation, Montana Power Co., & U.S. Army Engineers by the Water Resources Survey.
Drafted by: Hugh D. Greenup
Scale
2 Mi.
8 Mi.
LEGEND
Dams 50 acre feet or more

GROUNDWATER

James E. Halloran, Geologist

The Tertiary Fort Union formation makes up the surface of most of Richland County. Below the Fort Union lies the Hell Creek and Fox Hills formations which are exposed in the northwestern corner of the county. There are two gravel formations overlying the Fort Union; on some hills in the southwestern part of the county rests the Flaxville gravel, and in the valleys of the Missouri, Yellowstone and smaller streams are stream gravels. Exposed in the northwestern corner are upper Cretaceous shale and sandstones at the surface.

The geologic structure of Richland County is simple. Richland County is located over the deepest part of the Williston Basin in Montana. All the formations dip gently eastward under the county. Any one formation under the town of Fairview will be about 1,750 feet higher under Poplar. Perhaps the most important geologic structures are the small oil associated domes and anticlines on the Red River formation.

GEOLOGIC HISTORY

From very early geologic time eastern Montana has been the scene of marine deposition. In this area are limestone formations several thousand feet thick, as evidenced of long periods of submarine accretion of sediments. The thick beds of salt are intermittently found in this limestone sequence. This sedimentary sequence was interrupted several times by periods of erosion. During the 150 million years between the end of the thick limestone sequence and the first uplift of the Rocky Mountains, the Williston Basin became the site of both marine and continental deposition. The marine formations are gray and green shales, many thin limestones and several sandstones. The continental beds are generally red, or maroon sandstone, siltstones and shales. After the Rockies were uplifted, the shallow seas slowly drained to the east and the basin then became buried by eroded debris from the mountains. Formations such as the Fort Union, Flaxville and recent alluvium have been eroded from the mountains and deposited in eastern Montana. This type of sediment ranges from clay to coarse gravel. The Fort Union consists of clays, silts, sands and coal. The Flaxville and alluvium are typically fine gravel and sand formations.

The "Ice Ages" glaciated most of northern Montana. The best evidence of the glacial advance is the presence of erratic granitic boulders. These boulders are not indigenous to eastern Montana, they were carried in by the ice sheet from the Hudson Bay area of Canada. The glacier as it moved south, pushed ahead, or carried top soil which was deposited along the line of its farthest advance. A small portion of glacial Lake Circle was formed in the Lambert-Enid area.[1] This lake was formed by the glacier, part of which filled the Missouri valley and another part filled the Yellowstone valley. Glacial Lake Glendive and glacial Lake Circle were formed similarly. Streams and melt water filled these prehistoric lakes. The glacier migrated up the Yellowstone valley to about where Intake is now located. It is believed that there were three separated glacial stages in northeastern Montana. For purposes of this report all the glacial deposits will be lumped together. They are typically 0 to 60 feet thick in this area and composed of boulders, gravel, sand, silt and clay all mixed together.

The courses of the Missouri and Yellowstone Rivers before, during and after the various ice ages are interesting. The pre-glacial path of the Missouri cut off at Poplar, flowed up through the Medi-

[1] Parker, F. S., 1936.

cine Lake area and on into North Dakota. At this time, the Yellowstone River flowed in about its same course as now to the Williston area where it veered north towards the Canadian border perhaps to join with the Missouri. Their exact courses became uncertain beyond the border; however, they did flow into the Hudson Bay.

The advance of glacial ice caused the Missouri River to change its course to the south. According to Colton,[2] the Missouri at one time in Richland County flowed through Manrock, Lane, Enid, Lambert and down the North Fork of Burns Creek. This stream joined with the ancestral Yellowstone in glacial Lake Glendive behind its ice dam which was located near the town of Intake. The combined Missouri and Yellowstone flowed out of the state through the most northeastern township in Wibaux County.

At a later time when the glacier had receded somewhat the Missouri flowed from the Lambert area down Fox Creek to join the Yellowstone. The combined Yellowstone and Missouri Rivers flowed through the valley and across the divide of Pierre Creek. At still another stage of recession the combined rivers flowed through the Charbonneau Creek valley in North Dakota. Eventually these rivers adopted their present courses. More research needs to be done in establishing the ancient routes of the Missouri.

Before, during and since the "Ice Ages," streams have been carrying and depositing their sediment load of sand, silt, gravel and clay. This type of accumulation is known as alluvium. There are three alluvial formations studied in this report; the Flaxville, terraces and alluvium. The grain size of this deposited sediment is directly related to the velocity of the flow. Large particles such as gravel are deposited by swift water, while smaller particles, namely silt and clay, are carried and dropped by very slow currents. Streams, especially those that meander, can be expected to change their courses somewhat every year. This change may be hardly noticeable, or it may be of major economic and political importance. This changing of channels leaves the old stream gravels to be buried by finer sediments during floods and then to be grown over by vegetation. These buried channels then become shallow, underground aquifers.

Similar erosional and depositional processes caused what is known as colluvium. This is very much like alluvium, except it is not deposited by a well defined stream. These deposits are the effects of a heavy runoff coming from a hard rain or rapid snow melt. Colluvium is a "slope-wash deposit derived from topographically higher deposits."[3] These sediments consist of clay, silt, sand and gravel.

The valleys of the Redwater Creek and other creeks were filled with as much as 30 feet of alluvium. The surfaces of the alluvial flat are now being eroded by entrenched streams. This alluvium is believed to have been deposited since the last glacial advance because it does not have erratics on the top of it. With the coming of the semi-arid climate the ephemeral streams have cut 30 or more feet into the creek alluvium.

The lower valley of the Yellowstone River is generally better developed than the corresponding segment on the Missouri. The Yellowstone has a wide floodplain throughout the lower valley, abandoned river terraces and a wide valley. The Missouri in some places has a wide floodplain and no well developed terraces; although in the stretch between Fort Peck Dam to Virgelle, it has a very narrow valley.

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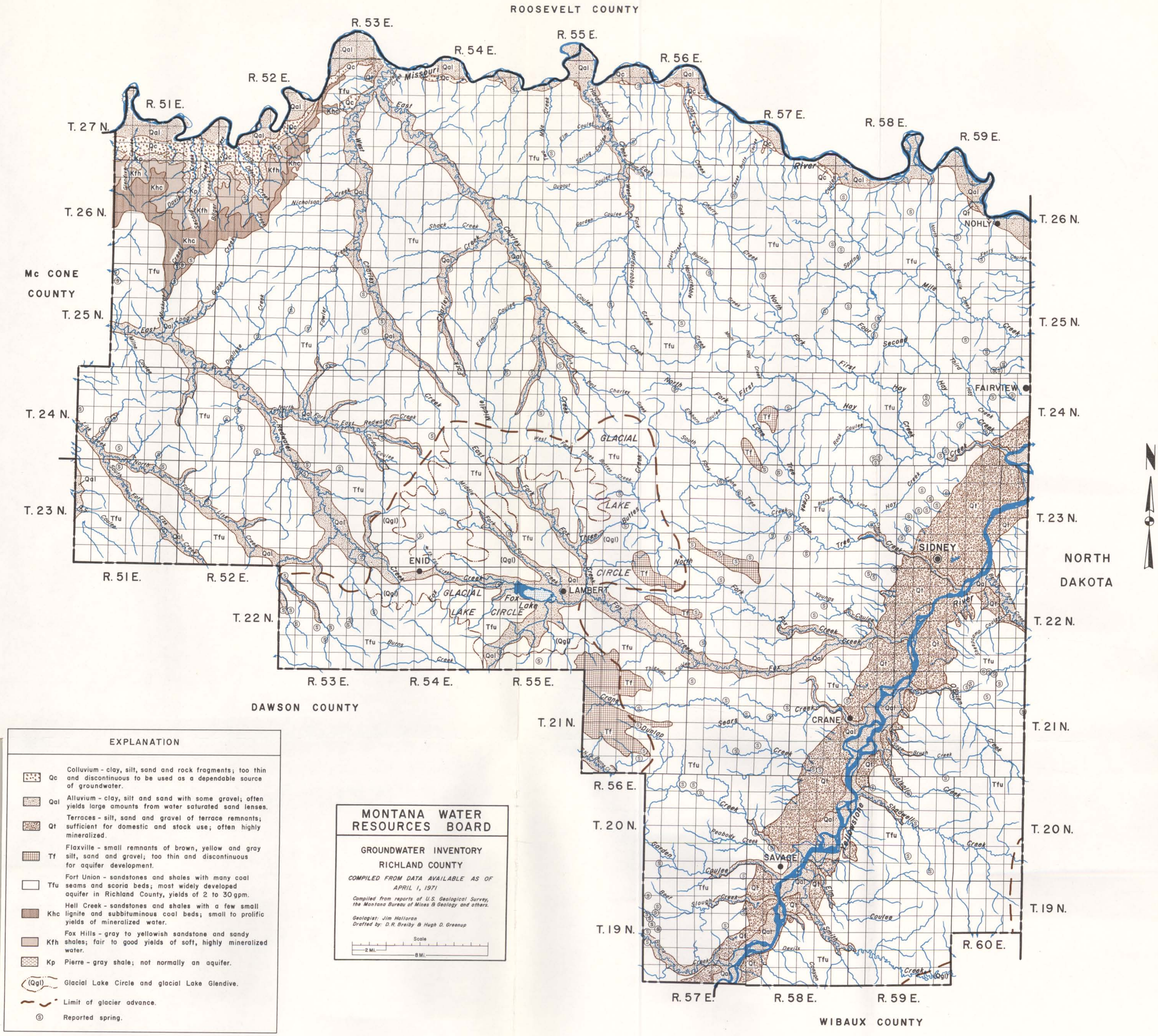
[2] Colton, R. B.; Lemke, R. W.; Linwall, R. M., 1961.

[3] Colton, R. B., 1963.


ROOSEVELT COUNTY
Mc CONE COUNTY
DAWSON COUNTY
WIBAUX COUNTY
NORTH DAKOTA
R. 51 E.
R. 52 E.
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T. 20 N.
T. 19 N.
Missouri River
Yellowstone River
SIDNEY
FAIRVIEW
NOHLY
LAMBERT
ENID
CRANE
SAVAGE
Fox Lake
GLACIAL LAKE CIRCLE
EXPLANATION
Qc Colluvium - clay, silt, sand and rock fragments; too thin and discontinuous to be used as a dependable source of groundwater.
Qal Alluvium - clay, silt and sand with some gravel; often yields large amounts from water saturated sand lenses.
Qt Terraces - silt, sand and gravel of terrace remnants; sufficient for domestic and stock use; often highly mineralized.
Tf Flaxville - small remnants of brown, yellow and gray silt, sand and gravel; too thin and discontinuous for aquifer development.
Tfu Fort Union - sandstones and shales with many coal seams and scoria beds; most widely developed aquifer in Richland County, yields of 2 to 30 gpm.
Khc Hell Creek - sandstones and shales with a few small lignite and subbituminous coal beds; small to prolific yields of mineralized water.
Kfh Fox Hills - gray to yellowish sandstone and sandy shales; fair to good yields of soft, highly mineralized water.
Kp Pierre - gray shale; not normally an aquifer.
(Qgl) Glacial Lake Circle and glacial Lake Glendive.
Limit of glacier advance.
Ⓢ Reported spring.
MONTANA WATER RESOURCES BOARD
GROUNDWATER INVENTORY
RICHLAND COUNTY
COMPILED FROM DATA AVAILABLE AS OF APRIL 1, 1971
Compiled from reports of U.S. Geological Survey, the Montana Bureau of Mines & Geology and others.
Geologist: Jim Halloran
Drafted by: D.R. Breiby & Hugh D. Greenup
Scale
2 Mi.
8 Mi.
N

The Missouri has changed courses numerous times, not being in any course long enough to erode a well developed valley as the Yellowstone. This feature may be seen in the amount of irrigated land in the Yellowstone valley compared to the Missouri's.

AVAILABILITY OF GROUNDWATER

The following is a description of the various formations with an estimate of their groundwater potential. This study starts with the youngest and shallowest formation and ends with the oldest and deepest.

Alluvium and Colluvium

Recent sand and gravel found along many streams in the state are generally known for an abundance of groundwater. Quite often this water can be reached by digging 10 to 30 feet below the surface. Water from the stream seeps into the sand to move downstream in the alluvium. This water, after it has filtered through the sand for some distance, loses its sediment and most of its disease bacteria. The mineral solution is not filtered out, however. Circulation of groundwater is an important process in preventing it from becoming stagnant and mineralized. Large valleys like the Yellowstone and Missouri have deep wide valley fills that may have highly mineralized water in the deeper alluvium and good quality water at shallower depths near the river. Typical dissolved salts in the Yellowstone and Missouri alluviums are sodium, calcium and magnesium cations; and bicarbonates and sulfates anions.

In Richland County there are economic quantities of alluvial groundwater under the floodplains of the Yellowstone and Missouri Rivers. Wells penetrating the alluvium can expect to strike water from 8 to 20 feet below the surface. There is usually sufficient water for stock and domestic needs.

Significant colluvial deposits are present along sides of the Missouri's floodplain. Colluvium is debris that has been sheet-washed or fallen from steep slopes. A fairly continuous belt of colluvium borders the badlands along the Missouri. Colluvium tends to have more clay than the alluvium; and for this reason, it tends to become waterlogged by alkaline water. Alluvium as it is being deposited by a stream has the clay winnowed out. Without this clay the permeability is increased so water may pass through and not become trapped by the clay.

Glacial Deposits

Glacial deposits can be classed in two groups: direct and indirect. A direct glacial deposit would be glacial drift, or a till deposit. An indirect deposit would be glacial lake sediments and glacial river channel alluvium.

Glacial drift is unconsolidated deposits of everything the glacier carried; that is, boulders, gravel, sand and clay that have been mixed together. Drift deposits are often poor sources of groundwater because of the high percentage of clay. There are no significant glacial drift deposits in Richland County, although there are extensive drifts north of the Missouri River.

Glacial lake deposits are much more widespread in Richland County than glacial drift. Glacial Lake Circle was dammed by the glacier in the Yellowstone and Missouri valleys. Part of this lake was in the Enid-Lambert area. Typical glacial lake deposits are alternating light and dark laminations of clay with occasional boulders. The boulders floated out on melting icebergs and were dropped into the lake. Lake sediments are poor sources of groundwater due to the extremely fine particle size limiting porosity and permeability.

There are no reported wells producing from the glacial deposits.

Terraces

There are nine well developed stream terraces bordering the Yellowstone River. These terraces are stream gravel deposits made by the Yellowstone River thousands of years ago, both before, during and after the ice ages. The terraces have been eroded away in some places yet in other areas they are quite prominent. Those stream terraces have flat to gently rolling surfaces. The soil on them is sandy with thick unconsolidated gravels underlying the soil. The sandy soil permits easy recharge of the underlying gravel. These porous and permeable gravels make excellent aquifers when they are adequately recharged. On the lower terraces that are irrigated, the terrace aquifer is recharged by infiltration of canal water in addition to natural recharge.

The nine reported terraces (counting the Flaxville and older)[4] along the Yellowstone valley range in height from 14 to 430 feet above the river. These unconsolidated deposits of gravel, sand, silt and clay range in thickness from 0 to 30 feet. Yellowstone River gravels are characteristically well rounded pebbles and cobbles of quartzite and intrusive igneous rocks. Agate and petrified wood are common in these old gravels.

There are terraces along the Missouri River, but they are not as extensive nor as obvious as along the Yellowstone. The Missouri probably did not develop as many terraces as did the Yellowstone. There may be some Missouri terraces buried under the glacial drift, however. The Missouri valley terraces seem to be formed by glacial melt-water streams rather than the Missouri itself. These terraces are sand and gravel deposits about 30 to 40 feet above the Missouri floodplain.

These gravels, deposited in a high energy environment, are by nature porous and permeable; and therefore, good potential aquifers. The limited areal extent and inadequate recharge prohibit the higher terraces from being good sources of groundwater. The lower irrigated terraces have good recharge from irrigation and canals. In some spots relatively large yields can be obtained from these terraces deposits.[5]

Typical wells drilled into the terrace aquifers are from 10 to 30 feet deep and static water levels are from 5 to 25 feet below the surface. The quantities are usually sufficient for stock and domestic use, but often the water is highly mineralized.

Flaxville Formation

The Flaxville is a gravel formation that forms the caprock on the hills above Fox Creek in southwestern Richland County. The porosity and permeability of the Flaxville gravel causes it to act as a sponge on the flattop hills. That is, the water is absorbed instead of running off and eroding.

The Flaxville is a fluvial gravel very similar to the sands and gravels in the present Yellowstone valley. In fact, many geologists believe the gravel is that of the ancestorial Yellowstone River.

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[4] Howard, A. D., 1960.
[5] Torrey, A. E. and Kohout, F. A., 1956.

RICHLAND COUNTY STRATIGRAPHIC SECTION

Rock Unit or Formation (Youngest to Oldest)	Geologic Age	Geologic Symbol	Approximate Thickness in Feet	Lithology	Water-Bearing Character
Alluvium	Quaternary	Qal	0 to 40+	Sand, gravel, silt and clay.	Yields of 5 to 150 gpm reported, with most yields in the range of 10 to 20 gpm.
Glacial lake deposits of Lake Circle	Quaternary	Qlc	Unreported	Fine sand, silt, and clay; patchy distribution or absent.	Unreported.
Glacial river alluvium of the Missouri River	Quaternary	Qra	0 to 100+	Sand, gravel, silt and clay.	Unreported but small to moderate yields may be expected.
Terrace deposits	Quaternary	Qt	0 to 120+	Sand, gravel, silt and clay.	Yields of 5 to 500 gpm reported, most in the range of 5 to 20 gpm; adequate for domestic needs, and small-scale irrigation.
Flaxville	Tertiary	Tf	0 to 40+	Sand and gravel; patchy distribution where present.	Unreported.
Fort Union	Tertiary	Tfu	0 to 1200+	Interbedded buff sandstone and shale, with coal seams.	Yields of 2 to 20 gpm reported, most in the range of 2 to 12 gpm; adequate for ranchers in some instances.
Hell Creek	Cretaceous	Khc	0 to 150	Interbedded gray-brown sandstone and carbonaceous gray shale.	Yields adequate for ranchers in some instances. The lower part is hydraulically connected with the underlying Fox Hills sandstone.
Fox Hills	Cretaceous	Kfh	150 to 220	Gray to white massive to thin bedded sandstone, silty and shaly in part.	Yields of 2 to 200 gpm reported; usually adequate for ranchers; and locally adequate for municipal and small-scale industrial uses.
PIERRE SHALE: Bearpaw	Cretaceous	Kb	200 to 1200	Dark colored shale.	Not normally an aquifer.
PIERRE SHALE: Judith River	Cretaceous	Kjr Kp	400 to 600	Interbedded tan sandstone, siltstone, and shale, becoming sandy shale eastward.	Sandstone intervals may yield small to moderate amounts of water locally, often flowing especially near the Missouri bottom land.
PIERRE SHALE: Claggett	Cretaceous	Kcl Kp	300 to 500	Tan-gray shale and sandy shale.	Not normally an aquifer.
PIERRE SHALE: Eagle	Cretaceous	Ke	200 to 300	Gray, white, "salt and pepper" sandstone and gray shale, becoming sandy shale eastward.	Sandstone intervals may yield small amounts of water locally.
PIERRE SHALE: Telegraph Creek	Cretaceous	Ktc	50 to 100	Gray sandy shale.	Not normally an aquifer.
Colorado group	Cretaceous	Kc	2,000+	Dark-colored shales with thin sandstone stringers.	Not normally an aquifer, although sandstones within the interval may locally yield water.
Dakota	Cretaceous	Kd	70 to 100	Light-colored siltstone and sandstone.	Sandstone intervals may yield small to moderate amounts of water locally.
Fuson	Cretaceous	Kf	50 to 100	Dark and varicolored shales, locally with light-colored sandstone.	Sandstone may yield moderate amounts of water.
Lakota	Cretaceous	Kl	80 to 150	White standstone, locally clay-filled.	Normally yields small to moderate and occasionally large, amounts of potable water.
Jurassic interval	Jurassic	Ju	900 to 1,000	Light-colored sandstone, tan limestone, gray and dark-colored shales.	Sandstone may locally yield small amounts of water.

By nature, the Flaxville gravel should be a productive aquifer since it is porous and permeable. However, it yields little water for three reasons: (1) it covers only limited areas; (2) its permeable nature allows rapid percolation of water; and (3) it is not recharged to its capacity. On these mesas, the gravel caps are seldom wider than 5 miles, nor longer than 15 miles. This means it is beween 1 and 2½ miles to the outcrop. It is only recharged by precipitation in the late spring and early summer, which percolates through the gravel to seep out as springs beneath the scarps. There is very little recharge in the winter and early spring because of the frozen ground, and in the late summer and fall seasons, there is little precipitation. For adequate recharge, there should be perennial streams crossing the gravel.

Most, if not all, of the water wells drilled into the Flaxville continue on into the Fort Union to yield water from both formations. (The Flaxville in this area is reported to be not thicker than 40 feet.) It is difficult to say just what a Flaxville well will yield by itself.

Fort Union Formation

The Fort Union formation is presently under approximately 95 percent of Richland County. Its thickness varies from a featheredge to near 1,200 feet in the western part of the county.

Strata of the Fort Union are of continental origin. They represent an environment that may have been similar to that on the Mississippi delta today. It is thought that lowland swamps subsided to a level that allowed the streams to change course and spill out over the swamps. The streams flooded the swamps with sediment thereby burying the organic material. This burial kept the plant debris from being oxidized or burned. A repetitious process like this could explain the cyclic nature of the repeated coal beds, shales and sandstones. Individual beds cannot be traced over great distances.

The Tertiary Fort Union formation is the most widespread aquifer in Richland County. A well, drilled to a depth of one or two hundred feet, is almost certain to produce adequate water for stock and domestic needs. Sandstones and coal beds generally yield water; if not capping ridges, or too near their outcrop. This formation produces water from the porous sandstone, the very porous scoria beds, and the intensely fractured coal beds. The quantity of water that can be expected is usually from 5 to 20 gallons per minute. Water from the sandstones is often mineralized and the water from coal is frequently very pure and low in mineral content. Fort Union water is often quite soft. Flowing wells can be obtained at greater depths in the Missouri River bottom land. The water from the flowing wells is mineralized, but is readily used by stock. If the flow to stock tanks is not regulated, the water can be wasted. The wasting of groundwater is a misdemeanor and endangers the water levels on nearby wells. Flows up to 10 gallons per minute are common.

Hell Creek Formation

The Hell Creek formation consists of massive brown to gray sandstones with interbedded carbonaceous shales. Often the carbonaceous shale grades into shaly lignite. The presence of abundant rust colored concretions are one of the distinguishing features of this formation. The other is large dinosaur fossils. The concretions are limonite-cemented balls of sandstone which range in size from 1-inch to 6 inches in diameter. Frequently several of these balls are grown together to form doll-like figures. The soft rock of this formation erodes easily to form badlands. The Hell Creek is exposed in the northwestern corner of the county.

The Hell Creek formation is uppermost Cretaceous in age. The sandstones are believed to have been deposited in a fresh to brackish water environment.

The Hell Creek's depth ranges from the surface near the town of Poplar to about 1,300 feet below the surface at Sidney, and its thickness is 125 to 150 feet. The lower sandstone unit of the Hell Creek is very similar to the underlying Fox Hills sandstone and forms a continuous aquifer with it.

Small to moderate yields of groundwater can be obtained from wells in the formation. Recharge to the formation is by direct infiltration of precipitation that falls on the outcrops, by seepage from the overlying Fort Union and by infiltration from streams that pass over it.

Fox Hills Formation

The Fox Hills formation consists of fine-grained sandstones, siltstones and shales. It outcrops in a belt along the Missouri River in the northwestern corner of the county. The depth to the top of it varies from zero to about 1,700 feet, and in thickness it ranges from 150 to 220 feet.

The Fox Hills is a marine to brackish water deposit and is subdivided into two members. The upper member, the Colgate, is a light gray sandstone. The lower member is a medium-grained, light brown, yellow brown, or light green sandstone and interbedded shales and silty sandstones.

Wells drilled into this formation in the Yellowstone valley flow in southern Richland County. Flowing wells tapping the Fox Hills are rare in upland areas. The sandstones of this formation are water-bearing and yield soft water, which is desirable for domestic and stock usage. The importance of it as an aquifer decreases to the north while it increases toward the southern portion. Most wells that penetrate this formation in the northern townships produce water from the Hell Creek as well as the Fox Hills. The Hell Creek is reported to be the better aquifer and is hydraulically connected with the Fox Hills.

Pierre Formation

The Pierre formation is for the most part a shale formation. This is especially true in North Dakota. As you go westward it gradually grades into shales and sandstones. In the western portion of Richland County the Pierre may be subdivided into the Bearpaw shale, Judith River sandstone, Claggett shale, Eagle sandstone and Telegraph Creek shales and sandstones. The subdivisions are not well defined until you reach the Wolf Point area and west of there.

The Bearpaw shale is a dark gray, slightly sandy, marine shale formation. The Bearpaw is reported to be about 1,000 feet thick at its full section. The shale is tight and usually unproductive of good water. What little water that would come from it is too highly mineralized for domestic, or stock use.

The Judith River, directly below the Bearpaw, is a possible source of groundwater. The Judith River is basically a sandstone, but it has shale beds and numerous coal seams. Although some water may be found in the Judith River in Richland County, it should not be considered as a reliable source of groundwater this far east. What little water that may come from this formation will probably be salty.

The Claggett and the Telegraph Creek formations are predominantly shale formations and not considered to be aquifers. The Eagle sandstone,while it is a very good aquifer in north central Montana, is too shaly to yield groundwater in Richland County.

Deeper Formations

There are deeper formations that have the potential of yielding water. The depths to them are usually not economically feasible for most agricultural and domestic needs. There is also the possibility that in these formations there may be no water, the water may be saline, or the water may be mixed with oil and gas.

WELLS

The oldest wells reported in Richland County were dug in 1850 and used for stock and domestic uses. The majority of the wells in the county were drilled since 1940. As of January 1969 there were 1,092 wells in the county. The following table shows the total appropriations and wells reportedly used in Richland County based on information on groundwater appropriation forms. It must be noted that several wells may be filed on each appropriation form, therefore, there are more wells than appropriations.

Well Use	Reported Use As Per App.* Forms	Reported Annual Withdrawals**	Total Number Reporting Annual Withdrawals	Total Number Not Reporting Annual Withdrawals	Percent Of Total
1. Domestic	165	36,585,300	82	84	15.1
2. Stock	643	194,118,965	344	299	59.0
3. Irrigation	12	7,915,650	6	6	1.1
4. Industrial	7	2,500,000	1	6	.6
5. Municipal	9	80,000,000	2	7	.8
6. Domestic/Stock	205	83,230,300	162	43	19.0
7. Domestic/Irrigation	13	3,132,000	8	5	1.2
8. Stock/Irrigation	18	5,180,000	12	6	1.6
9. Domestic/Stock/ Irrigation	10	20,613,850	7	3	.9
10. Unknown	10	639,000	6	4	.7
TOTALS	1092	433,915,065	630	463	100%

*App.—Appropriation
**Withdrawals are shown in gallons

SPRINGS

Springs in Richland County are scattered around with little pattern. There is an increase in number along the Yellowstone valley and a decrease in the northcentral townships.

Springs occur where the land surface intersects the water table. The springs in Richland County are generally found in the coulees that cut deep into the Fort Union formation. The Yellowstone River has cut deep into the Fort Union, explaining the slight increase in density of springs near this river valley. Springs often show up in the spring of the year, but dry up in late summer.

The use of springs historically dates back to the mid-1880's. Springs were predominantly used for stock watering then, as they are now.

There are 219 appropriated springs on file with the Montana Water Resources Board, as of January 1, 1971. The following table is a breakdown of each reported appropriation and its use. Again, it must be noted that several springs are filed on each appropriation form.

Spring Use	Reported Use As Per App.* Forms	Reported Annual Withdrawals**	Total Number Reporting Annual Withdrawals	Total Number Not Reporting Annual Withdrawals	Percent Of Total
1. Domestic	0	0	0	0	0
2. Stock	109	5,753,000	18	91	45.2
3. Irrigation	2	0	0	2	00.9
4. Industrial	0	0	0	0	0
5. Municipal	0	0	0	0	0
6. Domestic/Stock	2	0	0	2	00.9
7. Domestic/Irrigation	0	0	0	0	0
8. Stock/Irrigation	4	50,000	1	3	01.8
9. Domestic/Stock/ Irrigation	0	0	0	0	0
10. Unknown	102	2,786,800	3	99	51.2
TOTALS	219	8,589,800	22	197	100%

*App.—Appropriation
**Withdrawals are shown in gallons

WATER QUALITY ANALYSIS

This Water Resources Survey has included a table of water analysis data. This information is available in and is taken from U. S. Geological Survey Water Supply Paper 1263; U. S. Geological Survey Circular 93; and Montana State Department of Health, "Chemical Analysis of Municipal Water Supplies". This data is republished in this survey for the convenience of the residents of Richland County and other interested people.

