

**COMPREHENSIVE STRATEGIC PLAN FOR IRRIGATION IN NORTH DAKOTA
2017 - 2021**

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SUMMARY

COMPREHENSIVE STRATEGIC PLAN FOR IRRIGATION IN NORTH DAKOTA

The mission of the North Dakota Irrigation Association is “to strengthen and expand irrigation to build and diversify our economy.”

INTRODUCTION

North Dakota’s economy, population, and vitality can be greatly enhanced with the development of a viable and expanded irrigation industry. Through the years, efforts have been made to increase irrigation development with some success. Currently there are approximately 275,000 acres developed for irrigation in the state. However, a more united and proactive approach is needed to increase the irrigated acreage. North Dakota lags far behind the 17 western states in irrigation development, all of which lack sufficient rainfall to consistently produce high-value and other crops.

Since the 1970s, the largest expansion of irrigated acreage took place when markets and prices were available to make irrigation development profitable. In the mid-1970s, the price of conventional crops increased substantially allowing the investment in irrigation to enhance yields and make irrigation economically viable. Beginning in about 1989, the french fry potato industry was expanding and the drought during that period caused a major potato processor to require irrigation for the production of a consistently high-quality product. Because of the crop rotation and soil requirements for potatoes and the potential for high profits, many thousands of acres were developed for irrigation to serve the needs of the plant. Again, in the mid-1990s a new french fry plant was constructed in Jamestown, which required an annual production from approximately 16,000 acres of irrigated land. This, too, resulted in the development of many thousands of new irrigated acres. Markets were the key factor in those major expansions.

North Dakota has the water and land resources and climate to produce many crops under irrigation. Irrigation in many of the other western states is quite mature and in some instances the water once used for irrigation is going to other purposes and irrigated acreage is being retired for urban, municipal and industrial development. Processors and producers alike are looking at new areas where water and suitable land are available to develop irrigation to efficiently grow the crops to meet the food and fiber needs of the U.S. and the world. Recently, that has also included crops from which biofuels are produced.

To develop new irrigation, it is necessary to have long-term markets for the crops produced at a price that can repay the initial investment in irrigation and make a profit. The continued markets for potatoes, irrigated malt barley, corn and energy beets to produce ethanol, a fledgling vegetable industry, and the market for identity preserved crops, are either growing or poised for growth. They provide an excellent foundation on which to build. Irrigation development is a priority component of the economic initiative in North Dakota.

Producers, communities, and processors must undertake a comprehensive and united effort to successfully take advantage of the opportunities irrigation offers. Requirements for new and successful irrigation development include favorable financing programs, irrigation research, strategic planning, water permits, favorable energy rates, good and genuine communication, and dependable markets. Irrigation development will take place more efficiently and timely, with a united voice advocating those interests.

Attention is being given to North Dakota for new opportunities to produce crops under irrigation and add value to them because of the availability of untapped land and water resources. The french fry potato market is experiencing positive returns and that may create an opportunity for a new processing plant. Several ethanol plants are operating throughout the state and have the potential for additional growth to utilize locally grown irrigated corn. The preserved identity of certain crops used for human consumption is an expanding opportunity that requires consistent quality and quantity. Irrigated production will have a role in supporting that market.

Achieving optimum irrigation development in the state will require a comprehensive and united effort by all groups and individuals involved in irrigated agriculture. This Comprehensive Strategic Plan for Irrigation in North Dakota as discussed below will require cooperative and proactive efforts by all partners involved in irrigation, including individual irrigators, potential irrigators, irrigation districts, North Dakota State University, the State Water Commission, Garrison Diversion Conservancy District, North Dakota Irrigation Association, federal and state agencies, economic development groups, commodity organizations, farm equipment dealerships, processors, and others.

The purpose of this Plan is to provide a single source of information for all irrigation activities in North Dakota that will be a common awareness of activities, opportunities, and objectives. The NDIA will facilitate a proactive approach to irrigation and economic development in the state by providing avenues of open communication among these groups, providing general awareness of activities, promoting new technologies and encouraging cooperation on a united front.

