



An economic analysis of selected Montana State Water Conservation Board projects
by Elroy C McDermott

A thesis submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree
MASTER OF SCIENCE in Agricultural Economics
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Abstract:

This study is an attempt to determine the economic impact of water resource development in Montana, not only to the direct users of the project water, "but to those to whom indirect benefits accmeas well.

Three State water development project's were analyzed in terms of the direct and indirect benefits generated by them, changes in land values, land productivity, changes in the tax base, and other related economic measurements. The three projects studied were the Broadwater-Missouri project, the Ruby River project and the North Fork of the Smith River Project.

It is concluded that, the development of these irrigation projects has greatly stabilized the economy of their particular areas. They have assured the production of sufficient winter feed to balance and stabilize the livestock operations from which the majority "of the income is derived in each area. The Broadwater-Missouri project has also made possible the production of such cash crops as sugar beets and potatoes, thus affording the water users an opportunity to increase their net returns per acre. These projects have greatly enhanced land values, increased production, broadened the tax base and raised the level of living in their respective areas.

For each \$1.00 of direct benefits obtained, there are approximately \$1.35 of indirect benefits generated by these projects. These indirect. benefits may either "stem from" the processing of goods produced on the projects or be "induced by" the added expenditures of the primary producers.

The local attitude towards each of these projects was one of satisfaction and praise, with both the user and non-user attesting to the great worth of these projects in stabilizing the local economy.

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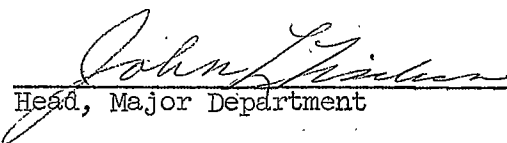
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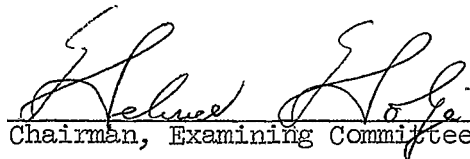
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All errors and omissions are the responsibility of the author.

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ABSTRACT

This study is an attempt to determine the economic impact of water resource development in Montana, not only to the direct users of the project water, but to those to whom indirect benefits accrue as well.

Three State water development projects were analyzed in terms of the direct and indirect benefits generated by them; changes in land values, land productivity, changes in the tax base, and other related economic measurements.

The three projects studied were the Broadwater-Missouri project, the Ruby River project and the North Fork of the Smith River Project.

It is concluded that the development of these irrigation projects has greatly stabilized the economy of their particular areas. They have assured the production of sufficient winter feed to balance and stabilize the livestock operations from which the majority of the income is derived in each area. The Broadwater-Missouri project has also made possible the production of such cash crops as sugar beets and potatoes, thus affording the water users an opportunity to increase their net returns per acre. These projects have greatly enhanced land values, increased production, broadened the tax base and raised the level of living in their respective areas.

For each \$1.00 of direct benefits obtained, there are approximately \$1.35 of indirect benefits generated by these projects. These indirect benefits may either "stem from" the processing of goods produced on the projects or be "induced by" the added expenditures of the primary producers.

The local attitude towards each of these projects was one of satisfaction and praise, with both the user and non-user attesting to the great worth of these projects in stabilizing the local economy.

CHAPTER I

INTRODUCTION

Historical Development of Irrigation

The artificial application of water to crops has long been known on all continents. No one has yet determined whether irrigation originated in Asia, Africa, Europe, or America. For wherever evidence has been unearthed of the activities of man through the ages, there also, remnants of irrigated agriculture have been found. 1/

The success of most early civilizations was, to a great extent, due to a stable and productive agriculture based on irrigation.

The fertility for which Egypt was known throughout the recorded past, must be attributed to the utilization of the waters of the Nile for irrigation. In about 2000 B.C., the Nile was diverted through a channel twelve miles long into Lake Moeris. During flood periods, excess river waters were stored in the lake; in times of drought, the lake waters irrigated adjoining farm lands. 2/ This project of the Egyptian's appears to be the world's first artificial lake and storage reservoir for irrigation water. The Egyptians were also first in certain other irrigation developments, such as the artesian well, the milometer for gauging streams, and great canal systems for both irrigation and navigation.

Hammurabi, great builder of the Babylonian Empire, counted the extensive irrigation systems among his proudest accomplishments. Records have been unearthed expressing his personal pride in having "changed desert plains into well watered lands." The ancient works of Babylonia included a lake

1/ Roy E. Huffman, Irrigation Development and Public Water Policy, New York, the Ronald Press Company, 1953, p. 7.

2/ Huffman, pp. 7-8, quoting Lute Wilcox, Irrigation Farming, New York, Orange Judd Co., 1895, p. 2.

42 miles in circumference and 35 feet deep to store the flood waters of the Euphrates River for irrigation. 3/ The great Nahrawn Canal, which diverted water from the Tigris River, was more than 400 miles long, varied in width from 250 to 400 feet, and was used for both irrigation and navigation. 4/

Semiramis appears in Babylonian history about 1200 years after Hammurabi. She also showed great pride in the irrigational developments under her regime. The proclamation on her tomb reads: "I constrained the mighty river to flow according to my will and led its water to fertilize lands that had before been barren and without inhabitants." 5/

Early Irrigation in North and South America

Irrigation practices have flourished in both the North and South American continents since before the time of Christ. When Pizarro arrived in Peru, he found gigantic irrigation structures which dated back to the first traditions of the native population. These structures were of extremely high quality, one huge canal being more than 400 miles in length. Kinney 6/ points out that considerable knowledge of engineering was necessary to produce so great a work.

There are numerous remains of irrigation structures in the Western United States which indicate the antiquity of irrigation in this country.

The existing ruins of many ancient towns and irrigation systems in Arizona and New Mexico indicate that at one time a dense population inhabited the area. It has been estimated that the canals and laterals exceeded 1,000 miles in length and that the area irrigated in the Salt River Valley approximated 250,000 acres. One canal has a drop over rock of 40 or 50 feet and is

3/ Huffman, p. 9, quoting Charles F. Davis, The Law of Irrigation, Denver, Colorado, Publishers Press Room and Bindery Co., 1915, p. 8.

4/ Huffman, pp. 7-8, quoting Wilcox, op. cit., p. 1.

5/ Huffman, p. 9.

6/ Clesson S. Kinney, A Treatise on the Law of Irrigation, Washington, D. C. W. H. Lowdermilk and Co., 1894, p. 18.

worn to an extent that would require centuries of water action. 7/

Modern Irrigation Development in the United States

The Mormon pioneers are generally given credit for the founding of modern irrigation in the United States. Until they settled in the desertous valley of the Great Salt Lake in 1847, no extensive utilization of irrigation had taken place in the great agricultural expansion and settlement of the United States.

Prior to this time, most settlers had located in the more humid areas of the country and those who did venture westward, continued on to the Pacific Coast where there again was sufficient rainfall.

After modern irrigation had proved itself in Utah, it spread to California and Colorado and then to the other western states. As irrigation expanded into new areas, great interest was created throughout the nation. This has resulted in numerous legislative acts in an effort to aid irrigation development.

History of Montana's State Water Conservation Board

The early 1930's found the agriculture and livestock industry of Montana greatly aggravated by severe drought in addition to the critical depression then in full swing. This resulted in extensive individual and group effort in seeking ways and means of putting Montana's water resources to use.

In 1933, the Federal Government, in an attempt to alleviate mass unemployment, established work programs designed to encourage the construction of public works. Great emphasis was placed upon this new program which, it was hoped, would remedy the nation's economic ills. The state, as well as the nation, was not prepared to meet the emergency that existed, and more particularly, they were not ready with programs of public works projects. The result was that any type of endeavor that would immediately permit people to be placed on public agency payrolls was undertaken. It was soon recognized

7/ Ibid., p. 21

that a great many of these so-called "pump priming" projects were of little value and served only in avoiding actual gifts to the previously unemployed. A great demand existed in Montana for a program to guide these expenditures into projects more permanent in nature and to stabilize its agricultural and livestock economy. It was felt that a broadening of these public works programs to include the construction of water conservation projects would be of great benefit. Governor Cooney proposed to President Roosevelt that Montana be allowed to proceed with such a program under loan and grant offers being made by the Federal Public Works Administration. He was assured by the President that if Montana would enact the necessary legislation in such form that the government could buy the bonds of the state agency, that the Public Works Administration would finance a state water conservation program to the extent of \$5,000,000. 8/

Work was immediately begun on the preparation of legislation to create the State Water Conservation Board. Late in 1933, Governor Cooney called a special session of the state legislature for the prime purpose of enacting this legislation.

As a result, the State Water Conservation Board was created under House Bill. No. 39 which was approved by the Governor on January 9, 1934.

A year later the Act was amended to include the establishment of the "Conservation Revolving Fund", and also broadened the Board's powers. The Act has been interpreted twice by the Montana Supreme Court and its provisions held constitutional. The Board held its first meeting on January 22, 1934. 9/ As constituted by the Act, the Board consists of five members; namely, the Governor who serves as chairman, the State Engineer and three members appointed by the Governor.

8/ Robert J. Kelly, Summary of Activities of the Montana State Water Conservation Board, From Inception January 22, 1934 to June 30, 1960, p. 1.

9/ Ibid., p. 2

The State Water Conservation Board Act

This Act declared that the purpose of the Board was to encourage public works and to reduce unemployment; thereby assisting in the national recovery and helping to promote the public welfare. It also declared that the public interest, welfare, convenience and necessity required the construction of a system of works for the conservation, development, storage, distribution and utilization of water. It declared that the Board was performing a governmental function in carrying out the provisions of the Act and that water conservation was a state purpose. It further specified that the Board was a body corporate and politic with perpetual existence and was an agency of the State of Montana. Broad powers were given to the Board allowing it to cooperate and enter into agreements with all federal and state agencies, investigate, survey, construct, operate and maintain, and to finance the construction of projects either through funds appropriated to it, by grants or by the sale of water conservation revenue bonds. It established the various funds that were necessary in servicing the bond issues as well as the funds required to carry on the business of the Board. It also gave the Board authority to file on unappropriated waters of the state and the right of eminent domain to acquire lands needed for projects. Also included within the Act were several clauses broadening the powers of the Board to include all types of development of natural resources. 10/

Actions and Policies of the Board

Necessity rather than sound judgment determined many of the Board's early actions and policies. There was an immediate demand for prompt action. Upon its creation, the Board had a mandate from the legislature to proceed with a construction program of water conservation projects to alleviate existing depressed economic conditions. The Board then had to immediately

10/ Ibid., p. 3.

assemble and train engineers and other personnel for a program of dam and canal building, a field in which there were few men with experience. 11/

The continued drought had made individuals from all areas of the state very conscious of the need for irrigation. With each area thinking their proposed project the most meritorious, continued pressures were brought upon the Board. Add to this the lack of experienced engineers and pressing deadline dates set by the federal agency for filing of applications and it becomes evident that it was humanly impossible to base these applications on complete and thorough analysis of the projects.

After getting their application filed, many of these groups would then bring pressure on Montana's congressional delegation to have funds allocated by the federal agency for their particular project. The Board had no say in which projects would be constructed out of the 67 applications that were filed with the Public Works Administration. All they could do was choose the projects they felt most likely to be selected and then conduct further engineering studies on them. Often, because of heavy unemployment or other serious local conditions, funds were allocated to projects which the Board was not prepared to construct.

The Board would receive no notice of allocations until they were announced in Washington. The State's Congressmen would then wire the local people under the selected projects that funds were now available for their project.

The government would set a date for starting construction as well as other terms of the offer; failure to meet these requirements resulted in the offer being declined. Consequently, many agreements and contracts of the Board were entered into under duress because it was a matter of meeting the conditions imposed or losing the construction funds. The time allowed to get projects under construction was not sufficient to enable the federal agency's employees to make more than a cursory examination of the Board's

11/ Ibid.

ability to meet the requirements of the Loan and Grant offer before construction contracts were awarded.

This resulted in much controversy, with the government withholding construction funds at times from the Board causing it to delay payments to the contractors and for other items, all of which contributed to additional costs of the projects. The government representatives argued that these extra costs were compensated for by grants it was making to the projects. ^{12/} In spite of the many handicaps under which most of these projects were constructed, the majority of them have since proven to be highly successful.

The use of project water is sold very much in the same manner as a public utility sells its service. The Board is interested primarily in the measurement and delivery of the proper amount of water according to the contracts; it makes no particular difference upon what lands the water is used. The amount of water contracted for is optional with the purchaser and these contracts can be transferred. In case of non-payment by a water user on his contract, the Board has three options: ^{13/} (1) It may refuse delivery of water until all back payments have been made; (2) It may cancel the contract entirely; or (3) It may bring suit in the district court to collect on the contract in the same manner as a suit brought to collect on a personal note.

In determining the feasibility of a project the Board's general policy has been to consider first, engineering feasibility; that is, a certain amount of water can be available for a certain cost; second, that there is land available on which this water can be used to produce net wealth in excess of the charges necessary to meet construction repayment and operation and maintenance costs; third, that there are water users available to make profitable use of the water.

^{12/} Ibid., p. 4

^{13/} Fred Buck, "State Responsibility for Small Project Development", Proceedings of the Seventeenth Annual Meeting of the National Reclamation Association, Oklahoma City, November 17-19, 1948, pp. 205-212.

The Board has recognized that irrigation projects should not be built to meet only the immediate demand for their use, but should be constructed to serve the ultimate demands of the area. The full utilization of the Board's projects has been retarded some from acreage restrictions on farm production, also from ability to produce crops due to more adequate rainfall since the drought was broken, and to a great extent by improved stream flow over the years since the project was built. 14/

The development of facilities over and above the immediate need for them requires a longer repayment period for the return of funds invested in the projects. Repayment of construction funds in a limited time is required when private financing is involved, thus, in that type of development, facilities could only be offered for those areas ready for irrigation. The State program has a much greater aim for it recognizes that its projects will be serviceable for many years and will stabilize the economy of the entire state through an increased tax base, enhanced incomes and higher production.

This program represents the State's investment in the development of its water resources, and it preserves for Montana a prior right to use water for its projects as against claims which might subsequently be made for water used by downstream states. 15/

As of June 30, 1960, 181 projects had been constructed by the Board. Based upon the source of construction funds, the Board's projects divide themselves into three groups. The first group consists of 18 projects constructed principally through the sale of bonds to and from grants received from the Public Works Administration.

The second group of projects is made up of those principally financed through state appropriations. This has been the only source of Board funds since the federal agencies furnishing construction funds were discontinued by Congress.

14/ Kelly, op. cit., p. 5.

15/ Ibid.

The third group consists of small projects constructed under government make-work programs in which the Board assumed full ownership and acted as sponsor in providing limited funds.

Included within the 181 projects are 141 dams and reservoirs which were built to store 438,017 acre feet of water. Some of these storage projects also have diversion structures and canals. Including these diversion structures and canals, forty-five projects with 815.8 miles of canals were built. They permit the use of 260,563 acre feet of direct stream flow. The projects constructed by the Board were built to furnish a water supply for 405,582 acres of land. Also 23.6 miles of pipe line for domestic water supply projects and 24.36 miles of transmission lines for pumping projects were constructed. 16/

In addition to the projects constructed, the Board, in its study of water conservation possibilities in the state, has conducted surveys of 182 projects and also a very limited investigation of 132 others. A great many of these projects should, and no doubt will, be constructed in the future. The information which has been collected by the Board will be of great value in any future construction program.

The Board has been most anxious to see Montana's vast water resources not only developed but conserved and has worked cooperatively with other groups towards this end. An example of this is the survey made in cooperation with the Montana Power Company and the Bureau of Reclamation of the Upper Missouri Basin, which resulted in the construction of the Canyon Ferry Project.

In 1935, the legislature gave the Board certain other responsibilities. This legislature created the State Electrification Authority and named the State Water Conservation Board as the authority. The Board has furnished engineering services to 23 cooperatives at a cost of \$1,079,815.08. Repayments on current accounts amounted to \$1,123,185.53 as of June 30, 1960,

16/ Ibid., p. 6.

leaving a balance of \$43,368.45 to apply on an additional amount of \$144,533.02 which the Board has spent on general engineering and other construction costs attributable to this program.

Created also by the 1935 legislature was the State Planning Board, which consisted of the five members of the State Water Conservation Board. Its purposes, as stated by the Act, were to develop plans and policies for the conservation of Montana's land, water, timber, mineral, oil, coal and other natural resources. This Board is currently engaged in an active program to increase the economic growth of Montana.

The Financing of Board Projects

History has proven irrigation financing to be very hazardous and therefore, officials in Washington were quite skeptical of the Board's plan to use the irrigation water itself as security on the loans. The original plan of the Board was to sell water from its projects just as any other commodity is sold. This, then, would permit the Board to adjust its charges on projects to fit costs and also allow it to make changes that economic conditions might require. This plan had to be modified somewhat, however, before the Public Works Administration would agree to purchase any of the Board's bond issues. An agreement was finally reached whereby the government was willing to accept individual water purchase contracts specifying the number of years and amounts of payments as security on the bonds.