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CHEMICAL ANALYSIS OF SURFACE AND GROUND WATER

Source	Location	SiO_2	Fe	Ca	Mg	Na & K	HCO_3 & CO_3	SO_4	Cl, F & NO_3	Total Dissolved Solids	Hardness as $CaCO_3$	Specific Conductance	pH
SURFACE WATER	Irrigation Canal N of Sidney	13	.12	65	25	77.2	190	248	11.6	572*	265	864	7.3
	Ditch 6 miles SW of Sidney	22	.06	77	47	91.8	402	208	11.4	680*	386	941	8.1
	Ditch 2 miles SW of Sidney	24	1.00	124	110	207.0	540	676	11.0	1420	762	1970	7.7
	Ditch 6 miles NE of Sidney	20	.02	61	128	370.6	676	860	12.1	1790	679	2490	7.7
GROUNDWATER (Wells)	**ALLUVIUM**												
	T 16 N R 55 E Sec. 2 SWSE	21	.22	107	60	407.2	682	812	6.2	1750	......	......	....
	18 56 34 NWNE	17	.31	56	71	152.0	472	356	4.8	934*	......	......	....
	27 49 3 NESW	11	.34	58	25	265.0	534	345	13.8	987	248	1470	7.8
	28 55 33 NESE	12	3.60	229	103	481.0	1190	971	32.2	2410	995	3230	7.1
	27 59 7 SESE	26	4.00	73	35	444.8	731	645	7.9	1600	326	2200	8.4
	28 53 25 NWSE	14	3.40	105	111	719.0	1130	1270	9.1	2780	718	3750	7.8
	28 57 32 NWSE	21	.10	158	59	23.0	351	293	63.1	829	637	1240	8.1
	GLACIAL DRIFT												
	23 59 8 SESE	18	.11	63	23	4.5	246	16	35.0	270*	252	447	7.6
	TERRACE DEPOSITS												
	19 57 26 SENE	25	.32	87	66	217.4	292	628	49.6	1220	489	1680	7.7
	20 58 21 NWNW	30	.17	98	90	220.4	694	456	12.4	1250	615	1720	8.0
	20 58 32 SWNE	27	4.70	84	33	56.6	268	204	10.6	566*	345	778	7.4
	21 58 15 NWSE	33	.06	61	75	77.0	464	224	28.6	774*	461	1060	7.8
	21 59 5 NENW	26	.06	50	74	709.0	852	1180	11.5	2480	430	3560	7.6
	22 59 16 SWSE	18	.06	108	45	35.0	453	128	9.8	562*	455	873	7.0
	22 59 19 NWNE	23	8.10	124	84	230.0	648	588	13.6	1400	655	1830	7.5
	23 59 11 NENW	24	.22	55	80	205.0	635	332	13.0	1030	467	1520	7.8
	23 59 31 NENE	19	.42	55	56	408.0	342	164	7.0	496*	368	746	7.8
	23 59 32 SENE	26	2.60	65	56	62.2	348	208	6.6	600*	393	847	7.6
	23 60 7 SENE	21	10.00	158	69	184.0	843	332	19.2	1200	678	1810	7.3
	23 60 19 NESW	22	8.40	103	69	954.0	1020	1660	24.8	3350	541	4180	7.7
GROUNDWATER (Wells)	**FORT UNION**												
	22 59 2 NESE	16	.15	3.0	7.4	859.4	2137	1.6	73.2	2060	38	2960	8.3
	22 59 30 NWNW	14	.06	6.0	6.6	612.0	1579	10.0	20.7	1500	42	2400	8.2
	22 59 34 NESW	15	9.90	100.0	46.0	32.4	532	66.0	1.2	530*	439	803	7.5
	23 59 2 NENW	10	1.00	6.5	6.0	585.2	940	436.0	16.2	1540	41	2380	8.3
	23 59 32 SESE	22	.40	6.0	10.0	891.8	2249	0.0	45.6	2140	56	3050	8.3
	26 59 10 NWSE	12	.05	9.7	4.4	865.0	2022	9.1	55.4	2000	42	3070	8.7
	27 55 23 SESE	10	.05	9.8	4.6	745.0	1711	16.0	47.2	1760	43	2770	8.7
	28 58 26 SESW	7	.02	7.0	12.0	752.6	1898	6.8	55.9	1830	67	2920	8.3
	HELL CREEK & FORT UNION												
	27 54 7 NENW	16	.10	6.8	2.0	468.2	943	5.8	121	1120	25	1950	8.5
	HELL CREEK												
	28 53 30 SENE	8	.68	34.0	20.0	340.2	882	157.0	9.5	1000	167	1570	7.6
	LOCAL MUNICIPALITIES												
	Brockton Well		....	28	44	220	610	191	22.7	816	250	......	....
	Culbertson Well		.20	44	27	77	214	182	16.7	460	220	......	....
	Fairview #1 Well		1.80	64	66	302	689	485	11.9	1300	430	......	....
	Fairview #2 Well		.90	22	35	409	714	461	9.9	1290	200	......	....
	Fairview #3 Well		2.40	69	32	235	662	243	12.8	898	306	......	....
	Richey #2 Well		0.00	8	6	475	1171	0	81.4	1170	45	......	....
	Richey #3 Well		.19	0	0	345	958	0	96.9	1034	0	......	....
	Sidney #3 Well		.50	64	52	99	396	232	13.2	670	374	......	....
	Sidney #4 Well		.15	97	63	130	430	384	19.0	950	506	......	....
	Sidney #5 Well		0.00	88	50	107	442	251	23.1	764	424	......	....
	Sidney #6 Well		0.00	79	12	109	323	183	19.7	520	247	......	....
	Sidney #7 Well		9.94	51	60	80	360	219	15.1	654	374	......	....
	Sidney #8 Well		2.68	84	1	153	369	226	9.0	650	215	......	....
	Sidney #9 Well		1.06	90	46	69	378	226	9.0	626	413	......	....

*These figures were derived by a slightly different method than total dissolved solid figures without an asterisk. An asterisk indicates the water sample was evaporated at 180°C and the residue was weighed. The T.D.S. without the asterisk is the sum total of the constituent anions and cations.

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ECONOMIC MINERAL DEPOSITS

Economic mineral deposits—metallic, nonmetallic, mineral fuels and groundwater—are directly related to the geology of a given area. The geologic situation in Richland County is therefore summarized before the resources are considered.

Richland County is situated within the Northern Great Plains physiographic province, which may also be called the High Plains province. There are no mountains within the county, and the terrain is typically a high plain dissected by stream valleys.

In much of the county, glacial drift obscures the bedrock. The Fort Union Formation covers most of the county, but the underlying Hell Creek Formation, Fox Hills Sandstone, and Bearpaw Shale are exposed near the Missouri River in the northwestern corner of the county. A few patches of Flaxville Gravel are scattered over the southern part of Richland County.

Petroleum Resources

Approximately 60 exploratory wells have been drilled in Richland County. Brorson field produced Richland County's first oil in 1954 but proved disappointing because production problems plagued the field. Since the discovery of Spring Lake field in 1963, production from the older Red River Formation has spurred exploration activities, and total reserves are now estimated to be 5.5 million barrels of oil. Exploratory drilling has increased steadily; 20 wells were drilled in 1968, and in 1969 the search for deep production seems likely to maintain the pace.

Coal

Richland County has an estimated 21,085 million short tons of lignite (coal) of which 420 million short tons can readily be stripped. Previous production has come from the Pust, Lane, F. S, H, and lower Elvira coal beds of the Tongue River Member of the Fort Union Formation. The Pust bed contains most of the coal and ranges from 7 to 25 feet in thickness. Major strippable coal fields in the county are the Fox Lake field (50 million short tons), the Breezy Flat field (220 million short tons), and the O'Brian-Alkali Creeks field (150 million short tons).

Sand and Gravel

Deposits of sand and gravel are widespread throughout the county in the valley alluvium and the Flaxville Gravel. Most of this material would probably have to be washed to remove clay and soil before it could be used.

Metals

Richland County has no known deposits of metals.

SOIL AND WATER CONSERVATION DISTRICT

Richland County is served by the Richland County Soil and Water Conservation District. The district was first organized in 1940 as the Mona-Andes Soil Conservation District. The district later revised its name in 1951 to reflect the fact that its boundaries were identical to those of Richland County. The district is governed by 7 supervisors, 5 of whom are elected by the land occupiers of the district and 2 of whom are appointed by the town of Fairview to represent Fairview which was added to the district in 1969.

The supervisors conduct a program of resource conservation and development which involves soil and water conservation, soil management, land improvement, land use adjustment, recreation and wildlife developments. This program is accomplished by providing assistance to landowners and operators, on a voluntary basis, to plan and apply resource conservation and development work.

Under state laws, the supervisors have the authority to call upon local, state and federal agencies to assist in carrying out a soil and water conservation program. The Richland District works closely with the Soil Conservation Service, Farmers Home Administration, Extension Service, Agricultural Research Service, Agricultural Stabilization and Conservation Service, Montana Fish and Game Department and the Montana Water Resources Board. In relation to working with these agencies the district has signed memorandums of agreement with the Soil Conservation Service, U. S. Department of Agriculture, U. S. Bureau of Land Management, U. S. Department of Interior, Montana Fish and Game Department, Montana State Forester and the Montana Water Resources Board. The cooperation the district enjoys with these agencies makes a complete and balanced soil and water conservation program possible in the district.

The Soil Conservation Service provides the major assistance to the district by furnishing and interpreting basic data on soils, plant cover and other features of the land. Technical data are interpreted in terms of acceptable alternative uses and treatments to assist landowners and operators in developing, conserving and utilizing their soil and water resources. The SCS also aids district cooperators in performing operations requiring technical skills beyond the experiences of the individuals involved.

Any landowner or operator in the county may receive technical assistance without cost by making a request to the district for such service. Cost sharing assistance to offset part of the cost of applying soil and water conservation practices is available through the Great Plains Conservation Program administered by the Soil Conservation Service, and the Agricultural Conservation Program administered by the Richland County Agricultural Stabilization and Conservation office. Loans to apply conservation and development work are available through the Richland County Farmers Home Administration office.

Richland County comprises a land area of 1,321,600 acres. Public ownership of land consists of the U. S. Bureau of Land Management, 53,504 acres; Montana State lands, 81,136 acres; U. S. Bureau of Reclamation, 1,120 acres; Richland County, 2,400 acres; and the Montana Fish and Game Department, 1,380 acres. About 89.5 percent of the land in the district, or 1,178,981 acres are under private ownership.

The agricultural land in the county consists of 458,811 acres of cropland and approximately 760,000 acres of rangelands. Approximately 42,000 acres are presently irrigated, of which about 38,-000 acres are cropland. There are 4,400 acres of ponds and small lakes in the county. The county is bordered on the north and east by the Missouri River. The Yellowstone River crosses through the east side of the county. Urban and built-up areas comprise about 12,755 acres in the county.

The major crops grown in Richland County on the dryland consists of small grain and forage crops. The major crops on irrigated lands are beets, alfalfa, and corn silage. Some potatoes are raised. Beef cattle is the major livestock enterprise in the county. Cattle feeding and sheep feeding are major winter enterprises on the irrigated lands in the Yellowstone valley.

The major conservation practices in the district on rangeland are construction of dams, springs and wells for livestock water, grass seeding for hay and pasture, and cross fencing of ranges for better management of grazing. Major conservation and development work on irrigated lands consist of land leveling, reorganization of irrigation systems, concrete ditch lining and land drainage. Dry cropland conservation problems consist of wind and water erosion. Erosion control measures commonly applied in the district are stripcropping, stubble mulching, grassed waterways, floodwater diversions, and farmsteads and field windbreaks.

FISH AND GAME

Richland County contains some of the finest deer habitat in eastern Montana. The wooded bottoms and islands on the Lower Missouri and Lower Yellowstone Rivers are heavily populated with whitetails, while the "Breaks" along these rivers and their tributaries support good populations of mule deer. Almost 1,000 whitetails and 600 mule deer were reported harvested from the county in 1968.

Sharptailed grouse and Hungarian partridge are the two leading game birds. Numerous brushy coulees adjoining good grassland and wheat fields provide the necessary habitat for these two species. Pheasants, although not as numerous as in the past, are still found in huntable numbers in some parts of the county.

Richland county lies within a major flyway for both ducks and geese and also produces a substantial number of ducks on artificial reservoirs. The State Fish and Game Department is now developing a major waterfowl production area at Fox Lake near Lambert, Montana.

Stream fishing opportunities are confined to the Yellowstone River which produces good catches of warm-water species. Sauger and channel catfish are the main fishes sought by the angler, but goldeye, walleye, northern pike, ling and sturgeon are also taken.

Several small reservoirs now provide fair to excellent fishing for rainbow trout and largemouth bass. A lack of high quality streams and reservoirs in Richland County limits fishing opportunities; however, there is a good potential for development of small reservoir sites which would greatly enhance fishing.

WATER RESOURCES SURVEY

Richland County, Montana

PART II

Irrigation Development With Maps Showing Irrigated Areas in Colors Designating Sources of Supply

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IRRIGATION DEVELOPMENT

LOWER YELLOWSTONE PROJECT

HISTORY

The Bureau of Reclamation first began investigations of the Lower Yellowstone Valley in 1903. Prior to that time the early settlers of the area, now comprising the Lower Yellowstone Project depended on stock raising for their livelihood.

In the spring of 1904, a board of consulting engineers examined the project and submitted a report on April 23, 1904, which served as a basis for authorization of the project by the Secretary of the Interior on May 10, 1904. The Lower Yellowstone Water Users' Association was formed during the fall and winter of 1904 and 1905, and on May 31, 1905, they entered into a contract with the Secretary of the Interior to repay the cost of constructing a project. Construction began on July 22, 1905, and water was available for irrigation during the season of 1909.

The Lower Yellowstone Project is located in east-central Montana and western North Dakota. It includes the Lower Yellowstone Diversion Dam, Thomas Point Pumping Plant, the Main Canal, 225 miles of laterals and 110 miles of drains. The purpose of the project is to furnish a dependable supply of irrigation water for about 56,000 acres of fertile land along the west banks of the Yellowstone River. About one-third of the project lands are in North Dakota and two-thirds in Montana.

Water is diverted from the Yellowstone River into the Main Canal by the Lower Yellowstone Diversion Dam near Intake, Montana and carried by gravity to a greater portion of the project lands. Approximately 2,300 acres of benchland is irrigated by water pumped from the canal by the Thomas Point Pumping Plant.

This project is operated by the Board of Control of the Lower Yellowstone Project.

PRESENT STATISTICS

Location: Lands irrigated under the Lower Yellowstone Project in Richland County are located in sections 15, 22, 23, 24, 25 and 26, T. 26N., R 59 E.; sections 25 and 36, T. 25 N., R. 59 E.; sections 24, 25, 26, 35 and 36, T. 24 N., R. 59 E.; sections 5, 8, 17, 18, 19, 20, 29, 30 and 31, T. 24 N., R. 60 E.; sections 1, 2, 3, 9, 10, 11, 12, 13, 14, 15, 16, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 31, 32, 33, 34, 35 and 36, T. 23 N., R. 59 E.; sections 5, 6, 7, 8 and 18, T. 23 N., R. 60 E.; sections 13, 23, 24, 25, 26, 35 and 36, T. 22 N., R. 58 E.; sections 2, 3, 4, 5, 6, 7, 8, 9, 10, 17, 18, 19, 20, 30 and 31, T. 22 N., R. 59 E.; sections 1, 2, 3, 10, 11, 12, 14, 15, 21, 22, 27, 28, 29, 31, 32, 33 and 34, T. 21 N., R. 58 E.; section 6, T. 21 N., R. 59 E.; sections 1, 2, 3, 4, 9, 10, 11, 12, 13, 14, 15, 16, 17, 20, 21, 22, 23, 24, 28, 29, 32 and 33, T. 20 N., R. 58 E.; sections 13, 24, 25, 26, 33, 34 and 35, T. 19 N., R. 57 E.; and sections 5, 7, 8, 17, 18, 19 and 20, T. 19 N., R. 58 E.

Length and Capacity of Canal: The main canal of the Lower Yellowstone Project has an initial capacity of 1,200 c.f.s. and total length of 71.6 miles from its point of diversion near Intake, Montana. Approximately 57 miles of the canal lies within the boundary of Richland County.

The Thomas Pumping Plant is located on the main Canal about 19 miles from its headworks near Intake in SE¼NW¼ section 28, T. 20 N., R. 58 E. This plant has two (2) hydraulic turbine-driven centrifugal pumps with a total capacity of 45 c.f.s.

Operation and Maintenance: The charge for operation and maintenance under the Lower Yellowstone Project is $4.50 per acre.

Present Users: During the irrigation season of 1969 there were approximately 539 users of water under the Lower Yellowstone Project in Richland County.

Acreage Irrigated: In 1969 there were 32,049.24 acres irrigated under the Lower Yellowstone Project, with 968.66 acres potentially irrigable under existing ditch facilities and a maximum of 33,017.90 acres.

WATER RIGHT DATA

Water Rights appurtenant to the Lower Yellowstone Project are as follows:

1. An appropriation by the United States of America from the Yellowstone River, dated October 30, 1905, for 1,000 c.f.s. (Reference: Book "B" Water Right Location, page 357, Clerk and Recorder's office, Dawson County, Glendive, Montana.)

2. An appripriation by the Lower Yellowstone Irrigation District #1 from the Yellowstone River, dated June 27, 1939, for 1,300 c.f.s. (Reference: Book IV Water Right Locations, page 394, Clerk and Recorder's office, Dawson County, Glendive, Montana.)

(See maps in Part II pages 1, 2, 3, 5, 6, 7, 8, 12, 13, 16, 17, 23 and 27.)

MISSOURI RIVER BASIN PROJECT

(Savage Unit)

HISTORY

Interest in the development of the Savage Unit began as early as 1920 and, as the Lower Yellowstone Project continued to prosper the interest grew in getting water to the adjacent higher land. Private capital was not available to finance the cost of construction. With pumping a necessary requirement, the lack of low-cost power presented a problem to either private or Federal development until Fort Peck power became available. Proposing to use this source of power, the farmers and community leaders requested the assistance of the Bureau of Reclamation in the irrigation development of the Savage Unit.

The area now comprising the Savage Unit was surveyed during the first investigations and construction of the Lower Yellowstone Project in 1903 to 1909. Additional investigations were made in 1941 and Project Investigations Report No. 68, dated January 1942, was written. The detailed investigations leading to construction of the unit were undertaken during 1945 and 1946, from which a development report "Savage Unit—Yellowstone Pumping Units, Montana," dated December 9, 1946, was prepared.

The project authorization was by the Flood Control Act of December 22, 1944.

Public Law 534, which approved the general comprehensive plan set forth in Senate Documents 191 and 475, as revised and coordinated by Senate Document 247, 78th Congress, 2nd Session.

Water is delivered by a pumping plant on the Main Canal of the Lower Yellowstone Project where it is pumped through a 1000-foot pipeline into the main canal of the Savage Unit. The capacity of Lower Yellowstone Canal is sufficient, without enlargement, to supply the Savage Unit.

Construction of irrigation facilities of the "Savage Unit" began April 18, 1949, and was completed December 6, 1949. The first water was made available for irrigation on May 27, 1950.

PRESENT STATISTICS

Location: Land irrigated under the Savage Unit is located in section 12, T. 19 N., R. 57 E.; sections 5, 6, 7 and 18, T. 19 N., R. 58 E.; and sections 9, 16, 17, 20, 29, 30, 31 and 32, T. 20 N., R. 58 E.

The pumping plant is located on the Lower Yellowstone Canal in NW¼SW¼ section 18, T. 19 N., R. 58 E. It contains two electrically driven 300 horsepower motors, each delivering 21 cubic feet per second of water with an 84-foot head. Power to operate the pumps is delivered over lines of the Montana-Dakota Utilities Company to a Bureau constructed substation at Savage.

Length and Capacity of Canal: From the 1,000-foot pipeline which extends from the pumping plant, the main canal of the Savage Unit has a length of 7.8 miles and an initial capacity of 44 c.f.s.

Operation and Maintenance: Under this unit the O & M charges are $3.90 for each acre of land irrigated.

Present Users: In 1969 there were 28 water users under the Savage Unit.

Acreage Irrigated: There were a total of 2,269.35 acres irrigated by this project in 1969, with a potential irrigable acreage under present ditch facilities of 55.70 acres and maximum irrigable acreage of 2,325.05 acres.

WATER RIGHT DATA

The water right that applies to the Savage Unit was made by the United States of America (Bureau of Reclamation) from the Yellowstone River under the appropriation date of August 14, 1946 in the amount of 42 cubic feet per second. (Reference for the location of this water filing is Book D-4, page 414, Water Rights Records, Clerk and Recorder Office, Dawson County.)

(See maps in Part II: Pages 1, 2 and 3.)

SIDNEY PUMPING PROJECT

(Montana Water Resources Board)

HISTORY

The land under this project is located across the Yellowstone River from the town of Sidney in Richland County. Construction of the Sidney Pumping Project was financed by a loan and grant from the Public Works Administration supplemented by State Water Conservation Board funds. The project consists of three pumping plants; three canals; a 13,200-volt power line twelve miles long from Sidney to the pumping station; and construction of a substation.

The project was designed to furnish a full water supply to 5,000 acres along the Yellowstone River valley. The distribution canals for the project were built in conjunction with the Works Progress

Administration. The original project was to include lands in North Dakota but the Board was never able to get sufficient allocation to extend the project even though special legislation for this purpose was enacted by the Montana legislature.

In order to operate the project the Sidney Water Users' Association was incorporated on October 21, 1937. It was authorized to issue 25,000 shares of stock at a par value of $1.00 per share and is governed by five directors.

Bids were received for construction of the project on November 27, 1937, but they were returned unopened because financing of the project had not been completed. On March 23, 1938 the Board awarded a contract to D. M. Manning in the amount of $63,529.03. The award of this contract was not approved by the Public Works Administration until October 11, 1938 and the contract completed May 26, 1939. Fairbanks-Morse and Company was awarded a contract for $16,687.00 to furnish pumps for the project. This contract was completed on September 6, 1939.

Other construction was for canals to be built by the Works Progress Administration under sponsorship of Richland County and the Sidney Chamber of Commerce. This construction proved to be too much of a financial burden for those organizations, and it became necessary for the Board to assume this responsibility and complete the project. The Works Progress Administration spent $53,563.56 on this project and no record is available of the other sponsors' contribution. To help in maintaining the canal, the Board, on August 26, 1948 authorized the purchase of a dragline at a cost of $7,000 for which the Association agreed to repay the Board $900.00 a year. Financial difficulties have prevented the Association from carrying out this agreement. An extensive program of constructing drainage ditches have been carried on using this dragline, and some cooperation in this work has been received by the water users assigning to the Association government payments.

Under the original application water purchase contracts were issued for 6,800 acres to be served with 20,400 acre-feet of water. The water was to be paid for at 45 cents per acre-foot for a period of 29 years. As finally accepted, 11,500 acre-feet were signed up and accepted on October 19, 1938. This consisted of 29 contracts and was supplemented by 22 other contracts to commence payment in 1941 for 3,500 acre-feet.

There was a partial operation of the project in 1939 but serious trouble developed with the pumps and the project did not satisfactorily deliver water. This created a financial problem in that the power charge had to be paid whether the water was used or not. With the unsuccessful operation of the project and financial difficulties, the Board started negotiations with the water users and the Reconstruction Finance Corporation, the holder of the bonds, to rewrite the contracts. On May 12, 1943 there were good contracts outstanding in the amount of 8,661 acre-feet. Using this as basis, an amended trust indenture calling for 8,661 acre-feet of contracts was negotiated. The actual cancellation of the original contracts and approval of the amended finance plan was not fully approved until June 1945. There are presently outstanding, 53 contracts for 9,093 acre-feet, calling for payment of 45 cents per acre-foot for 36 years. The present value of these contracts is $71,877.65. Water for this project is signed upon a basis of 3 acre-feet per acre of land.

A financial statement of the total cost of the Sidney Pumping Project (including $53,563.56 spent by the Works Project Administration) was $315,915.05 as of June 30, 1960.

Since 1965, the Sidney Water Users' Association and the Montana Water Resources Board have cooperated in an effort to rehabilitate the Sidney Pumping Project. For several years the project has been plagued by a shifting of the water in the channels of the Yellowstone River. With the channel changes and the pumping of excess sand through the pumps has caused a rapid deterioration of the pumps combined with excess of cleaning of the canal system.

At the present time negotiations are being made for the contracting of a new pump station, and it is hoped that a contract for construction of canals and appurtenant structures will be let this spring (1971). It is anticipated that some new land will be irrigated under the new system.

PRESENT STATISTICS

Location: The **Sidney Pumping Unit No. 1** consists of 3 pumps having capacities of 44 c.f.s. and is located in the NW¼NW¼ of section 5, T. 21 N., R. 59 E. Land irrigated under Unit No. 1 is in section 5, T. 21 N., R. 59 E.; sections 9, 15, 16, 17, 20, 21, 22, 28, 29 and 32, T. 22 N., R. 59 E.

Sidney Pumping Unit No. 2 contains one pump having a capacity of 10 c.f.s. and is located in the SW¼NW¼ of section 11, T. 22 N., R. 59 E. Land irrigated under Unit No. 2 is located in sections 1, 2, 11 and 12, T. 22 N., R. 59 E.

Sidney Pumping Unit No. 3 contains 2 pumps having capacities of 22 c.f.s. and is located in the SW¼SE¼ of section 25, T. 23 N., R. 59 E. Lands irrigated under Unit No. 3 are located in sections 24 and 25, T. 23 N., R. 59 E.; and in sections 17, 18, 19, 20 and 30, T. 23 N., R. 60 E.

Length and Capacity of Canal: The two main canals of Unit No. 1 have a total length of approximately 12 miles and an initial capacity of 25 c.f.s. Unit No. 2 has two main canals with a total length of 3 miles and a combined initial capacity of about 15 c.f.s. Unit No. 3 has three main canals under its system, having a total length of approximately 8 miles with an initial capacity of 25 c.f.s.

Operation and Maintenance: Water for this project is contracted on a basis of 3 acre-feet per acre of land irrigated. At the present time operation and maintenance charges are $2.10 per acre with construction charges set at 45 cents per acre. An increase in this total water charge will be necessary in rehabilitation plans for the project in 1971.

Present Users: In 1969 there were 18 water users under contract with the Sidney Pumping Project.

Acreage Irrigated: In 1969, 3,217.50 acres irrigated under the Sidney Pumping Project with 253.00 potential acres under existing ditch facilities, totaling 3,470.50 maximum irrigable acres under the project.

WATER RIGHT DATA

The State Water Conservation Board made two (2) filings for water of the Yellowstone River and tributaries that apply to the Sidney Pumping Project. The first filing was made on September 1, 1937 as a "Declaration of Intention" to store, control and divert all unappropriated water of the Yellowstone River and its tributaries. (Reference: Book 3 of Water Right Records, page 171, Clerk and Recorder's office, Richland County, Sidney, Montana.) The second filing was an "Amendatory Declaration" dated December 15, 1938 for all the unappropriated water of the Yellowstone River and its tributaries. (Reference: Book 3 of Water Right Records, page 202, Clerk and Recorder's office, Richland County, Glendive, Montana.)

(See maps in Part II, pages 6, 8, 12 and 13.)