This Plan has six components (see below), which outline the specific areas of need and the actions to accomplish irrigation development within the state on an optimum level. Putting united efforts into these categories and making the results available to interested parties will enhance the basis for carrying out this mission.

- 1) Marketing
- 2) Funding and Financing
- 3) Projects
- 4) Research
- 5) Energy
- 6) Communication and Coordination

I. MARKETING

A. Goal: Identify and implement ways to develop feasible and long-term markets for irrigated crops in North Dakota.

One critical objective is to foster the development and sustainability of feasible markets for irrigated and potentially irrigable crops, which generally includes barley, corn, beans, some hay crops, potatoes, onions, carrots, sugar beets, energy beets (sugar) and others. These crops can and have been grown successfully, but developing sustainable, feasible, and timely markets has many challenges to overcome, especially for some of the high-value crops such as onions and carrots. Identifying the areas of need and market development priorities for irrigated crops will continue to be an important work aspect.

Farmers markets are becoming an increasingly popular way to market locally grown produce. Following a national trend, the number of farmers markets has dramatically increased over the past decade, and North Dakota has followed suit, adding new markets each year. The total number of farmers markets in North Dakota is estimated to be at least 50. The reason for this increase is because of the major increase in the demand for locally grown products. Some of the benefits of farmers markets include face-to-face interaction between the producer and customer, producers are able to charge a premium for their product because there is no middle man involved. They allow residents of small towns to buy fresh produce, keep money in and bring growth to local communities, and provide added income for rural families.

In regard to mass marketing of high-value and traditional crops, the partners will continue to communicate with Busch Agricultural Resources, Cargill Malt, Red Trail Energy, Blue Flint Ethanol, Green Vision and other industry representatives to encourage and support irrigation and market development for barley, corn, and other crops. Higher-quality crops with larger yields can be more consistently grown with proper irrigation practices. The support of premium prices for irrigated crops along with providing educational and other materials showing the best methods and advantages of irrigating crops in North Dakota will be continued and emphasized.

The partners have and will work closely with appropriate groups to support funding for studies and continue to work with individuals and industry representatives to develop high value crop production, processing, and marketing.

Education is an important aspect of irrigating crops. Consequently, appropriate partners work together in writing and publishing brochures on producing corn and malt barley and other crops and activities, as well as publishing newsletters and magazine articles. In addition, cooperative efforts are used in planning and conducting irrigation workshops for irrigators and potential irrigators in the state.

Cooperative work is ongoing with state agencies, irrigation equipment dealers, individuals and others involved in irrigation to strengthen and expand irrigation and to build and diversify our state's economy.

The following identifies completed items and work that is being actively pursued and implemented to accomplish the irrigation mission in North Dakota.

B. Completed Work

1. Met with a group conducting a feasibility study to locate a potato processing plant in northwestern North Dakota. Information was provided on irrigation opportunities to support a potential plant.
2. Met with representatives of Forage Genetics International, a company that expressed a desire to contract a substantial number of irrigated acres of alfalfa for seed production in western North Dakota. There does not appear to be any interest in this venture at the present time.
3. Worked with and attended numerous meetings with the Commercial Vegetables Growers to help develop the high-value crop industry, particularly onions and carrots, in North Dakota. Secured a grant from APUC and assisted in the funding for a carrot study in North Dakota.
4. Met with industry representatives, producers, technical, and other representatives to pursue the development of the onion packing operation in Oakes.
5. Met with governor's representative and Department of Commerce personnel to discuss and determine appropriate actions for high-value crop development, financing, and marketing in North Dakota.
6. Met with representatives of the ethanol industry to support irrigation of corn.
7. Compiled, revised and distributed "Irrigated Corn Production" and "Irrigated Malt Barley Production" grower guides for North Dakota.
8. Worked in cooperation with NDSU to develop and revise the "Benefits, requirements, and Steps in forming an Irrigation District in North Dakota" and "A Guide to Funding for Irrigation Development in North Dakota" brochures.
9. Worked with representatives of the onion industry to identify alternative financing opportunities for needed infrastructure. Those identified did not fit the needs of the principals.
10. Cooperated with the Green Vision Group and others in conducting a study to determine the feasibility of using energy beets for the production of biofuel and other industrial products. The study was successfully completed but was put "on hold" because of the uncertainty of a federal mandate.