Montana was the only state that was successful in getting government financing for a construction program even though other western states passed similar water conservation legislation at that time. This was accomplished only through the foresight and willingness of the Governor and the Board members to compromise and meet the requirements of the federal agencies in order that construction might proceed. Much credit also should be given the State legislatures for their understanding and support in supplying the State's part of the needed funds.

During this early period the Board worked cooperatively with other federal agencies created by Congress to relieve unemployment. Congress required that a public agency sponsor these programs and contribute part of the funds while the government would pay labor costs plus some material and other costs. Anxious to see this labor employed on more useful projects, the Board sponsored many water conservation projects in conjunction with the Civil Works Agency, which was later succeeded by the Works Progress Administration. In 1935 an overall agreement was made with the Works Progress Administration, wherein that agency would allocate \$2,000,000 to a water conservation program in Eastern Montana if the Board would provide sponsorship funds in the amount of \$100,000. Most of the 128 projects in the Board's small project program were constructed under this agreement. Two projects were also built in cooperation with the Civilian Conservation Corps.

Since federal funds are no longer available, Board projects are financed with funds provided by the State Legislature. The Board does not place a lien on the lands to be irrigated but obtains water purchase contracts from each user on the project, stating the amount of yearly repayment over the period of the loan.

Substantially, the same type of organization and water purchase contracts have been used by the Board on all of its projects, including those built entirely with State funds. By keeping the overall program uniform, management and operational problems have been kept at a minimum.

The projects of the Board have been financed from various sources. The total cost of the program and the source of the funds as of June 30, 1960 were: 17/

Bonds Sold	\$ 4,356,500.00
Cash Grants	3,569,477.33
Other Grants	3,454,710.90
Board Funds	10,311,883.65
Administration Charge	178,640.41
Total Cost of Program	\$21,871,212.29

The following is a brief breakdown of these various sources through which the funds were raised: Eighteen issues of bonds totaling \$4,123,000. were sold to the Public Works Administration. The Reconstruction Finance Corporation purchased one bond for \$135,000 and four issues for \$98,500 were purchased by local individuals.

The Public Works Administration made cash grants in the amount of \$3,330,994.90; two projects received cash grants in the amount of \$178,632.78 from Federal Flood Disaster Funds, and three projects were financed in part by local sources in the amount of \$59,849.65. Labor, materials and other grants in the amount of \$3,454,710.90 were substantially all received from federal agencies, principally the Works Progress Administration. To justify the grant base for some of its projects, the Board made a 3 percent administration charge on its larger projects and 5 percent on the small ones--this resulted in a charge to the projects of \$178,640.41. Board funds in the amount of \$10,311,883.65 were spent on the program. Included within this amount is \$375,529.85 spent on surveys and investigations and \$1,079,815.08 spent on rural electrification projects. 18/

The Board's Role in the Future

The Board has a dual purpose for the future: First, the continuing development of our water resources, and secondly, the protection of the State's investment in the projects now built so as to secure from them the greatest economic returns to the State, as well as the State's funds now invested in them. 19/

The Board's construction activities have been slowed considerably by limited funds and increasing costs. Although the Board is primarily a construction agency, it now has an opportunity to give more attention to the problems of management of its projects. Insofar as is possible, the Board

18/ Ibid.

19/ Ibid., p. 13.

has attempted to place the management and operation of these projects with the local water users through their associations.

The Board has faced a serious problem in continuing the construction of projects. Rising construction costs have far out-distanced the increase in farm income. The Board originally charged 4 percent interest on funds it furnished for projects but as costs continued to grow it abandoned this charge. Board projects were first financed on a 30-year repayment basis. This repayment period has necessarily been lengthened to keep the annual charge within the water users' ability to pay. With present high construction costs, a greatly extended repayment period is the only practical way in which the annual costs of repayment can be kept within an amount the water user can reasonably be expected to meet.

Inasmuch as the Board has no outstanding indebtedness, it is in a position to let its projects develop in a more sound manner, there being no compelling reason to force the immediate utilization of water from the projects. This has also enabled the Board to guide the use of this water in such a way as to be of most benefit to the economy of the State.

Although the Water Conservation Board was created to aid in alleviating unemployment, its continuing purpose has been to strengthen and stabilize the agricultural and livestock economy of the State. It has accepted the legislature's mandate that it construct projects for the development of natural resources to benefit and bolster the economy. It continues to make beneficial use of existing water resources, thereby preserving them and creating a vested right for Montana's future generations.

This program has been a splendid example of Montana's initiative and enterprise. No program is more fundamental, more effective, or more widely beneficial in stimulating economic growth than a well-balanced program of water development. However, only through the cooperation and support of everyone in Montana will the State Water Conservation Board be able to provide continued service and a well-balanced program of water development projects in the future. As pointed out in a recent speech by Mr. Fabrick,

President of the Montana Reclamation Association, 20/ the practical opportunities for further development of water projects are nearly exhausted under the Board's program as now constituted, which requires full repayment of construction costs by the water users.

Under the State Board program, no part of the construction cost is being paid from surplus power revenues, and none is being allocated as non-reimbursable expenditures for benefits to fish and wildlife, navigation, flood control or recreation as is the case under the federal program.

The importance of these recreational benefits should not be overlooked. In addition to producing broad social and individual benefits, they bring about desirable economic effects as well. The provision of outdoor recreation often enhances community values by creating a better place to live and by increasing land values.

The recreational opportunities within the State have been broadened as a result of water resource conservation and development. Most people seeking outdoor recreation desire that there be water close at hand. It may be to swim and fish in, to ski across, to dive under, to run their boats over or just to sit by. Swimming, boating and fishing are among the top ten outdoor activities and are gaining in popularity all the time. Such activities as camping, picnicking and hiking are also high on the list and are far more attractive near water sights.

Mr. Fabrick also pointed out that if a sizeable future program of small projects is to be carried on, then it will be necessary to apply such non-reimbursable costs to State programs or to pay part of the cost from the power revenues of the Missouri Basin Project set aside for that purpose. To establish such a future State reclamation program would require a constructive and non-political effort on the part of all, including the citizens of the State, such groups as the Farmers' organization, the Stockmen's associations,

20/ D. P. Fabrick, "The Need for Further Reclamation Developments in Montana," Proceedings of the Thirtieth Annual Meeting of the National Reclamation Association, Billings, Montana, October 19-21, 1961, pp. 87-90.

the Montana Reclamation Association, the Chambers' of Commerce, the State and Federal departments and legislators.

The natural resources of the State are not political blessings and political differences should not be allowed to interfere with constructive efforts towards the wise and beneficial use of the State's resources.

The State program will have to be updated if it is to carry on the constructive program it has in the past and continue to play a vital role in expanding and stabilizing the economy of Montana.

Advantages of a State Agency

The question of how to construct small irrigation projects has long been an aggravating one. There have been numerous potential small projects scattered throughout the West which have not been constructed, even though studies have proven them to be feasible. Through wisdom and foresight, the people of Montana pioneered a program to solve this question. Neighboring states were quick to realize the advantages of a state water conservation and construction agency and followed Montana's leadership in this program. Utah and North Dakota in particular have patterned the Acts creating their Boards largely from the Montana Act. This plan has proven to be workable and seems to be, at present, the best solution to the small project problem.

Federal agencies play a very essential role in the national picture through the construction of large irrigation projects. Many of these projects could not, or most likely would not, be built in any other way. Most small projects, however, are purely local in character with the generated benefits being confined to a relatively small geographical area. In such cases the responsibility for development would rest with the state rather than the federal agencies. More reliance should be placed upon the state government to supply sufficient funds for these small projects.

Under the State Water Conservation program, it is not necessary to create an irrigation or drainage district. An association composed of those interested in purchasing water is organized and incorporated under the State

Corporation Laws. Its by-laws are then formulated and officers chosen. The Board then deals with the corporation rather than the individual users. All the necessary surveys and investigations, arrangements for financing, the letting of contracts and supervision of construction are carried out by the Board.

The Board is often able to concentrate its own forces on a small project and have it completed in less time than would have been required in drafting formal plans, writing specifications, calling for bids and then letting the contract. There is also a corresponding savings in costs to the water users. Through this economic method of construction, many projects are made feasible which would not be so otherwise.

A state agency not only speeds up the construction of these small projects but enables the state to have an accurate inventory of its water resources. Through these field surveys and extensive investigations, the state can build up a reserve of potential projects, their priority being determined according to their economic feasibility.

The responsibility of operation and management rests with the Water Users' Corporation. The Board retains ownership of the projects, however, and serves in a supervisory capacity. This affords many advantages to the water users. They have ready access to the Board's legal services, engineering advice and operational experience. Also, in case of damages the Board is responsible as well as the project directors. If the directors so elect, they can rent the Board's equipment to repair these damages at actual cost. Betterments and repairs to the projects are carried out under the direction and supervision of the Board. At times major repairs must be made which the individual projects are unable to finance themselves. In such cases, the Board loans the association a sufficient amount to finance the repairs interest free. The water users then repay this amount from operation and maintenance assessments over a period of possibly three to five years, or sometimes even longer, depending upon the cost of the repairs and their ability to repay.

The Board owns suitable equipment to maintain and keep in proper repair the projects which it has built. Its machine operators are employed the year around and are always available to take care of difficulties that might occur on any of the projects. In case of a project failure, the Board's equipment can be immediately on the scene to correct the situation. A repair shop is also maintained where its equipment is kept in good running order. Access to such equipment and the services that accompany it could not be afforded by one project or even a group of small projects. Also, there is no extended delay while bids are being advertised for, as is prescribed by law if the work is to be let out on contract.

The advantages of a state agency have been pretty well summed up by Mr. Buck. 21/ He points out that red tape is eliminated, thus bringing about corresponding reductions in cost. Maintenance is simplified and made more efficient and economical, and new projects can be initiated and construction completed in a relatively short period of time. Also, the state agency works in harmony with the various federal agencies interested in the development of land and water resources, and is an excellent means of perfecting programs that are fostered by the State Reclamation Association. This plan provides an agency very accessible to the people of the state and one on which farmers can call, explain their problems and receive an answer without undue formality.

21/ Buck, Op. Cit.

CHAPTER II

PROJECT JUSTIFICATION AND MEASUREMENT

Determining the Value and Feasibility of Irrigation Projects

"We have a national obligation to manage our basic water supply so it will be available when and where needed and in acceptable quality and quantity, and we have no time to lose." This timely advice was given in a message to Congress in mid-July of 1961 by President Kennedy.

Secretary of the Interior, Stewart L. Udall, placed great emphasis on water conservation in stating that unless ways are found to conserve more fresh water and to convert salt water cheaply into fresh, the United States only 20-years from now will lack enough water to meet its basic needs. 22/

Wayne N. Aspinall, Chairman of the House Interior and Insular Affairs Committee, made the following comments concerning the importance of conserving water resources. 23/ The future water needs of this nation demand that we make the most efficient and wise use of our limited water resources. The continued economic growth and well-being of the United States generally and its regional river basin areas are dependent upon our doing so. A sound, progressive water resources development and conservation policy is as essential to the future welfare of this nation as is a strong national defense program.

A great deal has been said both locally and nationally concerning the importance of efficient programs for the development and conservation of our water resources, yet there are some who are still quite opposed to these programs. Reclamation does have its enemies, many of which are

22/ Stewart L. Udall, Proceedings of the Thirtieth Annual Meeting of the National Reclamation Association, Billings, Montana, October 19-21, 1961, pp. 12-19.

23/ Wayne N. Aspinall, Centralized Planning Versus Inefficiency and Waste in Water Resources Development, Proceedings of the Thirtieth Annual Meeting of the National Reclamation Association, Billings, Montana, October 19-21, 1961, pp. 19-24.

quite vociferous. There are some, of course, who oppose it for purely selfish reasons, but the majority simply do not understand the value of reclamation work; what it means to Montana and to the United States as a whole...

The question is often asked, "Why should we spend state and federal money to build reclamation projects and bring more land into agriculture production when we are already producing more than we can consume?" Secretary Udall ^{24/} cited the following statistics in answer to this question. The Bureau of the Census recently issued a very comprehensive report which indicated that by 1980 the nation's population shall have increased from the present 180,000,000 to 261,000,000. This is an average increase of about 4,000,000 persons each year or a 45 percent increase in 20 years. By the year 2000 we are told we can expect a population of about 383,000,000. These additional mouths will need food. The Department of Agriculture, reporting on future food and fiber needs, indicates that to meet our domestic and export need of 1980 will require continued technological gains to provide 42 percent greater yields, plus a net gain of 20,000,000 acres of cropland. By the year 2000, our needs will require 75 percent greater yields, plus a net addition of 63,000,000 acres of cropland. Each year losses of agricultural land to urban expansion, industrial, highway and other non-agricultural uses exceed 1,000,000 acres. Equivalent losses due to erosion and other causes add another half million acres each year.

Since 1920, the acreage available for crop production has remained fairly constant at about 400,000,000 acres. This provided 3.8 acres per capita in 1920, 2.1 in 1960 and based on indicated trends, by 1980 this will be reduced to 1.5 acres of cropland for each person. If this is projected to the year 2000, the figure will be less than one acre per person.

Though few people realize it today, this is an alarming trend. In Utah, for example, economists have projected present trends to indicate

^{24/} Udall, Op. Cit.

that the state will have a 24 percent deficit in agricultural production by 1975. It is by no means too early to undertake and expand positive action to protect our agricultural heritage of plenty which is such a blessing and the envy of much of the world. 25/

The surplus production of a few crops in this country has caused a great deal of expense and a continual effort of economic adjustment. Through all the publicity given to this problem, the general public has been led to assume that this country now has a surplus of all agricultural products. Actually, just five crops make up 96 percent of this country's entire surplus, and only insignificant amounts of these five crops are grown on Reclamation projects. 26/ This country, on the other hand, has a strong market demand for numerous agricultural products, many of which are pre-eminently irrigation project crops.

Today, Americans face the problem of a few surpluses, tomorrow their children will face the problem of serious shortages. Projects to meet tomorrow's shortages must be begun now, or else they will not be ready when they are needed. 27/ The confusion and irritation caused by the surplus problem has blinded many people to the urgent need of making these vital preparations.

Governor Tim Babcock recognized the great opportunity in Montana for the wise use of water resources in his address to the Columbia Basin Inter-Agency Committee in the following statement:

25/ Ibid.

26/ LeSelle E. Coles, Two Big Issues, Proceedings of the Thirtieth Annual Meeting of the National Reclamation Association, October 19-21, 1961, Billings, Montana, pp. 34-39.

27/ Ibid.

"What we are doing in water conservation is not only for today but for the future generation. Most of the dams and works we are building will be here for many years--some, many hundreds of years. Benefits will accrue during their entire existence. In one place flood danger will be minimized--in another, life giving waters will continue to flow on crops. Even the fisherman, hunter and vacationist will have improved facilities from these things we are doing today. Increased values of land, increased production of food, increased wealth to roll through the channels of trade and industry, but probably most important, proper utilization of our water resources results in increased security and stability to our farm homes for many generations." 28/

Project Justification

The fact that efficient development and conservation of Montana's water resources should be of vital interest to every citizen of the State does not necessarily mean that a greatly accelerated program of irrigation development should be implemented immediately. A sound appraisal of the extent to which water development projects contribute to the economy, and the extent to which these programs increase the welfare of farmers and the local communities is dependent upon careful research and analysis of all information available.

The development of water resources is steadily becoming more detailed and complicated. With improvements in technical knowledge, there are more and more things which must be considered in connection with irrigation project investigations, authorizations, appropriations, construction and operation. 29/ The determination of project justification is one of the things which has greatly increased in complexity and will be discussed herein.

28/ Minutes of the 114th Meeting of the Columbia Basin Inter-Agency Committee, Helena, Montana, December 6-7, 1961, p. 17.

29/ James K. Carr, Project Justification, Proceedings of the 29th Annual Meeting of National Reclamation Association, November 16-18, 1960, Bakersfield, California, pp. 97-101.

Communication frequently becomes a problem when the factors involved in determining the economic justification of a project are discussed. Each writer often has his own definitions which are slightly different from those formulated by others. To avoid communication problems and to make subsequent discussions and analysis more precise, it is desirable to define the terms to be used. The definitions used here are consistent with those set forth in the "Green Book". 30/

Primary Benefits.--The value of products or services directly resulting from the project; net of all associated costs incurred in their realization. Primary benefits are also referred to as direct benefits.

Secondary Benefits.--(a) From a national viewpoint, they are the excess of secondary beneficial effects over the sum of; (1) the costs incurred in secondary activities; and (2) the net secondary benefits that would have been expected from other uses of project required resources. (b) From a local or regional viewpoint, secondary benefits would include the overall secondary benefits, which are the total values added in secondary activities minus only those costs incurred in secondary activities. It is the second definition with which we will be concerned, since this report is primarily an analysis of local water development and its effects on the local economy. Secondary benefits are also referred to as indirect benefits. Secondary benefits may either "stem from" or be "induced by" the project. "Stemming from" benefits may be defined as those benefits that arise from the processing of goods produced on the project. "Induced by" benefits are those benefits that result from increased economic activity stimulated by the expenditures of those who produce the immediate products.

Primary Costs.--The value of the goods and services needed for the establishment, maintenance and operation of the project and to make the immediate products of the project available for use or for sale.