WATER RIGHT DATA AND IRRIGATION SUMMARY OF RICHLAND COUNTY BY STREAMS

(Filings of Record)

Locator**	Stream	No. of Filings	APPROPRIATIONS Miner's Inches	APPROPRIATIONS Cu. Ft. Per Sec.	IRRIGATION SUMMARY Present Irrigated Acres	IRRIGATION SUMMARY Irrigated Acres Under Present Facilities	IRRIGATION SUMMARY Maximum Irrigated and Irrigable Acres Under Present Facilities
	MISSOURI RIVER BASIN						
28N-53E	Missouri River	24	32,270.80	806.77	1,219.00	619.00	1,838.00
27N-50E	Redwater River*	0	0.00	0.00	0.00	0.00	0.00
23N-51E	H. S. Coulee	1	120.00	3.00	0.00	0.00	0.00
23N-50E	Unnamed Tributary	1	446.00	11.15	21.00	0.00	21.00
23N-51E	Bickett Coulee	1	70.00	1.75	0.00	0.00	0.00
24N-51E	Lisk Creek	0	0.00	0.00	0.00	0.00	0.00
24N-51E	South Fork of Lisk Creek	2	800.00	20.00	0.00	0.00	0.00
24N-51E	North Fork of Lisk Creek	0	0.00	0.00	0.00	0.00	0.00
23N-52E	Unnamed Tributary	1	1,200.00	30.00	0.00	0.00	0.00
23N-51E	Unnamed Tributary	1	800.00	20.00	0.00	0.00	0.00
25N-51E	East Redwater Creek	1	160.00	4.00	0.00	21.00	21.00
25N-51E	Unnamed Tributary	1	1,000.00	25.00	0.00	0.00	0.00
24N-52E	North Fork of East Redwater Creek	0	0.00	0.00	0.00	0.00	0.00
24N-53E	Carda Coulee	2	260.00	6.50	0.00	0.00	0.00
24N-54E	Unnamed Tributary	1	60A/F***	60A/F***	12.00	36.00	48.00
24N-54E	Unnamed Springs	1	69.40	1.74	0.00	0.00	0.00
24N-53E	Unnamed Tributary	1	100A/F***	100A/F***	0.00	0.00	0.00
24N-53E	Unnamed Tributary	1	1,120.00	28.00	0.00	48.00	48.00
24N-53E	Dry Coulee	1	All	All	0.00	0.00	0.00
24N-52E	Unnamed Tributaries	1	80A/F***	80A/F***	0.00	0.00	0.00
24N-52E	Duplissie (Coulee) Creek	2	10,000.00	250.00	0.00	0.00	0.00
25N-52E	North Fork of Duplissie (Coulee) Creek	4	6,129.20	153.23	0.00	16.00	16.00
25N-52E	East Fork of Duplissie (Coulee) Creek	2	800.00	20.00	0.00	16.00	16.00
25N-51E	Longrass Creek	0	0.00	0.00	0.00	0.00	0.00
25N-51E	Milne Coulee	0	0.00	0.00	21.00	0.00	21.00
25N-51E	Unnamed Tributary	0	0.00	0.00	19.00	0.00	19.00
26N-51E	Unnamed Tributary	1	4,520.00	113.00	0.00	0.00	0.00
27N-51E	Woods Coulee	2	7,200.00	180.00	0.00	0.00	0.00
27N-51E	Glendive Coulee	3	3,220.00	80.00	59.00	0.00	59.00
27N-51E	Unnamed Tributary	1	800.00	20.00	17.00	27.00	44.00
27N-51E	Colgan Creek	1	8,000.00	200.00	0.00	0.00	0.00
27N-51E	Unnamed Tributary	1	124.00	3.10	0.00	0.00	0.00
27N-51E	Davis (Second) Creek	2	120.00	3.00	0.00	0.00	0.00
26N-51E	Spring Coulee	1	300.00	7.50	0.00	0.00	0.00
27N-51E	Unnamed Tributary	1	67A/F***	67A/F***	0.00	0.00	0.00
27N-51E	Second Creek	3	1,320.00	33.00	0.00	0.00	0.00
26N-51E	Unnamed Tributary	1	18A/F***	18A/F***	0.00	0.00	0.00
26N-51E	Bilger Creek	1	500.00	12.50	0.00	0.00	0.00
27N-52E	First (Wedium) (Deep) Creek	4	1,720.00	43.00	0.00	0.00	0.00
27N-52E	Deep (Third) Creek	5	2,600.00	65.00	0.00	0.00	0.00
27N-52E	Renz Creek	2	1,500.00	37.50	32.00	29.00	61.00
27N-52E	No Name Coulee	1	500.00	12.50	0.00	0.00	0.00
27N-52E	Old House Coulee	1	121.00	3.03	0.00	0.00	0.00
27N-52E	Sand Coulee	1	121.00	3.03	0.00	0.00	0.00
28N-53E	Well	1	0.40	0.01	2.00	140.00	142.00
27N-53E	Charley Creek	3	3,320.00	83.00	0.00	0.00	0.00
27N-53E	East Charley Creek	4	3,508.00	87.70	0.00	0.00	0.00
24N-55E	Unnamed Tributary	1	90A/F***	90A/F***	0.00	18.00	18.00
25N-55E	Unnamed Creek	2	120,000.00	3,000.00	0.00	0.00	0.00
25N-55E	Timber Creek	3	940.00	23.50	0.00	0.00	0.00
20N-55E	Elm Coulee	1	120.00	3.00	0.00	0.00	0.00
26N-54E	Hay Coulee	1	120.00	3.00	0.00	0.00	0.00
26N-54E	Middle Fork of Charley Creek	2	3,500.00	87.50	0.00	0.00	0.00
24N-54E	Unnamed Fork of Middle Fork of Charley Creek	1	400.00	10.00	0.00	0.00	0.00
25N-54E	Unnamed Coulee	1	400.00	10.00	0.00	33.00	33.00
26N-54E	Unnamed Tributary	1	All	All	44.00	0.00	44.00
26N-54E	Shack Creek	1	160.00	4.00	0.00	0.00	0.00
26N-54E	Unnamed Tributary	1	1,400.00	35.00	114.00	0.00	114.00
26N-54E	Unnamed Tributary	1	340.00	8.50	0.00	0.00	0.00
27N-53E	Curran Coulee	1	160.00	4.00	0.00	35.00	35.00
27N-53E	West Charley Creek	3	1,020.60	25.52	0.00	0.00	0.00
26N-53E	Fowler Creek	2	2,280.60	57.02	19.00	0.00	19.00
26N-53E	West Branch of West Charley Creek	2	3,188.80	79.70	0.00	0.00	0.00
26N-53E	Nickolson (Patch) Creek	3	2,000.00	50.00	0.00	0.00	0.00
27N-53E	Hagen Coulee	0	0.00	0.00	0.00	20.00	20.00
27N-53E	Eagle Nest Coulee	1	200.00	5.00	0.00	0.00	0.00
27N-53E	Cow Coulee	1	200.00	5.00	0.00	0.00	0.00
27N-53E	Well	1	178.40	4.46	36.00	0.00	36.00
27N-53E	Smythe Creek	1	200.00	5.00	0.00	0.00	0.00
27N-53E	Cherry Coulee	1	300.00	7.50	0.00	0.00	0.00
27N-55E	Hardscrabble (East Charley) Creek	4	3,460.00	86.50	0.00	0.00	0.00
26N-55E	West Fork of Hardscrabble Creek	4	760.00	19.00	0.00	0.00	0.00
26N-56E	East Fork of West Fork of Hardscrabble Creek	3	322.00	8.05	0.00	0.00	0.00
25N-56E	Unnamed Tributary	1	162.00	3.05	0.00	0.00	0.00
26N-56E	Garden Coulee	1	800.00	20.00	0.00	0.00	0.00
26N-55E	Unnamed Tributary	0	0.00	0.00	3.00	0.00	3.00
26N-55E	Dugout Coulee	1	1,000.00	25.00	0.00	0.00	0.00
26N-55E	East Fork of Hardscrabble Creek	13	6,200.00	155.00	14.00	0.00	14.00
25N-56E	Cherry Coulee	1	200.00	5.00	0.00	0.00	0.00
26N-56E	Buckley Creek	5	1,920.00	48.00	0.00	0.00	0.00
26N-56E	Antelope Creek	1	600.00	15.00	0.00	0.00	0.00
26N-56E	Blue Hill Coulee	0	0.00	0.00	0.00	0.00	0.00
26N-56E	North Fork of Blue Hill Coulee	1	200.00	5.00	0.00	0.00	0.00
26N-56E	South Fork of Blue Hill Coulee	1	200.00	5.00	0.00	0.00	0.00
26N-56E	Palmer's Creek	1	900.00	22.50	0.00	0.00	0.00
26N-56E	Cherry Creek	0	0.00	0.00	0.00	0.00	0.00
26N-57E	Unnamed Tributary	1	All	All	0.00	0.00	0.00
26N-56E	Hackley Coulee	1	10A/F***	10A/F***	0.00	0.00	0.00
26N-56E	Dry Creek	1	320.00	8.00	0.00	0.00	0.00
26N-56E	North Fork of Cherry Creek	3	2,000.00	50.00	0.00	0.00	0.00
26N-56E	Three Butte Coulee	1	400.00	10.00	0.00	0.00	0.00
26N-56E	Goodman's Coulees	1	120.60	3.02	0.00	0.00	0.00
26N-56E	Ferry Coulee	1	1,000.00	25.00	0.00	0.00	0.00
27N-55E	Spring Coulee	2	640.00	16.00	0.00	0.00	0.00
27N-55E	Elm (East Fork) Coulee	2	481.13	12.03	0.00	0.00	0.00
27N-55E	Timber Coulee	1	120.55	3.01	0.00	0.00	0.00
27N-55E	Unnamed Tributary (McCanaha Coulee)	0	0.00	0.00	62.00	11.00	73.00
27N-56E	Day Creek	1	600.00	15.00	65.00	0.00	65.00
27N-56E	Elm Coulee	1	250.00	6.25	0.00	0.00	0.00
27N-56E	Devil (Rattlesnake) Creek	1	400.00	10.00	0.00	0.00	0.00
27N-57E	Three Butte Coulee	3	740.00	18.50	0.00	0.00	0.00
27N-57E	South Fork of One Mile Creek	1	400.00	10.00	0.00	0.00	0.00
26N-58E	Spring (Otis Creek) Coulee	7	2,965.00	74.13	253.00	0.00	253.00
26N-58E	Unnamed Tributary	0	0.00	0.00	0.00	0.00	0.00
26N-58E	Unnamed Springs	1	80,000.00	2,000.00	0.00	0.00	0.00
26N-58E	Dry Coulee	1	500.00	12.50	0.00	0.00	0.00
26N-58E	Unnamed Coulee	1	55.85	1.40	0.00	0.00	0.00
26N-57E	Plum Coulee	1	400.00	10.00	0.00	0.00	0.00
26N-58E	Ranch Coulee	1	100.00	2.50	0.00	0.00	0.00
26N-58E	Sheep Camp Coulee	1	400.00	10.00	0.00	0.00	0.00
26N-58E	Seels Coulee	1	500.00	12.50	0.00	0.00	0.00
26N-59E	Grant Coulee	3	600.00	15.00	102.00	0.00	102.00
26N-59E	Gate Coulee	2	2,120.00	53.00	0.00	0.00	0.00
26N-59E	Badland Coulee	0	0.00	0.00	0.00	0.00	0.00
26N-59E	Certain Springs	1	2,000.00	50.00	0.00	0.00	0.00
23N-60E	Yellowstone River	17	149,494.00	3,737.35	38,617.09	1,346.36	39,963.45
22N-59E	Unnamed Tributary	1	500.00	12.50	0.00	0.00	0.00
23N-59E	Unnamed Spring	1	10.00	0.25	0.00	0.00	0.00
19N-57E	Burns Creek	6	2,460.00	61.50	0.00	30.00	30.00
19N-57E	Burns Lake	2	400.00	10.00	37.00	0.00	37.00
20N-58E	Garden Coulee	0	0.00	0.00	0.00	0.00	0.00
20N-57E	Wells	1	7.00	0.18	0.00	0.00	0.00
20N-58E	Dunlap Creek	1	30.00	0.75	0.00	0.00	0.00
20N-58E	Unnamed Coulee	0	0.00	0.00	0.00	0.00	0.00
20N-58E	Unnamed Spring	1	800.00	20.00	0.00	0.00	0.00
20N-58E	Grant Creek	1	150.00	3.75	46.00	0.00	46.00
20N-58E	Well	1	0.00	0.00	43.00	10.00	53.00
19N-58E	Smith Creek	5	1,920.00	48.00	0.00	24.00	24.00
19N-59E	Unnamed Tributary	1	60A/F***	60A/F***	0.00	0.00	0.00
19N-59E	Unnamed Tributary	1	60A/F***	60A/F***	0.00	0.00	0.00
20N-58E	Elm Coulee	3	1,918.00	47.95	38.00	0.00	38.00
20N-58E	Gordon Draw	0	0.00	0.00	95.00	0.00	95.00
19N-58E	Unnamed Springs	1	All	All	0.00	0.00	0.00
20N-58E	Bear Island Slough	1	800.00	20.00	0.00	0.00	0.00
20N-59E	Shadwell Creek	1	500.00	12.50	0.00	0.00	0.00
21N-58E	Alkali Creek	1	47A/F***	47A/F***	0.00	0.00	0.00
21N-58E	Sagebrush Creek	1	2,000.00	50.00	0.00	0.00	0.00
21N-58E	Crane (Crain) Creek	9	3,001,670.00	75,041.75	0.00	0.00	0.00
21N-58E	Unnamed Coulees	1	All	All	0.00	0.00	0.00
21N-58E	Unnamed Coulees	1	8,000.00	200.00	0.00	0.00	0.00
21N-59E	Coal Bank Slough	1	800.00	20.00	27.00	0.00	27.00
21N-59E	O'Brien Creek	1	1,000.00	25.00	0.00	0.00	0.00
22N-59E	Unnamed Coulee	0	0.00	0.00	0.00	0.00	0.00
22N-59E	Unnamed Springs	1	23.14	0.58	0.00	0.00	0.00
22N-58E	Fox Creek	12	4,960.00	124.00	8.00	30.00	38.00
23N-56E	West Fork of Fox Creek	2	1,640.00	41.00	0.00	3.00	3.00
22N-55E	Fox Lake	1	2,000.00	50.00	0.00	0.00	0.00
22N-55E	Unnamed Tributary	1	1,000.00	25.00	0.00	0.00	0.00
22N-55E	Middle Foik of Fox Creek	1	1,000.00	25.00	0.00	0.00	0.00
22N-55E	East Fork of Fox Creek	2	1,120.00	28.00	0.00	0.00	0.00
23N-55E	Three Buttes Creek	5	4,600.00	115.00	134.00	0.00	134.00
23N-56E	Unnamed Tributary	1	18,000.00	450.00	0.00	0.00	0.00
23N-56E	Unnamed Tributary	0	0.00	0.00	15.00	0.00	15.00
23N-56E	Unnamed Tributary	0	0.00	0.00	40.00	0.00	40.00
22N-56E	Unnamed Tributary	1	1,200.00	30.00	0.00	0.00	0.00
22N-57E	Thiessen Creek	1	24,000.00	600.00	0.00	0.00	0.00
22N-58E	North Fork of Fox Creek	5	595.98	14.90	0.00	0.00	0.00
22N-58E	Young's Coulee	1	100.00	2.50	0.00	0.00	0.00
22N-59E	Unnamed Coulee	0	0.00	0.00	0.00	0.00	0.00
22N-59E	Unnamed Springs	1	40,000.00	1,000.00	0.00	0.00	0.00
22N-59E	Wells	0	0.00	0.00	4.00	0.00	4.00
23N-59E	Unnamed Coulee	1	500.00	12.50	0.00	0.00	0.00
22N-59E	Lone Tree Creek	9	6,510.00	162.75	125.00	84.00	209.00
23N-58E	North Fork of Lone Tree Creek	8	6,134.00	153.35	27.00	46.00	73.00
24N-57E	Elkhorn Coulee	3	2,500.00	62.50	0.00	0.00	0.00
24N-57E	Blue Hill Coulee	1	1,000.00	25.00	0.00	0.00	0.00
24N-57E	Dry Creek	1	800.00	20.00	0.00	0.00	0.00
24N-57E	Horse Thief Spring Coulee	0	0.00	0.00	0.00	0.00	0.00
24N-57E	Horse Thief Spring	1	200.00	5.00	0.00	0.00	0.00
23N-57E	Unnamed Tributary	1	800.00	20.00	0.00	0.00	0.00
23N-58E	Hugunan Coulee	2	320.00	8.00	0.00	0.00	0.00
23N-58E	South Fork of Lone Tree Creek	0	0.00	0.00	0.00	0.00	0.00
23N-57E	Unnamed Tributary	1	100.00	2.50	0.00	0.00	0.00
23N-58E	Unnamed Tributary	1	682.00	17.05	0.00	0.00	0.00
23N-58E	Brorson - Branch of Lone Tree Creek	1	47A/F***	47A/F***	0.00	0.00	0.00
23N-59E	Wells	2	54.40	1.36	23.00	0.00	23.00
22N-59E	Bennie Peere (Bennie Deer) (Bernie Pierre) Creek	3	780.00	19.50	0.00	0.00	0.00
22N-60E	Sheep Camp Coulee	1	400.00	10.00	0.00	23.00	23.00
24N-60E	First (Hay Creek) Hay Creek	8	7,180.00	179.50	191.00	0.00	191.00
24N-57E	Main Hay Creek	3	6,000.00	150.00	0.00	0.00	0.00
25N-57E	Unnamed Tributary	1	500.00	12.50	0.00	0.00	0.00
24N-58E	Unnamed Tributary	0	0.00	0.00	0.00	0.00	0.00
24N-58E	Unnamed Spring	1	40.00	1.00	0.00	0.00	0.00
24N-58E	Rock Coulee	1	500.00	12.50	0.00	0.00	0.00
24N-58E	North Fork of First Hay Creek	12	9,000.00	225.00	68.00	8.00	76.00
25N-57E	Baue Coulee	0	0.00	0.00	22.00	0.00	22.00
25N-57E	Unnamed Tributary	0	0.00	0.00	0.00	0.00	0.00
25N-57E	Unnamed Small Lake	1	200.00	5.00	0.00	0.00	0.00
24N-59E	Unnamed Tributary	1	2,000.00	50.00	0.00	0.00	0.00
24N-59E	Unnamed Tributary	1	108A/F***	108A/F***	0.00	0.00	0.00
24N-59E	Unnamed Tributary	1	500.00	12.50	0.00	0.00	0.00
24N-59E	Aitchinson Coulee	0	0.00	0.00	0.00	0.00	0.00
24N-59E	Aitchinson Spring	1	20.00	0.50	0.00	0.00	0.00
24N-60E	Second Hay Creek	3	1,120.00	28.00	0.00	0.00	0.00
25N-59E	Southwest Branch of Second Hay Creek	3	3,000.00	75.00	0.00	0.00	0.00
24N-60E	Unnamed Coulee	1	2,000.00	50.00	0.00	0.00	0.00
24N-60E	Unnamed Tributary	0	0.00	0.00	0.00	0.00	0.00
24N-59E	Unnamed Spring	1	36.00	0.90	0.00	0.00	0.00
24N-60E	Third Hay Creek	1	11.58	0.29	0.00	0.00	0.00
24N-60E	Pratt Coulee	1	120.00	3.00	0.00	0.00	0.00
25N-60E	Four Mile Creek	9	13,164.40	329.11	81.00	0.00	81.00
25N-58E	Unnamed Tributary	1	400.00	10.00	0.00	0.00	0.00
25N-58E	East Coulee	3	82,200.00	2,055.00	0.00	0.00	0.00
25N-58E	West Coulee	1	200.00	5.00	0.00	0.00	0.00
25N-58E	Unnamed Coulee	1	2,000.00	50.00	0.00	0.00	0.00
25N-58E	Unnamed Tributary	1	2,000.00	50.00	0.00	0.00	0.00
25N-58E	Unnamed Tributary	1	80,000.00	2,000.00	0.00	0.00	0.00
25N-59E	North Fork of Four Mile Creek	1	1,200.00	30.00	0.00	0.00	0.00
25N-59E	Unnamed Tributary	1	7,400.00	185.00	0.00	0.00	0.00
24N-60E	Unnamed Tributary	0	0.00	0.00	0.00	0.00	0.00
25N-59E	Simon Spring	1	1,000.00	25.00	0.00	0.00	0.00
25N-59E	One Mile Coulee	1	1,000.00	25.00	0.00	0.00	0.00
25N-59E	South Fork of One Mile Coulee	1	1,000.00	25.00	0.00	0.00	0.00
25N-59E	Unnamed Coulee	0	0.00	0.00	0.00	0.00	0.00
25N-59E	Unnamed Spring	1	2,000.00	50.00	0.00	0.00	0.00
26N-59E	Ferry Coulee	1	80.00	2.00	0.00	0.00	0.00
	Total of Missouri River and Tributaries	199	345,685.33	8,641.65	2,114.00	1,069.00	3,183.00
	Total of Yellowstone River and Tributaries	196	3,519,350.50	87,983.77	39,641.09	1,604.36	41,245.45
	GRAND TOTAL OF RICHLAND COUNTY	395	3,865,035.83	96,625.42***	41,755.09	2,673.36	44,428.45

*Names of streams indented on the left hand margin indicate that they are tributaries of the first stream named above which is not indented.

**The township and range shown in the locator column indicates either where a stream enters the next larger drainage or where a stream or drainage leaves the county.

***Filings made in Acre-Feet are not included in the total.

NOTE: There are no decreed rights in Richland County.

DRAINAGES NOT LOCATED IN RICHLAND COUNTY

Certain Reservoir	1	25.00	0.63
Smith Creek Spring	1	400.00	10.00
Unnamed Springs	1	800.00	20.00
TOTAL	3	1,225.00	30.63

SUMMARY OF IRRIGATED LAND BY RIVER BASINS IN THE FOLLOWING COUNTIES COMPLETED TO DATE

Big Horn, Blaine, Broadwater, Carbon, Carter, Cascade, Chouteau, Custer, Dawson, Deer Lodge, Fallon, Flathead, Gallatin, Glacier, Golden Valley, Granite, Hill, Jefferson, Judith Basin, Lake, Lewis & Clark, Liberty, Lincoln, Madison, Meagher, Mineral, Missoula, Musselshell, Park, Phillips, Pondera, Powder River, Powell, Prairie, Ravalli, **Richland**, Rosebud, Sanders, Silver Bow, Stillwater, Sweet Grass Teton, Toole, Treasure, Valley, Wheatland, Wibaux and Yellowstone.

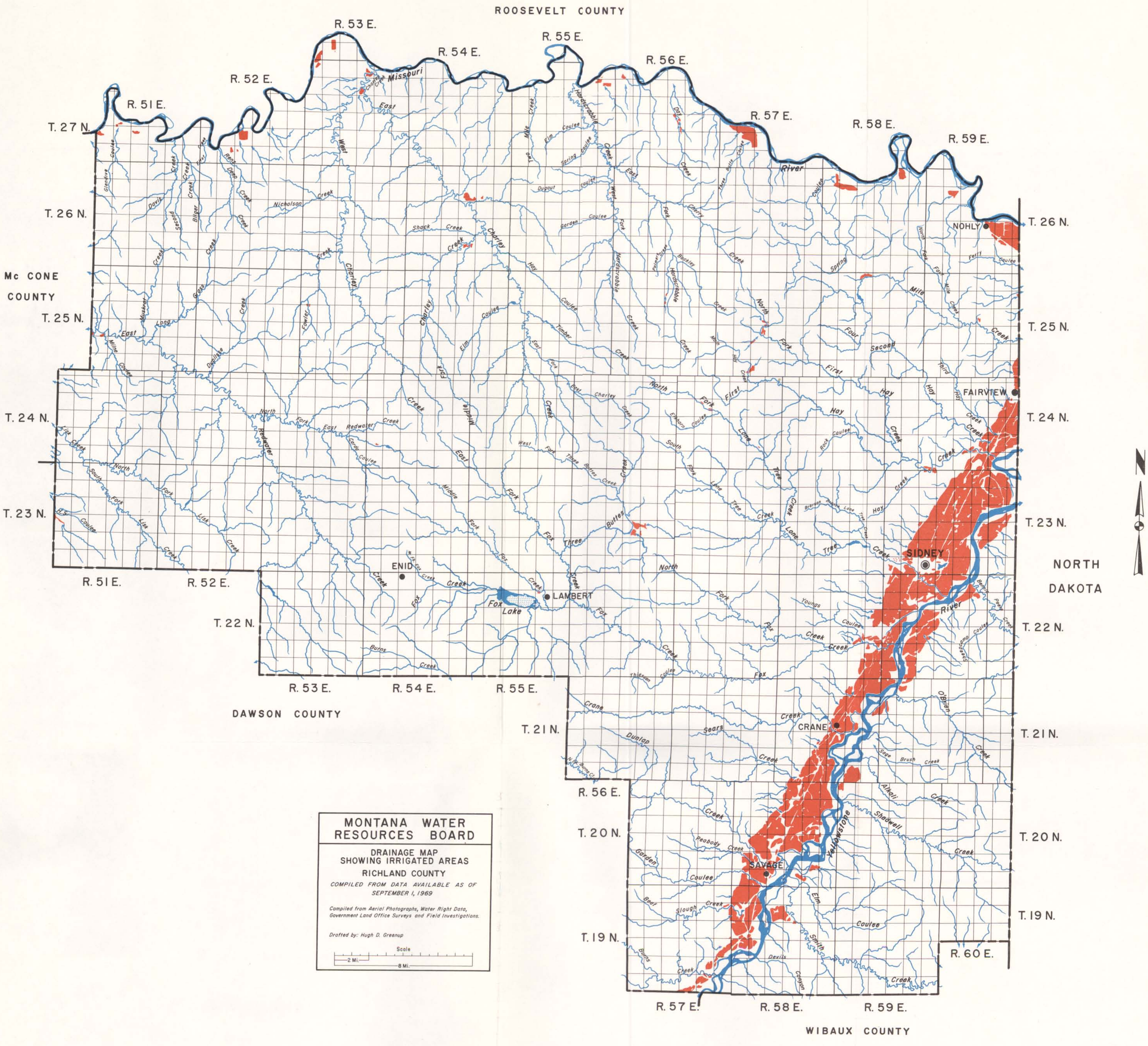
RIVER BASIN	Present Irrigated Acres	Irrigable Acres Under Present Facilities	Maximum Irrigated & Irrigable Acres Under Present Facilities
Hudson Bay Drainage Basin			
***Hudson Bay**	**0.00**	**0.00**	**0.00**
Nelson River	**0.00**	**0.00**	**0.00**
Lake Winnipeg	**0.00**	**0.00**	**0.00**
Saskatchewan	0.00	0.00	0.00
Oldman River	0.00	0.00	0.00
St. Mary River	587.00	0.00	587.00
Unnamed Coulee	26.00	0.00	26.00
Kennedy (Otatso) Creek	0.00	71.00	71.00
Willow Creek	0.00	4.00	4.00
Grand Total Hudson Bay Drainage Basin	613.00	75.00	688.00
Missouri River Drainage Basin			
Missouri River	**138,552.50**	**28,036.33**	**166,588.83**
Jefferson River	**61,291.00**	**9,713.00**	**71,004.00**
Beaverhead River	**40,771.00**	**6,076.00**	**46,847.00**
Big Hole River	**23,775.00**	**1,950.00**	**25,725.00**
Madison River	**39,445.00**	**7,660.00**	**47,105.00**
Gallatin River	**112,054.00**	**21,242.00**	**133,296.00**
Smith River	**32,934.00**	**19,679.00**	**52,613.00**
Sun River	**124,474.58**	**4,385.00**	**128,859.58**
Marias River	**149,004.42**	**20,756.88**	**169,761.30**
Teton River	**74,653.00**	**15,882.33**	**90,535.33**
Musselshell River	**64,789.00**	**57,870.00**	**122,659.00**
Milk River	**217,402.62**	**50,044.76**	**267,447.38**
Yellowstone River**	**375,720.09**	**99,861.96**	**475,582.05**
Stillwater River**	**30,423.50**	**8,028.53**	**38,452.03**
Clarks Fork River**	**88,160.97**	**1,530.83**	**89,691.80**
Big Horn River	**65,005.00**	**23,858.00**	**88,863.00**
Tongue River	**28,170.00**	**7,762.00**	**35,932.00**
Powder River	**36,030.00**	**2,578.00**	**38,608.00**
Little Missouri River	**42,513.00**	**1,499.00**	**44,012.00**
Grand Total Missouri River Basin	**1,745,168.68**	**388,413.62**	**2,133,582.30**
Columbia River Drainage Basin			
Columbia River	**0.00**	**0.00**	**0.00**
Kootenai (Kootenay) River	**9,914.13**	**968.00**	**10,882.13**
Clark Fork (Deer Lodge) (Hellgate) (Missoula) River	**156,269.70**	**17,293.20**	**173,562.90**
Bitterroot River	**111,102.43**	**3,200.00**	**114,302.43**
Flathead River	**141,511.19**	**5,135.22**	**146,646.41**
Little Bitterroot River	15,297.00	337.00	15,634.00
Grand Total Columbia River Basin	**434,094.45**	**26,933.42**	**461,027.87**
GRAND TOTAL COUNTIES COMPLETED TO DATE	**2,179,876.13**	**415,422.04**	**2,595,298.17**

*Name of streams indented on the left-hand margin indicate that they are tributaries of the first stream named above which is not indented.