C. Ongoing Work (2016)

1. Provide information to growers through workshops, newsletters, and individual contact and correspondence.

2. Continue to communicate and work with groups, agencies, individuals, and companies to discuss and identify mutual areas of work and provide information as needed.
3. Develop new and keep existing educational materials up-to-date.
4. Provide assistance to individuals and groups for developing high-value and other irrigated crops and support increases in the acreage and prices of these crops in North Dakota.
5. Support the development of Farmers Markets in North Dakota.
6. Continue to support the Green Vision Group as needed in developing ethanol production facilities utilizing energy beets.
7. Support and participate in the field days at NDSU Extension Centers where irrigation research is conducted. The sites include Carrington, Oakes, and Williston (Nesson).
8. Work with North Dakota Departments of Agriculture and Commerce and others to develop markets for irrigated crops.
9. Meet with ethanol, malt barley, vegetable and other crop industry representatives as needed to support irrigation and price premium for these crops.
10. Followed up as needed with efforts to support the development of markets in the high value irrigated crops.

D. Future Work (2017-2021)

1. Develop and update educational materials related to irrigated agriculture as needed.
2. Work with NDSU and others to support programs for improvement of our natural resources (soil health, water quality, water conservation, drainage, salinity, etc).
3. Continue to develop markets for irrigation as appropriate.

II. FUNDING AND FINANCING

A. Goal: Identify, support, enhance and develop financing programs to support new irrigation development and for the modification of existing irrigation systems.

Irrigation is one of the initiatives identified by the governor's office for economic development in North Dakota. On average, one acre of irrigation generates income that approximates that produced by 3 to 5 acres of dryland before government payments. Substantially increasing irrigated acres would provide a large increase in the economic activity in rural North Dakota. Irrigation also allows more crop diversification, which can result in new opportunities for value-added processing including added opportunities for developing alternative energy sources. In many instances the cost

of developing new irrigated acreage is at the limits of economic feasibility based on the returns for the crops to be produced. Having programs that enhance the terms of financing irrigation development provides greater assurance that it will be economically successful.

A brochure published by NDSU and NDIA entitled, “Funding Assistance Programs for Irrigation Development in North Dakota” presents financial incentives and opportunities for private irrigation and irrigation districts.

1. **AgPace Program** – The Bank of North Dakota (BND) AgPace Program is available to persons developing new irrigation. Changes in the program during the past several years have enhanced its application. One of the more recent changes increased its use from one-time-only to once-per-biennium with a limit of three cycles to use the maximum interest buy-down. The maximum interest buy-down is \$20,000 per cycle. After the first loan cycle, BND policy requires that the net worth of the borrower must be less than \$1 million.
 - a. The State Water Commission (SWC) also makes funds available to the Bank of North Dakota for an additional \$20,000 of interest buy-down for the first time borrower. This brings the total to \$40,000. The State Water Commission funds are used when the loan structuring exceeds the initial \$20,000 from the BND. The funds from the SWC are used subject to the standard policies of the BND. This program has also been widely used.

The partners confer periodically with representatives of the BND and the SWC to determine program effectiveness and the availability of funds. Because of the increased cost of development, consideration should be given to requesting an increase in the interest buy-down limit of \$20,000 for the first time borrower. In addition, the SWC should be encouraged to make funds available to participate in the second and third cycle loans for a borrower, subject to BND policies.

2. **State Water Commission Cost Share** – The State Water Commission (SWC) will cost-share with an irrigation district or any other water oriented political subdivisions the construction of the primary water supply infrastructure. The SWC may provide up to 50 percent cost share on the total cost of qualified infrastructure items associated with the principal capture and conveyance works, depending on the availability of funds. Intake structures, pumps, power units, pipeline, and power supplies are the primary items. On-farm costs such as pipeline and sprinkler systems are not eligible items for this cost-share program. The NDIA and partners supported GDCD in obtaining cost-share funding for developing irrigation on the irrigation projects using water from the McClusky Canal.