30/ Proposed Practices for Economic Analysis of River Basin Projects, Report to the Inter-Agency Committee on Water Resources, Prepared by the Subcommittee on Evaluation Standards, May, 1958. See particularly pp. 7-10.

Secondary Costs.--From a regional viewpoint, they include only those costs incurred in secondary activities.

Extra Market Benefits.--These are benefits which cannot be or are not evaluated in monetary terms. They have been called intangibles, indirect benefits and public or social values. Referring to such benefits as extra-market would appear to provide a term which cannot be misinterpreted. ^{31/} An example of extra-market benefits would be the improvement of scenic and recreational resources.

The Subcommittee prefers to use the terms "primary" and "secondary" rather than "direct" and "indirect" in referring to costs and benefits. "Direct" and "indirect" are more commonly used however, and will be used in this report.

Project justification is the process by which it is decided whether a proposed project should or should not be built. The decision generally rests on two estimates; one being the annual cost of financing and operating the project and the other, the annual benefits derived from the project. A comparison of these two estimates is referred to as the benefit-cost ratio. If the annual cost is greater than the annual benefit, then the proposed project will most likely not be constructed. The methods used in making these estimates very often determine whether an area will enjoy future growth and development or future stagnation.

In analyzing the cost side of the benefit-cost ratio, it will be noted that the annual portion of construction costs is determined by dividing the number of years in the amortization period into total construction costs. Any change in this amortization period will greatly affect the ratio and therefore, whether a particular project would be constructed or not.

It has been the government's official rule and practice that the life

^{31/} Roy E. Huffman, Extra-Market Values in Irrigation Development, Report No. 0 of the Committee on the Economics of Water Resource Development, Ogden, Utah, December, 1951, p. 73.

of a reclamation project cannot be assumed to be greater than 50 years and that to consider any useful service beyond that period would be highly speculative. It has also been the practice of state agencies to limit the amortization period to 50 years or less.

Many leaders in water resource development feel that this 50-year limitation is very unrealistic. The President of the National Reclamation Association, in a recent speech, 32/ pointed out that it is sheer foolishness to claim that a project will have a useful life of only 50 years. There are in the United States 21 Federal projects that are now more than 50 years old, and every one of them is flourishing and still gathering impetus. He states that a realistic estimate would often be 100 years or more--rather than 50 years, and that by using a realistic rather than an arbitrary estimate of project life, many a project now doomed to rejection could be justified and built. If construction costs are divided by 100, a smaller annual cost is obtained than when divided by 50, and annual project benefits which were insufficient when compared with a fictional 50-year cost figure, are now sufficient to justify construction of the project. It is of extreme importance that resource-development proposals be evaluated on a sound and factual basis and that a more realistic estimate of project life be considered.

On the benefit side of the ratio there appears need for reform also. It has been the practice to largely ignore any benefits except those derived in the actual project area, giving little, if any, weight to such indirect benefits as the growth of trade and markets, the creation of jobs, the production of tax revenues, and the stabilization and diversification of regional economics. 33/

32/ LaSalle E. Coles, Two Big Issues, Proceedings of the Thirtieth Annual Meeting of the National Reclamation Association, Billings, Montana October 19-21, 1961, pp. 34-39.

33/ Ibid.

There has been considerable controversy centered around the problems associated with indirect benefits. The question of whether or not indirect benefits normally occur from a National point of view will be ignored in this report, and attention directed towards the existence of local and state indirect benefits.

There is no doubt but what significant local and state indirect benefits result from water resource development projects. If excess capacity or unemployment exist, the project then affords a more efficient use of these local resources. If marketing and processing facilities are inadequate to handle the products from the project, then outside resources will be attracted to the area, which, in turn, will stimulate economic activity and create many "stemming from" indirect benefits.

Considerable "induced by" indirect benefits result from the expenditures of the project producers. There will be an increased demand for production supplies such as machinery, fuel, irrigation equipment and seed. This means either increased volume for the local dealers or the establishment of new businesses. Consumption expenditures will be greatly increased also. Not only will there be additional spending from the primary producers, but from those who supply the producers and those who process the products as well. This requires more food, clothing, housing, and transportation facilities; more of everything necessary in satisfying the wants and desires of the consumers.

The population would normally increase, employment opportunities be expanded, and the tax base broadened. An increased demand would exist for schools, medical and hospital services, roads, churches, law enforcement facilities, etc.

There is little doubt that these indirect benefits are very real and important from a local or state viewpoint. People familiar with water development projects know that these indirect benefits often form the most valuable returns from an irrigation project. If project appraisal is to be realistic, factual, and sound, an adequate computation of indirect

benefits must be included in estimating the total anticipated benefits of a project. ^{34/}

Many worthwhile potential projects which could contribute importantly to the prosperity of the local area, the state, and the nation are condemned to death by these unrealistically high cost estimates and low benefit estimates.

Measurement of Indirect Benefits

One of the earliest studies in the measurement of indirect benefits was conducted on the Bureau Project at Payette, Idaho. ^{35/} Mr. Marts studied an area which, in the absence of irrigation, would not support commercial agriculture. He computed, as nearly as possible, the net farm income and return to labor for the agricultural sector. He then computed the net non-farm entrepreneurial, property and labor income. From these two net income figures he was able to calculate a ratio of direct to indirect project benefits, and also a multiplier factor. He defines the multiplier as the ratio between total local benefits and direct benefits. The ratio of direct to indirect benefits was 1 to 1.27 and the multiplier factor 2.27 to 1. These two ratios show that for each \$1.00 of net farm income and labor payments there will be created \$1.27 of net non-farm income in the area, and that \$2.27 of total local benefits will be created for each \$1.00 of direct benefits.

In measuring the contribution of an irrigation project to the local economy, this study has been of considerable value. In regard to the importance of these indirect benefits, Mr. Marts concludes that "the indirect benefits are such an important portion of total benefits that they must

^{34/} Ibid.

^{35/} M. E. Marts, An Experiment in the Measurement of the Indirect Benefits of Irrigation-Payette, Idaho, Bureau of Reclamation, Boise, Idaho, June, 1950.

be taken into account in any valid appraisal of the economic aspects of resource development. 36/

Another study designed to measure the quantitative significance of indirect benefits was conducted by the Montana State College Agricultural Experiment Station. 37/ In this study, consideration was given to the local relationships of direct and indirect benefits. They investigated numerous means of measuring the effect of irrigation development on local business activity. From these investigations, it was concluded that "the ratio of farm to non-farm workers was discovered to be the most satisfactory measure and is recommended as the best method for determining the general relationship between farm and non-farm earnings in a given locale". "It is a relatively simple concept, and an adequate supply of secondary data is available to facilitate its computation." 38/

In computing these ratios, it was found that the ratio for irrigated areas was much greater than for dryland. If a ratio of one to one represents the dryland areas, the irrigated areas would have a ratio of 1.3 to 1.4. The steps involved in calculating indirect benefits using this ratio is shown in the hypothetical model outlined in Table I.

36/ Ibid., p. 42.

37/ Helmer C. Holje, Roy E. Huffman and Carl F. Kraenzel, Indirect Benefits of Irrigation Development--Methodology and Measurement, Technical Bulletin 517, Agricultural Experiment Station, Montana State College, Bozeman, Montana, March, 1956.

38/ Ibid., pp. 19-20.

TABLE I. HYPOTHETICAL MODEL ILLUSTRATING THE CALCULATION OF THE NONFARM AND THE TOTAL POPULATION FROM AN ASSUMED FARM POPULATION; THE TOTAL NUMBER, EARNINGS, AND PERCENT OF WORKERS BY INDUSTRY; AND THE NUMBER OF FIRMS AND GROSS SALES OF THE RETAIL, WHOLESALE, AND SERVICE TRADES.

I. To determine the nonfarm and total population from an assumed farm population.			
A. Assumed farm population			5,000
B. Multiply by nonfarm ratio factor <u>a/</u> (1.35, see text, p. 27)			6,750
C. Add A and B to secure total population			11,750
II. To determine the total number of nonfarm workers, their earnings, and the number of workers in major industries.			
A. Multiply nonfarm population by percent of population in labor force (approximately 36 % for areas studies in 1950)			2,430
B. Multiply number of nonfarm workers by median wage reported in U.S. Census for area of interest (Mont. \$2,837)			\$6,893,910
C. Multiply total number of nonfarm workers by percent of workers in each industry.			
Manufacturing and construction	(22%)		534
Utilities and transport	(9%)		219
Retailing and wholesaling	(32%)		778
Business and professional services	(37%)		899
III. To determine the number of retail, wholesale, and service stores and the total gross sales of each trade.			
A. Divide total population by inhabitants per store index	Retail	Wholesale	Service
	162	44	36
B. Multiply number of stores as given in A by gross sales per store index	\$10,935,000	\$13,662,352	\$297,288

* Source: Helmer C. Holje, Roy E. Huffman and Carl F. Kraenzel, Indirect Benefits of Irrigation Development--Methodology and Measurement, Technical Bulletin 517, Agricultural Experiment Station, Montana State College, Bozeman, Montana, March, 1956.

a/ This ratio is indicated in the text as a variable and the value chosen would need to be analyzed in the light of the growth of the area of interest. This is likewise true of the average gross sales value. The other factors might be thought of as constants for particular type of areas. Again it would be necessary to select the proper "type" factor.

These studies have shed considerable light on the importance of indirect benefits and have proven to be landmarks in the difficult task of measuring these benefits. Additional studies need to be made, however, and improved methods of measurement derived in order that the value of indirect benefits be fully recognized and weighted properly in benefit-cost analysis.

A uniform basis for attributing costs and benefits to a project is needed in order that the results be comparable. The basis generally accepted is the "with" and "without" approach. This involves a careful analysis of conditions expected to prevail both with and without the project, in which the differences in expectations provide the basis for determining the effects of the project.

In order to make meaningful comparisons, diverse effects must be converted to a common value basis. Monetary estimates constitute the best means of expressing these diverse physical effects in terms that are subject to comparison.

The problem exists, in benefit-cost analysis of determining just what prices should be used in computing benefits and costs. The Subcommittee on Evaluation Standards summarized its recommendations on prices to be used as follows: 39/

In order to satisfy the various purposes to be served by benefit-cost analysis, the use of prices reasonably expected to prevail at the time costs are incurred and at the time benefits are realized, in terms of a constant general price level, is recommended. Projected prices for the period of analysis should be used as the basis for evaluating project benefits, as well as all costs of operation, maintenance, replacements and deferred construction and installation. Long-term projected prices are also considered appropriate for estimating initial investment costs when the time for installation or construction of the project is deferred or indefinite. In this case it it may be desirable to present the estimates of initial

39/ Proposed Practices for Economic Analysis of River Basin Projects, Report to the Inter-Agency Committee on Water Resources, Prepared by the Subcommittee on Evaluation Standards, May 1958, pp. 21-22.

investment costs on a current price basis also. The projected general price level should reflect high employment conditions and stability in the long-term value of the dollar. For projects or portions of a program expected to be placed under construction at an early date, prices current at the time of the analysis should be used in estimating construction and installation costs. It may be useful to supplement current cost estimates with costs based on long-term projected prices.

When benefits are expressed in terms of the cost of a justifiable alternative source of the benefits, the prices for the alternative costs should be the prices expected to prevail at the time the alternative costs would be incurred.

This method of determining prices to be used is followed by almost all agencies and groups involved in water resource development.

The sum of the direct and indirect benefits expected to accrue with the project, minus those that would normally be expected to accrue without the project are referred to as the "project benefits". It is the average annual equivalent of this benefit figure that is used in the benefit-cost ratio.

In order to compare benefits with costs, both are normally converted to an average annual basis. The annual equivalent cost of the project includes installation costs, replacement costs, and operation and maintenance costs. The complete installation cost is amortized over the evaluation period to obtain an annual equivalent installation cost. The interest rate used will depend upon the source of the installation funds. Replacement costs include those replacements which will be necessary during the evaluation period. The costs (using projected long-term prices) of replacements needed during the period may either be included as part of the operation and maintenance costs, or be brought to the present value using appropriate interest rates, and amortized over the evaluation period. The operation and maintenance costs should include all the costs necessary to operate and maintain the project. They are usually either estimated as a percent of

the installation cost, or determined by estimating the amount of materials and labor that will be required. The operation and maintenance costs are based on long term projected prices and set up on an average annual basis.

The annual cost figure, then, in the benefit-cost ratio, is the sum of the annual equivalent costs for installation, replacement, and operation and maintenance.

If the annual project benefits were twice the annual costs, that project would have a benefit-cost ratio of two to one. Any project which has a ratio in excess of one to one would be considered economically feasible.

There are, however, certain extra-market benefits and costs which result from development projects which cannot be valued in monetary terms. These extra market effects need to be described with care and should not be overlooked or discredited, merely because they cannot be assigned dollar values.

Water resource development should be formulated and evaluated in such a way that the excess of benefits over costs is maximized. In choosing between and among alternative projects and programs, the emphasis must be on net benefits if the maximum in market values is to accrue as a result of expenditures for the development of water resources. ^{40/} Net benefits will be maximized at the point at which benefits and costs of incremental segments are equal.

Through proper project formulation, the problem of evaluation is greatly reduced. A project is properly formulated and economically justified if: ^{41/}

^{40/} Roy E. Huffman, Irrigation Development and Public Water Policy, New York, The Ronald Press Company, 1953, p. 197.

^{41/} Proposed Practices for Economic Analysis of River Basin Projects, Report to the Inter-Agency Committee on Water Resources, Prepared by the Subcommittee on Evaluation Standards, May, 1958, p. 15.

- (1) Project benefits exceed project costs;
- (2) Each separable segment or purpose provides benefits at least equal to its costs;
- (3) The scale of development is such as to provide the maximum net benefits; and
- (4) There are no more economical means of accomplishing the same purpose which would be precluded from development if the project were undertaken.

If development funds are limited, extending the scale of development to the point at which incremental benefits and costs are equal, may not be justified. If this is the case, the objective should be to maximize net returns from the limited funds.

Methodology

Location of Study

The three State water development projects analyzed in this report are:

- (1) The Broadwater-Missouri Project at Toston and Townsend in Broadwater County.
- (2) The Ruby River Project, servicing the Alder, Laurin and Sheridan areas in Madison County.
- (3) The North Fork of the Smith River Project at White Sulphur Springs in Meagher County.

Objectives

To determine the impact of the development of water projects in Montana upon the economic position of groups and individuals concerned with these projects.

- (a) Relate the costs of developing the projects to the change in land values, land productivity, labor income and related economic measurements.
- (b) Relate the project developments to the indirect benefits accruing to the community serving the project farm operators.

- (c) Relate the project developments to the change in the tax base, the returns to the county and state in increased taxes; business activity, and expanded economic activity in the state.

Procedure-

The personal survey method of research was used in this study. Water Users on each project were personally contacted and interviewed with the aid of a formal questionnaire. Information concerning land values, acreages of various crops raised, yields per acre, amount and sources of irrigation water used, and conditions as they existed without the project were obtained. Interviews were also conducted with local businessmen, bankers, managers of Soil Conservation Service and Agricultural Stabilization and Conservation offices, as well as county and town officials.

Information on the history of the Board, costs incurred, water rights sold and related data dealing with the individual projects were obtained from the Montana State Water Conservation Board.

CHAPTER III

AN ANALYSIS OF THREE STATE WATER PROJECTS

Broadwater-Missouri Diversion Project

The Broadwater-Missouri Diversion Project consists of an overflow gravity type concrete diversion dam across the Missouri River about five miles above Toston in Broadwater County. The project also includes the Main Canal and the East and West Side distribution canals. The Main Canal is one and one-half miles long, diverts directly from the West end of the diversion dam, has a capacity of 342 second feet and divides into the East and West Side Canals.

The West Side Canal has an initial capacity of 90 second-feet and extends a distance of 12.4 miles in a northwesterly direction to the lower end of the Crow Creek Valley. A very important structure contained in the West Side Canal is an inverted syphon, 1,442 feet long and 54 inches in diameter, built through a narrow section of the river canyon.

The East Side Canal, at its beginning point, crosses the Missouri River by a steel pipe line 84 inches in diameter and 667 feet long, supported by concrete piers at a height of 25 feet above the river bottom. It then runs in a northerly direction with an initial capacity of 262 second-feet. It formerly was 38.4 miles in length and terminated at Confederate Gulch with a capacity of 42 second-feet. Extreme difficulty was experienced in getting water through the last four miles. This section was abandoned and the canal now tails out into Duck Creek.

The project was designed to irrigate 21,000 acres of land and to furnish two acre feet per acre. It is presently estimated that 15,000 acres of land in the Toston and Townsend area are being served by the project.

Construction of the Project

The project was first submitted to the Board on February 6, 1934 and an application was then made to the Public Works Administration for construction funds on April 5, 1935. A memorial was adopted by the 1937

legislature urging the Board to build the project. On June 28, 1938, the Board filed on waters of the Missouri River and recorded a water right in the amount of 16,000 miner's inches. 42/ Right of way was then secured for the project.

On October 27, 1938, the Board received a Federal loan of \$900,000 to finance the building of the project. On June 19, 1940, an additional \$58,500 was authorized, making a total of \$958,500 available for the project. J. C. Boespflug, with a bid of \$529,585.10, was low bidder for construction of the dam and siphon. The contract was awarded to him subject to approval of the Public Works Administration. Before construction had gotten under way, the Montana Power Company objected to the construction of the project, claiming that it would interfere with the present water rights. It became necessary to decline the original award of the contract, since the Public Works Administration insisted that this matter be settled before it would make any funds available.