**Figures in these River Basins revised by resurvey of Carbon County, 1965.

MAP INDEX

All maps have been made from aerial photographs



ROOSEVELT COUNTY
Mc CONE COUNTY
DAWSON COUNTY
WIBAUX COUNTY
NORTH DAKOTA
R. 51 E.
R. 52 E.
R. 53 E.
R. 54 E.
R. 55 E.
R. 56 E.
R. 57 E.
R. 58 E.
R. 59 E.
R. 60 E.
T. 27 N.
T. 26 N.
T. 25 N.
T. 24 N.
T. 23 N.
T. 22 N.
T. 21 N.
T. 20 N.
T. 19 N.
N
Missouri River
Yellowstone River
NOHLY
FAIRVIEW
SIDNEY
ENID
LAMBERT
Fox Lake
CRANE
SAVAGE
MONTANA WATER RESOURCES BOARD
DRAINAGE MAP SHOWING IRRIGATED AREAS
RICHLAND COUNTY
COMPILED FROM DATA AVAILABLE AS OF SEPTEMBER 1, 1969
Compiled from Aerial Photographs, Water Right Data, Government Land Office Surveys and Field Investigations.
Drafted by: Hugh D. Greenup
Scale
2 Mi.
8 Mi.

MAP SYMBOL INDEX

BOUNDARIES

- INTERNATIONAL
- STATE
- COUNTY
- NATIONAL FOREST

DITCHES

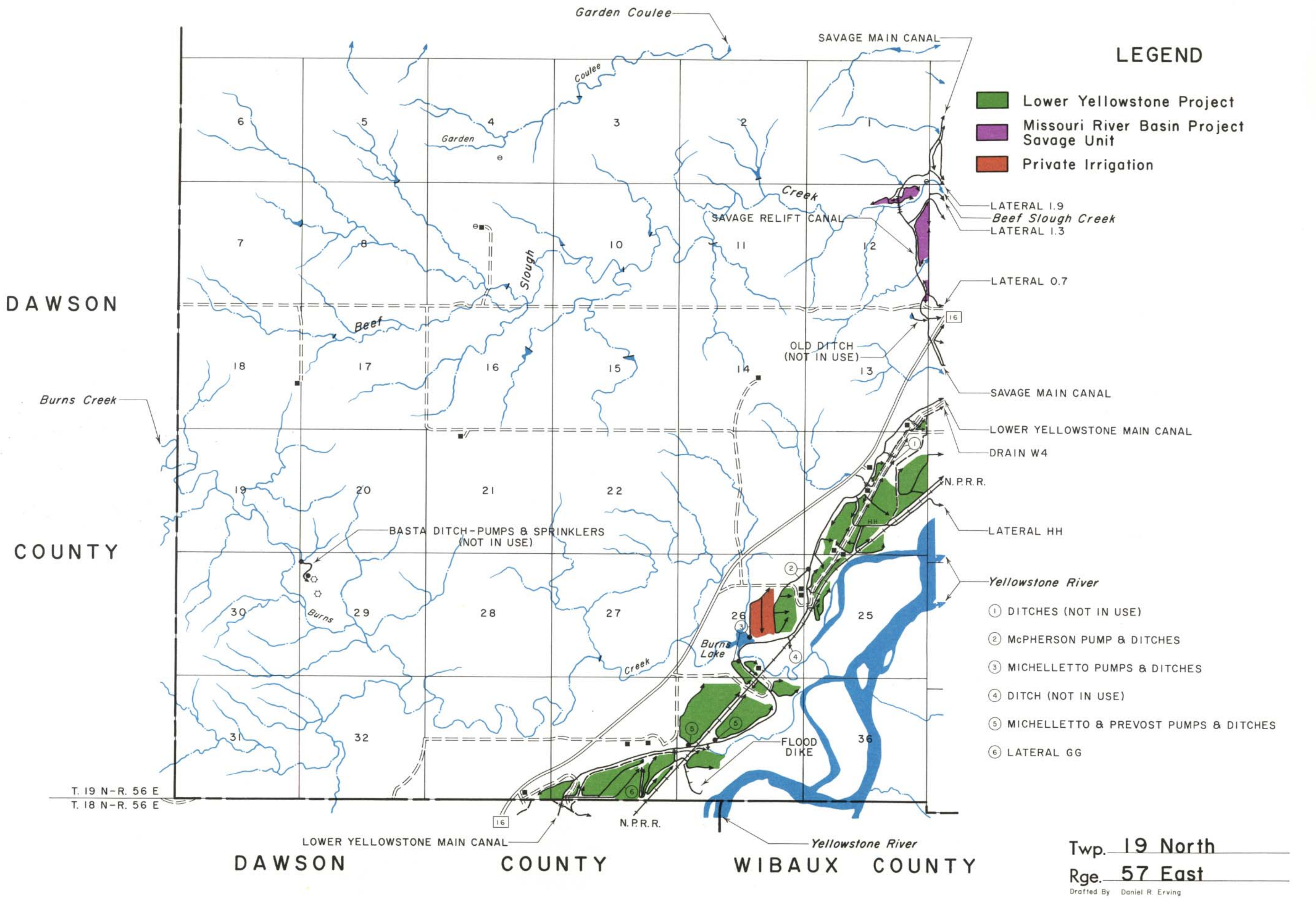
- CANALS OR DITCHES
- DRAIN DITCHES

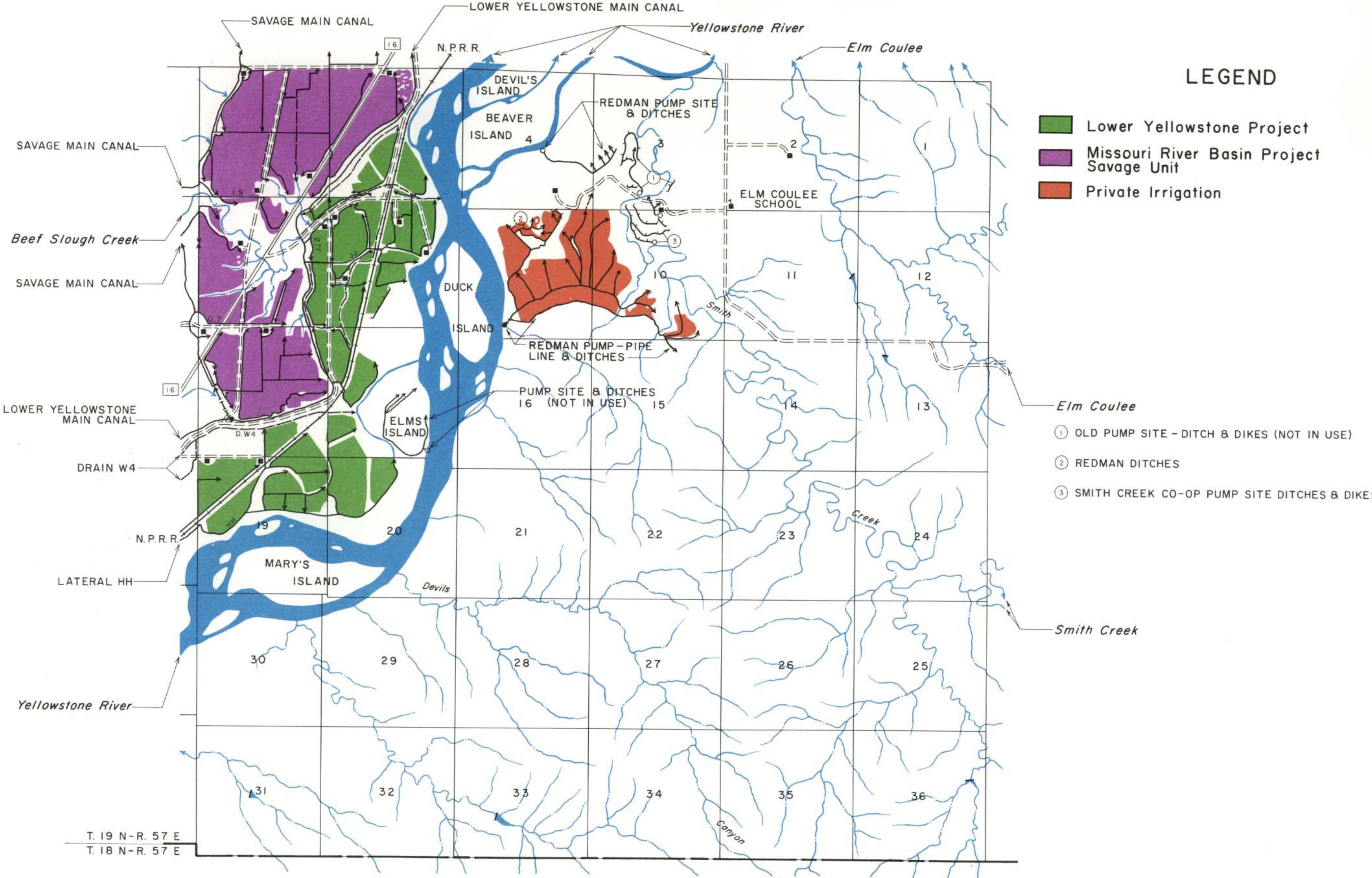
TRANSPORTATION

- PAVED ROADS
- UNPAVED ROADS
- RAILROADS
- STATE HIGHWAY
- U.S. HIGHWAY
- INTERSTATE HIGHWAY
- AIRPORT
- LANDING STRIP

STRUCTURES & UNITS

- DAM
- DIKE
- FLUME
- SIPHON
- SPILL
- SPRINKLER SYSTEM
- WEIR
- PIPE LINE
- PUMP
- PUMP SITE
- WELL
- ARTESIAN WELL
- + + + NATURAL CARRIER USED AS DITCH
- SPRING
- RESERVOIR
- SWAMP
- GAUGING STATION
- POWER PLANT
- STORAGE TANK
- CEMETERY
- FAIRGROUNDS
- FARM OR RANCH UNIT
- SCHOOL
- LOOKOUT STATION
- RANGER STATION
- BRIDGE
- RAILROAD TUNNEL
- REST AREA
- SHAFT, MINE, OR GRAVEL PIT
- OIL WELL OR OIL FIELD


LEGEND
Lower Yellowstone Project
Missouri River Basin Project Savage Unit
Private Irrigation
Garden Coulee
SAVAGE MAIN CANAL
LATERAL 1.9
Beef Slough Creek
LATERAL 1.3
SAVAGE RELIFT CANAL
LATERAL 0.7
OLD DITCH (NOT IN USE)
SAVAGE MAIN CANAL
LOWER YELLOWSTONE MAIN CANAL
DRAIN W4
N.P.R.R.
LATERAL HH
Yellowstone River
① DITCHES (NOT IN USE)
② McPHERSON PUMP & DITCHES
③ MICHELLETTO PUMPS & DITCHES
④ DITCH (NOT IN USE)
⑤ MICHELLETTO & PREVOST PUMPS & DITCHES
⑥ LATERAL GG
DAWSON COUNTY
Burns Creek
BASTA DITCH-PUMPS & SPRINKLERS (NOT IN USE)
Burns Lake
FLOOD DIKE
T. 19 N-R. 56 E
T. 18 N-R. 56 E
LOWER YELLOWSTONE MAIN CANAL
N.P.R.R.
Yellowstone River
DAWSON COUNTY
WIBAUX COUNTY
Twp. 19 North
Rge. 57 East
Drafted By Daniel R. Erving