3. **Cooperation with the Natural Resources Conservation Service (NRCS) Program** – The NDIA entered into a Agreement with the NRCS in March 2009, under the Agricultural Water Enhancement Program (AWEP) to promote water and energy conservation and improve natural resources in the state. Under this program, producers applied to NDIA for cost sharing programs with the NRCS to enhance these activities. Major objectives of the program were to improve water use efficiencies by changing the irrigation method (i.e. gravity to sprinkler system) or modifying existing systems (i.e. changing from high to low

pressure systems). Energy conservation is also an objective and is achieved in this process by utilizing variable speed drives and/or other management practices which are eligible for cost sharing under AWEP. Other aspects under this Agreement which qualified for cost sharing include the improvement of natural resources (water quality, soil health, etc) and the construction of ponds or other innovative methods for storage of water used for irrigation.

The three-year AWEP agreement ended on September 30, 2011; however, it is still administered in a similar manner by the NRCS. The partners will continue to work closely with the NRCS to seek funding sources and support programs which enhance more efficient irrigation development in the state.

4. **Value-added** – Efforts have been underway for several years by a few producers to grow and market certain vegetables. The production of vegetables has a relatively high risk, but it also carries with it a correspondingly high profit potential. A vibrant vegetable industry usually includes processing, which provides employment opportunities. The potato industry is well established and proven in North Dakota. Other vegetables identified as having excellent potential to be grown in the state are carrots, onions and cabbage. All require irrigation to ensure high yields and quality.

The partners will work with interested parties and/or groups as opportunities occur to provide information and facilitate the development of innovative ways to foster the development of vegetable production in North Dakota. Favorable financing programs are an important component for fostering the initial stages of establishing the industry. Information relative to programs of the federal and state government, in conjunction with political subdivisions of the state, would be provided as a part of the effort.

B. Completed Work

1. Met and worked with representatives of the State Water Commission and the Bank of North Dakota to increase the number of times a producer can use the AgPace Program from one to three times.

2. Consummated a 3-year Agreement with the NRCS in March 2009 under the AWEP for water and energy conservation and natural resource improvement and other related activities. This Agreement ended on September 30, 2011, and all work under this Agreement should be completed in 2012. The NDIA will continue to work with NRCS to achieve the objectives of the Environmental Quality Incentives Program.

3. In 2010, the NDIA Board of Directors approved a contribution of \$5000 as matching funds to the Green Vision Group for their application for grant funding to the Renewable Energy Commission for research work being done by the Group on a project to produce advanced biofuels using energy beets (sugar). NDIA will continue to follow and support this project as it has high potential for enhanced renewable energy and irrigation development.

4. Initiated a successful effort in the 2009 Legislature to remove sales tax from irrigation equipment repair parts.

5. Supported or opposed legislation affecting irrigation development and management in the state.
6. Supported the NDSU Extension and Experiment Station 2011-2013 biennial budget to fund the Soil Health Initiative developed by SBARE. Results of the future research will strengthen the informed management of soil and water resources.

C. Ongoing Work (2016)

1. Review the AgPace Program periodically to determine that it is effective and sufficient funds are available to meet the needs of the qualified applicants.
2. Attend NRCS Technical Committee meetings to keep abreast of their activities and seek methods, programs, and funding to enhance future irrigation development and improvement in the state.
3. Continue to work with the Upper Sheyenne Basin Joint Water Resource Board in the development of water retention ponds for irrigation water storage in the Upper Sheyenne Basin; qualified work under this program is being funded under the Red River Basin Commission AWEP.

D. Future Work (2017-2021)

1. Work with NRCS through AWEP and other programs to support and develop methods to improve irrigation practices, water and energy conservation, enhancement of our natural resources, and other items to improve irrigated agriculture.
2. Support the NDSU budget and other activities during future legislative sessions which may potentially promote and enhance irrigated agriculture in North Dakota.
3. Support funding and related efforts for upgrading and operating the Oakes Irrigation Research Site and support other irrigation related research as needed.

III. PROJECTS

A. Goal: Identify existing and potential irrigation activities and projects in the state which may enhance irrigation development and initiate needed actions and assist in bringing these projects to fruition.

There are numerous opportunities in North Dakota, which if developed, can significantly increase the irrigated acreage and rural economic development. The strategic approach of the partners in developing and assisting irrigation projects is being approached from several fronts which are discussed below.