Bids were again received on May 5, 1939, with the Utah Construction Company being awarded the contract on a low bid of \$642,210.85. A contract for construction of the canals was awarded to Douglas and Gender at their bid of \$138,439.00. Included in the contract was the relocating and raising of three and one-half miles of the main line of the Northern Pacific Railway tracks. This was necessary because of the raised water level in the river channel above the dam. Construction on the contracts was started on July 1, 1939. The canals were accepted as complete on July 7, 1940, and the dam likewise was accepted by the Board as complete on November 6, 1940.

The furnishing and placing of turnouts was not included in the original contract on the canals and was subsequently done at a cost of approximately \$20,000. There has been only one major failure on the project, this being a break in the Main Canal.

42 Reference Book 3, page 75 of Water Right Records, Broadwater County.

Uncertainty of Water Supply

Additional difficulty was encountered in the early stages of this project. On May 19, 1939, just two weeks after the construction contracts had been re-awarded, officials of the Montana Power Company advised the Board that they were commencing a suit against it to prohibit the diversion of water for the project during the low flow season. The officials declined to negotiate an agreement with the Board even though the Board offered to recognize the minimum rights of the Power Company. 43/

A complaint was filed on May 23, 1939, by the Montana Power Company in the District Court of the United States for the District of Montana, Helena Division, against the Broadwater-Missouri Water Users' Association and the State Water Conservation Board and its members. The purpose of the suit was to quiet title to the plaintiff's alleged water rights at seven dams and hydro-electric plants on the Missouri River and to enjoin the defendants from interfering therewith. The prayer of the complaint asked that the defendants be permanently enjoined from constructing and maintaining the project. 44/

A Special Master was assigned to take testimony and make finding of fact and conclusions of law regarding the case. Extensive hearings were held and his report was approved by the District Court. A decree was entered on October 2, 1942, confirming in the Montana Power Company the right to the use and control of the waters of the Missouri up to a stated maximum flow necessary to operate the power plants of the Company, plus the flow requisite to keep its storage reservoirs filled. The defendants were permanently enjoined by the decree from diverting, storing, or using the waters of the river except at times when the prior demands of the plaintiff have been satisfied. The decree was appealed to the United States Circuit Court for the Ninth Circuit. 45/

43/ Robert J. Kelly, Summary of Activities of the Montana State Water Conservation Board, From Inception January 22, 1934, to June 30, 1960, p. 18.

44/ Ibid.

45/ Ibid.

The judgment and decree of the lower court was reversed by the Circuit Court of Appeals and dismissal of the suit was ordered on grounds that the Federal Court lacked jurisdiction. It was held by the Court that the State Water Conservation Board is an agency of the State and, in effect, a part thereof and that the federal district courts do not possess the right of jurisdiction of suits by or against a state. 46/

When suit was filed and it appeared that the Board might lose the case, the Public Works Administration held up funds for the project until an agreement was reached whereby the Association would purchase 10,000 acre feet of water annually from the Ruby River Storage Project. This agreement was subsequently cancelled.

Water Users' Association

Articles of Incorporation for the Broadwater-Missouri Water Users' Association were filed on November 10, 1938, with 60,000 shares of stock at \$1.00 par value being authorized. The articles state that the corporate power of the Association and the general supervision and management of its property and affairs shall be vested in and executed by a Board of Directors who are elected by plurality vote of the stockholders and hold office for one year.

In all elections for Directors, each stockholder shall have the right to vote, in person or by proxy, the number of shares standing in his name for as many persons as there are directors to be elected, or to cumulate said shares and give one candidate as many votes as the number of directors multiplied by the number of his shares of stock shall equal, or to distribute them on the same principle among as many candidates as he shall deem fit. 47/

46/ The decision of the Court is reported in 139 Fed. (2d) 998.

47/ Article I, Section 7, of the By-Laws of the Broadwater-Missouri Water Users' Association.

The Executive officers of the Association are elected by the Board of Directors and consist of a President, Vice-President, Manager, Treasurer, and Secretary. ^{48/} The term of office, like that of the Directors, is for one year, though all are eligible for re-election each year. Any two of these offices, except that of President and Vice-President, may be held by the same persons. The President is acting as Manager at the present time and the offices of Secretary and Treasurer are held by one person also.

Water Purchase Contracts

Under the Loan and Grant offer made by the Public Works Administration, it was necessary to obtain water purchase contracts for 42,000 acre feet at \$.91 an acre foot. These were thirty-year contracts and included an annual operation and maintenance charge.

Due to the question of there being sufficient available water, the Public Works Administration required that all the contracts be resigned and that they include in them provision acknowledging an obligation to purchase 10,000 acre feet of water annually from the Ruby River Storage Project.

Of the 42,000 acre feet of original contracts, it subsequently became necessary to cancel 24,955 acre feet of those due to heavy default. The factors contributing most to this high degree of default seem to be extensive outside ownership of lands, the delay in getting the project constructed and the sale of water to non-users.

Progress has been steadily made in re-selling much of this water. As of June 20, 1962, there were 144 water purchase contracts for 27,310 acre feet outstanding.

Approximately 3,800 acre feet of water subscribed for under the project is exchanged for regular stream flow in Deep Creek. This type of arrangement enables many above the canal to also benefit from the project. In 1957 this arrangement was converted into a formal agreement.

^{48/} Article V, Section 1, of the By-Laws of the Broadwater-Missouri Water Users' Association.

Operation and Maintenance

Operation and maintenance charges are presently \$.41 an acre foot per year for each acre foot of water sold. For the years 1962-64 an additional annual assessment of \$.19 an acre foot has become necessary to cover the costs incurred in completely repainting the structures of the dam during the summer of 1962. This undertaking will add to the life of the project and shouldn't need to be done again for 40 to 50 years.

Expenditures for the Project

On November 2, 1938, the Board accepted a Loan and Grant agreement from the Public Works Administration for \$900,000. Under the agreement \$495,000 in bonds were to be issued and \$405,000 was to be in the form of a grant. An additional grant of \$58,000 was authorized on June 19, 1940, making a total of \$958,500 of federal funds available for the project. The following is a report of the federal and state funds spent on the project up to June 30, 1960. 49/

	<u>Federal Funds</u>	<u>State Funds</u>	<u>Total</u>
Right of Way	\$ 26,660.77	\$ 8,286.54	\$ 34,947.31
Construction			
Contracts			
Utah Const. Co.	\$730,227.80		
Douglas and Gender	152,754.85		
N. P. Ry. Co.	8,109.35	891,092.00	891,092.00
Construction			
Other		42,195.13	42,195.13
Damtender's Salary		24,870.00	24,870.00
Ruby W.U.A.		7,800.00	7,800.00
Advances to Ass'n.		13,027.66	13,027.66
Engineering	10,572.63	103,628.88	114,201.51
Legal and			
Administration	2,124.60	16,818.36	18,942.96
Administration			
Charge		11,322.67	11,322.67
Int. during			
construction	28,050.00		28,050.00
Totals	\$958,500.00	\$227,949.24	\$1,186,449.24

49/ Kelly, Op. Cit., p. 19.

Analysis of Empirical Data

Broadwater County is primarily an agricultural county with most of its income being derived from the sale of crops and livestock. The land area of the county covers 795,520 acres. Approximately 63 percent of this amount is in private ownership. In 1962, there was 30,778 acres assessed as irrigated land, 63,499 acres of tillable non-irrigated, and 364,733 acres of grazing land.

The irrigated land has been a stabilizing factor in assuring income from the sale of cash crops and abundant winter feed for livestock.

It is claimed that Broadwater County was named after the broad Missouri River that flows through it. Much of the irrigation carried out in the county is with water diverted from the Missouri River. One of the most important of these diversion systems is the Broadwater-Missouri Diversion project.

This project is supplying irrigation water to approximately 15,000 acres of land under the Eastside and Westside Canals. This represents a primary supply to approximately 7,000 acres of new land and a supplementary supply to approximately 8,000 acres which had previously been irrigated to some extent. 50/

To save time and keep costs at a minimum, it was hoped that much of the data could be collected through group interviews. Only one group interview was held however, since most of the water users who attended were quite reluctant to give information with a group present. By contacting them personally, excellent cooperation was obtained. Some mail questionnaires were also sent out, but due to the busy harvest season, only a 30 percent response was received. They have been used primarily to supplement data obtained through personal interviews. The following analysis is based upon the farming and ranching operations of 25 project water users,

50/ These figures were obtained from the office of the State Water Conservation Board.

representing 12,062 acre feet or 44.2 percent of the total water sold on the project.

These 25 units had a total of 80,634 acres. This total comprised of 9,289 irrigated acres, 2,815 acres of dryland and 68,530 acres of grazing land. In Table II, this irrigated land is broken down according to the crops raised, acres of each, average yield and the percent of the total irrigated acres which each crop represents.

TABLE II: IRRIGATED CROPS ON 25 BROADWATER-MISSOURI DIVERSION PROJECT FARMS, BY TOTAL ACRES OF EACH CROP, PERCENT OF TOTAL ACREAGE, AND AVERAGE YIELD PER ACRE.

Crops	Acres	Percent of Total	Average Yield/acre
Alfalfa	4,665	50.2	3.3 T
Pasture	1,667	17.9	5 AUM
Sugar Beets	600	6.4	14.3 T
Wheat	426	4.6	38.4 Bu.
Oats	405	4.4	60.3 Bu.
Grass Hay	398	4.3	2.3 T
Feed Grain-Mix	315	3.4	60 Bu
Alfalfa-Mix	275	3.0	3.5 T
Barley	181	1.9	43.9 Bu.
Potatoes	167	1.8	160 Bu.
Summer Fallow	165	1.8	- -
Corn Silage	25	.3	20 T
Total	9,289	100.0	

It is significant to note that alfalfa was by far the most important irrigated crop, in terms of acres raised. It accounted for 50.2 percent of the total irrigated acres and averaged 3.3 tons to the acre. Irrigated pasture ranked next in number of acres, representing 17.9 percent of the total.

If the ratio of the total acres of each irrigated crop to the total irrigated acres, as shown in Table II, is applied to the acres being served by the project, the estimated acreages of each project crop can be determined. This is illustrated in Table III. Also shown are the estimated average

yields, prices received and gross income received from each crop raised on land served by the project.

TABLE III. ESTIMATED TOTAL ACREAGE OF IRRIGATED CROPS ON THE BROADWATER-MISSOURI DIVERSION PROJECT, WITH AVERAGE YIELDS, TOTAL PRODUCTION, AVERAGE PRICES RECEIVED AND TOTAL VALUE BY CROPS.

Crop	Acres	Ave. Yield Per Acre	Total	Price ^a /	Gross Value
Alfalfa	7,530	3.3 T	24,849	\$24.96	\$620,231
Pasture	2,685	5 AUM	13,425	4.00	53,700
Sugar Beets	960	14.3 T	13,728	12.40	170,227
Wheat	690	38.4 Bu.	26,496	1.67	44,248
Oats	660	60.3 Bu.	39,798	.59	23,481
Grass Hay	645	2.3 T	1,484	24.62	36,536
Feed Grain	510	60 Bu.	30,600	.66	20,196
Alfalfa-Mix	450	3.5 T	1,575	24.69	38,887
Barley	285	43.9 Bu.	12,512	.66	8,258
Potatoes	270	160 Bu.	43,200	2.81 ^b /	121,392
Summer Fallow	270	- -	- - -	- - -	- - -
Corn Silage	45	20 T	900	7.00 ^c /	6,300
Total	15,000				\$1,143,456

a/ Based on the average annual price received in 1960, as stated in Bulletin No. 563, Prices Received and Paid by Montana Farmers and Ranchers, 1958-60, Montana Agricultural Experiment Station and the Agricultural Marketing Service, USDA, January, 1962.

b/ Three year average price, 1958-60.

c/ Price quoted by local producers.

Of the estimated 15,000 acres being served by the project, approximately 7,530 acres were in alfalfa, 2,685 acres in pasture, 960 acres in sugar beets and the remainder in relatively small acreages of various crops, as listed in Table III.

The gross income from all crops raised on lands served by the project is approximately \$1,143,456, while the average gross income per acre is \$76.24. In order to determine the primary gross income that results from the project itself, the gross value of production that would have resulted without the project, must be subtracted from the gross income figure stated above.

Approximately 8,000 project acres receive only supplementary water through the project. This water assures the users of a crop even in the driest years, thus alleviating much risk and uncertainty. Eighteen of the 25 water users interviewed had some other source of irrigation water. Those, who used project water to supplement a previous supply, stated that on the average, crop yields were doubled as a result of the supplementary project water. If, based on this statement, we reduce gross income by one-half on these 8,000 acres, the gross income derived from the project would be \$38.12 per acre on these acres served with supplemental project water. 51/

On the 7,000 acres dependent upon the project for its complete supply, the gross income that would have been realized through the best alternative use of this land must be determined.

Most of the water users interviewed stated that dryland farming was not an economic alternative on their lands being served by the project. The sandy soils plus only sporadic rainfall makes dry farming a marginal operation. Eight of the 25 users interviewed engaged in some dry farming, though a major portion of this land being dry farmed is in areas of the county more conducive to the production of dryland crops. On those acres being dry farmed in the area of the project, production is relatively unstable and yields are considerably below the county average. With very few of these acres possessing a wheat allotment, dry farming, at its best, is quite marginal. On this basis, the best alternative use of these 7,000 acres is assumed to be grazing. Admittedly, this may not be the case for a small portion of these acres, but, inasmuch as some of the 7,000 acres yielded very little grazing prior to receiving water, it is felt that to assume grazing as the best alternative use for the total acreage will not be in serious error.

The average yield of land of similar quality, lying just above the ditch or for which there isn't sufficient water, is approximately .3 AUM's per acre. It is assumed that this would represent the average yield of

51/ The net return per acre derived from this additional water will be understated somewhat, since the marginal cost of producing the additional output is normally less.

these project acres in the absence of water. Figuring an AUM at \$4.00, gross income would then be approximately \$1.20 per acre. The gross income derived from the project, on these 7,000 acres, would then be \$76.24 minus \$1.20 or \$75.04 per acre.

The gross primary benefits, or income, derived from the project in 1961 would then be approximately \$830,240. This would consist of the 8,000 supplemental acres at \$38.12 an acre, plus the 7,000 primary acres at \$75.04 an acre.

In 1961, the net return to farm operators in the United States was 31.9 percent of gross farm income. If it is assumed that 31.9 percent of the gross income derived from the project represents the net income, then the "direct benefits" from the project in 1961 were \$264,847.

If the direct to indirect benefit ratio of 1 to 1.35 derived in the Montana State College study 52/ by Holje, Huffman and Kraenzel is used, there would be \$357,543 of indirect local benefits created as a result of the water project.

Another method of evaluating direct irrigation benefits, being strongly considered, is through the changes in land values resulting from irrigation. 53/

The average value of irrigated land, as stated by the water users, was \$193.22 an acre compared to \$51.24 for non-irrigated farm land and \$12.03 for grazing land. The value of land should represent the capitalized value of the net returns discounted over time. Nine of the 25 water users stated that they had land comparable to their irrigated land in quality, but which they could not irrigate. The average value of grazing land of similar quality was \$19.06 an acre. This difference in price of approximately \$174.00 an acre should then represent the capitalized value of the net returns of the water discounted over time.

The average yield of this grazing land of similar quality was approximately .3 AUM's per acre, while the average yield reported on irrigated pastures was approximately 5 AUM's per acre. There were some users obtaining considerably greater yields than this. Through the use of

52/ Discussed on page 27 of this report.

53/ J. W. Milliman, Land Values and Irrigation Benefits, P-1489-RC, The Rand Corporation, Santa Monica, California, September 15, 1958.

improved pasture mixes and proper rotation and irrigation, the average yield could be markedly increased.

The project has made possible the production of such cash crops as sugar beets and potatoes. This has afforded the water users an opportunity to increase their net returns per acre.

Risk and uncertainty have been greatly reduced as a result of the project. On the 8,000 acres depending upon the project for supplemental water, production has been approximately doubled. This would make the rate of return for the money invested in this additional water very high. Two crops of hay can now be raised and where only one crop is cut, abundant fall feed is available. Without this additional water, the users rarely had water for irrigation past the first of July, and on particularly dry years, little crop could be expected. These users are now assured of a crop even in the driest years. The project has added stability and balance to their operations.

The price of land was affected considerably by the construction and development of the irrigation project. Even before the project was started, land values immediately increased in anticipation of increased water supply. The availability of water is still the prime determinant of land values. This is attested by the average difference of \$174 an acre between irrigated land and grazing land of equal fertility but for which water cannot or has not been made available.

Change in Tax Base.--From the number of irrigated acres reported annually in Broadwater County, very little can be determined concerning the actual impact of the project upon the tax base.

During the 1930's and since, many acres, having very little or no water, were on the tax rolls as irrigated land. The county was subsequently forced to take tax title to many of these acres, and in so doing, reclassified most of them as grazing lands. As a result of these acres being reclassified from irrigated to grazing during the development period of the project, the addition of approximately 7,000 project acres to the irrigated

tax rolls was not greatly noticed. This timely addition of irrigated acreage was of great importance to the county however, for without it, a considerable reduction in the tax base would have resulted.