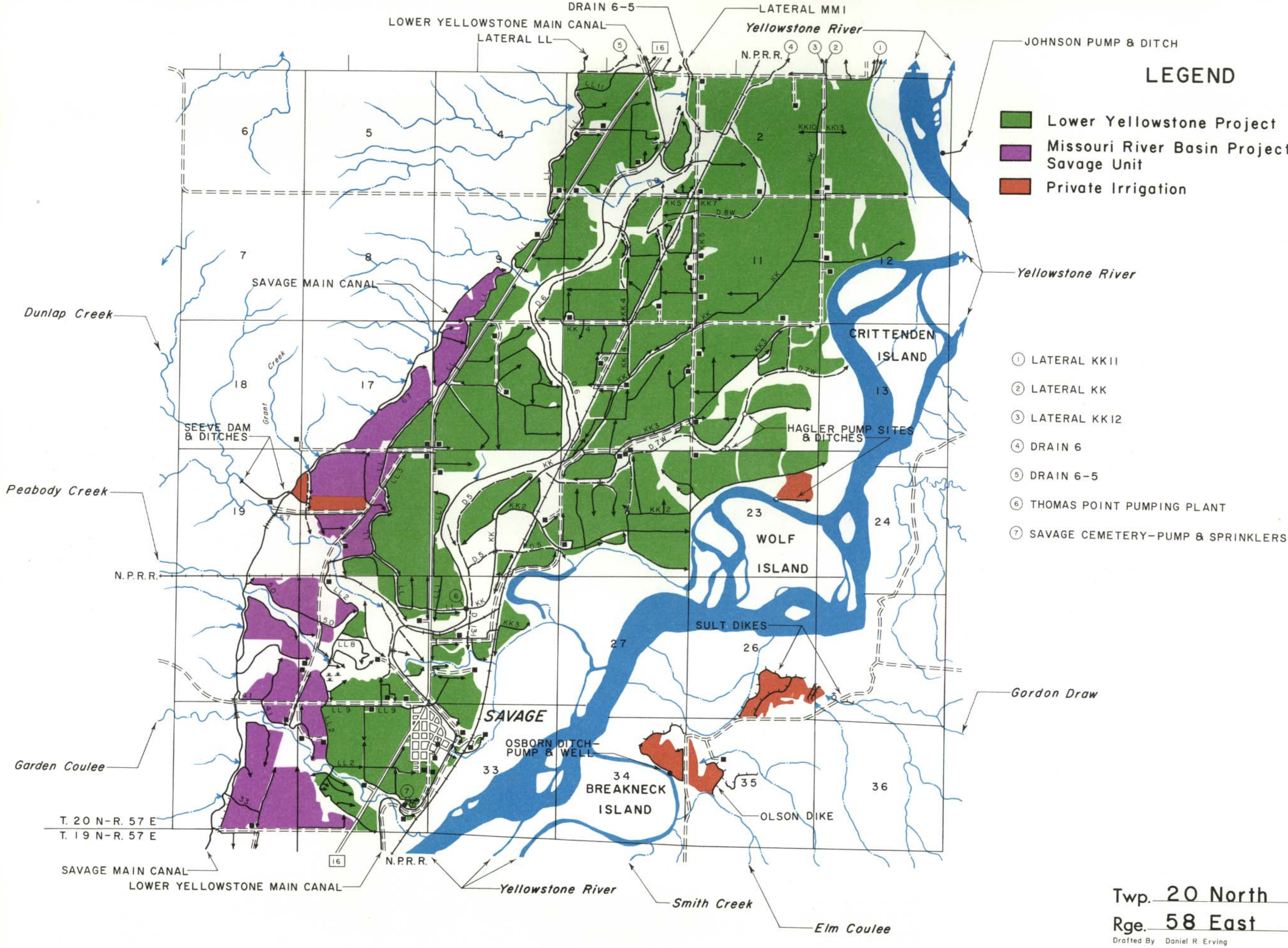


WIBAUX COUNTY

Twp. 19 North

Rge. 58 East

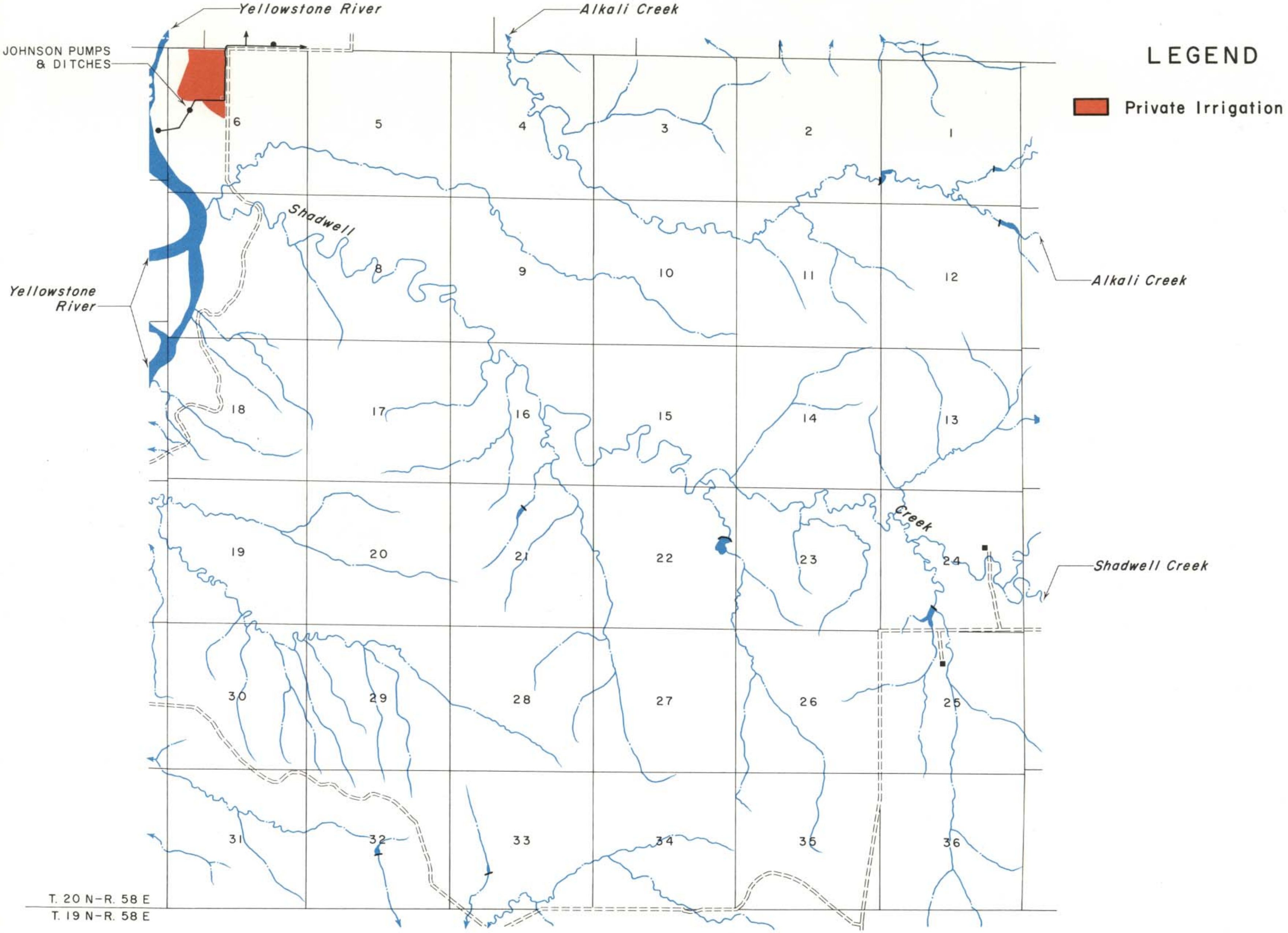
Drafted By Daniel R. Erving



Twp. 20 North

Rge. 58 East

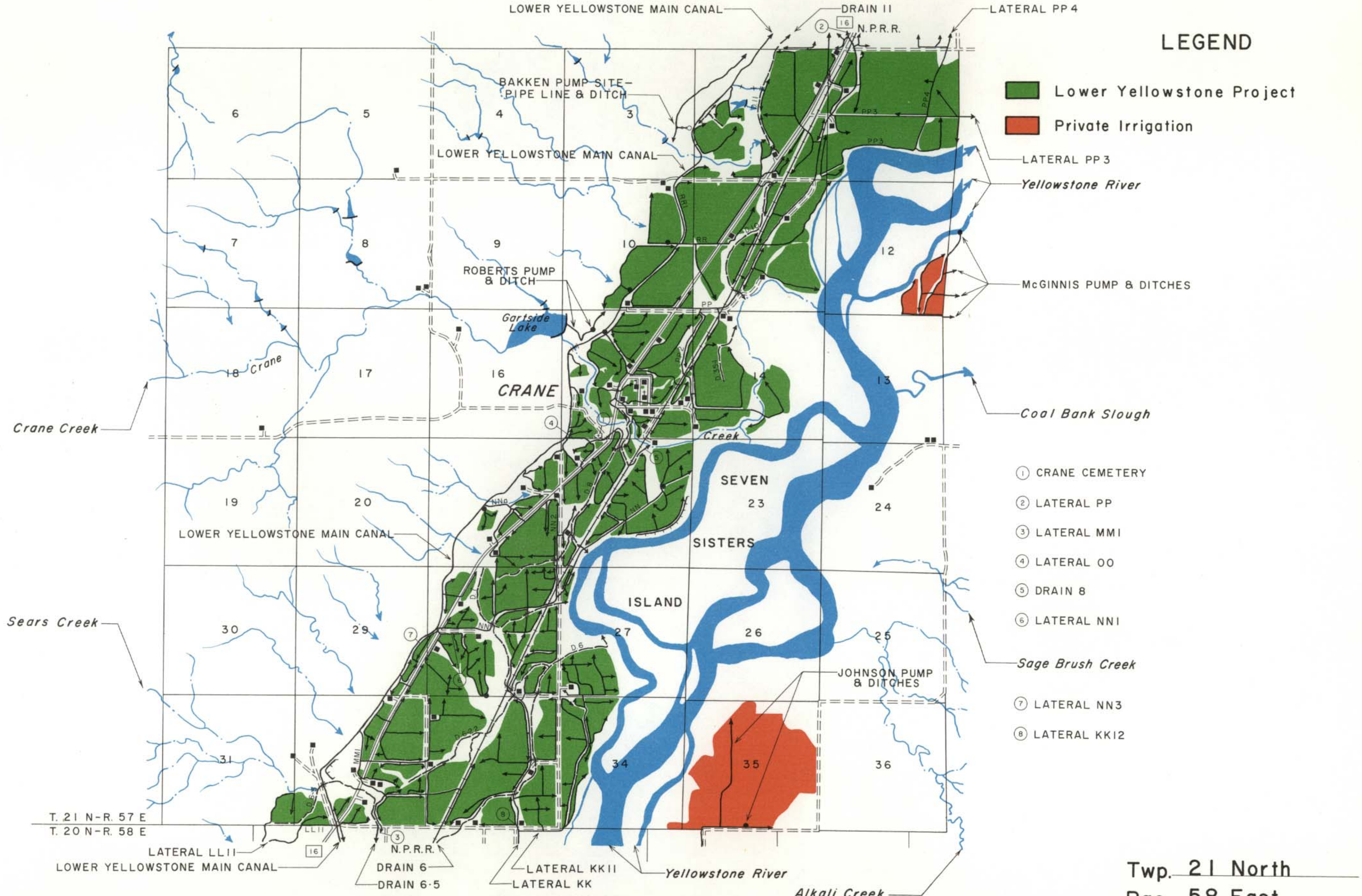
Drafted By Daniel R Erving



Twp. 20 North

Rge. 59 East

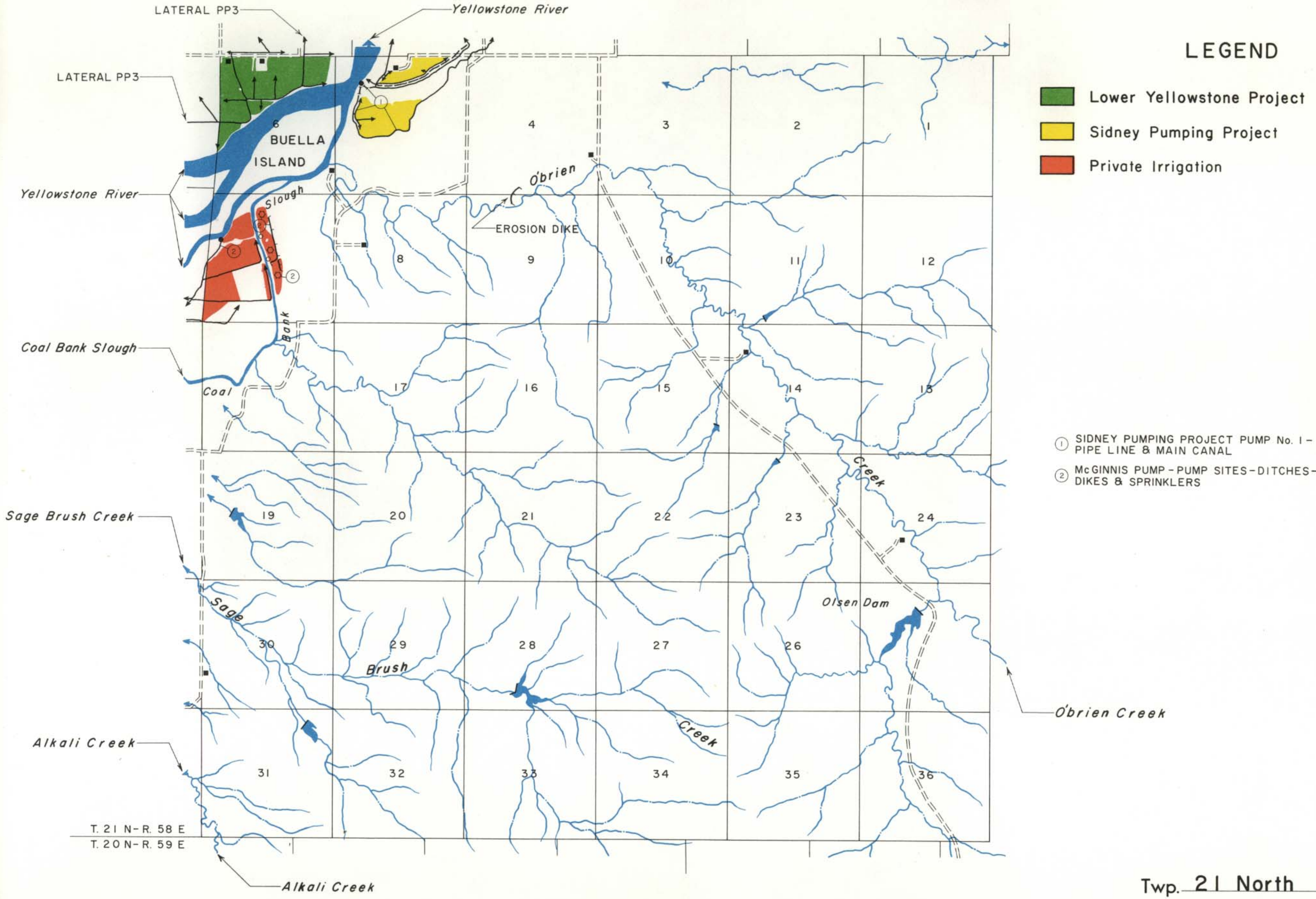
Drafted By Dan Nelson



Twp. 21 North

Rge. 58 East

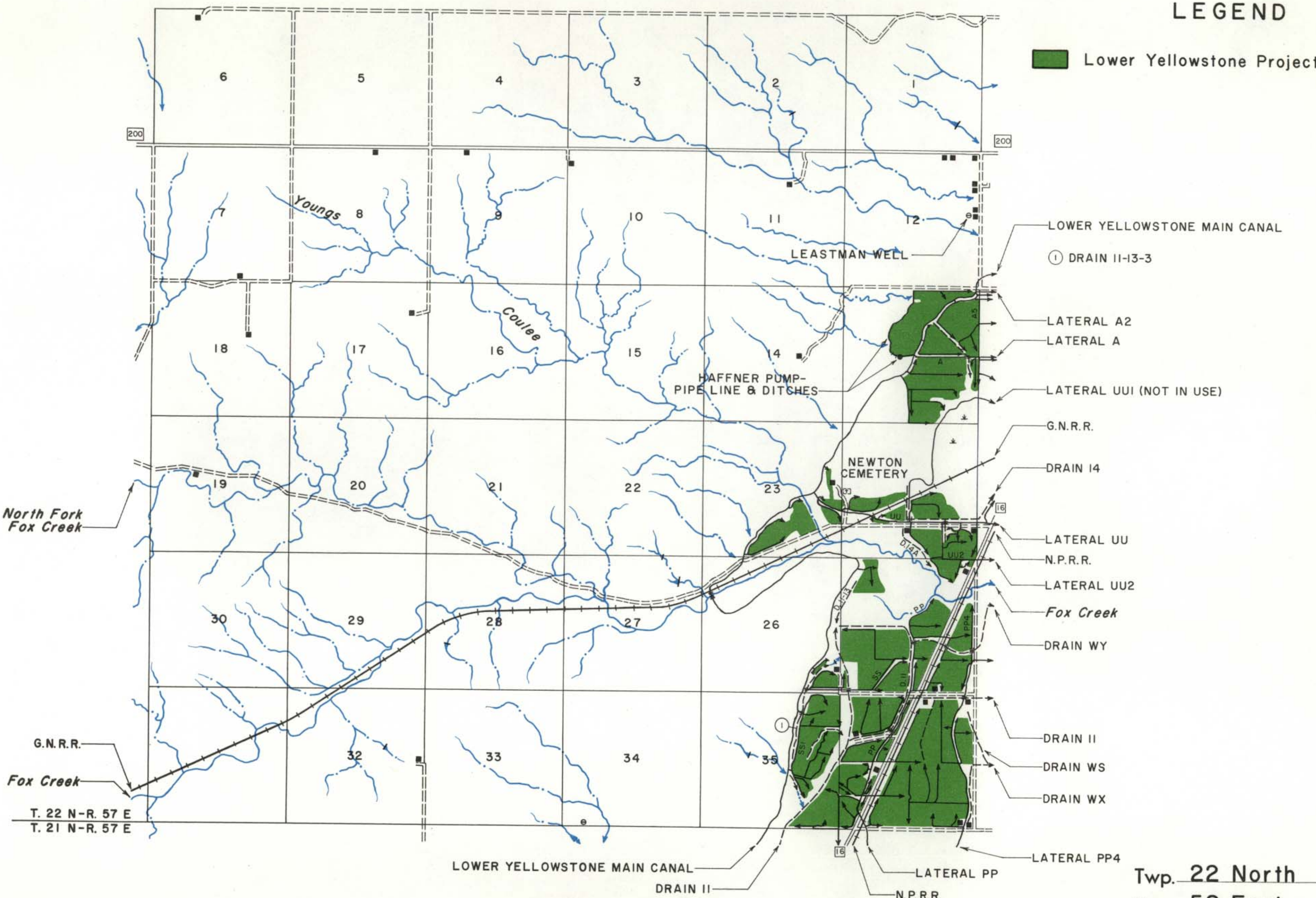
Drafted by Daniel R. Erving



Twp. 21 North

Rge. 59 East

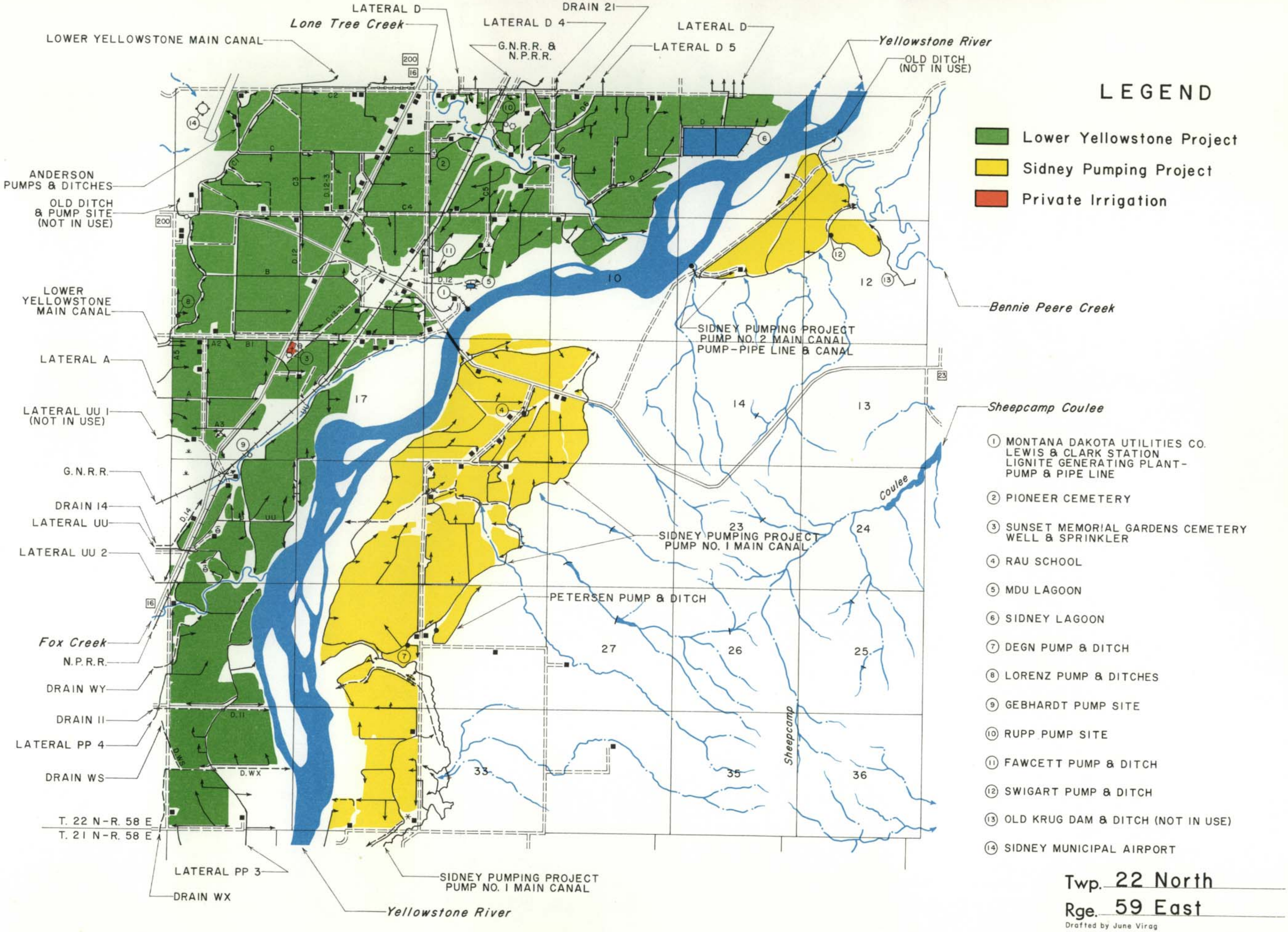
Drafted by Daniel R. Erving

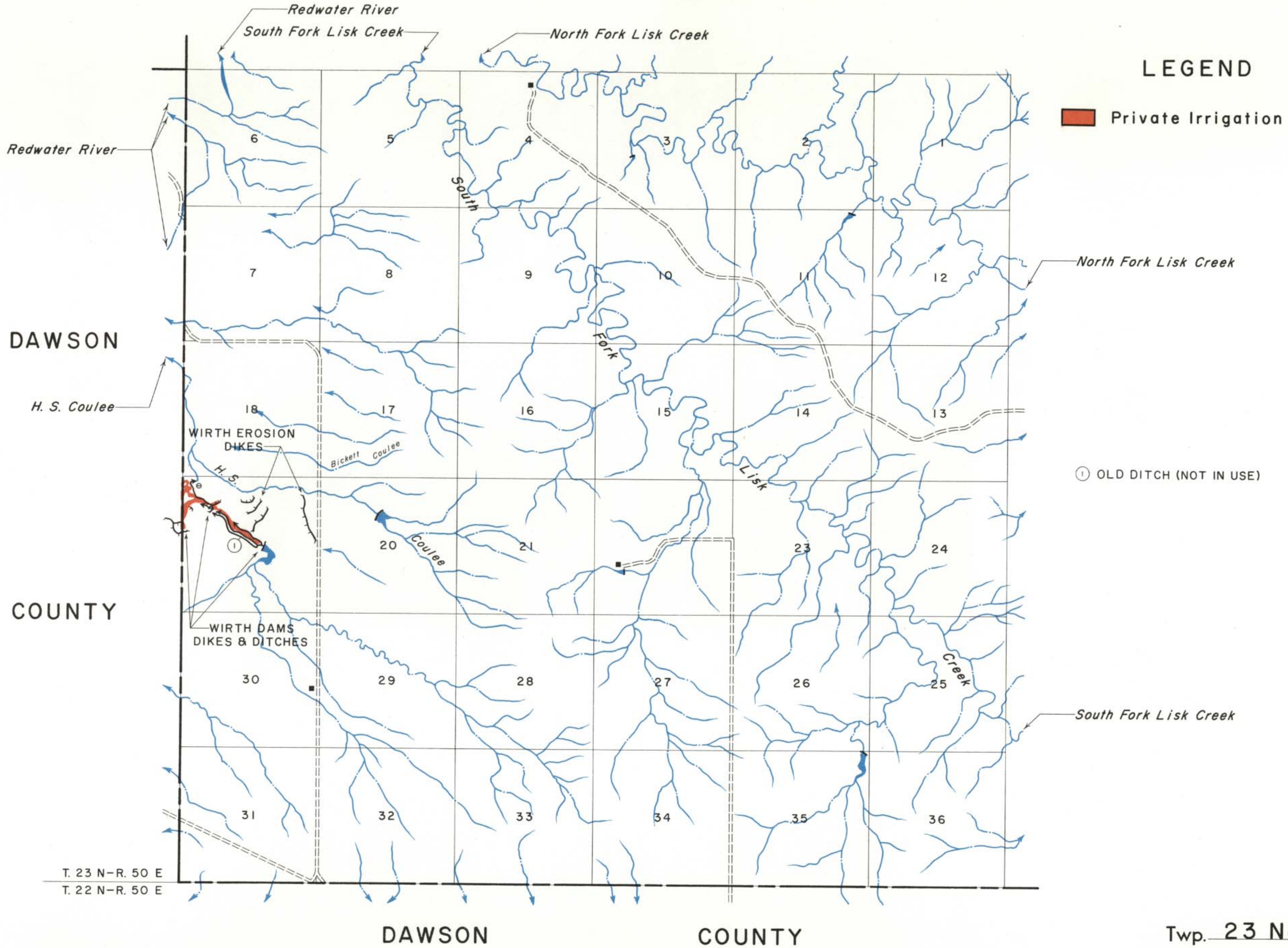


Twp. 22 North

Rge. 58 East

Drafted by June Virag

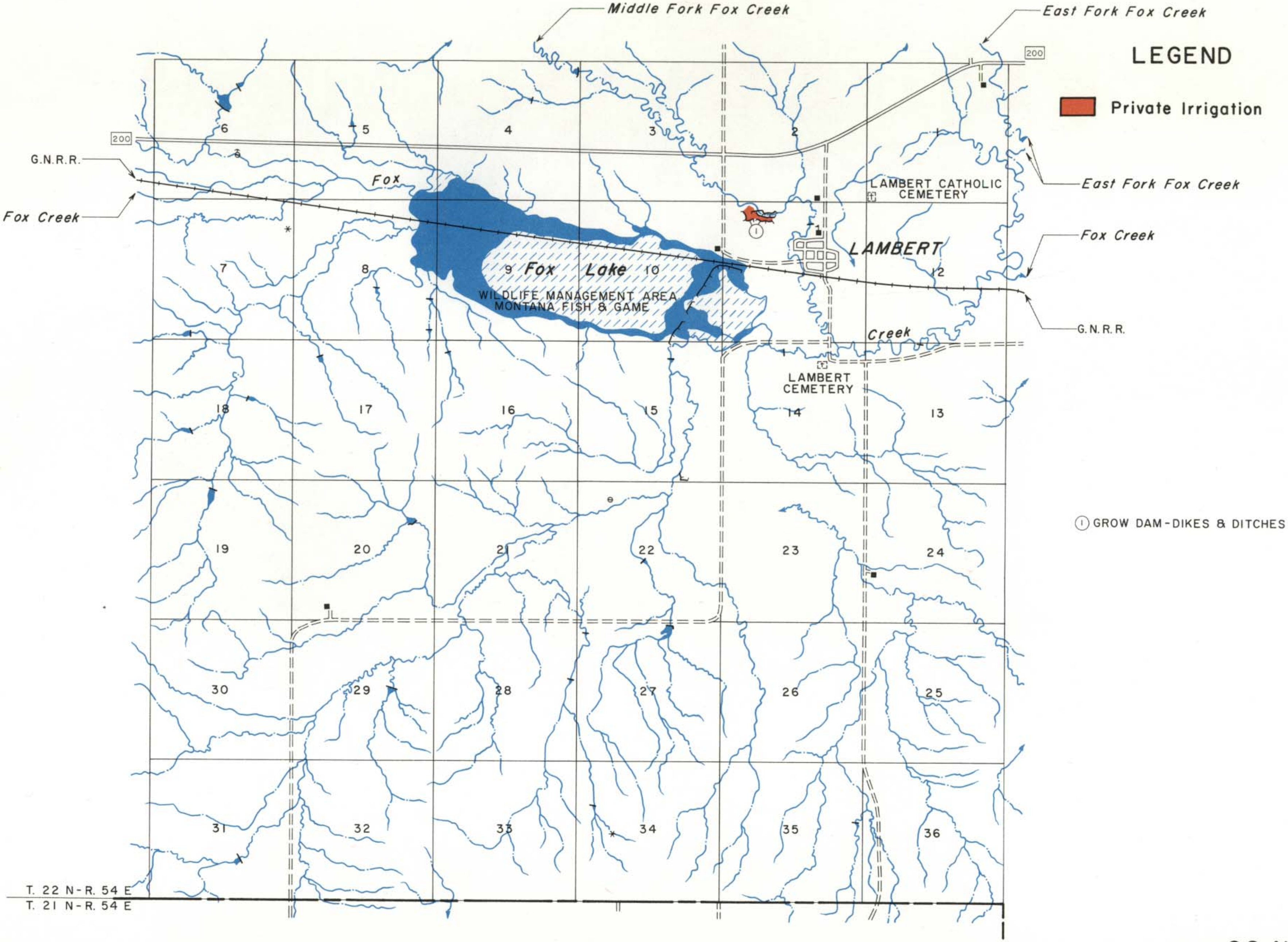

LATERAL D
Lone Tree Creek
DRAIN 21
LATERAL D 4
LATERAL D
LOWER YELLOWSTONE MAIN CANAL
G.N.R.R. & N.P.R.R.
LATERAL D 5
Yellowstone River
OLD DITCH (NOT IN USE)
LEGEND
Lower Yellowstone Project
Sidney Pumping Project
Private Irrigation
ANDERSON PUMPS & DITCHES
OLD DITCH & PUMP SITE (NOT IN USE)
LOWER YELLOWSTONE MAIN CANAL
LATERAL A
LATERAL UU I (NOT IN USE)
G.N.R.R.
DRAIN 14
LATERAL UU
LATERAL UU 2
Fox Creek
N.P.R.R.
DRAIN WY
DRAIN II
LATERAL PP 4
DRAIN WS
T. 22 N-R. 58 E
T. 21 N-R. 58 E
LATERAL PP 3
DRAIN WX
SIDNEY PUMPING PROJECT PUMP NO. I MAIN CANAL
Yellowstone River
Bennie Peere Creek
SIDNEY PUMPING PROJECT PUMP NO. 2 MAIN CANAL PUMP-PIPE LINE & CANAL
Sheepcamp Coulee
Coulee
SIDNEY PUMPING PROJECT PUMP NO. I MAIN CANAL
PETERSEN PUMP & DITCH
Sheepcamp
10
12
13
14
17
23
24
25
26
27
33
35
36
① MONTANA DAKOTA UTILITIES CO. LEWIS & CLARK STATION LIGNITE GENERATING PLANT- PUMP & PIPE LINE
② PIONEER CEMETERY
③ SUNSET MEMORIAL GARDENS CEMETERY WELL & SPRINKLER
④ RAU SCHOOL
⑤ MDU LAGOON
⑥ SIDNEY LAGOON
⑦ DEGN PUMP & DITCH
⑧ LORENZ PUMP & DITCHES
⑨ GEBHARDT PUMP SITE
⑩ RUPP PUMP SITE
⑪ FAWCETT PUMP & DITCH
⑫ SWIGART PUMP & DITCH
⑬ OLD KRUG DAM & DITCH (NOT IN USE)
⑭ SIDNEY MUNICIPAL AIRPORT
Twp. 22 North
Rge. 59 East
Drafted by June Virag



Twp. 23 North

Rge. 51 East

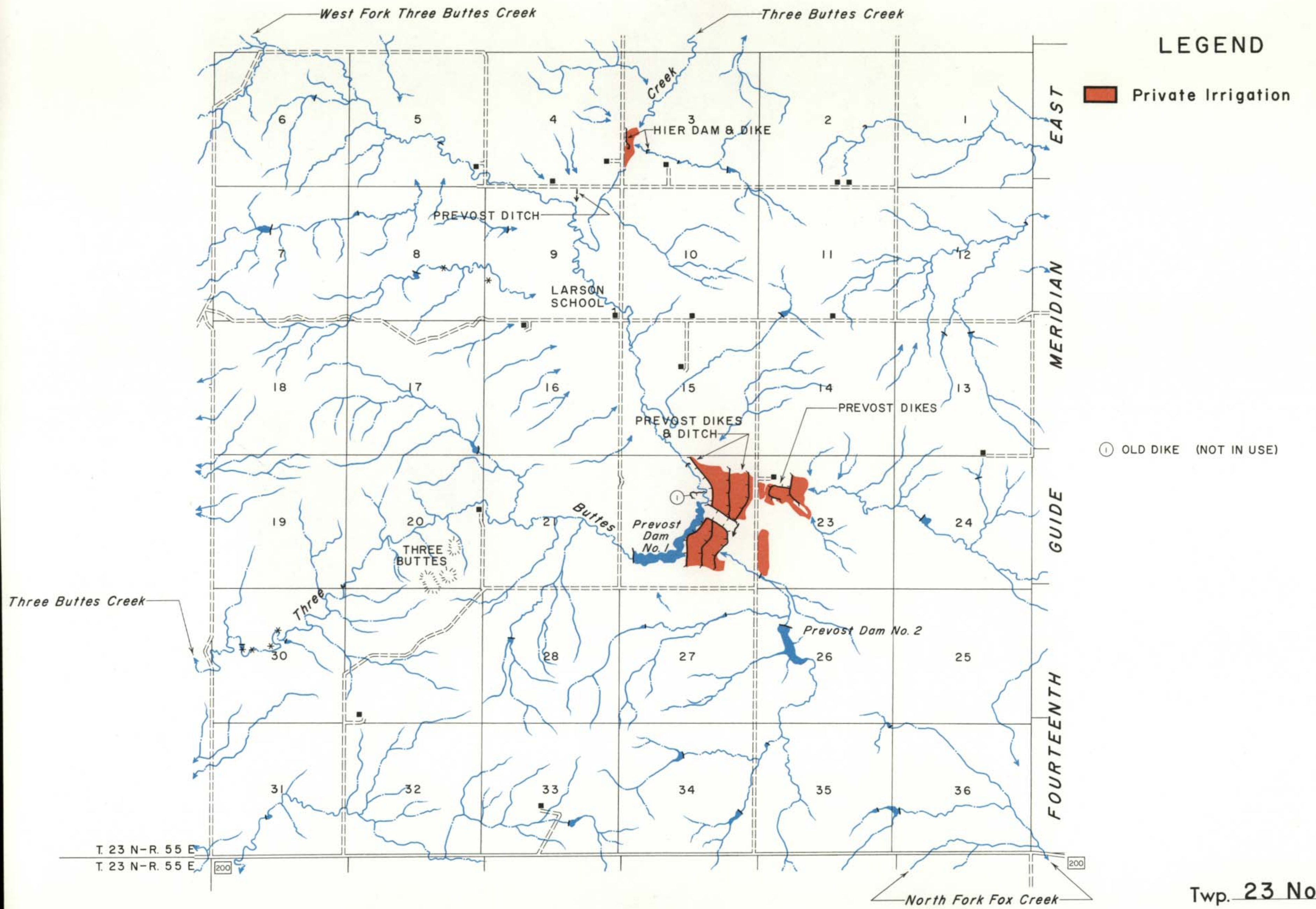
Drafted By Dan Nelson



DAWSON COUNTY

Twp. 22 North
Rge. 55 East

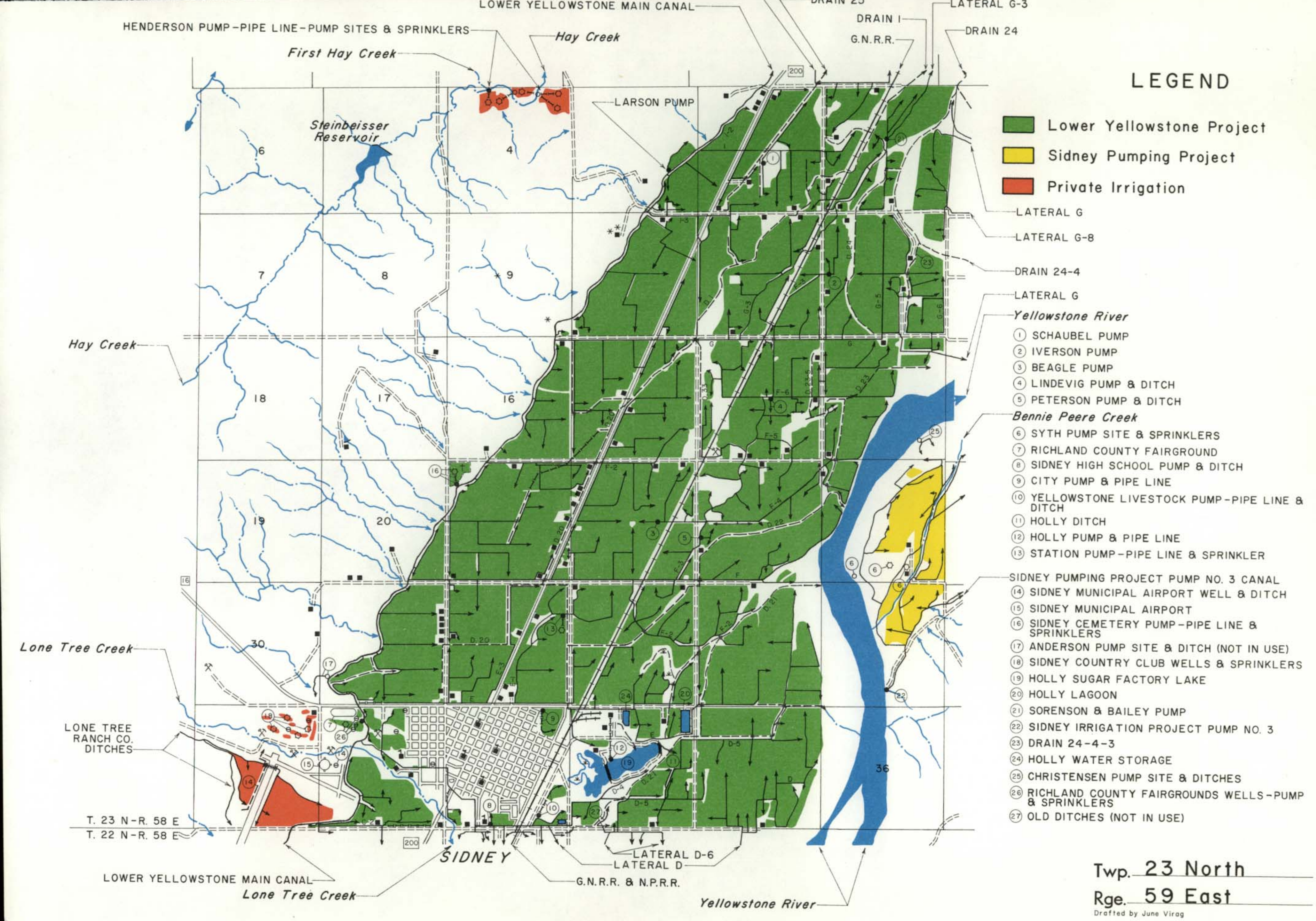
Drafted by Daniel R. Erving

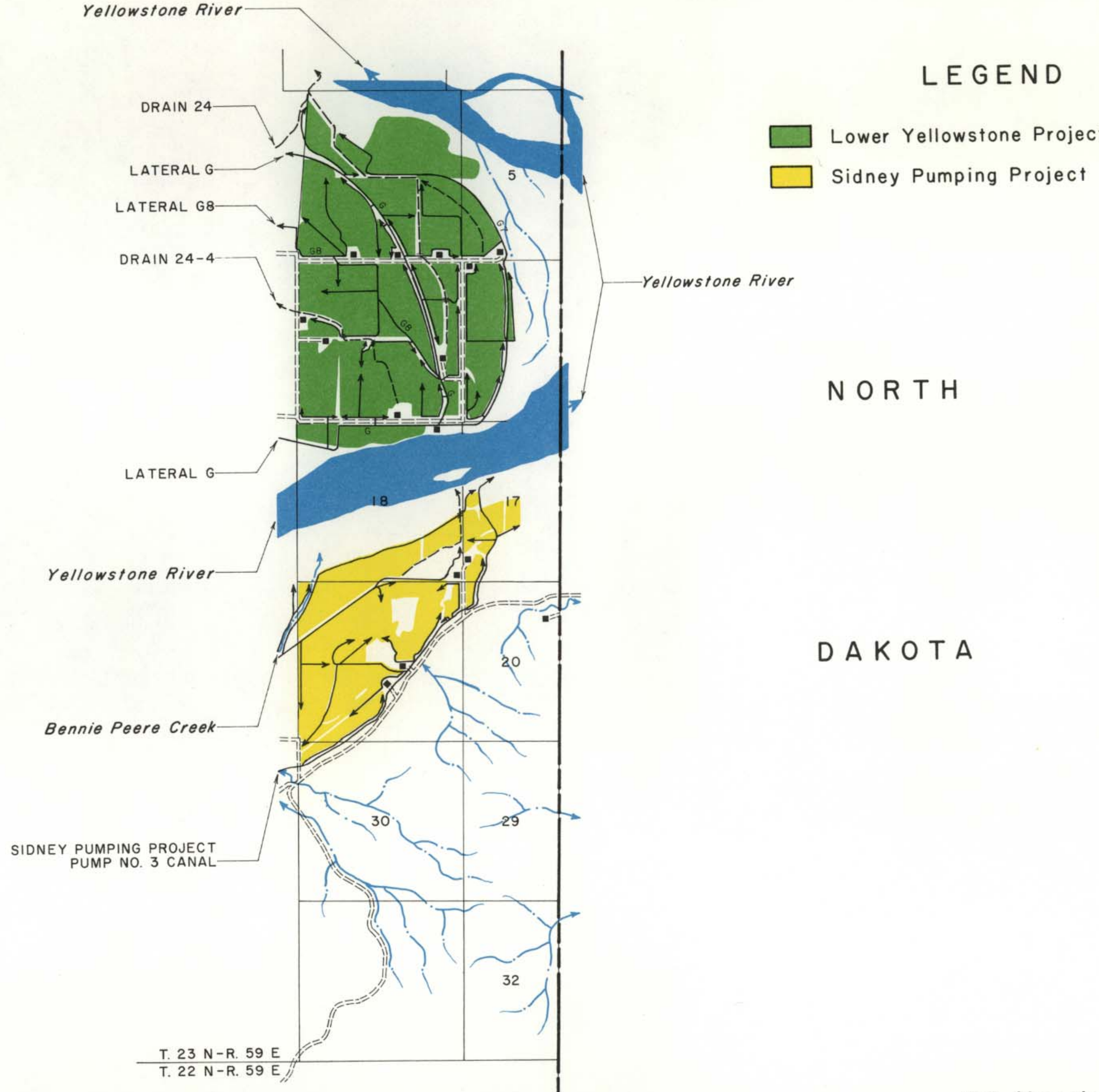


Twp. 23 North

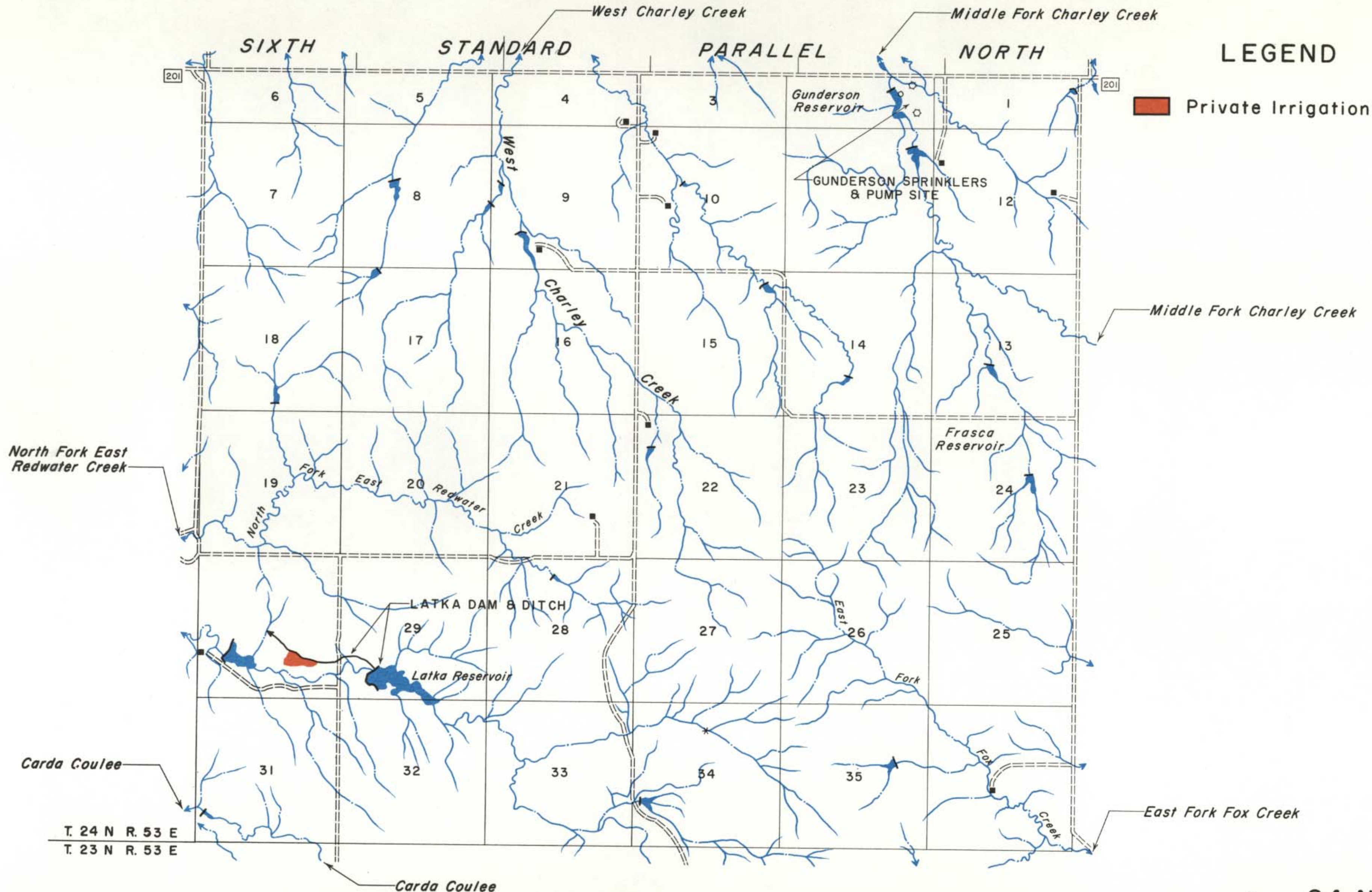
Rge. 56 East

Drafted By Dan Nelson


LEGEND
Lower Yellowstone Project
Sidney Pumping Project
Private Irrigation
① SCHAUBEL PUMP
② IVERSON PUMP
③ BEAGLE PUMP
④ LINDEVIG PUMP & DITCH
⑤ PETERSON PUMP & DITCH
⑥ SYTH PUMP SITE & SPRINKLERS
⑦ RICHLAND COUNTY FAIRGROUND
⑧ SIDNEY HIGH SCHOOL PUMP & DITCH
⑨ CITY PUMP & PIPE LINE
⑩ YELLOWSTONE LIVESTOCK PUMP-PIPE LINE & DITCH
⑪ HOLLY DITCH
⑫ HOLLY PUMP & PIPE LINE
⑬ STATION PUMP-PIPE LINE & SPRINKLER
⑭ SIDNEY MUNICIPAL AIRPORT WELL & DITCH
⑮ SIDNEY MUNICIPAL AIRPORT
⑯ SIDNEY CEMETERY PUMP-PIPE LINE & SPRINKLERS
⑰ ANDERSON PUMP SITE & DITCH (NOT IN USE)
⑱ SIDNEY COUNTRY CLUB WELLS & SPRINKLERS
⑲ HOLLY SUGAR FACTORY LAKE
⑳ HOLLY LAGOON
㉑ SORENSON & BAILEY PUMP
㉒ SIDNEY IRRIGATION PROJECT PUMP NO. 3
㉓ DRAIN 24-4-3
㉔ HOLLY WATER STORAGE
㉕ CHRISTENSEN PUMP SITE & DITCHES
㉖ RICHLAND COUNTY FAIRGROUNDS WELLS-PUMP & SPRINKLERS
㉗ OLD DITCHES (NOT IN USE)
LOWER YELLOWSTONE MAIN CANAL
DRAIN I
LATERAL G-3
DRAIN 24
G.N.R.R.
HENDERSON PUMP-PIPE LINE-PUMP SITES & SPRINKLERS
Hay Creek
First Hay Creek
LARSON PUMP
Steinbeisser Reservoir
LATERAL G
LATERAL G-8
DRAIN 24-4
LATERAL G
Yellowstone River
Bennie Peere Creek
SIDNEY PUMPING PROJECT PUMP NO. 3 CANAL
Hay Creek
Lone Tree Creek
LONE TREE RANCH CO. DITCHES
T. 23 N-R. 58 E
T. 22 N-R. 58 E
LOWER YELLOWSTONE MAIN CANAL
Lone Tree Creek
SIDNEY
LATERAL D-6
LATERAL D
G.N.R.R. & N.P.R.R.
Yellowstone River
200
16
6
4
7
8
9
18
17
16
19
20
30
36
Twp. 23 North
Rge. 59 East
Drafted by June Virag