1. **Project Development** – There are several projects in North Dakota which have high potential for irrigation development. The NDIA, along with NDSU Extension Service, the

SWC, Reclamation, GDCD, NRCS and other involved agencies are working with project managers to assist them in developing irrigation in these areas.

In northeastern North Dakota, there is high interest by some parties in developing irrigation. Water supplies for irrigation are being developed by constructing and utilizing off-stream water holding ponds and capturing water during peak flow periods. Pumping from natural stream flows is also being used along with utilizing water from existing reservoirs. In addition, the feasibility of constructing new reservoirs is being evaluated.

As authorized by the Dakota Water Resources Act, water is available from the McClusky Canal to irrigate up to 13,700 acres in the Turtle Lake Irrigation District (TLID) in addition to 10,000 undesignated acres along the canal. Until recently, water has only been available through annual water service contracts. NDIA, Reclamation, GDCD, NDSU, and others have worked with the TLID and individual irrigators to make water available for irrigation on a more consistent, long-term basis. In 2010, Reclamation made five-year water service contracts available to potential irrigators. A long-term 40 year water contract to use irrigation water from the McClusky Canal was finalized between GDCD and Reclamation in 2013.

Several meetings have been held with the Big Bend Irrigation District board of directors and representatives from the Mercer County Water Resource District to assist in developing irrigation in those areas. Although some individual irrigation is occurring, there are no specific plans to develop irrigation through a united project. Water for irrigation in this area is available from the Missouri River. The feasibility study for the Big Bend Irrigation District identified approximately 48,000 acres as potentially irrigable from the Missouri River in Mercer and Oliver counties.

Several projects have been studied and defined along the Missouri River. They include the Horsehead Project in Emmons county, the Nesson Valley project in southeast Williams county, and the Elk/Charbon project in northern McKenzie county. An irrigation district has been formed for each of the projects. An area in the vicinity of the city of Parshall in southeast Mountrail county has been studied on a preliminary basis and it also holds significant potential. Other areas along the Missouri River corridor may also have potential, but they have not been defined.

The Missouri River is the primary source of water in North Dakota from which substantial volumes of water are still available. To significantly increase irrigated acreage in the state, the Missouri River must be considered as the water source for a large portion of that acreage. In the 1970s, the Bureau of Reclamation and others conducted a reconnaissance study of the concept of diverting water from the McClusky Canal to irrigate lands in parts of Burleigh, Kidder and Emmons counties. Each county has significant acreage of irrigable land.

Large changes have occurred in the agricultural sector as a result of not only changing state and local conditions, but also changes on the national and international front. It is proposed that a preliminary review be made of the potential of diverting water from the Missouri River to irrigate lands in these counties. The entities that could conduct the review and the resources needed have not been identified. As an initial effort, NDIA personnel will research

the records for information developed from previous studies. The next step would be making informal inquiries to the State Water Commission, Reclamation, county water resource districts, and local irrigation districts to discuss and determine interest in the concept.

See “A Look Into The Future” which follows in this document, for more information on the potential for additional irrigation development in North Dakota.

2. Native American Irrigation Activities – Under the authorization of the Dakota Water Resources Act of 2000 the Secretary of the Interior is authorized to develop irrigation within the boundaries of the Fort Berthold (15,200 acres) and Standing Rock (2,380 acres) Indian Reservations.

The Standing Rock has about 600 acres remaining to develop of the 2,380 acres that were authorized for development.

Irrigation is authorized for Three Affiliated Tribes lands, which allows them to receive federal power; however, they have elected to receive their funding through an economic development fund rather than use it to fund irrigation development.

At the present time, there are no plans to develop lands for irrigation on the Fort Berthold Reservation, although a preliminary study has been completed to irrigate certain lands on the Reservation.

3. Water Supply Development – Consistent and adequate water supplies must be made available in areas which are presently being irrigated or have the potential to be feasible irrigation projects. For example, the Oakes Test Area operated by the Dickey-Sargent Irrigation District has a distribution system but does not have an adequate, consistent water supply for irrigation. The NDIA completed a study that identified potential water sources for about 3,500 acres and will continue to work on this project with the Dickey-Sargent ID as needed. As part of this process, the District has applied for a water permit through the SWC. A more efficient distribution system is also needed for these lands.