For 1962, the average assessed value of irrigated land in the county was \$34.54 per acre, compared to an average assessed value of \$11.13 for non-irrigated tillable land, and an average assessed value of \$3.42 for grazing land. ^{54/} If it is assumed that the entire 7,000 acres of new irrigated land was previously classified as grazing, then the average increase to the tax base would be approximately \$31.12 an acre, or a total of \$217,840. A more conservative estimate would be to assume that one-fourth of these acres were previously classified as non-irrigated tillable land. Based on this assumption, the increase in the tax base would amount to \$204,347, consisting of an average increase of \$23.41 per acre on 1,750 acres and \$31.12 per acre on the remaining 5,250 acres.

No attempt will be made to evaluate the indirect additions to the tax base, such as more farm machinery and equipment, improvements, etc. Also as increased direct and indirect benefits are generated, the state income tax base is broadened.

Bank Deposits.--On December 31, 1960, total deposits at the State Bank of Townsend were approximately six and one-half times what they were on the same date 20 years previous. This was an increase from \$448,086 to \$2,873,891. The actual extent to which the Broadwater-Missouri project contributed to this increase cannot be determined, though everyone questioned concerning it felt that the project was of major importance.

The bank's time deposits, demand deposits and loans outstanding for five year intervals are shown in Table IV.

^{54/} Figures obtained from Broadwater County Assessor.

TABLE IV. BANK DEPOSITS AND LOANS OUTSTANDING FOR FIVE YEAR INTERVALS, 1930-1960, AT THE STATE BANK OF TOWNSEND, MONTANA. *

Year	Time	Demand	Deposits		Loans Outstanding
			Total		
1930	\$ 238,689	\$ 290,756	\$ 529,445		\$ 383,977
1935	178,592	316,785	495,377		135,340
1940	86,884	361,202	448,086		122,725
1945	232,422	1,316,997	1,549,419		48,068
1950	427,744	1,724,861	2,152,605		275,376
1955	475,778	1,854,024	2,329,802		435,865
1960	1,034,384	1,839,507	2,873,891		256,407

* Source: This information was obtained through personal interviews with officials of the bank.

In 1960, the bank had only \$256,407 in loans outstanding. This was a decrease of approximately 40 percent from the previous five-year interval, and less even than the amount of loans outstanding in 1930. This amount could provide only a minimum of agricultural financing for such things as operational expenses, machinery and equipment, livestock and feed.

From 1940 to 1945, demand deposits made an enormous increase from \$361,202 to \$1,316,997. Time deposits also increased considerably, while loans outstanding decreased approximately 60 percent, from \$122,725 to \$48,065, during this same five-year period.

This period also marked the first five years of project operation. It is apparent that the water users were either getting their financing elsewhere or that they were sufficiently better off, having need of little credit. Some of the users stated that their capital needs exceeded the bank's loan limits, and as a result, borrowing from larger, out-of-town banks took place. A sizable share of the agricultural credit received during this development period, however, was from such agencies as the Federal Land Bank, Production Credit Association and the Farm Home Administration. These agencies were established for the purpose of granting long-term, low interest agricultural financing.

This period was also one of war; a period of greatly increased employment, rising prices and much higher incomes. It was, no doubt, these factors which contributed most to the enormous increase in bank deposits during the two decades preceding 1960. The direct and indirect benefits received from the project were also increasing during this period and, no doubt, contributed significantly to the increase in deposits.

Level of Living.--The concept of "level of living" refers to the actual living conditions of a population. It differs from the concept of "standard of living" which relates to the living conditions aspired to and which are regarded as proper or desirable. 55/

It is the average level of current consumption and utilization of goods and services that is intended to be reflected in the level of living indexes, and which constitutes the level of living concept.

The level of living of farm families in Broadwater County has been relatively favorable during the past three decades, compared to the level of living of farm families in the state as a whole and also the nation. This comparison is shown in Table V.

TABLE V. AVERAGE FARM OPERATOR LEVEL OF LIVING INDEXES.*

	1930	1940	1945	1950	1954	1959 a/
Broadwater County	98	98	111	161 b/	153 b/	140 b/
Montana	76	83	107	130	149	126
United States	75	79	100	122	140	100

* Source: Farm Operator Family Level of Living Indexes for Counties, U.S. Department of Agriculture, May, 1952, also Statistical Bulletin No. 204, March, 1957, and Statistical Bulletin No. 321, September, 1962.

a/ U. S. County average in 1959 = 100.

b/ Average of Broadwater, Meagher and Park Counties.

55/ Statistical Bulletin No. 321, Farm Operator Level of Living Indexes for Counties of the United States, 1950-59, U. S. Department of Agriculture, September, 1962, p. 6.

The Broadwater County indexes listed for 1950-59 are an average of Broadwater, Meagher and Park counties. For the years 1930-54, the indexes are in terms of a 1945 base equal to 100. The 1959 indexes are in terms of a 1959 base, where the U. S. County average equals 100.

The favorable position which this county holds can be largely attributed to the balanced livestock program and the increased production of farm crops. The Broadwater-Missouri project has significantly contributed to both of these.

Local Attitude.--The majority of the water users and local people interviewed expressed real satisfaction with the project. There were two or three who felt that each water user should have only one vote, regardless of the amount of stock he owned, and one or two felt that the water was too high-priced. With the exception of these few minor complaints, the general local opinion was one of support and praise.

The following opinions were expressed by reputable individuals concerning the project:

Robert L. Hensley, President of Broadwater-Missouri Water Users' Association.

"By the first of July, most creeks in the area are so low that very little irrigating can be done. The project has assured a crop, even on the driest years, when no crop at all would have been harvested without it. On the average, I'd say yields are about double what they would be without the water".

Walter L. and Kenneth Clark, Project Water Users.

"The value of the Valley Ranch was more than doubled by the Broadwater-Missouri Project."

Jack Smith, Project Water User.

"The State Water Board Project is supplemental water to my creek rights and is used on the same lands. It means the difference of raising a crop and not having a crop in dry years. It provides ample water at reasonable rates and is a well-managed and good working project."

Frank Hallaway, Broadwater County Assessor.

"The Broadwater-Missouri Project has contributed considerably to the tax base of this county and has done much to stabilize the local economy."

Summary and Conclusions.--1. Irrigation is of utmost importance to Broadwater County and is a stabilizing factor in assuring income from the sale of cash crops and abundant winter feed.

2. The Broadwater-Missouri Project is probably the most important irrigation project in the county. It serves approximately 15,000 acres, of which approximately 7,000 acres receive a primary supply and approximately 8,000 acres receive a supplementary supply.

3. In 1961, the direct benefits from the project were approximately \$264,847. This would represent direct benefits of \$17.66 per acre for the acres being served by the project.

4. The indirect benefits generated by the project in 1961 were approximately \$357,543. This figure was derived through use of the direct to indirect benefit ratio computed by Holje, Huffman and Kraenzel at Montana State College.

5. The average value of irrigated project land was \$193.22, while land of similar quality and fertility but which could not be irrigated, was \$19.06. The addition of water to lands of similar quality has increased their value approximately \$170 per acre. This difference in price should represent the capitalized value of the net returns to the water discounted over time.

6. The project has made possible the production of such cash crops as sugar beet and potatoes; thus affording the water users an opportunity to increase their net returns per acre.

7. Risk and uncertainty have been greatly reduced as a result of the project. Yields have been approximately doubled in normal years on those acres receiving a supplementary supply. In particularly dry years they are now assured of a crop, whereas little or no crop could have been harvested without the project water.

8. The project has contributed considerably to the tax base of Broadwater County. It is assumed that one-fourth of the 7,000 acres brought under irrigation by the project were previously classified as non-irrigated tillable lands, with the remainder classified as grazing land. On this basis, the increase in the tax base would amount to approximately \$204,347, consisting of an average increase of \$23.41 per acre on 1,750 acres and \$31.12 per acre on the remaining 5,250 acres. No attempt was made to evaluate the indirect additions to the tax base, such as more farm machinery and equipment, improvements, etc., nor the extent to which the state income tax base was broadened from the increased direct and indirect benefits.

9. The level of living of farm families in Broadwater County has been relatively favorable during the past three decades, compared to the level of living of farm families in the state as a whole and also the nation.

10. The majority of the water users and local people who were interviewed, expressed real satisfaction with the project. With the exception of a few minor complaints, the general local attitude was one of support and praise.

The Ruby River Storage Project

This project consists of a dam and storage reservoir located six miles above Alder. The reservoir has a storage capacity of 38,850 acre feet and has a drainage area above the reservoir of 560 square miles. Additional storage capacity is available by adding flashboards in the spillway. The reservoir covers an area totaling 1,143 acres and forms a lake three miles long. The project was set up to furnish a full water supply for 14,000 acres of land and a supplemental supply for approximately 20,000 acres along both the Ruby and Jefferson River Valleys. Of this amount, 10,500 acres are under the Vigilante and West Bench Canals. Water for storage on the project is covered by a water filing on the Ruby River and its tributaries under date of September 11, 1936.

As in all of its Public Works Administration applications, the Board had to certify that facilities existed to use the water on the lands of the project and that no new lands would be irrigated. The Board was not able to get funds for a project such as this without so certifying. This required the Board to provide money from its own funds to build canals when it was later determined that sufficient facilities did not exist. It was found that in order to supply water for a large irrigable area in the vicinity of Alder and Sheridan that construction of these canals would be necessary for proper distribution of the water. This resulted in the construction of the short Main Canal which then divides into the Vigilante and West Bench Canals. To administer operation of these canals, separate associations were formed for each of them and will be considered later in this report.

This project was presented to the Board on August 15, 1934, and thus was one of the first projects of the Board.

Construction of the Dam

On October 16, 1936, the State Water Conservation Board received a Federal loan offer which called for the construction of an earth-filled dam and appurtenances at an estimated cost of \$520,000. Of this amount, \$234,000 was to be in the form of a grant and the remaining \$236,000 as a loan, evidenced by Water Conservation revenue bonds.

Bids for construction of the dam were received on December 19, 1936. Tomlinson and Arkwright submitted the low bid of \$336,561.10 and received the contract. They began construction on January 11, 1937, but later ran into financial difficulties which resulted in a termination of their contract on January 19, 1938. The dam was only approximately 80 percent complete at this time and was in peril from high water. The Board ordered its own forces to do such work as was deemed necessary to protect the structure. After considerable negotiation with the Seaboard Surety Company, the bondsman for the contractor, a new contract was entered into with them for completion of the dam. This was signed on May 4, 1938, with the agreement

that the Board would withdraw the construction of the spillway from the contract and use \$24,000 of project funds to sponsor a Public Works Administration project to complete the spillway.

With the Board furnishing sponsor funds and the Public Works Administration contributing services and materials to the extent of \$105,496.07, the spillway was completed.

In 1956 a new leaf was installed in one of the gates on the outlet works and in 1957 an expenditure of \$21,000 was necessary to make repairs to the dam as it was discovered that considerable sloughing of the rip rap had taken place.

Water Users' Association

The Ruby River Water Users' Association was organized and incorporated December 22, 1936. Sixty thousand shares of stock at \$1.00 par value were authorized to be issued and stipulations set forth that management of the corporation would be in the hands of five directors. ^{56/} The secretary of the project also acts as its manager. He provides these same services for the Vigilante, and West Bench Projects also. The cost of his services are allocated 50 percent to Ruby Storage, 30 percent to the Vigilante Canal and 20 percent to the West Bench Canal.

Water Purchase Contracts

On its other projects the Board had made a policy of selling water to business people, ditch companies, lessees and tenants in addition to those who actually held title to the lands. On the original loan and grant offer made by the government for this project, a requirement was made that all water users must either own the land or have a contract to purchase and also that they have accessible facilities for delivery of the water. Much correspondence was necessary to get this provision modified to meet the Board's policy.

^{56/} For information as to election of directors, terms of office, their responsibilities, officers of the Corporation, etc., see Broadwater-Missouri Water Users' Association, p. 37 of this report, as the by-laws governing these corporations are primarily the same.

In the signing of the contracts it was found that about 30,000 acre feet was all that could be sold in the upper valley and that the before-mentioned canals would be needed to use 16,000 acre feet of this water. While the Board was in the process of signing up the water, the local people made an application to the Reconstruction Finance Corporation for \$100,000 to build the needed canals. The Public Works Administration had allowed construction to proceed on this project without having the water purchase contracts signed up. Upon receiving the application from the local people, the Reconstruction Finance Corporation immediately forwarded it to the Public Works Administration which in turn ordered all projects of the Board being financed by them to be shut down. They then charged that the Board had been concealing facts and wrongfully certifying that facilities for the projects were available. It was not until Board members had made a trip to Washington and got the matter straightened out that funds were released and construction again continued.

The Public Works Administration reduced the amount of bonds it would buy from the Board by \$71,000 since only 30,000 acre feet of water had been sold. They did agree, however, to purchase an additional \$7,000 of bonds for each additional 1,000 acre feet of water the Board was able to sell. It was right at this time that the Montana Power Company was questioning the availability of sufficient water for the Broadwater-Missouri Project. Each project was able to aid greatly in solving the other project's problems. It will be recalled that the Public Works Administration agreed that the Broadwater-Missouri Project could proceed with construction if the Board would furnish an additional 10,000 acre feet from the Ruby Storage Project. By selling this 10,000 acre feet of water to the Broadwater-Missouri Water Users' Association, the Board was then able to sell the remaining \$71,000 of bonds on the Ruby Project. Funds were advanced by the Board to pay the principal payment on this contract for one year and also to cover the operation and maintenance charges for two years.

The Board entered into an agreement with the Reconstruction Finance

Corporation on July 6, 1950, to renegotiate the water purchase contract on the project. The terms of the agreement required of the Board as follows: To bring legal proceedings to enforce payments on all contracts; to enter into contracts only with land owners or purchasers of land; to request that a water commissioner be appointed on the river each year, and that new contracts after September 7, 1950, be for a term of 40 years at \$.75 per acre foot except where the Board built the new facilities. On those facilities constructed by the Board the water could continue to be sold at \$.56 per acre foot, as it had been since the beginning of the project. ^{57/} In fulfilling this agreement it became necessary to cancel 26,555 acre feet of contracts, which was approved by the Reconstruction Finance Corporation on September 7, 1950. This left only 15,995 acre feet in force. The amount of water sold has steadily increased since that time and despite the cancellation of 2,285 acre feet of contracts in 1959 due to the inability to get the water through the Vigilante Canal, there is outstanding as of June 20, 1962, 154 contracts for 24,865 acre feet.

Operation and Maintenance

Operation and maintenance charges for the storage reservoir are administered under the Ruby River Water Users' Association. The operation and maintenance charges are presently \$.20 per acre foot with the principal payment on the dam running \$.56 per acre foot on the original contracts. This principal payment plus the operation and maintenance charges are assessed to the members of the Vigilante Water Users' Association and the West Bench Canal Users' Association in addition to their charges under their own associations.

Expenditures for the Project

To finance the project, the Board accepted a Loan and Grant offer of \$520,000 from the Public Works Administration on October 22, 1936. This

^{57/} Kelly, Op. Cit., p. 34.

agreement provided for the purchase of \$286,000 in bonds and a grant of \$234,000. Inasmuch as construction was started before the water purchase contracts were signed up, the Board was faced with considerable financial difficulty. By the time sufficient federal funds were made available, the Board had invested \$155,000 of its own funds in contractors' construction estimates, right of way, etc.

Before the Public Works Administration would purchase any of the bonds, the Board had to pass a resolution that it would not withdraw from federal funds any of the money it had spent for right of way, engineering, construction, legal or administrative costs until all other costs had been paid. As mentioned earlier, the Board also had to pass an irrevocable resolution that it would construct the Vigilante canal. On the basis of these resolutions, and the 30,000 acre feet of contracts that now had been signed, the government purchased \$215,000 in bonds on December 8, 1937. The remaining \$71,000 of the bond issue was purchased on May 17, 1940, when 10,000 acre feet of water was sold to the Broadwater-Missouri project.

Following is a financial statement, as of June 30, 1960, showing expenditures for the project and the source of these funds: 58/

	P.W.A. Fed. Funds	W. P. A. Fed. Funds	State Funds	Total
Lands and Right of Way	\$ 82,080.63		703.91	\$ 82,784.54
construction Contracts:				
Tomlinson & Arkwright	314,409.83		27,151.91	341,561.74
Seaboard Surety Co.	58,048.58			58,048.58
Other Construction	36,267.98	\$105,496.07	78.496.97	220,261.02
Engineering	24,944.46		19,956.92	44,901.38
Legal & Administrative	2,282.47		4,037.41	6,319.88
Administration Charge			12,176.31	12,176.31
Trustee Fees	1,416.61			1,416.61
Interest	549.44			549.44
Total	\$520,000.00	\$105,496.07	\$142,523.43	\$768,019.50

58/ Ibid., p. 35.