Twp. 23 North
Rge. 60 East
Drafted by June Virag



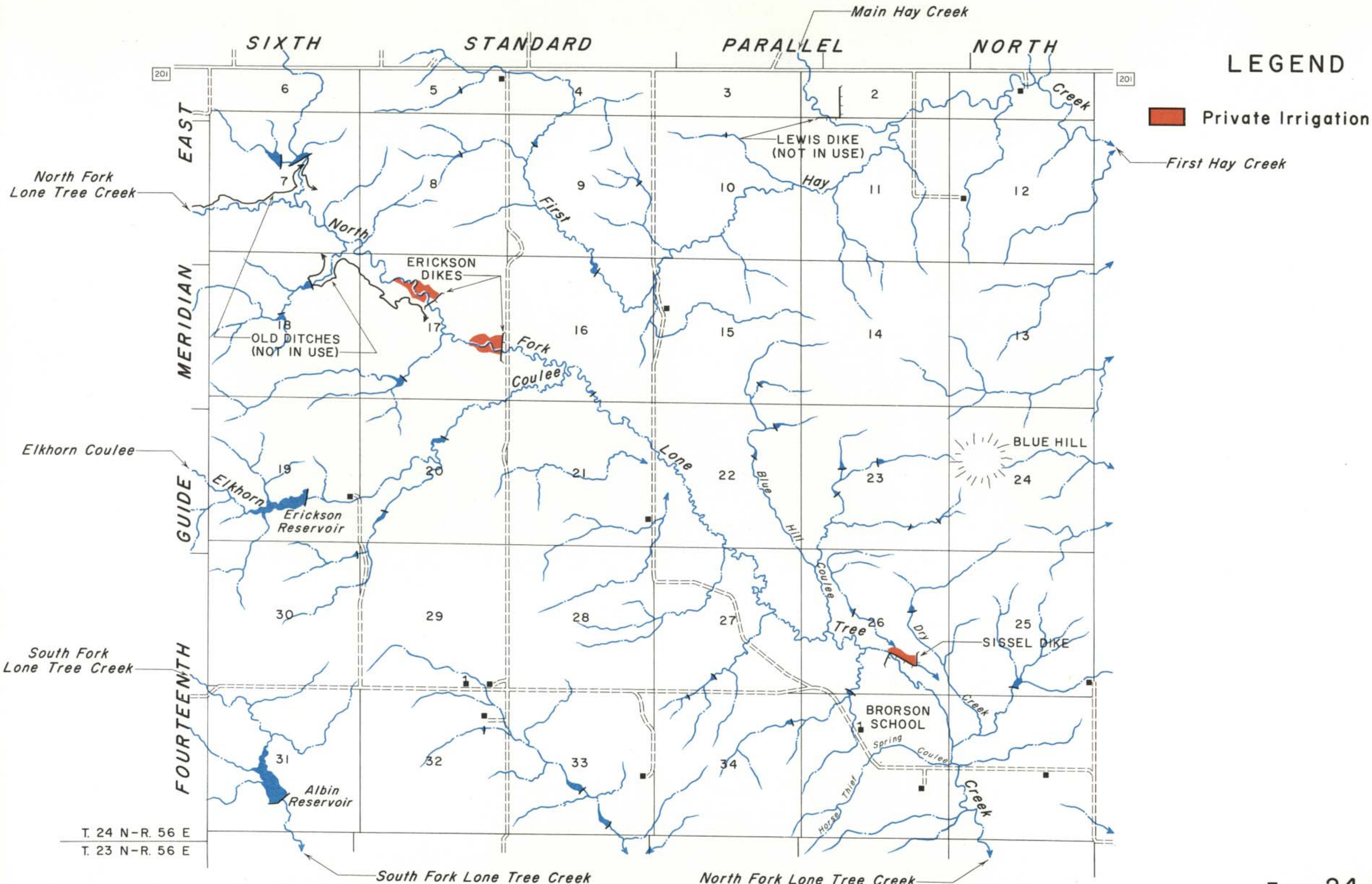
LEGEND

Private Irrigation

Twp. 24 North

Rge. 54 East

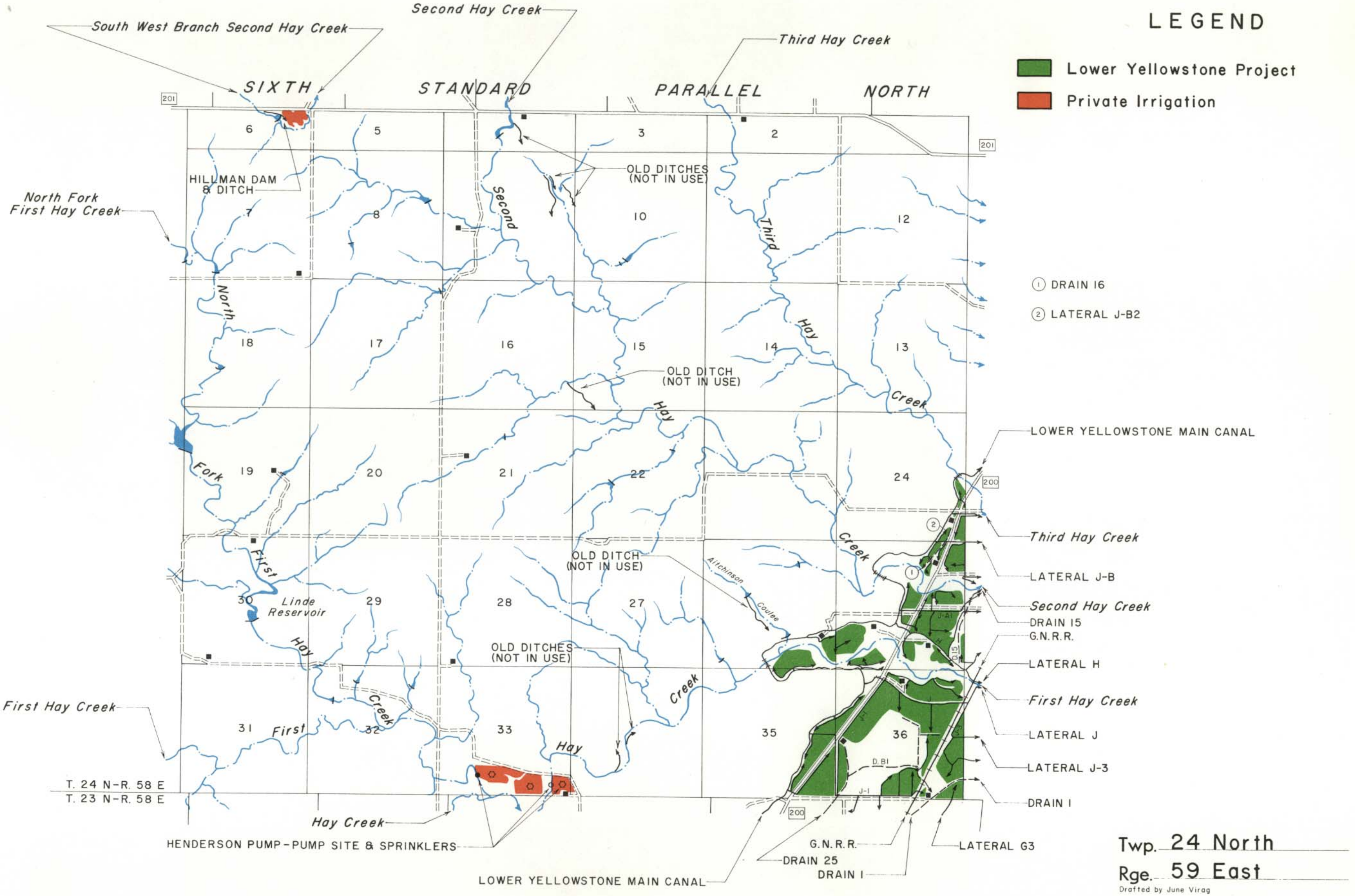
Drafted By Dan Nelson

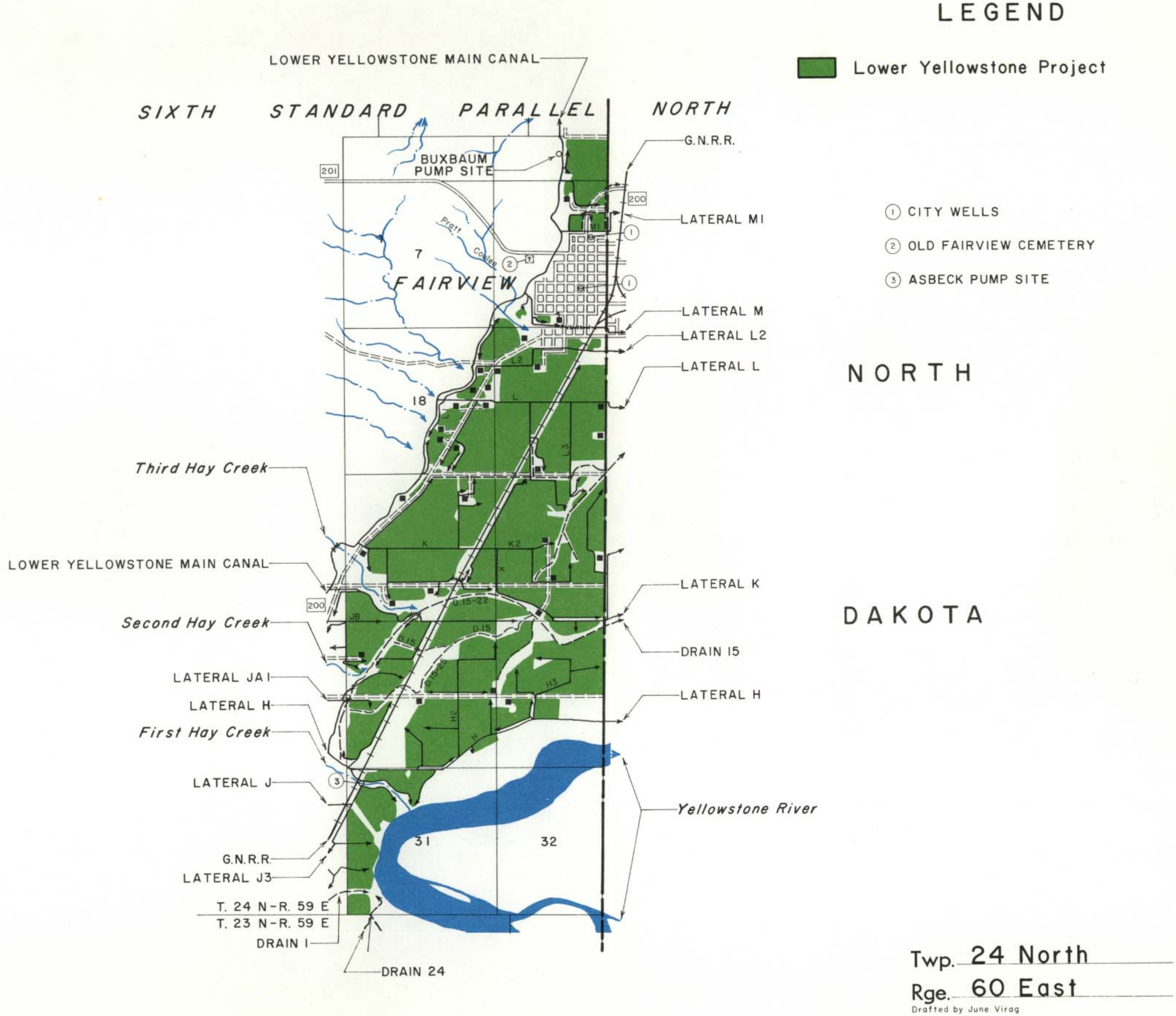


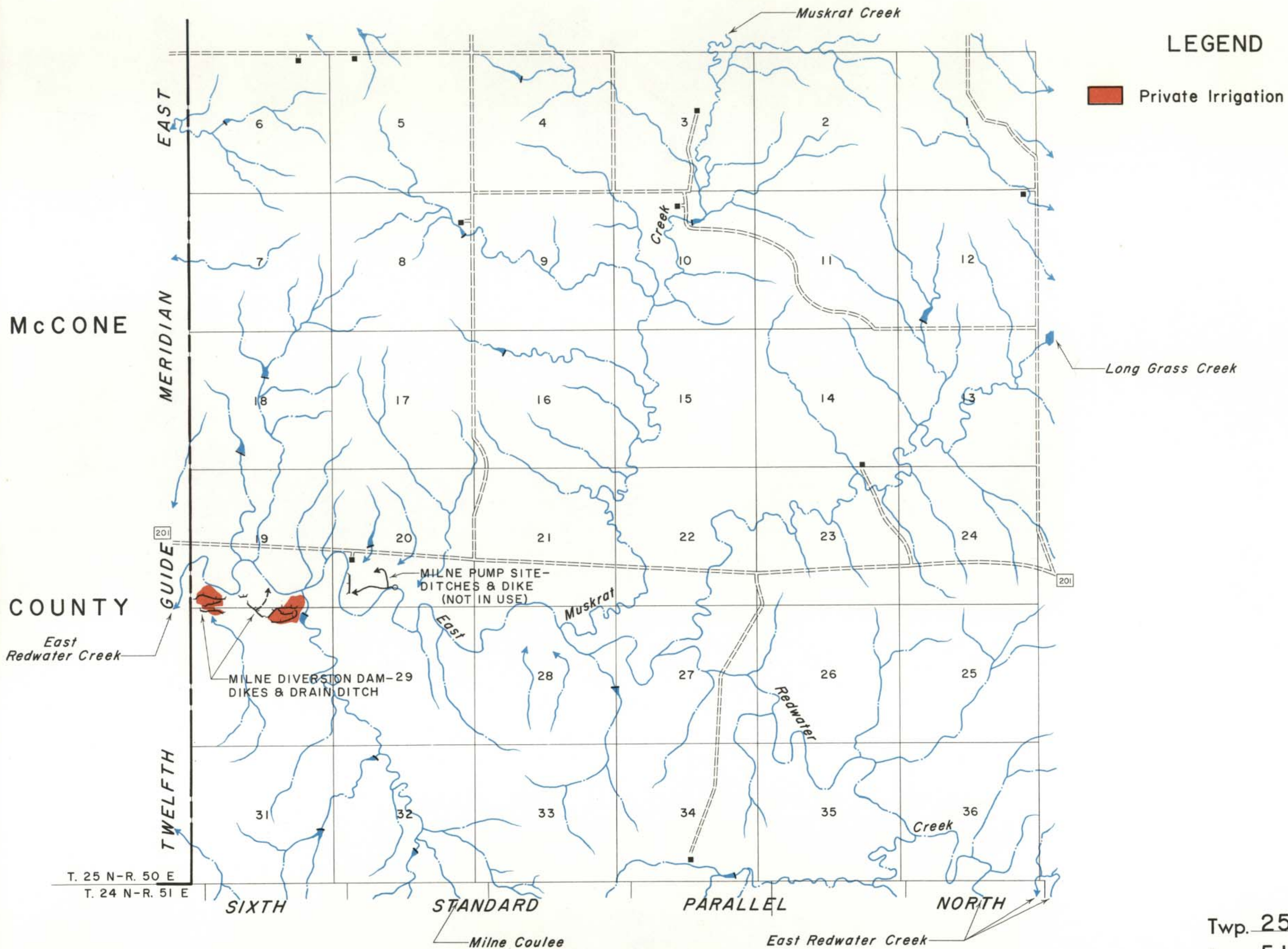
Twp. 24 North

Rge. 57 East

Drafted By Dan Nelson


LEGEND
Lower Yellowstone Project
Private Irrigation
① DRAIN 16
② LATERAL J-B2
South West Branch Second Hay Creek
Second Hay Creek
Third Hay Creek
SIXTH STANDARD PARALLEL NORTH
HILLMAN DAM & DITCH
North Fork First Hay Creek
OLD DITCHES (NOT IN USE)
OLD DITCH (NOT IN USE)
Linde Reservoir
Aitchinson Coulee
LOWER YELLOWSTONE MAIN CANAL
LATERAL J-B
DRAIN 15
G.N.R.R.
LATERAL H
First Hay Creek
LATERAL J
LATERAL J-3
DRAIN I
LATERAL G3
DRAIN 25
Hay Creek
HENDERSON PUMP-PUMP SITE & SPRINKLERS
T. 24 N-R. 58 E
T. 23 N-R. 58 E
Twp. 24 North
Rge. 59 East
Drafted by June Virag

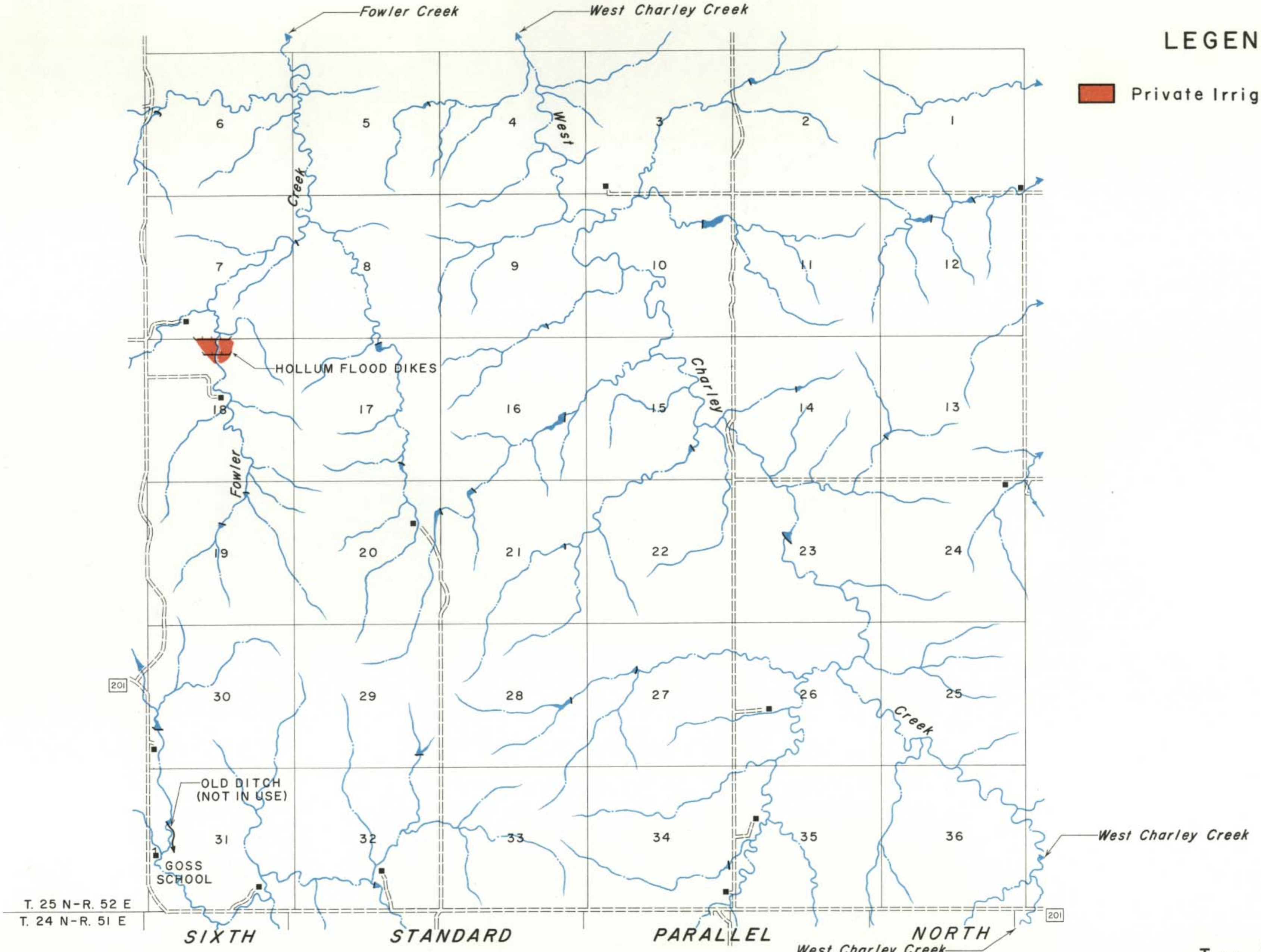

LEGEND
Lower Yellowstone Project
① CITY WELLS
② OLD FAIRVIEW CEMETERY
③ ASBECK PUMP SITE
SIXTH STANDARD PARALLEL NORTH
LOWER YELLOWSTONE MAIN CANAL
BUXBAUM PUMP SITE
201
200
G.N.R.R.
LATERAL M1
Pratt Coulee
7
FAIRVIEW
LATERAL M
LATERAL L2
LATERAL L
18
NORTH
DAKOTA
Third Hay Creek
LOWER YELLOWSTONE MAIN CANAL
LATERAL K
Second Hay Creek
DRAIN 15
LATERAL JA1
LATERAL H
First Hay Creek
LATERAL J
Yellowstone River
31
32
G.N.R.R.
LATERAL J3
T. 24 N-R. 59 E
T. 23 N-R. 59 E
DRAIN 1
DRAIN 24
Twp. 24 North
Rge. 60 East
Drafted by June Virag