The drought in the Missouri River Basin from 2006-2009 caused very low water levels in Lake Sakakawea and Lake Oahe, resulting in water being inaccessible to many adjacent irrigators. NDIA participated in a review to identify ways to develop pumping stations that would function under high and low water level conditions. Further study of the issue of pump intakes is needed.

4. Irrigation Assistance – Appropriate partners will continue to work with and assist irrigation districts relative to their organization, operation, management and financing needs in conjunction with the SWC. A list of active and inactive irrigation districts is available from the NDIA.

The partners will also continue to work with individual irrigators by providing information on an ongoing basis through workshops, newsletters, magazines and other means which will provide timely, pertinent, and needed information. Communicating with suppliers and

dealers to keep up-to-date on the latest technology will be done on an ongoing basis; this information will be disseminated to irrigators on request or through normal communication channels.

5. Partnerships – Partnerships with other entities, such as economic development organizations, which have the potential to foster irrigation development as a part of economic development will be continued.

6. Water Permit Application Backlog – The State Water Commission has a significant backlog of water permit applications, some of which have been held in abeyance for several years. The majority of the applications are requests to appropriate ground water for irrigation; however, some applications in the backlog are for surface water. The applications are addressed in their order of priority dates for each respective source. In many instances a computer model is required to adequately address the statutory requirements that must be met before a conditional water permit can be issued. Even though substantial data is available for the aquifer, additional data may need to be collected to ensure the model adequately represents the hydrogeologic conditions of the aquifer. These procedures require significant time, often upwards of a year or more.

Staff has been added after 2013 that helped address the water permit application backlog. However, issues have continued to grow in complexity. Monitoring of this issue will continue.

7. Federal Action – In 2011 the Environmental Protection Agency (EPA) initiated a rule making process that expands the definition of “waters of the United States” (WOTUS). The proposed rule would apply to the Federal Water Pollution Control Act, effectively amending the Act. It would negatively impact state rights for managing water resources by empowering the EPA to review and approve the appropriation of water. All sources of water would be affected, including ground water. This action would require that decisions by the State Engineer be reviewed and approved by the Corps of Engineers and likely the Environmental Protection Agency. These rules, if implemented, would usurp North Dakota’s authority in making decisions concerning the proper management of its water resources and create unacceptable delays in the permitting process. The process is currently (November 2016) being challenged in the courts as a result of lawsuits filed by several states. Pending resolution of the lawsuits, the proposed regulations are not being implemented and rules under the original Act are in effect.

B. Completed Work

1. Met numerous times and worked with existing irrigation districts (such as Horsehead and Turtle Lake) and individuals to assist them in formation, organization, management, financing and irrigation development.
2. Met with existing and/or potential individual irrigators on request and provided assistance related to irrigation development (also ongoing).

3. The partners participated with TLID and other partners in several meetings to determine the best options to obtain irrigation water from the McClusky Canal on a long-term and efficient basis and followed up on actions that would help bring this to fruition. Reclamation entered into long-term water service and power contracts with GDCD for irrigation out of the McClusky Canal.
4. Worked with Reclamation, SWC, and Horsehead Irrigation District to initiate and conduct a study to identify ways to access water for irrigation under variable water levels in Oahe Reservoir and to provide distribution efficiency in the district. This study has not been completed due to a lack of participation (funding) by the local irrigators.
5. Worked with and met with irrigators and potential irrigators in northeastern North Dakota to determine alternative and innovative methods to provide water supplies for irrigation (ponds, off-stream storage, peak flow water capture, etc) and provided assistance in meeting the requirements of state and federal agencies (also ongoing as needed).
6. NDIA and the NRCS entered into an Agreement in March 2009 to make programs available through the AWEP for water and energy conservation, natural resource enhancement, irrigation pond construction and related activities. About \$2 million was provided to producers on a cost share basis to implement these activities. Funding for this Agreement ended on September 30, 2011.
7. Worked with the State Water Commission as needed to obtain resources to provide additional personnel and/or funding to expedite the preparation of recommended decisions on water permit applications for irrigation.