The Vigilante Canal

This portion of the Ruby Project is located on the East side of the valley in the Alder, Laurin and Sheridan areas. It diverts its water from the main diversion canal by means of a siphon across the Ruby River. The Main Canal is .8 of a mile long and has a capacity of 210 second feet. The Main Canal also supplies water for the West Bench Canal Project. As originally constructed, the Vigilante Canal was 20.3 miles in length with a capacity of 110 second feet, terminating in the area of Sheridan. In 1955, it was extended 5.5 miles and now terminates north of Sheridan at Wisconsin Creek. Seven thousand five hundred acres can be served by this canal, which is referred to both as the Vigilante Canal and the East Side Canal.

When it became evident that this canal would have to be constructed, the local people made application to the Reconstruction Finance Corporation for funds to build the canal. Their application was denied and all Board projects being financed by the Public Works Administration were ordered to shut down. To meet the terms of the Public Works Administration, the Board passed an irrevocable resolution certifying that it would build the canal. Since the construction of the Ruby Storage Project was dependent upon the Board resolving to construct the canals itself, and since they are so vital to the success of the project, they are considered integral parts of the Ruby River Storage Project.

Construction of the Canal.--On July 13, 1943, the construction of the Vigilante Canal was authorized, the work to be carried on by the Board's own equipment. The Board then proceeded with construction of the canal, having it in operating shape for the 1946 irrigation season. It was later determined that a diversion dam was needed to insure water supply for the two canals and that a number of turnouts should be replaced also.

A contract to build the diversion dam was let on September 1, 1949, to Madsen Brothers in the amount of \$27,518. This contract was accepted as complete on March 4, 1950. A contract was also awarded on September 1, 1949,

to W. N. Cocoanaugher for the installation of turnouts. The contract was completed on July 6, 1950 and was in the amount of \$24,829.23.

These contracts applied to both canals and the costs were allocated 55 percent to the Vigilante Canal and 45 percent to the West Bench Canal.

The Board awarded a contract to the Long Construction Company for the construction of the extension to the Vigilante Canal. This contract was in the amount of \$99,800.43 and was completed in 1955.

Water Users' Association.--On November 6, 1943, the Articles of Incorporation for the Vigilante Water Users' Association were filed with 25,000 shares of stock at \$1.00 par value being authorized. The articles provided that the corporation be managed by five directors. They work on a cooperative basis with the Ruby Storage and West Bench Canal directors.

Water Purchase Contracts.--The project was to be financed through the sale of 15,000-acre feet of water at \$.40 an acre foot per year. These original contracts were for a period of 40 years but since 1954, all contracts are based on a 50-year repayment period. It was recently necessary to cancel 2,285 acre feet of contracts and there remains outstanding, as of June 20, 1962, 85 contracts for 11,940 acre feet of water.

Operation and Maintenance.--The association levied operation and maintenance charges of \$.33 per acre foot for many years. In 1959, \$.40 was levied and in 1960 this was increased to \$.50 per acre foot. The Vigilante Canal's share of the operation and maintenance charges for the main canal are included in this figure.

Expenditures for the Project.--Considerable difficulty was experienced in raising funds to build this project. The Board first offered to issue \$100,000 of its bonds and finance \$25,000 of them from its own funds. The local people were unable to find buyers for their share of the bonds however, and an application was subsequently made to the Public Works Administration for the necessary funds to build the project. This did not prove successful so the Board then tried to get a grant only allowance from them to build the project. When this too was turned down, the Board then made application

to the Works Progress Administration to furnish labor and materials for the project. This too failed to work out, as funds were never made available to carry on the work under this program. Construction of the Canal was finally gotten underway in 1943, with the State supplying the necessary funds.

The following is a statement showing the expenditures under both the original canal and the extension as of June 30, 1960: 59/

	<u>Vigilante Canal</u>	<u>Vigilante Extension</u>	<u>Total</u>
Right of Way	\$10,105.65	\$ 5,589.15	\$ 15,694.80
Construction Contracts		106,241.57	106,241.57
55 percent of cost of Main Canal and Structures	33,059.04		33,059.04
Other construction costs			
Labor	87,663.77	7,839.96	95,503.73
Materials	38,505.94	720.64	39,226.58
Equipment Hired	30,470.55		30,470.55
Engineering and Supervision	28,149.26	17,565.72	45,714.98
Legal and Admin.	462.50	15.50	478.20
Total	<u>\$228,416.71</u>	<u>\$137,972.54</u>	<u>\$336,389.25</u>
Credits by			
Collection, etc.	41,383.10		41,383.10
June 30, Book Balance	<u>187,033.61</u>	<u>\$137,972.54</u>	<u>\$325,006.15</u>

The West Bench Canal

This project serves lands on the west side of the Ruby River in the vicinity of Alder and Laurin. The West Bench Canal is 11.3 miles in length and has a capacity of 100 second feet at its beginning. It uses the same main canal from the Ruby River as the Vigilante Canal and was designed to supply full irrigation to 3,000 acres. Irrigation water was first delivered through the canal in 1945.

Construction of the Project.--The Board first agreed to build the West Bench and Vigilante Canals in 1937 but construction was not authorized and

gotten underway until July 13, 1943. ^{60/} The Board's own forces and equipment did all the excavation work for the canal. Contracts were let on September 1, 1949, for the construction of a diversion dam and for the installation of turnouts. Madsen Brothers constructed the diversion dam at a cost of \$27,518 and the turnouts were installed by W. N. Cocoanaugh for \$24,829.23. These contracts were completed by July, 1950. Forty-five percent of the cost of these two contracts was charged to the West Bench Canal and 55 to the Vigilante Canal, since the contracts applied to both.

Water Users' Association.--Articles of Incorporation for the West Bench Canal Users' Association were filed on September 30, 1943. Twenty-five thousand shares of stock at a par value of \$1.00 per share were authorized, with management of the project to be carried out by three directors, as provided by the Articles. These directors work through a cooperative arrangement with the Ruby River and Vigilante Water Users' Associations for more efficient operation of the entire project.

Water Purchase Contracts.--As of June 20, 1962, there was outstanding 43 water purchase contracts in the amount of 8,175 acre feet. These contracts are for 50 years with an annual payment of \$.33 per acre foot. The right of way of several existing canals were used in building this canal and resulted in the signing of several special contracts for use of the canal. For a nominal annual fee, to aid in the operation and maintenance of the project, these individuals are permitted to use the canal for the delivery of their decreed water.

Operation and Maintenance.--The association has levied an operation and maintenance charge of \$.20 per acre foot since 1950. This was increased to \$.25 in 1962. The operation and maintenance costs of the Main Canal and the diversion dam are shared on a 50-50 basis between the Vigilante and West Bench Canals. The operation and maintenance charges levied by each associ-

^{60/} For a description of the difficulties involved in raising funds to construct these canals, see "Expenditures for the Project", pp. 58 of this report.

ation include their share of these costs.

Expenditures for the Project.-- The following is a financial report of the project as of June 30, 1960, showing the cost of the project and the Board's present investment in it: 61/

Right of Way	\$ 95.69
Construction Contract:	
45 percent of Main Canal and Structures	29,064.15
Other Construction	
Labor	35,976.03
Materials	17,852.71
Equipment Hire	20,684.39
Administration	348.92
Engineering and Supervision	13,717.90
Total	<u>\$117,739.79</u>
Repayment to Date	<u>31,496.85</u>
June 30, 1960, Book Balance	86,242.94

Analysis of Empirical Data

Agriculture is the principal source of income in Madison County. The majority of this income is derived from the sale of livestock. In 1960, the county assessor's office listed 55,528 head of sheep, 50,219 head of beef cattle, and 1,009 head of dairy cattle. Some swine are also raised. The total assessed value of all livestock in the county was \$3,698,918 for 1960.

The county has a total land area of 2,259,200 acres. In 1962, there was 89,777 acres assessed as irrigated land, 8,947 acres of non-irrigated tillable lands and 938,923 acres of grazing land. 62/

The Ruby River is one of the most important sources of irrigation water in the county. This river is formed by drainages from the Gravelly, Snow Crest, and Green Horn Ranges in the southern portion of the county. The Ruby flows in a northerly direction to the Beaverhead River and is the source of water for the Ruby River Storage Project. This State Water Conservation

61/ Kelly, Op. Cit., p. 100

62/ These figures were provided by Madison County Assessor's office.

Board Project supplies supplemental water for approximately 20,000 acres, and provides a primary supply for approximately 13,000 acres which would otherwise be dryland, making a total of approximately 33,000 acres being served by this project.

The data presented in the following analysis were obtained primarily through personal interviews. A small number of mail questionnaires were also sent out. The information received from these was used to supplement data already obtained.

This analysis is based upon the farming and ranching operations of 28 project water users, representing 12,170 acre feet or 48.9 percent of the total water sold on the project.

These 28 units had a total of 89,345 acres, of which 11,047 were irrigated, 545 dryland, and 77,753 acres of grazing lands. The irrigated land is broken down in Table VI according to the crops raised, acres of each, average yield and the percent of the total irrigated acreage which each crop represents.

TABLE VI. IRRIGATED CROPS ON 28 RUBY RIVER PROJECT FARMS, BY TOTAL ACRES OF EACH CROP, PERCENT OF TOTAL ACREAGE, AND AVERAGE YIELD PER ACRE.

Crops	Acres	Percent of Total	Average Yield Per Acre
Alfalfa-Mix	3,585	32.4	2.03 T
Alfalfa	2,276	20.6	2.5 T
Grass Hay	1,882	17.0	1.6 T
Pasture	1,742	15.8	4 AUM
Barley	537	4.9	49.4 Bu.
Oats	440	4.0	64.5 Bu.
Wheat	285	2.6	51.5 Bu.
Summer Fallow	180	1.6	
Alfalfa Seed	<u>120</u>	<u>1.1</u>	100 Lbs.
Total	11,047	100.0	

In terms of acres grown, alfalfa-mix was the most important irrigated crop, representing 32.4 percent of the total acres with an average yield of 2.03 tons per acre. Alfalfa was next with 20.6 percent of the total acres and an average yield of 2.5 tons per acre. The fact, that the four most important irrigated crops consist only of hay and pasture, points out the importance of livestock production in the local economy.

If the ratio of the total acres of each irrigated crop to the total irrigated acres, as shown in Table VI, is applied to the acres being served by the project, the estimated acreages of each project crop can be determined. This is shown in Table VII, along with the estimated average yields, prices received, and gross income received from each crop raised on lands receiving water from the project.

TABLE VII. ESTIMATED TOTAL ACREAGE OF IRRIGATED CROPS ON THE RUBY RIVER PROJECT, WITH AVERAGE YIELDS, TOTAL PRODUCTION, AVERAGE PRICES RECEIVED AND TOTAL VALUE BY CROPS.

Crops	Acres	Ave. Yield Per Acre	Total	Price a/	Gross Value
Alfalfa-Mix	10,692	2.03 T.	21,705	\$24.69	\$535,896
Alfalfa	6,798	2.5 T.	16,995	24.96	424,195
Grass Hay	5,610	1.6 T.	8,976	24.62	220,989
Pasture	5,214	4 AUM	20,856	4.00 b/	83,424
Barley	1,617	49.4 Bu.	79,880	.66	52,720
Oats	1,320	64.5 Bu.	86,328	.59	50,933
Wheat	858	51.5 Bu.	44,187	1.67	73,792
Summer Fallow	528				
Alfalfa Seed	<u>363</u>	100.0 Lbs.	36,300	.25	<u>9,133</u>
Total	33,000				\$1,451,082

a/ Based on the average annual price received in 1960, as stated in Bulletin No. 563, Prices Received and Paid by Montana Farmers and Ranchers, 1958-1960, Montana Agricultural Experiment Station and the Agricultural Marketing Service, USDA, January, 1962.

b/ Average price stated by producers.

Approximately 10,692 acres of alfalfa-mix are raised on acres served by the project. The gross value of this hay is approximately \$535,896. Of the estimated 30,000 acres being served by the project, approximately 70 percent or 21,100 acres are in hay production, with an additional 15.8 percent in irrigated pasture. The remaining 14.2 percent consisted of small grain crops, alfalfa seed and summer fallow.

For 1961, the gross income, from all crops grown on lands served by the project, was approximately \$1,451,082. This represents an average gross income of \$43.97 per acre.

To determine the primary gross income attributable to the project for 1961, the gross value of production that would have resulted without the project must be computed, and then subtracted from the total gross income figure stated above.

In deriving the annual gross income expected to accrue in the absence of project water, the acres receiving their primary water supply from the project will be considered first. Only five, of the 28 water users interviewed, were doing any dry farming at all, and then only on a few acres. According to the water users, there just isn't sufficient rainfall in the main valley to make dry farming an economic alternative. Without water, this land would revert to dry grazing land. According to the Soil Conservation Service in Sheridan, an average yield of approximately .2 AUM's per acre could be obtained on these acres as dry pasture. The local water users stated that the average price per AUM is \$4.00. On this basis, the average gross income from these acres would have been \$.80 per acre, without the project water. The project then, has increased the average gross income per acre \$43.97 minus \$.80; or \$43.17.

There are approximately 20,000 acres which receive a supplementary water supply from the project. The majority of the users stated that in normal years, production is about double what it would be without the project. In particularly dry years, this additional water assures the users of a crop, whereas, without it little would be harvested. Assuming that production is doubled as a result of this water, then to derive the

actual gross income realized from the project itself, the average gross income per acre served by the project would have to be reduced by one-half. The average gross income attributable to this supplemental water would then be \$21.98 per acre. Inasmuch as the marginal cost of producing this additional output is normally less, the net profit per acre derived from the project will tend to be somewhat understated in the following analysis. As output per acre is doubled as a result of the additional water, net profits per acre would be more than doubled.

The total gross income derived from the Ruby project would then consist of approximately 13,000 primary acres at \$43.17 an acre and approximately 20,000 supplemental acres at \$21.98 an acre, for a total of \$1,000,810.

The net return to farm operators in the United States was 31.9 percent of gross farm income in 1961. If it is assumed that net income derived from the project also is equal to 31.9 percent of the gross income, then the "direct benefits" from the Ruby Project in 1961, were approximately \$319,258.

For each dollar of direct benefits created by a project, there are a certain amount of indirect benefits generated also. If the ratio of 1 to 1.35, as derived by Holje, Huffman and Kraenzel in a Montana State College study, 63/ is used, then approximately \$430,998 of indirect local benefits also resulted from the Ruby project in 1961.

An alternative method of evaluating direct benefits received from irrigation being strongly considered, is by the changes in land values resulting from additional water being made available.

The average value of irrigated land, as stated by those interviewed, was \$163.03 an acre, compared to \$32.59 for the few acres of dry, and \$20.31 for grazing land. The capitalized value of the net returns from an

63/ Refer to page 27 of this report.

acre of land, discounted over time, should be represented by the price of the land. Seven of the 28 users stated that they had land similar to their irrigated land in quality, but upon which they could not get water. On these acres of similar land, the average difference in price was \$153.95 per acre. This difference in price of approximately \$154 an acre should then be equivalent to the capitalized value of the net returns of the water discounted over time.

This project has greatly reduced risk and uncertainty in the area. A dry year no longer means major crop failures, for with the supplemental water, they can fill right in and are assured of a crop. On average years, their per acre production is approximately double what it would otherwise be. In addition to stabilizing the local economy, the project has enabled abundant supplies of winter feed to be produced, thereby adding balance to the livestock operations in the area.

Before the project was put in, most irrigation in the valley was from river ditches. The river would often run dry by the time it got to Sheridan, but this is not the case now. Within two or three weeks from the time the water is turned in the canals, it finds its way back into the river. The water users state that there is scarcely no such thing as a low river now. They claim that if a person took all the water in the river for irrigation, that in just a short distance the river would be up again. This water is being used several times as it moves down the valley.

The project has made the decreed rights worth many times what they were previously. There is plenty of water along the river now; sufficient to the extent that it isn't even necessary to have a water commissioner on the river.

Included in the project water sold, is 1,500 acre feet purchased by the Parrot Ditch Company. This water is used as a supplement to their present supply. The Parrot Ditch diverts from the Jefferson River and supplies water to approximately 4,000 acres in the area southwest of Whitehall.

Changes in Tax Base.--The average assessed value of irrigated land in Madison County for 1962 was \$25.47 per acre, compared to \$9.01 per acre for non-irrigated tillable land and \$2.19 per acre for grazing land. ^{64/} If it is assumed that the 13,000 acres of newly irrigated land was all previously classified as grazing land, then the average per acre increase in the tax base would be \$25.47 less \$2.19 or \$23.28. This average of \$23.28 on 13,000 acres would amount to an increase in the tax base of approximately \$302,640. It is assumed that the 20,000 acres receiving supplementary project water were all previously on the tax rolls as irrigated land. On this basis, no increase to the tax base will be attributed to these acres. It should be pointed out however, that when land receives an additional supply of water, it is often reclassified and goes on the rolls at a higher value. In many cases then, there is an increase to the tax base on acres receiving supplemental water, as well.

There has been no attempt made in this report to evaluate indirect additions to the tax base, such as increased machinery and equipment, more improvements, and greater numbers of livestock. Considerable increases in the state income tax base also result from the direct and indirect benefits generated by the project.

Bank Deposits.--Deposits and loans outstanding have steadily increased at The Bank of Sheridan during the period from 1935 to 1962. The bank is deeply interested in the welfare of the local farmers and ranchers, and in providing a real service for them.