Twp. 25 North

Rge. 51 East

Drafted By Dan Nelson



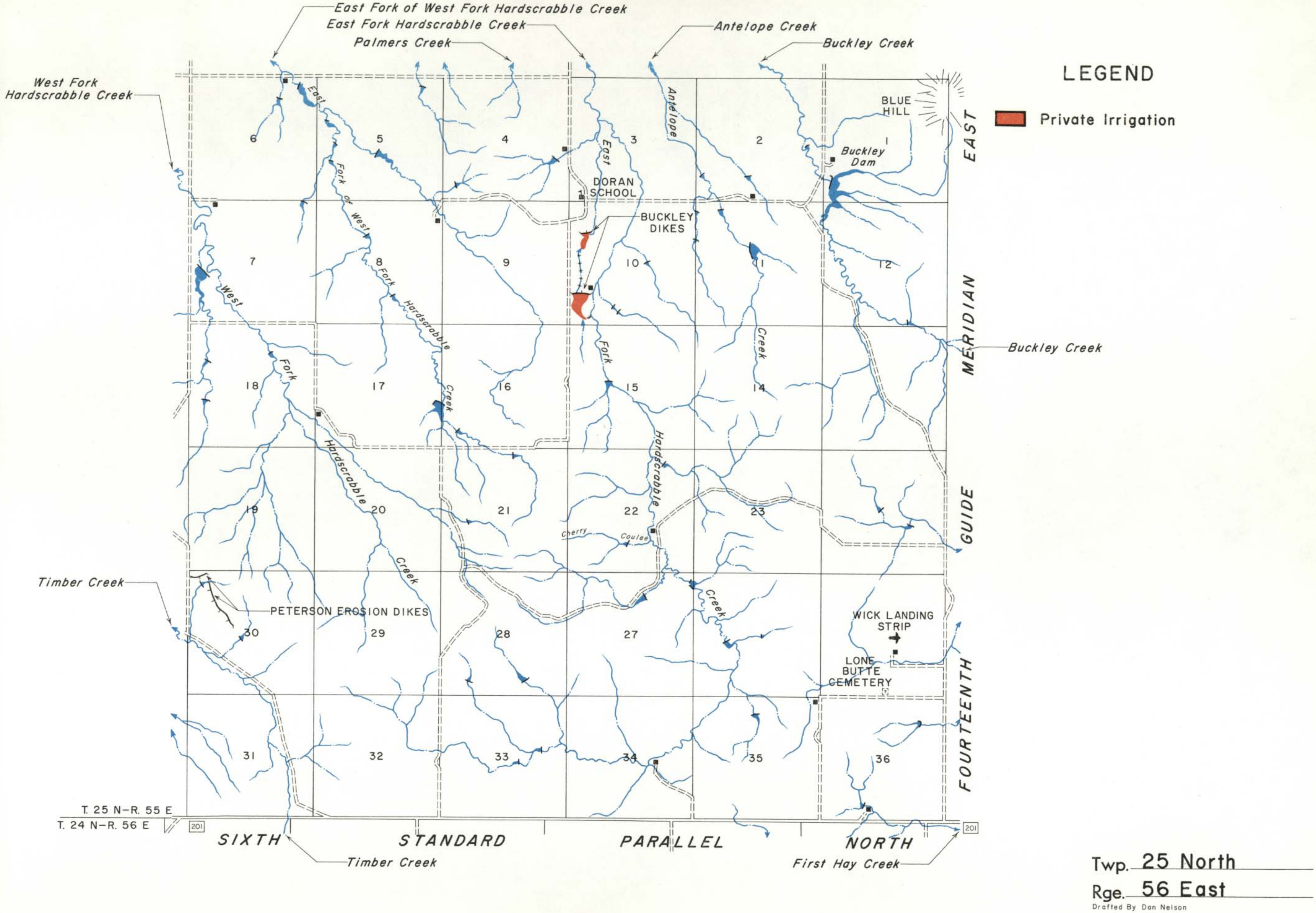
LEGEND

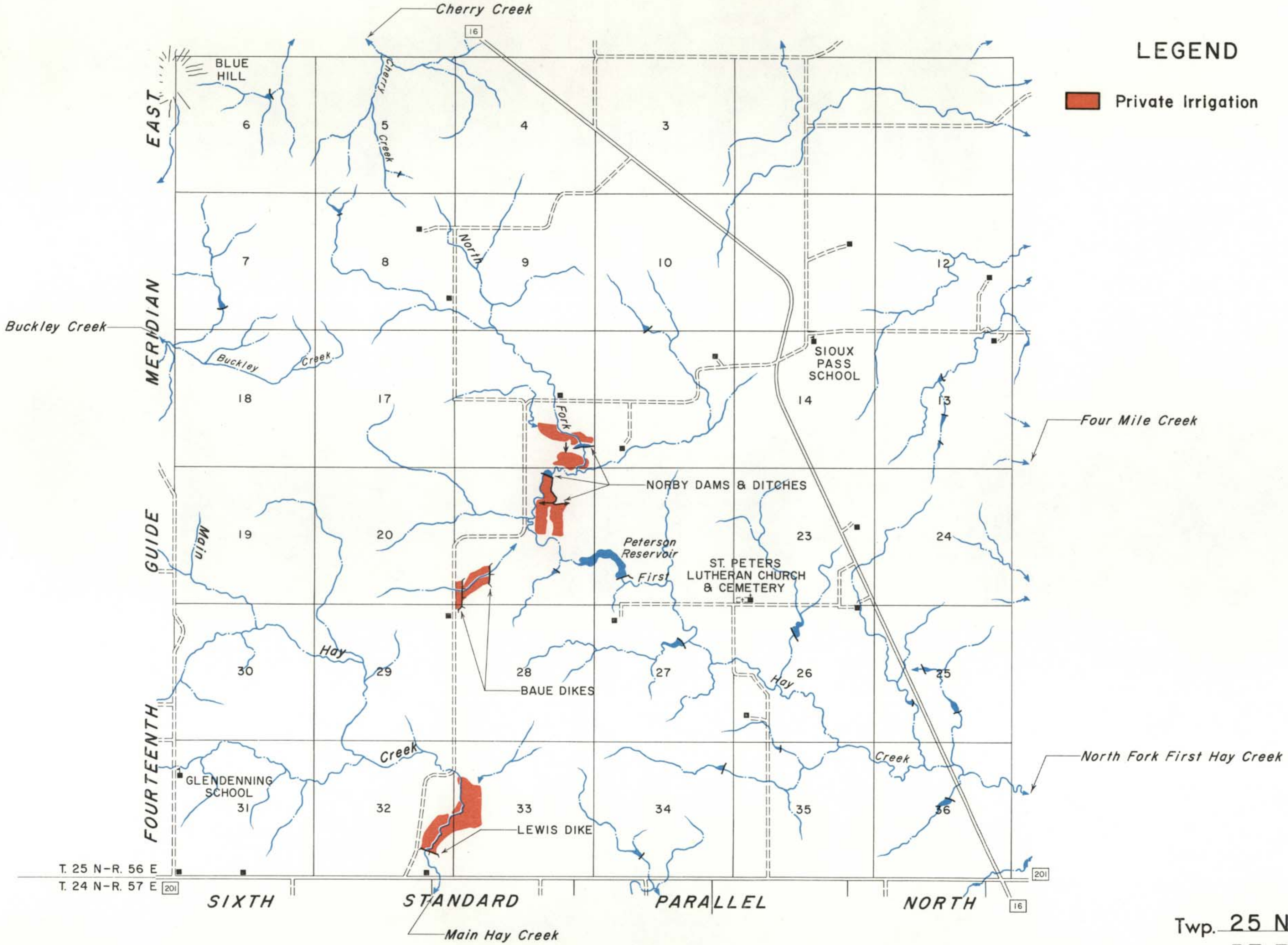
Private Irrigation

Twp. 25 North

Rge. 53 East

Drafted By Dan Nelson

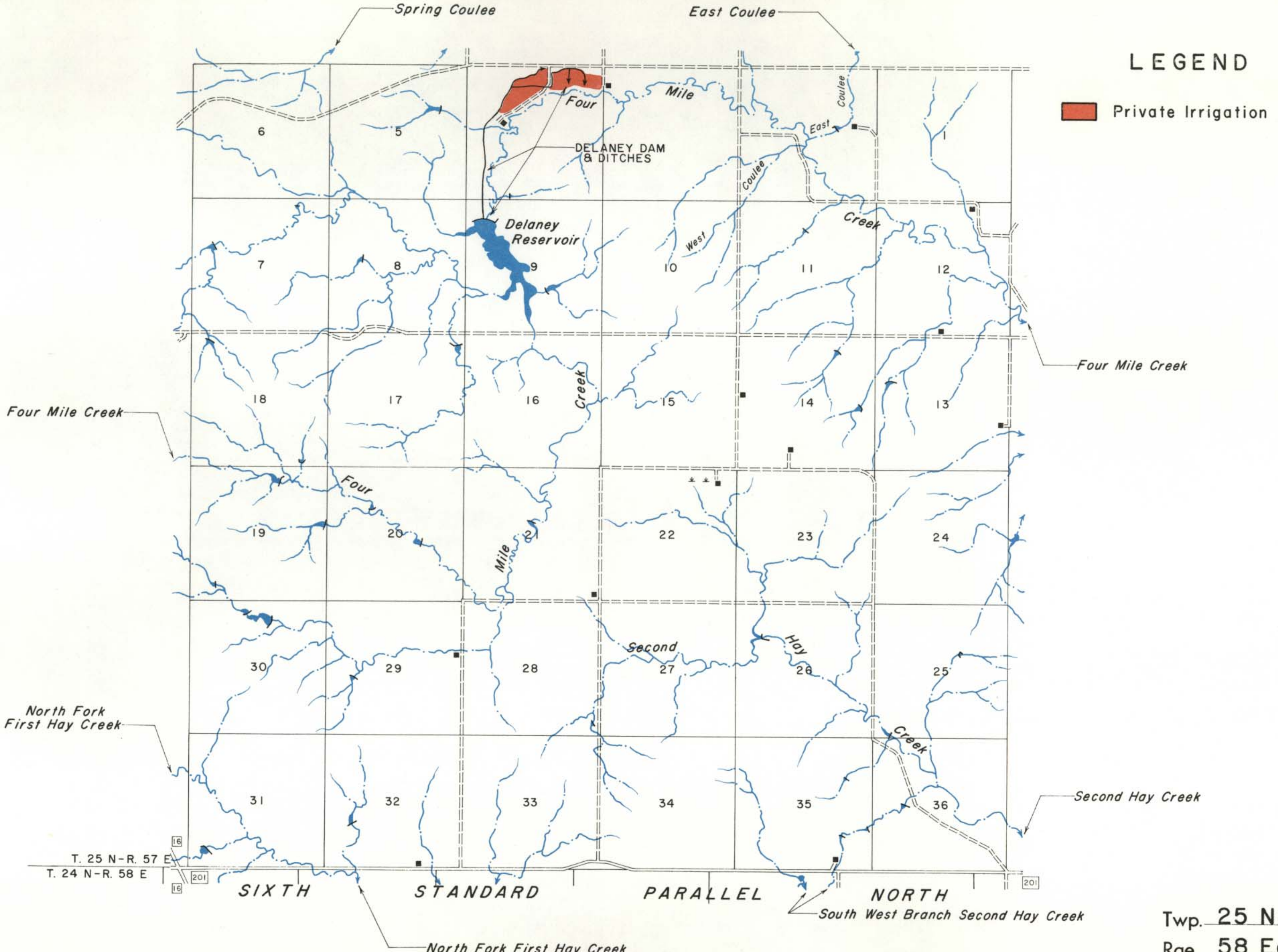

East Fork of West Fork Hardscrabble Creek
East Fork Hardscrabble Creek
Palmers Creek
Antelope Creek
Buckley Creek
West Fork Hardscrabble Creek
LEGEND
Private Irrigation
BLUE HILL
Buckley Dam
DORAN SCHOOL
BUCKLEY DIKES
EAST MERIDIAN GUIDE FOURTEENTH
Buckley Creek
Cherry Coulee
Timber Creek
PETERSON EROSION DIKES
WICK LANDING STRIP
LONE BUTTE CEMETERY
T. 25 N–R. 55 E
T. 24 N–R. 56 E
SIXTH STANDARD PARALLEL NORTH
Timber Creek
First Hay Creek
201
Twp. 25 North
Rge. 56 East
Drafted By Dan Nelson



Twp. 25 North

Rge. 57 East

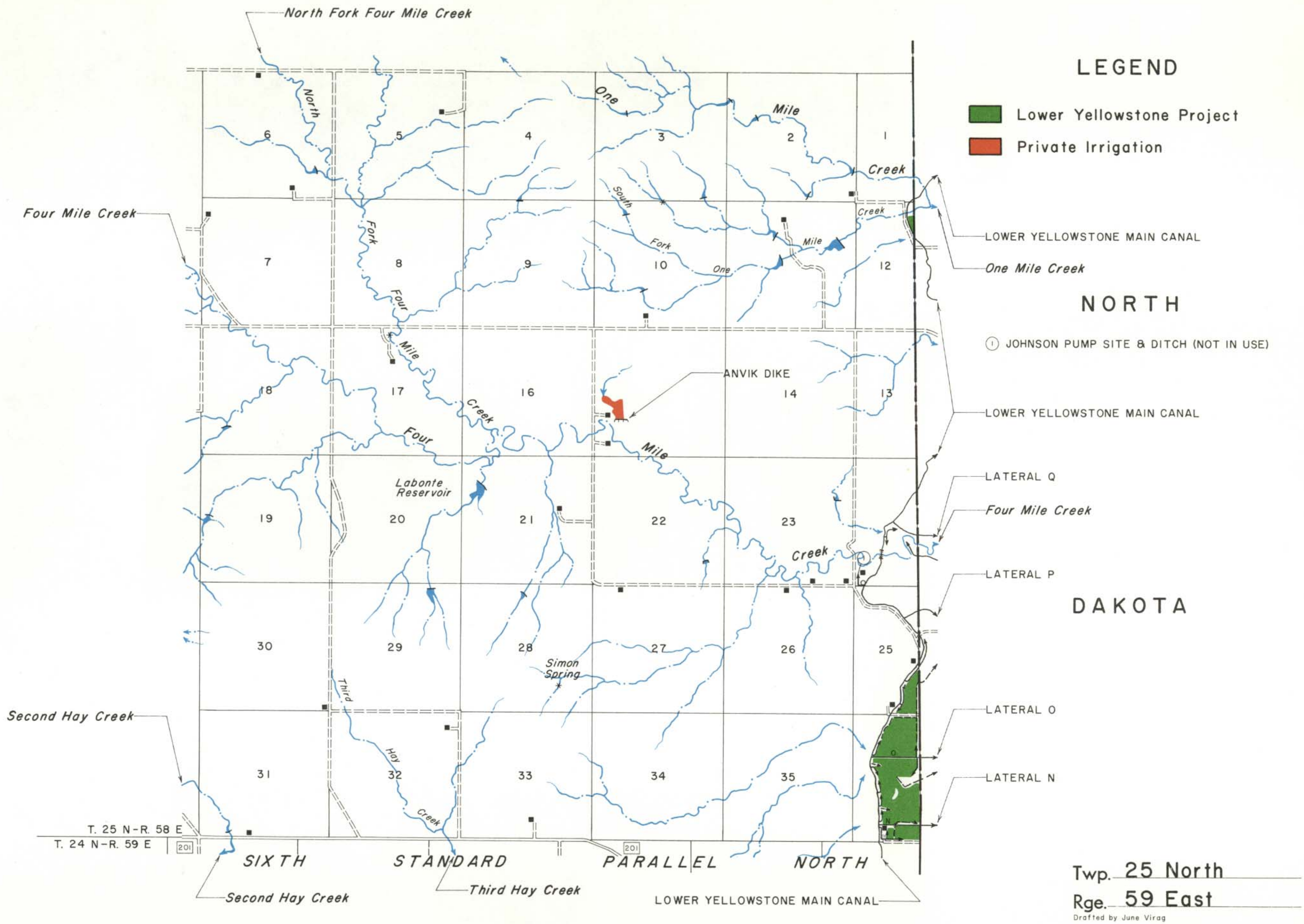
Drafted By Dan Nelson

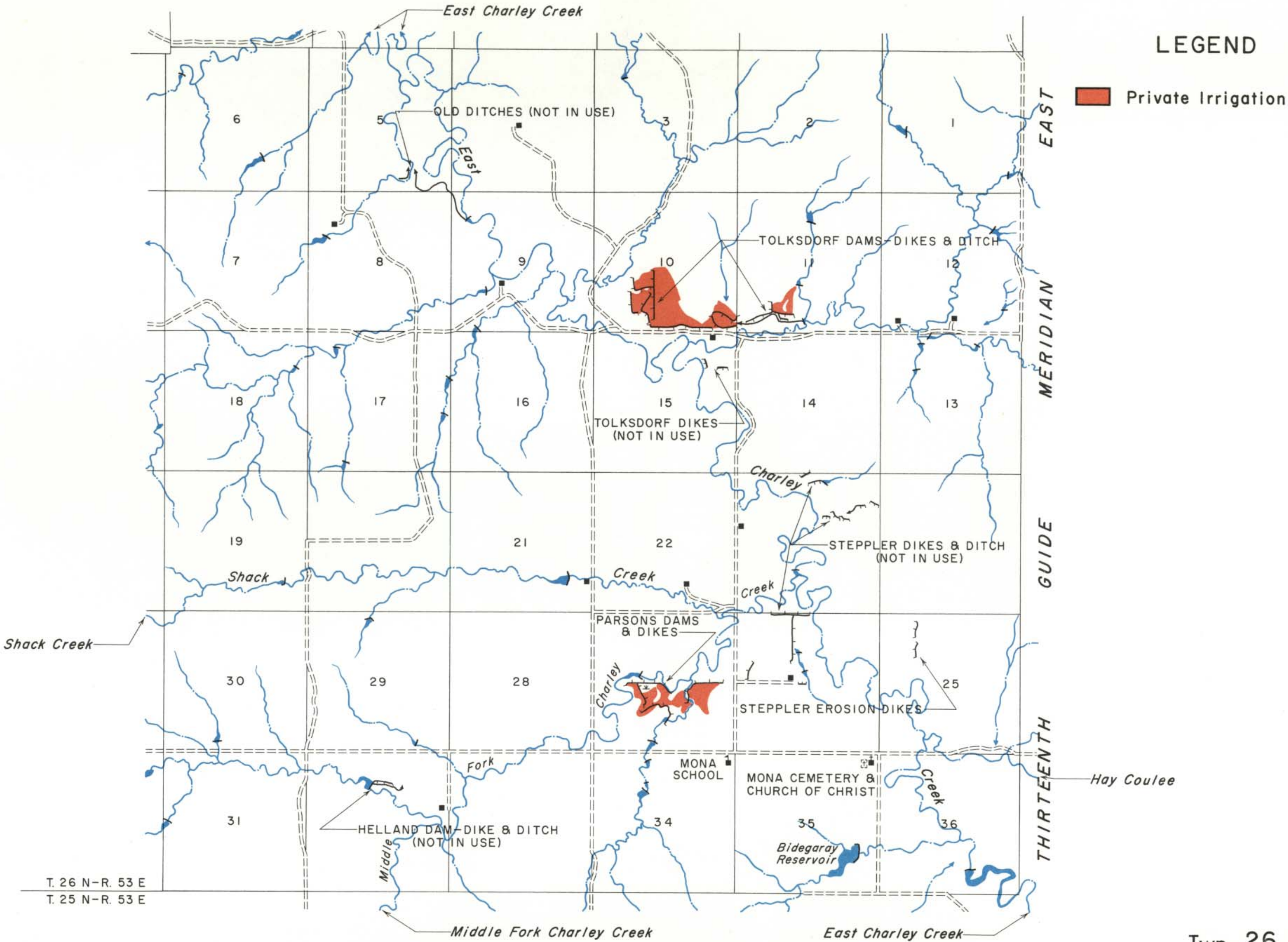


Twp. 25 North

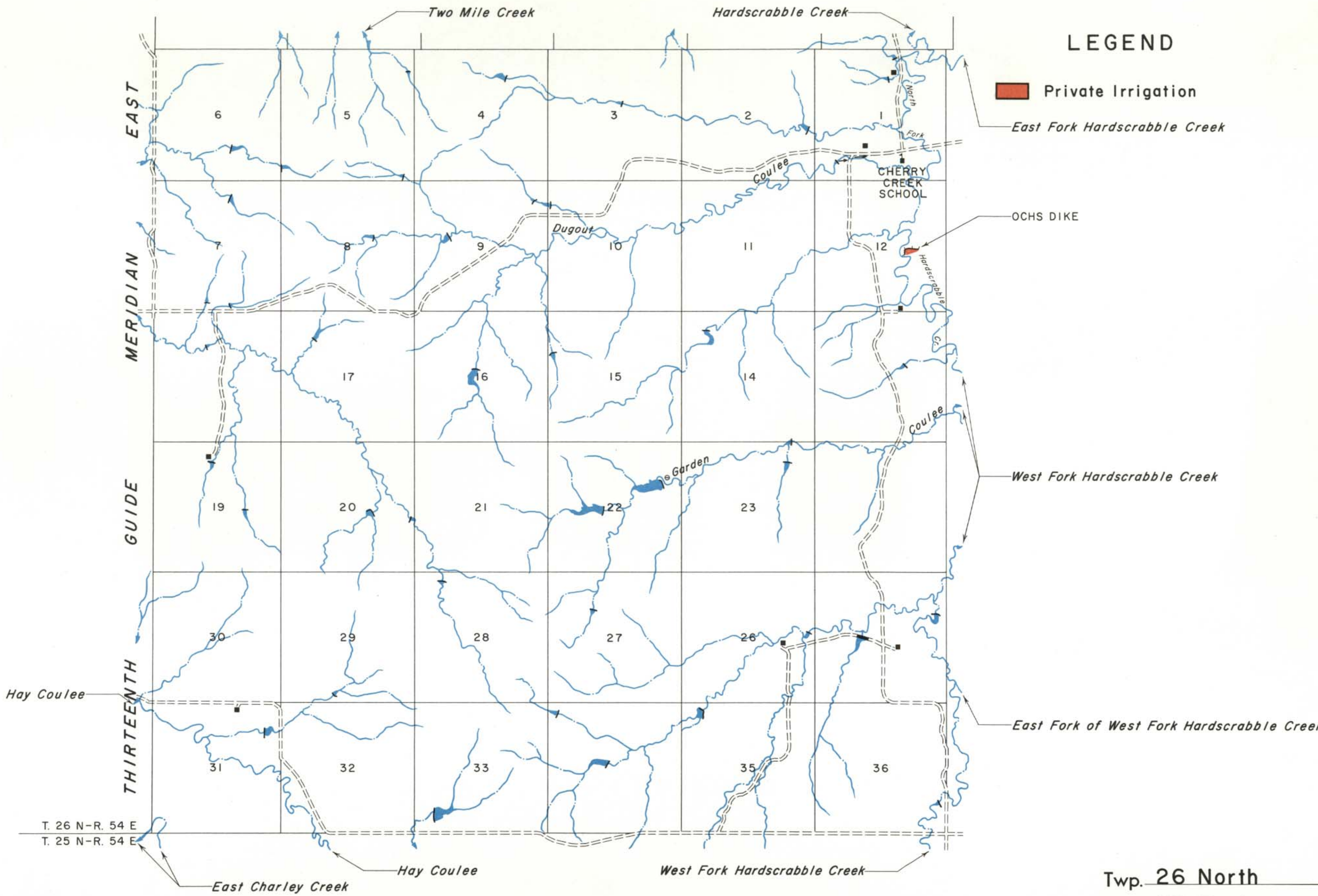
Rge. 58 East

Drafted by June Virag


LEGEND
Lower Yellowstone Project
Private Irrigation
NORTH
DAKOTA
① JOHNSON PUMP SITE & DITCH (NOT IN USE)
North Fork Four Mile Creek
Four Mile Creek
Second Hay Creek
Third Hay Creek
LOWER YELLOWSTONE MAIN CANAL
One Mile Creek
ANVIK DIKE
LATERAL Q
LATERAL P
LATERAL O
LATERAL N
Labonte Reservoir
Simon Spring
North Fork Four Mile Creek
One Mile Creek
South Fork One Mile Creek
Third Hay Creek
T. 25 N-R. 58 E
T. 24 N-R. 59 E
201
SIXTH STANDARD PARALLEL NORTH
1 2 3 4 5 6 7 8 9 10 11 12 13 14 16 17 18 19 20 21 22 23 25 26 27 28 29 30 31 32 33 34 35
Twp. 25 North
Rge. 59 East
Drafted by June Virag



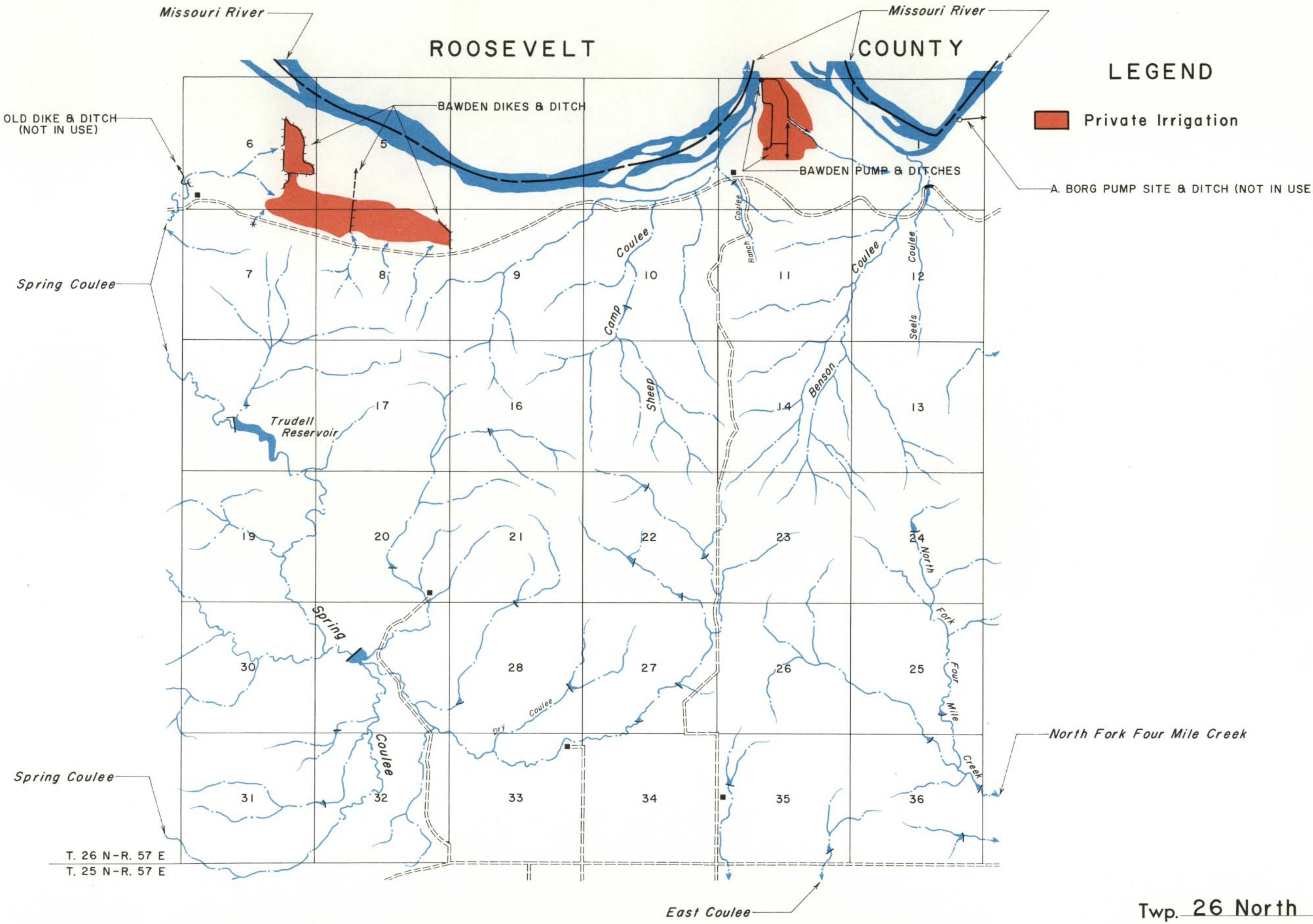
Twp. 26 North
Rge. 54 East
Drafted By Dan Nelson