C. Ongoing Work (2016)

1. Continue to meet with existing and potential irrigation districts and individuals as needed to assist them with the development, operation, management, financing and efficiencies of irrigation systems.
2. Work with Horsehead Irrigation District, SWC, and Reclamation as needed to identify ways of obtaining water from Lake Oahe and Lake Sakakawea under changing water levels. Related work such as system consolidation, project pumping power should also be pursued.
3. Work with irrigators in northeastern North Dakota on innovative water supply methods and permit processing to enhance irrigation development in that area..
4. Support and assist as appropriate all efforts for increased irrigation development with water from the McClusky Canal including the development of a long-term water supply contract, project pumping power, funding and other activities.
5. Seek out partnerships with economic development entities and other organizations to enhance irrigation and economic development.

6. Monitor actions relative to modification of the “Federal Water Pollution Control Act” (Clean Water Act) and oppose those which may be detrimental to irrigation and water development.
7. Work with the Upper Sheyenne Basin Joint Water Resource Board to identify areas for constructing water retention ponds for irrigation water supplies and reducing flows into the Sheyenne River. This project is ongoing with two sites identified and one site authorized and funded for construction using Red River Basin Commission AWEP funding. This work did not go forward at the present time for various reasons.
8. Attend meetings held relative to Missouri River activities and provide input to support irrigated agriculture.
9. Work with the SWC, irrigators and others to implement procedures to assure equitable use of irrigation and industrial water in compliance with permitted amounts.
10. Determine the extent and status of studies to determine the feasibility of pumping irrigation water through the use of horizontal wells.

D. Future Work (2017-2021)

1. Reevaluate options on past uncompleted studies for making irrigation water available to Horsehead ID irrigators from Lake Oahe and Lake Sakakawea under low and high water levels, along with the evaluation of the District’s pumping and distribution systems and pursue appropriate actions.
2. Work as requested with the Dickey-Sargent Irrigation District to determine potential water supplies and more efficient and economical water distribution methods for the Oakes Test Area in conjunction with the transfer of facilities to the District.
3. Continue to provide assistance to the Nesson Valley Irrigation District.
4. Work with the Upper Sheyenne Board and similar entities to enhance irrigation development in those areas.
5. Attend and provide input to all Missouri River studies to assure that irrigation interests are considered to provide optimum irrigation development in North Dakota.
6. Work as needed to support and assist with irrigation development on Native American lands.
7. Provide support as needed for the proposed potato processing plant in northwestern ND.
8. Review existing data to determine the potential and feasibility of using Missouri River water in nearby counties for irrigation development.

9. Work with irrigators in northeastern ND and other areas to develop innovative water supplies such as retention ponds, off-stream storage, ground water recharge and other methods for irrigation development.

10. Work on opposition to the COE proposal to charge for water pumped from Lake Sakakawea and Lake Oahe.

IV. RESEARCH

A. Goal: Identify and assist in implementing research programs which will be most beneficial to irrigation development in North Dakota.

Managing our land and water resources to their fullest potential is the goal of the irrigator and the State of North Dakota. The knowledge to manage these resources are best obtained through an effective and well thought out research program. It is critical that research related to irrigated agriculture in North Dakota be given a high priority. Management issues have become important in today's irrigation environment. Crop quality demands by food processors make proper water and chemical applications critical to meet quality standards. In addition producers must meet more stringent requirements in managing chemical, fertilizer, and fungicide application runoff throughout the growing year.

Historically, high fuel prices and the goal of sustainable agricultural production mandates a research effort on reduced tillage. These systems must show economical viability while protecting our environment. The opportunities and needs related to bio-fuels are becoming a major factor in determining what crops are to be grown and ultimately their composition. There is a limited understanding of the effects of removing organic matter for this crop use will have on the long-term productivity of our land base. Factors such as carbon sequestration, soil quality, nutrient cycling and soil erosion must be addressed before this practice becomes widely adapted.