The Bank's time deposits, demand deposits and loans outstanding for five-year intervals are shown in Table VIII.

^{64/} Figures taken from 1962 tax report of Madison County.

TABLE VIII. BANK DEPOSITS AND LOANS OUTSTANDING FOR FIVE YEAR INTERVALS, 1930-1962, AT THE BANK OF SHERIDAN, MONTANA. *

Year	Deposits			Loans Outstanding
	Time	Demand	Total	
1930	\$93,625	\$130,785	\$224,410	\$191,771
1935	45,448	174,132	219,580	78,206
1940	50,744	242,250	292,994	101,956
1945	102,872	794,224	897,096	156,353
1950	128,226	754,742	882,968	383,239
1955	167,463	742,397	909,860	380,935
1960	343,029	832,583	1,175,612	461,016
1962	440,329	983,384	1,423,713	535,637

* Source: These figures were obtained through personal interview with the bank manager.

The bank has enjoyed a continued period of steady growth. It was the opinion of the bank manager that the stabilizing effects of the project were a major factor in the stable growth of the bank and of the local economy as well.

As of November 15, 1962, the bank had approximately \$208,000 in live-stock loans and \$40,000 of machinery paper. ^{65/}

The capital requirements of some of the larger water users are in excess of the banks loan limits. If these users obtain money at a larger, out-of-town bank, they usually shift their deposit accounts there also. Considerable agricultural financing in the area is done by the Production Credit Association, Federal Land Bank, and Farm Home Administration. These agencies are generally able to offer a longer repayment period and a lower rate of interest, whereas the bank does primarily short-term financing.

Level of Living.--Level of living indexes are intended to reflect the average level of current consumption and utilization of goods and services.

The concept of "level of living" refers to the actual living conditions

^{65/} Figures provided by bank manager.

of a population. It differs from the concept "standard of living" which relates to the living conditions aspired to and which are regarded as proper or desirable. 66/

During the last three decades, the level of living of farm families in Madison County has been very favorable in comparison to the level for the state as a whole and also the nation. (See level of living indexes, Table IX).

The Madison County indexes listed for 1950-59 are an average of Madison and Beaverhead counties. Beaverhead County has enjoyed the highest level of living of any county in the state and therefore the county indexes listed are somewhat higher than would be the case for Madison County alone.

TABLE IX. AVERAGE FARM OPERATOR LEVEL OF LIVING INDEXES. *

	1930	1940	1945	1950	1954	1959 <u>a/</u>
Madison County	92	105	122	175 <u>b/</u>	179 <u>b/</u>	149 <u>b/</u>
Montana	76	83	107	130	149	126
United States	75	79	100	122	140	100

* Source: Farm Operator Family Level of Living Indexes For Counties, U.S. Department of Agriculture, May, 1952, also Statistical Bulletin 204, March, 1957, and Statistical Bulletin No. 321, September, 1962.

a/ U. S. County average in 1959 = 100.

b/ Average of Beaverhead and Madison counties.

The favorable position of this county can largely be attributed to the balanced livestock operations and the increased production of irrigated crops. The Ruby Project has contributed significantly to both.

The reason for the drop in 1959 is because these indexes are in terms of a United States county average equal to 100.

66/ Statistical Bulletin No. 321, Farm Operator Level of Living Indexes for Counties of the United States, 1950-59, U. S. Department of Agriculture, September, 1962, p. 6.

Local Attitude.--Without exception, every person interviewed commented on the great worth of the project in stabilizing the local economy. The ranchers are now able to raise sufficient winter feed to balance their livestock-operations. Many users stated that the project has made their previously marginal operations into sound economic units.

Water users from all three Users' Associations under the project expressed satisfaction with the management and operation of the project. The users were very cooperative in discussing their farming and ranching operations. Their attitude towards the project was one of satisfaction and appreciation.

The following statements were made by reputable users and non-users of the project:

Grover Goetschins, President of Ruby River Water Users' Association.

"The dam has made farming in the area safe and dependable. It has been wonderful for the valley as a whole and was a godsend in 1961."

Lowell Soubier, Vice-President of Ruby River Water Users' Association.

"The project has been of great importance to the valley. New acres have been brought into production and yields increased on those already with water. From Alder on down, you scarcely ever have a shortage of river water now."

L. W. Hansen, President of Vigilante Canal Users' Association.

"Considerable new ground was opened up when the project was put in. Some of this had been plowed years before but had gone back to sage brush. The additional water provided by the project stabilized our ranches by making it possible to produce more hay."

Pat Burk, President of West Bench Canal Users' Association.

"There was little here before the project was put in. This place was under the ditch, but there was very little water available."

"The people in this area greatly appreciate the State Water Board and their activities. The whole area has benefited from the project."

Clarke Raymond, Director of the Ruby River Water Users' Association.

"This project has increased the carrying capacity of my ranch by 50 percent. I can now raise excellent hay on land that was previously sage brush and greasewood.

"Three weeks after the water is turned in the canal, it finds its way back to the river. There is scarcely no such thing now as a low river. Before the project was put it, the river usually ran dry by the time it got to Sheridan."

Ben Hardin, Manager of local Soil Conservation Service Office.

"The Ruby Project has been vitally important in stabilizing the local economy. It has guaranteed a second crop of hay where only one could be grown before. An average acre of this land would produce .2 of an AUM without water, and three ton of alfalfa with water. This would be a difference in net return of approximately \$17.50 per acre."

Ted Darby, Manager of the Bank of Sheridan.

"This Ruby Project has greatly benefited the whole valley. It has held the town together and reduced turnover considerably."

Summary and Conclusions.--1. Irrigation is of vital importance in stabilizing the economy of Madison County. It assures the production of sufficient winter feed to balance and stabilize the local livestock operations; from which the majority of the county's income is derived.

2. One of the most important sources of irrigation water within the county is the Ruby River Storage Project. This project provides water to approximately 33,000 acres, of which approximately 20,000 receive a supplementary supply and approximately 13,000 receive a primary supply.

3. The "direct benefits" derived from the project in 1961 were approximately \$319,258. This would represent average direct benefits of \$9.67 per acre for the total acres being served by the project.

4. The "indirect benefits" generated by the project in 1961 were approximately \$430,998. The direct to indirect benefit ratio computed by Holje, Huffman and Kraenzel, at Montana State College, was used in deriving this indirect benefit figure.

5. On lands reported by the water users to be of similar quality and fertility, the average difference in value between the irrigated land and land which presently is unable to be irrigated, was approximately \$154 per acre. This difference in price should represent the capitalized value of net returns to the water discounted over time.

6. The project has greatly reduced risk and uncertainty. Crops are now assured even on the driest years, and on normal years, production is reported to be approximately doubled on supplementary acres. The project has enabled many previously marginal operations to become stable economic units.

7. The tax base of Madison County has been broadened considerably as a result of the Ruby River Project. It is assumed that the 13,000 acres of newly irrigated land was all previously classified as grazing land. The difference between the average assessed value of irrigated land and the average assessed value of grazing land was \$23.28 in 1962. This average increase on 13,000 acres would amount to a broadening in the tax base of approximately \$302,640. It is assumed that the 20,000 supplemental acres were all previously assessed as irrigated lands and have not been reclassified on the basis of additional water supply. No direct addition to the tax base has been attributed to them nor has any attempt been made to evaluate the indirect additions to the tax base, such as increased machinery and equipment, more improvements, and greater numbers of livestock. The state income tax base is also broadened as a result of the direct and indirect benefits generated by the project.

8. The local bank has enjoyed a period of steady growth during the life of the project. It was the opinion of the bank manager that the stabilizing effects of the project were a major factor in the steady growth of the bank, and of the local economy as well.

9. The level of living of farm families in Madison County during the last three decades has been very favorable in comparison to the level for the state as a whole, and also the nation. This favorable position can largely be attributed to the balanced livestock operations and the increased production of irrigated crops.

10. Every person interviewed, without exception, commented on the great worth of the project in stabilizing the local farming and ranching operations. Both users and non-users of project water were very cooperative in discussing their operations and the effects which they felt the project had upon their farm, ranch or business. The general attitude towards the Ruby River Project was one of satisfaction and appreciation.

North Fork Smith River Project

This project is located in Meagher County and consists of a dam and storage reservoir located nine miles northeast of White Sulphur Springs on the North Fork of the Smith River. The Southside Canal, an integral part of the project, will be discussed separately.

The project was constructed to furnish supplementary water for 9,000 acres and to irrigate 2,000 acres of new land under the Southside Canal. The original capacity of the reservoir was 11,000 acre feet but was subsequently increased to 11,600 acre feet through the addition of 27 inches of flashboards.

The local people first suggested the project to the Board on March 9, 1934, with petitions from the land owners being filed on September 19, 1934. Application was made to the Public Works Administration for funds to build the project on April 5, 1935, with a water filing on the North Fork of the Smith River and its tributaries being authorized on May 20, 1935.

Construction of the Project

The dam and reservoir were built under a Public Works Administration loan and grant agreement. The contract was awarded to J. L. McLaughlin of Great Falls on his low bid of \$202,146.65. The contract was approved by the Public Works Administration on April 28, 1936, and work commenced just six days later. The project was accepted as complete by the Board on November 19, 1936.

The dam is an earth, rock and sand gravel fill, having a total crest length of 1,200 feet and top width of 24 feet. The front slope is three to one below water line and two to one above the water line, while the downstream slope is two to one. The dam contains 391,000 cubic yards of material and has a maximum height of 81 feet above the natural creek bed. The reservoir covers 322 acres when filled and has a drainage area of 68.3 square miles. 67/

It has been necessary to do some repair work on the spillway from time to time, since it was not lined with concrete at the time of construction. The Board installed 27 inches of flashboards in the spillway in 1948, which increased the capacity of the dam some 600 feet to its present capacity of 11,600 acre feet. In 1958, it was discovered that wave action had undercut the rip-rap on the lower section of the dam. This also was repaired with the Board's forces, the costs incurred being repaid to the Board through operation and maintenance assessments to the users.

Water Users' Association

On November 5, 1935, the Articles of Incorporation for the Smith River Water Users' Association were filed. The articles authorized the issuance of 15,000 shares of stock at par value of \$1.00 and provided for management of the association by five directors.

Water Purchase Contracts

Water purchase contracts for 11,000 acre feet of water were signed up

67/ Water Resources Survey, Meagher County, Montana, Published by the State Engineer's Office, Helena, Montana, July, 1950, p. 29.

to finance the project. These contracts called for an annual repayment of \$.90 per acre foot for 29 years, 1937 to 1965. It was necessary to cancel out 2,450 acre feet of these contracts, however, for delivery of this water was impossible without constructing a canal. When the Southside Canal was constructed, new contracts were signed for the amount cancelled. As of June 20, 1962, there were 36 water purchase contracts with the full capacity of the project completely sold.

Operation and Maintenance

The operation and maintenance charge assessed by the association is \$.10 per acre foot. Little maintenance expense is incurred on the project since the water is delivered through the regular river channel. This small assessment provides them with barely enough to operate the project, making an additional assessment necessary where repairs are required.

Expenditures for the Project

The Board accepted a Loan and Grant offer from the Public Works Administration on January 10, 1936, in the amount of \$253,711.60. Of this amount \$110,711.60 was to be in the form of a grant and \$143,000 worth of Series "D" Water Conservation Bonds were to be purchased.

The Board made the Southside Canal a part of the project when it was found that 2,500 acre feet of project water could not be sold without the construction of this canal. Some of the costs of constructing the canal were charged to the project, as indicated below. The following statement of expenditures shows the amount of federal and state funds spent on the original project and also that portion of state funds spent on the Southside Canal which were charged to the project. This statement lists expenditures as of June 30, 1960. 68/

68/ Robert J. Kelly, Summary of Activities of the Montana State Water Conservation Board From Inception, January 22, 1934 to June 30, 1960, p. 37.

	<u>Fed. Funds</u>	<u>State Funds</u>	<u>State Funds for S.S.Canals</u>	<u>Total Cost</u>
Right of Way	\$ 4,868.81	\$ 920.84	\$ 951.15	\$ 6,740.80
Construction	220,893.91	13,274.89	17,359.80	251,528.60
Adm. & Legal	1,637.35	393.17	627.70	2,658.22
Adm. Charge		7,167.83		7,167.83
Engineering	21,625.68	4,429.64	3,387.74	29,443.06
Interest during Construction	4,685.85			4,685.85
Total	<u>253,711.60</u>	<u>\$ 26,186.37</u>	<u>\$ 22,326.39</u>	<u>302,244.36</u>

Additional funds spent by Works Progress

Administration, \$7,910.82, Refunds \$279.53

Total Cost

8,190.35
\$310,414.71

Federal Funds P.W.A.

253,711.60

Federal Funds W.P.A.

7,910.82

State Water Conservation Board

as of June 30, 1960

\$47,114.11

Refunds

1,678.18

48,792.29

Total Project Cost

\$310,414.71

The Southside Canal

The Southside Canal is 13.16 miles long and was designed to provide water for approximately 2,000 acres of new land on the East Bench, south of White Sulphur Springs. There are presently 1,600 acres being served by this project.

When the North Fork of the Smith River Storage Project was constructed, 2,500 acre feet of water was subscribed for by individuals not having access to the water. The water was sold to them with the agreement that they would build a canal for delivery of the water.

Construction of the Canal.--The local people commenced the original construction in cooperation with the Works Progress Administration in 1935. The cost of construction was more than the local people could afford and they appealed to the Board for aid. On April 21, 1937, the Board authorized funds to aid in its construction, furnishing equipment and materials as were needed.

Great difficulty was experienced in holding water in the canal, with

considerable work being done over a period of years to remedy the problem. Certain drainage facilities were constructed and in 1952 an extensive enlargement program was carried on. Also, a new diversion dam and head-gate to change the point of diversion, so as to alleviate drainage to adjoining lands, was constructed by the Board in 1959.

Water Users' Association.--Although the Articles of Incorporation of the Southside Canal Water Users' Association were drafted in 1939, they were not filed until May 8, 1948. The articles call for management of the Association by three directors and authorized the issuance of 5,000 shares of stock at par value of \$1.00 per share.

Water Contracts.--On April 20, 1950, the Association signed a Water Marketing Contract with the Board, agreeing to pay annually \$.10 per acre foot to apply on funds spent by the Board on the project. Prior to this time, funds spent on the canal were not charged directly to it, but were charged to the North Fork of the Smith River Project.

In 1951, the Association met and requested the Board to enlarge the canal. This enlargement was done with the Board's forces and by November 30, 1954, \$10,165.02 had been spent on this work. The Association agreed to assess their water users \$.20 per acre foot or \$750.00 per year to repay this amount to the Board.

As of June 20, 1962, there were outstanding six water purchase contracts for 2,500 acre feet of storage water and 1,250 acre feet of free flow if available.

Operation and Maintenance.--This canal has been continually plagued with seepage problems, culminating in the spring of 1962 with an exorbitant 82 percent water loss between the point of diversion and the first turn-out. The water was turned out of the canal for two weeks and approximately two and one-half miles were regraded and bentonited. This helped considerably, and for the remainder of the season they were successful in getting delivery of approximately 50 percent of their water. An additional section of the canal was regraded and bentonited after the water had been turned out in the fall. This completed the section where the greatest amount of seepage

was taking place and it is hoped that their serious seepage problems have now been alleviated. The full extent to which this undertaking has been successful cannot be determined until the 1963 irrigation season, however.

Since this work has just been completed, the exact cost has not yet been determined. The Board reports, however, that the total cost of this regrading and bentonite work will be approximately \$20,000. Since a repayment contract has not yet been negotiated with the Association, the exact terms cannot be covered here. It will however, be paid for from an additional operation and maintenance assessment spread over a sufficient period of years so as not to impose an unbearable load upon the water users.

Expenditures for the Project.--The following statement of expenditures on the project shows the total state funds invested in the project and the amount charged to the North Fork of the Smith River Project, as well as the present Revolving Fund investment. As of June 30, 1960, these expenditures were: 69/

	<u>State Funds</u>	<u>Less Amount Charged to North Fork of Smith River</u>	<u>June 30, 1960 Revolving Funds</u>
Contract	\$10,841.35		\$10,841.35
Right of Way	951.15	951.15	
Engineering	19,365.09	3,387.74	15,977.43
Labor	19,085.59	10,175.16	8,910.43
Materials	3,982.02	2,488.98	1,493.04
Equipment	8,801.41	4,695.66	4,105.75
Admin. & Legal	627.70	627.70	
Total Cost	<u>63,654.31</u>	<u>\$22,326.39</u>	<u>\$41,327.92</u>
Less Payments			<u>3,750.00</u>
June 30, 1960, Book Balance			<u>\$37,577.92</u>

69/ Kelly, Op. Cit., p. 95.

Analysis of Empirical Data

The low rainfall and short growing season has limited farming operations in the area of this project. With extensive range land being available, livestock ranching became the dominant agricultural activity. In order to stabilize these livestock operations, means of greatly increasing the production of winter feed needed to be established.

The North Fork of the Smith River project greatly increased the amount of feed that could be produced both on acres already being farmed and by bringing additional acres into production.

The project is presently supplying irrigation water to approximately 11,000 acres of land. This represents a supplementary supply to 9,000 acres previously irrigated and a primary supply to approximately 2,000 acres of new land. The following analysis is based upon personal interviews with 12 project water users, representing 8,450 acre feet, or 76.8 percent of the storage water made available by the project.