Twp. 26 North

Rge. 55 East

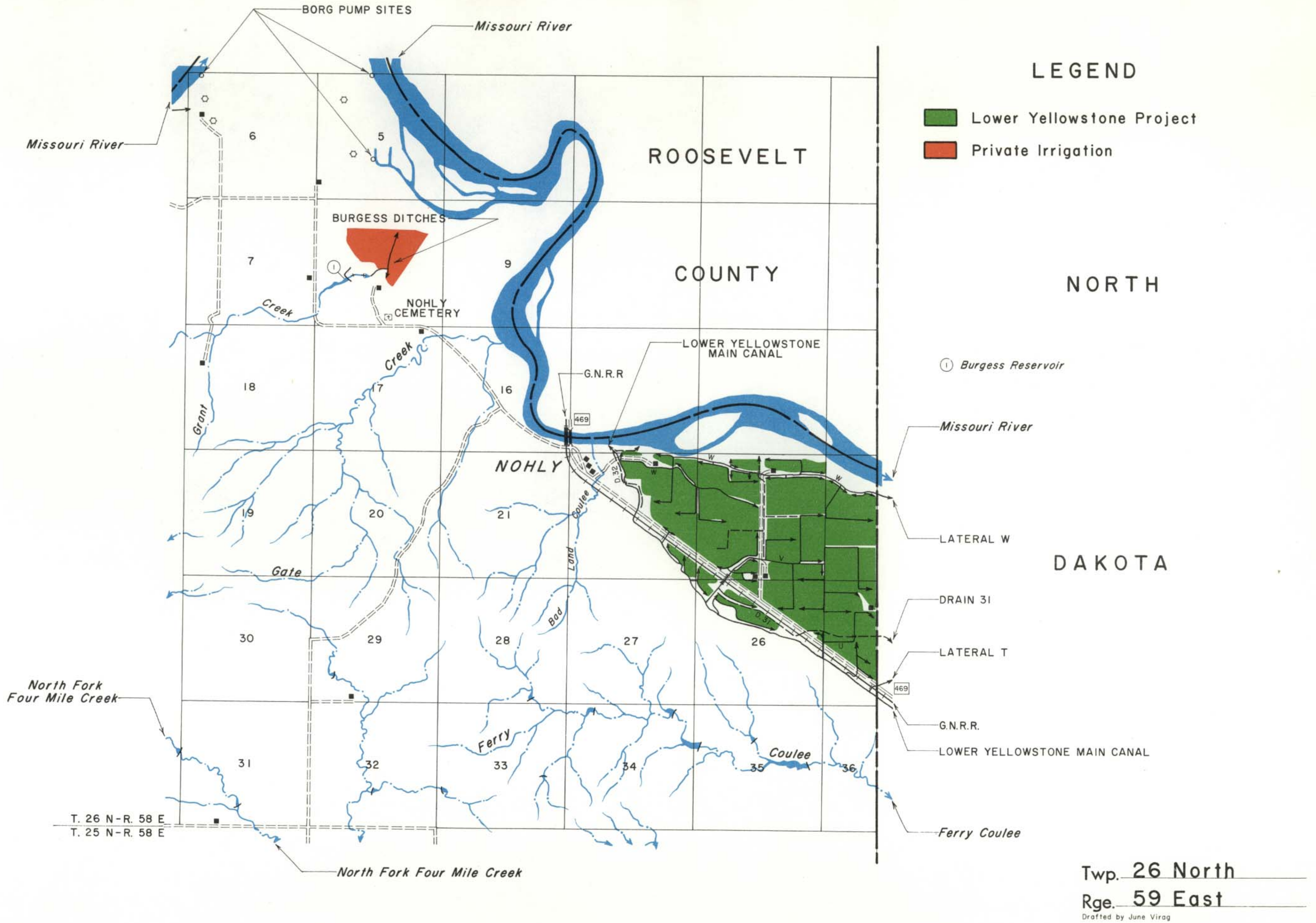
Drafted By Dan Nelson



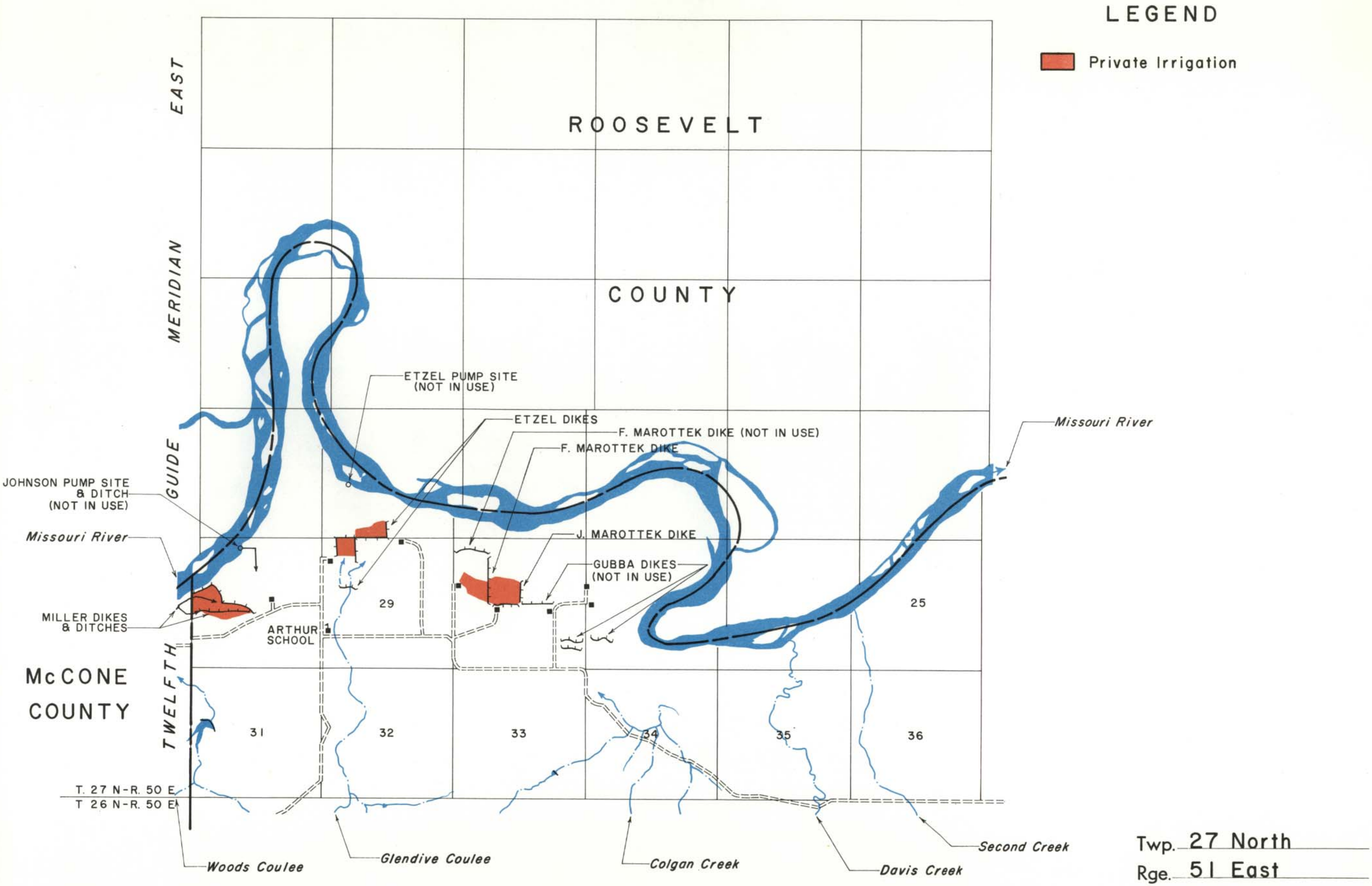
Twp. 26 North

Rge. 58 East

Drafted by June Virag



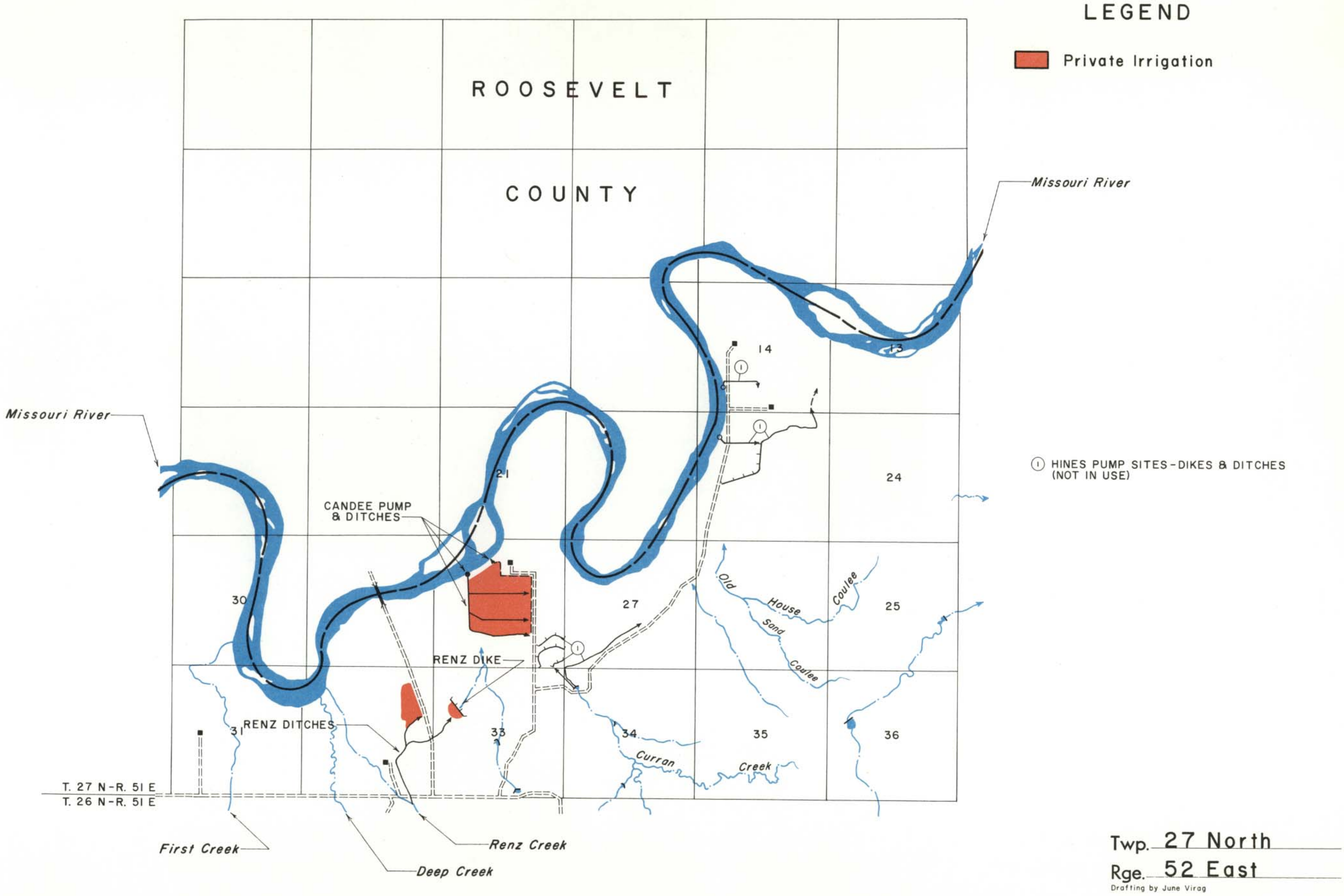
LEGEND
Lower Yellowstone Project
Private Irrigation
Burgess Reservoir
BORG PUMP SITES
Missouri River
Missouri River
Missouri River
BURGESS DITCHES
NOHLY CEMETERY
NOHLY
LOWER YELLOWSTONE MAIN CANAL
G.N.R.R
ROOSEVELT
COUNTY
NORTH
DAKOTA
LATERAL W
DRAIN 31
LATERAL T
G.N.R.R.
LOWER YELLOWSTONE MAIN CANAL
Ferry Coulee
North Fork Four Mile Creek
North Fork Four Mile Creek
T. 26 N - R. 58 E
T. 25 N - R. 58 E
Grant Creek
Creek
Gate
Bad Land Coulee
Ferry
Coulee
469
469
6
5
7
9
18
17
16
19
20
21
30
29
28
27
26
31
32
33
34
35
36
Twp. 26 North
Rge. 59 East
Drafted by June Virag

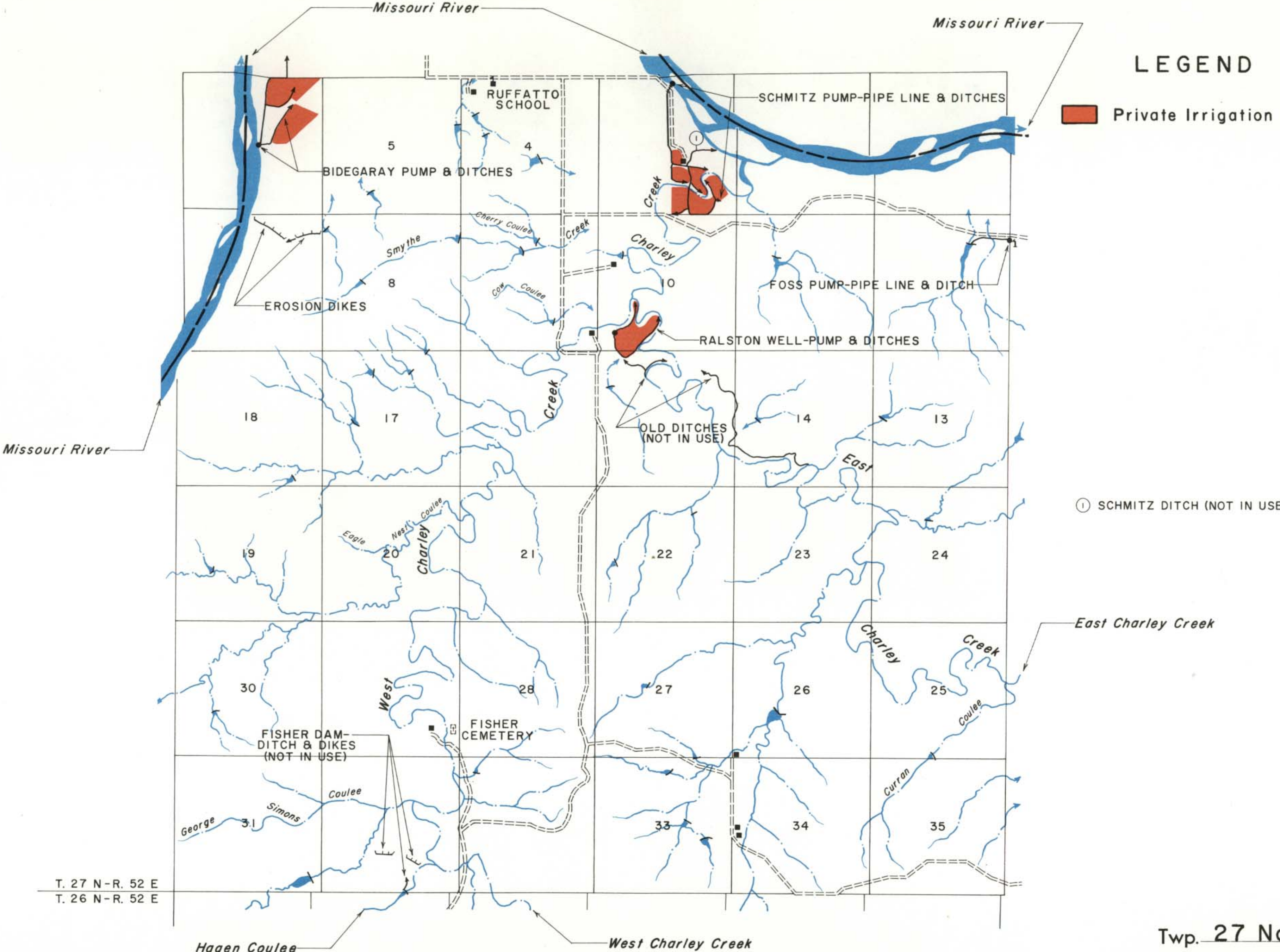


Twp. 27 North

Rge. 51 East

Drafting by June Virag

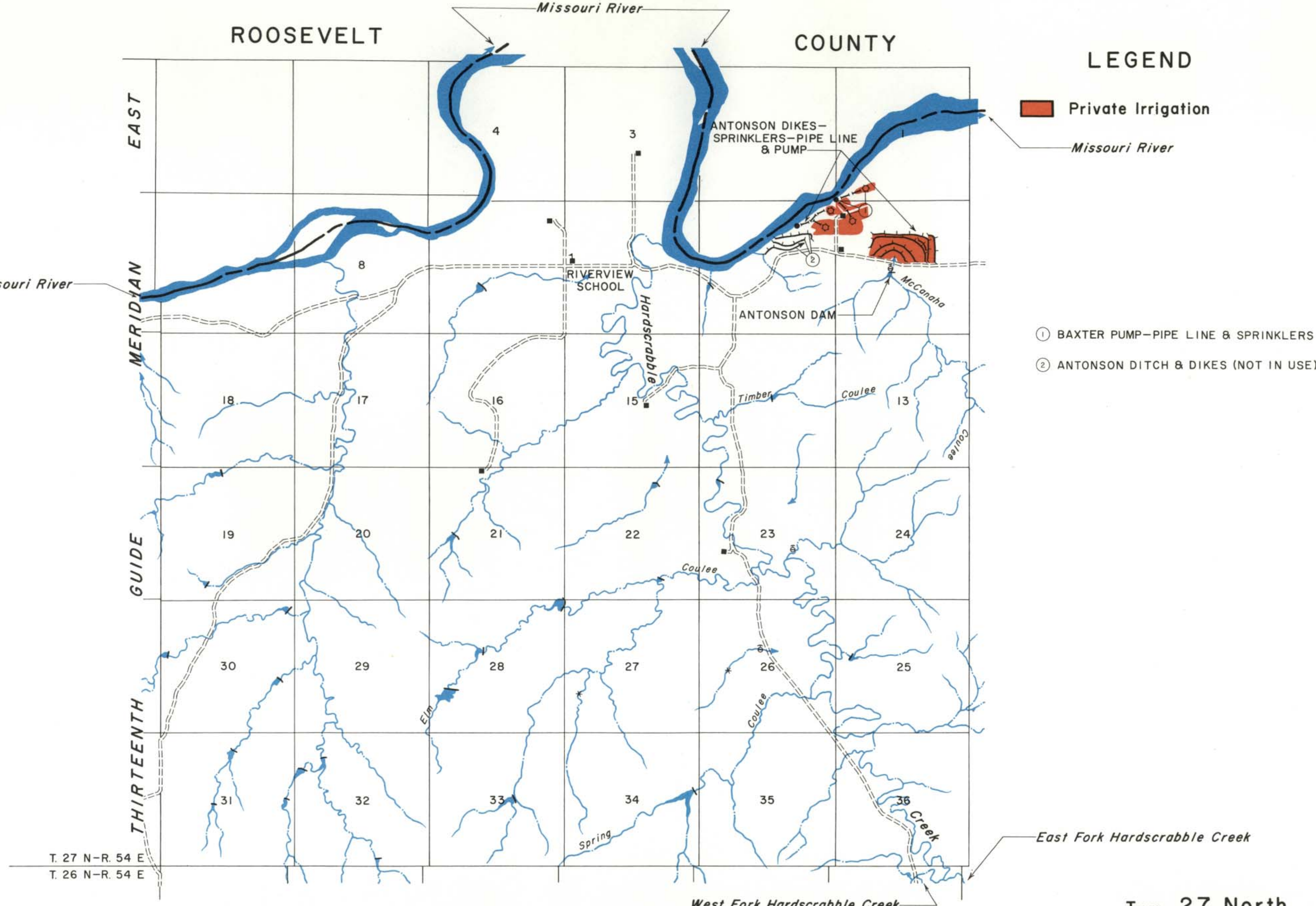

LEGEND
Private Irrigation
ROOSEVELT
COUNTY
Missouri River
Missouri River
HINES PUMP SITES-DIKES & DITCHES (NOT IN USE)
CANDEE PUMP & DITCHES
RENZ DIKE
RENZ DITCHES
Old House Coulee
Sand Coulee
Curran Creek
T. 27 N-R. 51 E
T. 26 N-R. 51 E
First Creek
Deep Creek
Renz Creek
14
13
21
24
30
27
25
31
33
34
35
36
Twp. 27 North
Rge. 52 East
Drafting by June Virag



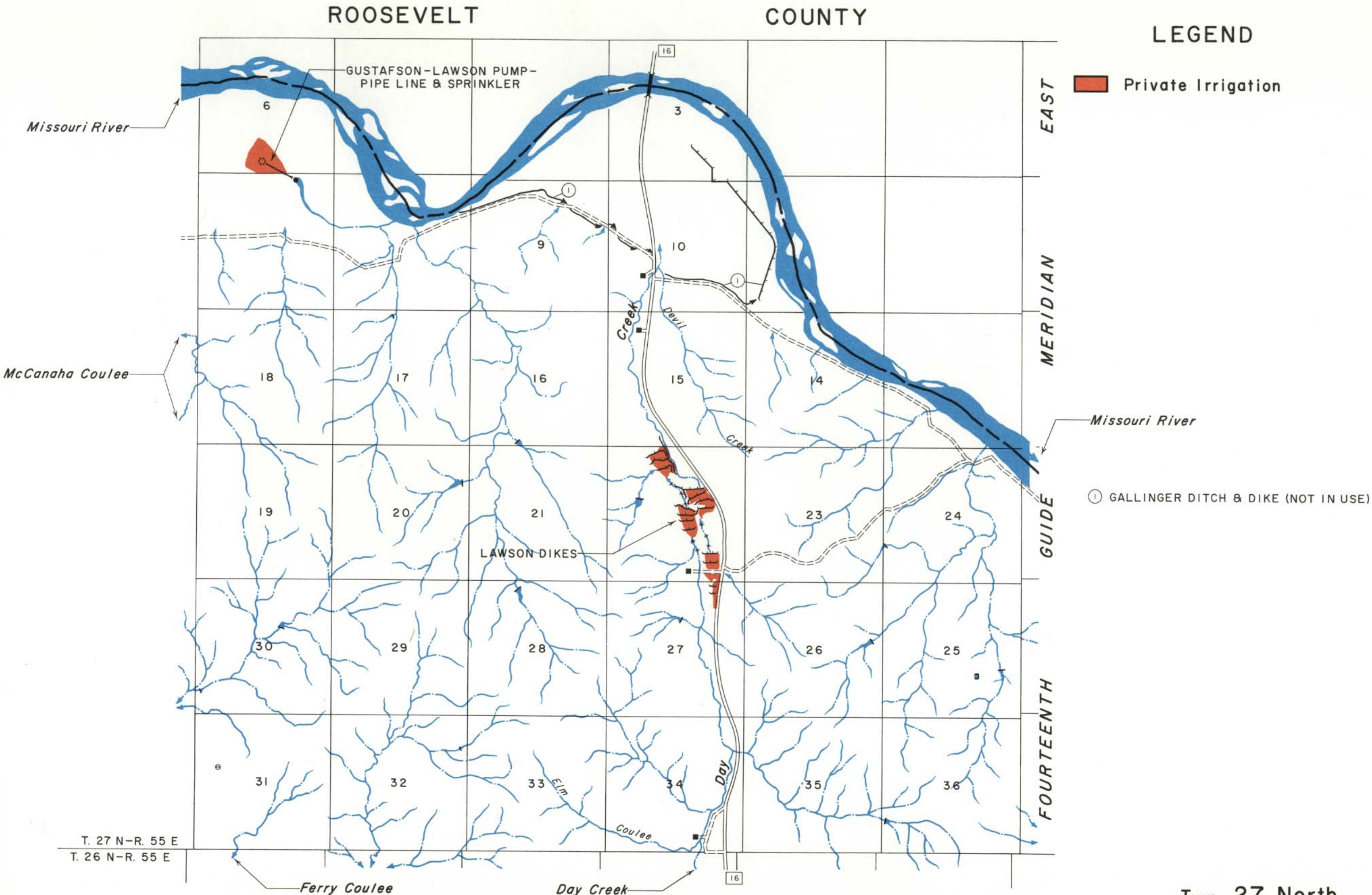
Twp. 27 North

Rge. 53 East

Drafted by June Virag



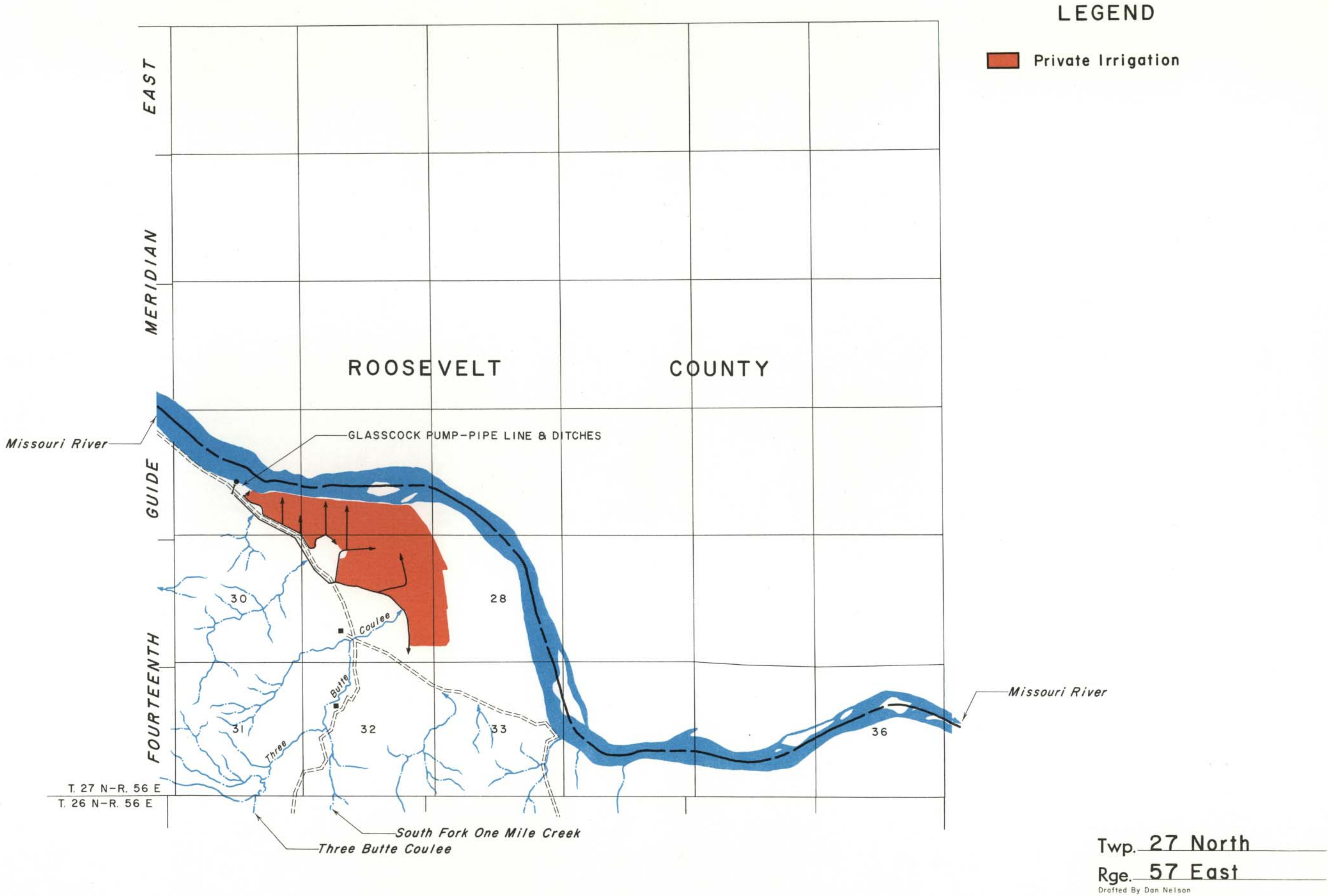
Twp. 27 North
Rge. 55 East
Drafted By Dan Nelson

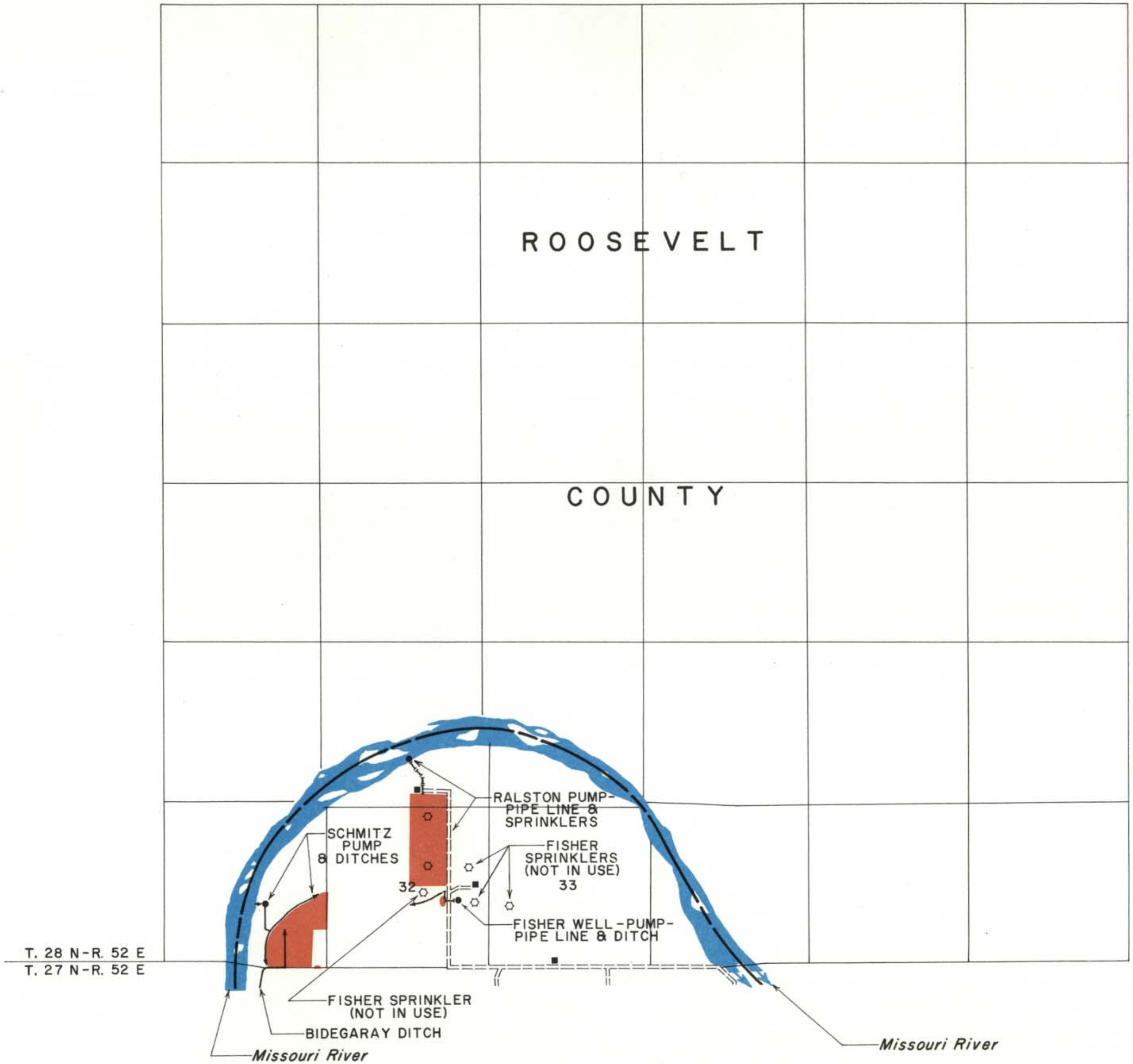


Twp. 27 North

Rge. 56 East

Drafted By Dan Nelson


LEGEND
Private Irrigation
ROOSEVELT COUNTY
FOURTEENTH GUIDE MERIDIAN EAST
Missouri River
GLASSCOCK PUMP-PIPE LINE & DITCHES
30
28
31
32
33
36
Coulee
Butte
Three
Missouri River
T. 27 N-R. 56 E
T. 26 N-R. 56 E
South Fork One Mile Creek
Three Butte Coulee
Twp. 27 North
Rge. 57 East
Drafted By Dan Nelson



LEGEND

Private Irrigation

Twp. 28 North

Rge. 53 East

Drafted by June Virag