These 12 units had a total of 87,937 acres, of which 7,540 were irrigated, 406 dryland and 79,991 acres of rangeland. In Table X, the irrigated acreage is broken down according to crops, acres of each, average yield and the percent of total irrigated acres each crop represents.

TABLE X. IRRIGATED CROPS ON 12 NORTH FORK OF THE SMITH RIVER PROJECT FARMS BY TOTAL ACRES OF EACH CROP, PERCENT OF TOTAL ACREAGE, AND AVERAGE YIELD PER ACRE.

Crops	Acres	Percent of Total	Average Yield/acre
Grass Hay	4,097	54.3	1.02 T
Alfalfa	1,430	19.0	2.66 T
Oats	413	5.5	41.5 Bu.
Pasture	370	4.9	3 AUM
Wheat	367	4.9	29.3 Bu.
Barley	365	4.8	36.8 Bu.
Alfalfa-Mix	325	4.3	2.0 T
Summer Fallow	173	2.3	- - -
Totals	7,540	100.0	

The ratio of the acres of each crop to the total irrigated acreage is then applied to the acres being served by the project. This is shown in Table XI., with the average yield, price received and the gross income received from crops raised on the acres receiving water from the project.

TABLE XI. ESTIMATED TOTAL ACREAGE OF IRRIGATED CROPS ON THE NORTH FORK OF THE SMITH RIVER PROJECT, WITH AVERAGE YIELDS, TOTAL PRODUCTION, AVERAGE PRICES RECEIVED AND TOTAL VALUE BY CROPS

Crop	Acres	Ave. Yield/Acre	Total Amount	Price a/	Gross Value
Grass Hay	5,973	1.02 T	6,092	\$24.62	\$149,985
Alfalfa	2,090	2.66 T	5,559	24.96	138,753
Oats	605	41.5 Bu.	25,107	.59	14,813
Pasture	539	3 AUM	1,617	4.00 b/	6,428
Wheat	536	29.3 Bu.	15,705	1.67	26,227
Barley	531	36.8 Bu.	19,541	.66	12,897
Alfalfa-Mix	473	2.0 T	946	25.00	23,650
Summer Fallow	253	- - -	- - -	- - -	- - -
Total	11,000				\$372,753

a/ Based on the average annual price received in 1960, as stated in Bulletin No. 563, Prices Received and Paid by Montana Farmers and Ranchers, 1958-1960, Montana Agricultural Experiment Station and the Agricultural Marketing Service, USDA, January, 1962.

b/ Prices quoted by local producers.

In order to determine the primary gross income that results from the project itself, the gross value of production that would have resulted without the project, must be subtracted from the gross income figure presented above.

The average gross income per acre is \$33.89. Of the 11,000 acres now served by the project, 9,000 receive only a supplemental supply. This supplementary water is worth far more some years than others. In 1961, the users realized just how beneficial this water was to their operation, and few crops would have been harvested without it. It was the concensus of those interviewed, that over a period of years, their crop yields are approximately twice what they would have been without the supplemental water.

If, in accordance with this, we reduce gross income on 9,000 acres by one-half, we find that gross income derived from the project water would be \$16.95 per acre on these acres.

On the 2,000 acres dependent upon the project for its complete supply, the gross income that would have been realized, through the best alternative use of this land, must be determined. Sixteen hundred acres of this new land is under the Southside Canal, with the remainder being northwest of town. The owners of these lands ruled out dry farming as an economic alternative due to insufficient rainfall, and maintained that without the water this land could be used only for grazing. The yield of land of similar quality, lying just above the ditch or for which there isn't sufficient water, is approximately .4 AUM's per acre. It is assumed that this would represent the average yield of these project acres in the absence of water. Figuring an AUM at \$4.00, gross income then, would be approximately \$1.60 per acre without the project water. Gross income per acre, resulting from the project, would then be \$33.89 less \$1.60, or \$32.29 on these 2,000 acres.

Gross annual primary benefits, or income derived from the project water would be \$217,130. This, as noted above, would consist of 9,000 acres at \$16.95 plus 2,000 acres at \$32.29.

The net return to farm operators, in the United States for 1961, was 31.9 percent of gross farm income. If it is assumed that 31.9 percent of gross income derived from the project represents the net income, then the annual "direct benefit" from the project would be \$69,264.

If the direct to indirect benefit ratio of 1 to 1.35 derived in the Montana State College study 70/ by Holje, Huffman and Kraenzel is used, there would be \$93,479 of indirect local benefits created as a result of the water project.

70/ Refer to page 27 of this report.

Another method of evaluating direct irrigation benefits is being given strong consideration. This involves the changes in land values resulting from irrigation. 71/

The average value of irrigated land, as stated by the water users, is \$124.15 an acre compared to \$24.98 for grazing land. The value of land per acre should represent the capitalized value of the net returns discounted over time. Ten users had land comparable in quality to their irrigated land, but which they could not irrigate. This difference of approximately \$100 per acre in price would represent the capitalized value of the net returns of the water discounted over time.

This means simply, that to justify this difference in price, the water must increase the net returns per acre by a certain amount. If 5 percent is used as the discount rate, then net income must be increased by \$5.00 per acre.

The average yield of this grazing land of comparable quality is approximately .4 AUM's per acre. When water is added, the yield is increased to approximately 3 AUM's per acre. Through the use of efficient pasture seeding, and proper rotation and irrigation, the yield could be increased considerably.

According to a preliminary production cost study conducted in February of 1962 by the Soil Conservation Service in Meagher County, for each one-half ton increase in yield per acre of hay, there is a corresponding increase in net income of \$6.71.

If interest on investment is figured at 5 percent, then according to this study, 1.7 tons per acre are required to cover the costs of production and interest on investment. The average yield for alfalfa on the project is 2.66 tons per acre. This would mean a net return to management of approximately \$12.88 per acre. If production is doubled as a result of the supplementary water, as the users state, the rate of return for the money invested in this additional water is extremely high. The producers are raised from

71/ J. W. Milliman, Land Values and Irrigation Benefits, P-1489-RC, The Rand Corporation, Santa Monica, California, September 15, 1958.

a level of little or no profit per acre to a position of favorable net returns.

Risk and uncertainty have been greatly reduced as a result of the project. Although crop yields were down somewhat in 1961, had it not been for project water, few crops would have been harvested. Where this water serves as a supplemental supply, the users' primary water comes from the North Fork of the Smith River by decree. With the exception of the first two rights, this water is usually gone by the first of July. The decreed water is generally sufficient for one complete irrigation and sometimes part of a second. With this supplementary water, they can fill right in and are assured of two good crops of alfalfa and an abundance of lush fall feed where they only cut one crop of grass hay.

The value of this fall pasture on grass hay is very important and should not be overlooked. This has been made available as a result of the supplementary water. When only the decreed water was available, this land could not be irrigated after the hay was harvested, and little regrowth occurred. Most users felt the value of this fall feed would be approximately 1.5 AUM's per acre, plus providing an excellent feeding area for the winter.

An example of the value placed upon this project water was manifest in 1961, when \$6,000 was paid for 100 acre feet, plus assuming the few remaining principal payments. This was nearly two and one-half times the contract price. The full capacity of the project is sold out, and were it possible to supply additional water, there is a ready demand for it.

In the early planning stages of the project, land values immediately rose in anticipation of increased water supply. The price of irrigated land is still largely determined by the amount of water available to it. The price of range land is also influenced somewhat by the amount of water available to an operation.

There is very little irrigated land sold as such in the valley. Most ranches sell for so much an acre straight through, dependent upon the balance and carrying capacity of the unit. Before the project was put in,

the problem existed of raising sufficient feed to winter what cattle the ranges would take care of in the summer. The units, which could raise sufficient feed to balance the operation, would automatically bring higher prices per acre straight through, and to this extent, the additional water tended to increase the price of range land as well.

Before the project was put in, thousands of cattle often had to be driven to other areas for wintering. The project has greatly stabilized the economy of the area and enabled many operations, which were previously little more than summer pastures, to be balanced economic units.

Changes in Tax Base.--The project, in bringing additional acres under cultivation, has added considerably to the tax base of Meagher County. An increase of 2,000 acres, to the irrigated tax rolls of the county, would be a conservative estimate. The average assessed value for irrigated lands in the county for 1962 was \$21.57 compared to the average assessed value of \$2.78 for grazing land. 72/ This difference of \$18.79 per acre on 2,000 acres represents an increase in the county tax base of \$37,580. Although most of these acres changed from grazing land to irrigated shortly after the project was put in operation, a review of the county tax records indicate that they were not reclassified until 1953. At that time approximately 18,000 acres were added to the irrigated tax base of the county. This faulty assessment resulted in the loss of considerable tax revenues.

Bank Deposits.--The assets of the First National Bank of White Sulphur Springs have more than tripled since the project was put in. 73/ It would be very difficult to determine just what portion of this increase should be attributed to the added economic activity generated by the project. The lumber industry has been expanding in the area and has also given the local economy a considerable boost.

72/ Figures supplied by Meagher County Assessor.

73/ Robert Johnson, Manager of the Bank.

The bank's time deposits, demand deposits and loans outstanding for five year intervals from 1930 to 1962 are shown in Table XII.

TABLE XII. BANK DEPOSITS AND LOANS OUTSTANDING FOR FIVE YEAR INTERVALS, 1930-1962, AT THE FIRST NATIONAL BANK, WHITE SULPHUR SPRINGS, MONTANA. *

Year	Time	Deposits		Loans
		Demand	Total	
1930	\$225,725	\$ 424,709	\$ 650,434	\$216,208
1935	280	365,849	366,129	5,150
1940	0	585,145	585,145	83,344
1945	0	1,186,980	1,186,980	45,195
1950	10,000	1,906,172	1,916,172	448,738
1955	15,000	2,062,288	2,077,288	611,976
1960	5,000	2,050,113	2,055,113	560,680
1962	30,000	2,192,758	2,222,758	499,615

* Source: This information was obtained through a personal interview with the bank manager.

Depression and drouth came to Montana at the same time. Conditions became so serious that the local bank was forced to liquidate. The bank discontinued its savings department in 1934 and by the end of 1935, savings deposits had dropped to only \$280. On December 31, 1930, savings deposits had amounted to \$225,725. The time deposits listed from 1950 through 1962 consist only of county funds and are set up on a special account. In 1935, loans outstanding were only \$5,150, which is indicative of the serious conditions that existed. It was at this time that application was made for funds to construct the irrigation project.

By 1940, the project was in operation and conditions in general were much better. During this five-year period, demand deposits had increased from \$365,849 to \$585,145, with loans outstanding being increased to \$83,344. The bank has continued to enjoy a rapid increase in demand deposits, having \$2,192,758 at the close of 1962. This represents over \$800 for every man, woman, and child in the county.

The majority of the farms and ranches on the project have been under the present ownership for many years and are pretty well in the clear. The bank is able to do considerable livestock and equipment financing however, as well as making money available for operating expenses. 74/ Since the capital requirements of some units are in excess of the bank's loan limits, considerable borrowing, and consequently banking, is done elsewhere.

Level of Living.--The level of living of farm families in Meagher County has been relatively favorable during the past three decades compared to the level of living of farm families in the State as a whole and the nation. (See level of living indexes, Table XIII). The county indexes for 1950-59 are an average of Meagher, Broadwater and Park counties.

TABLE XIII. AVERAGE FARM OPERATOR LEVEL OF LIVING INDEXES. *

	1930	1940	1945	1950	1954	1959 <u>a/</u>
Meagher County	88	110	133	161 <u>b/</u>	153 <u>b/</u>	140 <u>b/</u>
Montana	76	83	107	130	149	126
United States	75	79	100	122	140	100

* Source: Farm Operator Family Level of Living Indexes for Counties, U.S. Department of Agriculture, May 1952, also Statistical Bulletin No. 204, March, 1957, and Statistical Bulletin No. 321, September, 1962.

a/ U. S. county average in 1959 = 100.

b/ Average of Broadwater, Meagher and Park counties.

The concept of "level of living" refers to the actual living conditions of a population. It differs from the concept "standard of living" which relates to the living conditions aspired to and which are regarded as proper or desirable. 75/

74/ Ibid.

75/ Statistical Bulletin No. 321, Farm Operator Level of Living Indexes for Counties of the United States, 1950-1959, U. S. Department of Agriculture, September, 1962, p. 6.

For the years 1930-1954, the indexes are in terms of a 1945 base equal to 100. The 1959 indexes are in terms of a 1959 base, where the U. S. county average equals 100.

The favorable position of this county can be largely attributed to the balanced livestock program, to which the Smith River project has contributed greatly.

Local Attitudes.---The local attitude towards the North Fork of the Smith River project is one of satisfaction and praise. Farmers, ranchers, and merchants alike, attest to the great worth of the project in increasing and stabilizing the economy of the area. There is some concern in regards to the difficulties incurred in getting water through the Southside Canal, and the high costs involved in attempting to alleviate this serious seepage problem. Everyone is optimistic that the recent regrading and bentonite work will bring the problem under control, however.

Though the water users in general are well satisfied with the project, some expressed the need for better communication between the Board and the project users.

The following opinions were expressed by reputable individuals in the area:

Walter Donahoe, owner and manager of Castle Mountain Livestock Company.

"The project has been a remarkable thing for the valley. It has stabilized the economy of this county. The mental attitude is much better also. I would say that the valley is from five to ten times better off."

Fred Buckingham, President of the Smith River Water Users' Association.

"When I bought this place in the early thirties, it was extremely dry and loaded with gophers and grasshoppers. This irrigation project has stabilized my operation and the valley as well. In dry 1961, I raised 300 ton of hay on the same acres where, during the early thirties, I scarcely got any crop at all."

L. E. Dunkle, Manager of the Project.

"The problem here used to be that we couldn't raise enough hay to feed through the winter what our ranges would handle in the summer. Since the project went in, we have sufficient hay to feed more cattle than our ranges will take care of.

"On the average, my crops are about double what they were before the dam was built."

Ray Bailey, President of the Southside Water Users' Association.

"The project has completely made this place of mine. With the water, I have a balanced operation; without it I would have nothing but a summer pasture."

E. L. Jones, Manager of the Soil Conservation Service office in White Sulphur Springs.

"This State irrigation project has been a great stabilizer. Crops were not as good in 1961 as they were in 1962, but far better than they would have been without the project.

"There is a need of better water management in this valley. The water presently being used would go much farther if properly managed. The farmers need instruction in better water management."

Robert Johnson, Manager of the local bank.

"The project has contributed substantially to the well-being of the community and has helped to stabilize local farming and ranching. When I came in 1936, serious hay shortages required many cattle to be moved out for the winter. Since the dam was put in, the valley has been virtually contained."

Summary and Conclusions.--1. Livestock ranching became the dominant agricultural activity in Meagher County, due to the scarcity of rainfall and short growing season. In order to stabilize these livestock operations, means of greatly increasing the production of winter feed needed to be established. The North Fork of the Smith River Project greatly increased the amount of feed that could be produced, both on acres already being farmed and by bringing additional acres into production. This project serves

approximately 11,000 acres of land, consisting of 9,000 supplementary acres and approximately 2,000 acres receiving a primary supply.

2. The "direct benefits" derived from the project in 1961 were approximately \$69,264. This represents an average of \$6.30 per acre in direct benefits received from the project.

3. The "indirect benefits" generated by the project in 1961 were approximately \$93,479. This figure was derived by applying the direct to indirect benefit ratio computed by Holje, Huffman and Kraenzel at Montana State College.

4. The average value of irrigated land, as stated by the local water users, was \$124.15 compared to \$24.98 for grazing land of comparable quality and fertility. This difference of approximately \$100 in value should represent the capitalized value of the net returns of the water discounted over time.

5. Risk and uncertainty have been greatly reduced as a result of this irrigation project. The users report that had it not been for the project, they would have harvested very little in 1961. Yields, on the average, have been approximately doubled on supplementary acres, and in dry years it means the difference of either getting a crop or not getting a crop.

6. The Smith River Project has considerably broadened the tax base of Meagher County. The average assessed value of irrigated lands in the county for 1962 was \$21.57 compared to an average of \$2.78 per acre on grazing land, making an average difference of \$18.79 per acre. The addition of 2,000 acres to the irrigated tax rolls would increase the tax base by approximately \$37,580. It is assumed the 9,000 supplementary acres were previously classified as irrigated lands. There are indirect additions to the tax base resulting from the project, such as more machinery and equipment, more improvements and increased numbers of livestock. The state income tax is also increased by the direct and indirect benefits produced by the project. No attempt has been made in this study to evaluate these effects.

7. Meagher County has experienced a relatively favorable level of living, during the last three decades, compared to the level of living of farm families in the state as a whole and also the nation. The favorable position of this county can be largely attributed to the balanced livestock program, to which the Smith River Project has contributed greatly.

8. The general local attitude towards the project is very favorable. The farmers, ranchers, and merchants alike, all attest to the great worth of the project in increasing and stabilizing the economy of the area. There is some concern in regards to the difficulties experienced in getting water through the Southside Canal. Everyone is optimistic however, that the repair work completed in the fall of 1962 will bring the problem under control.

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