North Dakota State University has facilities for irrigation research at Carrington, Oakes, and Williston (Nesson). Research related to irrigation should receive a high priority in areas such as outreach programs, soil and water and nutrient management, energy issues, farm budgets, disease, sustainable agriculture, value added crops, dairies, processing, cropping practices (crop rotations, variety comparison, irrigation systems), and crop storage.

North Dakota producers must be able to compete at the regional, national and international level. The development of new management practices and technologies through vision and innovation are necessary. These practices and technologies must be tested to determine their adaptability and viability to all regions of the state; therefore, it is imperative that appropriate research be conducted on a high priority basis at each of the research sites in North Dakota for irrigated agriculture.

Following are brief summaries of the objectives for irrigation research at NDSU Research Centers located at Carrington, Oakes, and Williston (Nesson) and the Northern Potato Growers site at Forest River. More detailed information can be obtained for these and other NDSU Research sites at <http://www.ag.ndsu.edu.research.recenthp.htm>.

Research Sites

1. Carrington Research Extension Center and Oakes Irrigation Research Site Carrington Research Extension Center

The Carrington Research Extension Center (CREC) has been conducting research and educational programs to enhance the productivity, competitiveness, and diversity of agriculture in central North Dakota for about 60 years. The research effort focuses on traditional crop variety evaluation, crop production and management, alternative crop development, cropping systems, irrigation integration of crop and livestock production, beef cattle feeding, feedlot management, intensive cow/calf production, foundation feedstocks production, and the development of new agricultural enterprises. The central location of the CREC is significant in that the research program is able to address research needs that represent a significant part of agriculture in North Dakota.

Objectives: (2017-2021)

- Conduct a continuing broad-based agronomy research program to address the diverse crop base of the region and the state.
- Conduct research and demonstration studies at on-farm sites to determine crop tolerance to saline soils.
- Conduct research and studies related to cow/calf production studies.
- The CREC is serving as the lead department for the establishment of regional sugar beet trials to determine sugar beet productivity and viability as a feedstock for biofuel production.
- Perform research on the use of distillers grains as a livestock feed.
- Extended CREC's research capabilities by conducting site specific research to evaluate crop variety performance, disease control strategies, cover crops, planting-tillage systems, saline soil management, and organic farming practices at off-station research sites near the communities of Oakes, Newburg, Fingal, Dazey, Turtle Lake, Wishek, Robinson, Cathay, Menoken, and Buchanan.
- Study the viability of manufacturing and marketing "North Dakota Superfeeds" from combinations of agricultural processing co-products available in the region.
- Continue to lead North Dakota's Discovery Farm Project.
- Perform research and studies on the potential of fruit production in North Dakota.
- Develop, refine, and test cropping systems and agronomic practices for traditional and high value irrigated crops that result in efficient and economical crop production.
- Investigate tillage systems that produce optimum crop performance and are environmentally and economically sustainable.
- Review and refine crop fertility recommendations.
- Develop research projects and collaborations with private and public entities interested in irrigation development and pursue stated objectives.
- Identify and secure appropriate land base and associated infrastructure necessary to empower a sustained research program of ongoing and long-term projects.

2. Oakes Irrigation Test Site

Data on irrigated crop production have been collected for the past 41 years on approximately 20 acres at this site located on the Robert Titus farm. The site is located 4.5 miles south of Oakes adjacent to ND State Highway 1.

This Site was upgraded from 2014-2016 to include about 35 acres on which research can be conducted; a new linear irrigation system with modern technology has been installed on this site which is supplied water from a horizontal well constructed for this purpose. A shop and laboratory building is also planned for construction.

A cooperative agreement between NDSU and the GDCD makes this research possible. NDSU provides the technical expertise and researches and GDCD provides most of the financial resources. Presentations have been made to SBARE to provide authority and funding from NDSU for the operation and maintenance of this facility.

Objectives (2017-2021)

- Provide irrigators with information for more efficient crop production.
- Develop and refine Best Management Practices that are producer acceptable.
- Promote irrigation development in North Dakota.
- Determine alternate and specialty crops to be grown under irrigation in North Dakota and develop agronomic practices for their successful adaptation.

To achieve the general objectives listed above, the following trials, studies, and extension activities are performed (these will vary somewhat from year to year).

Performance Trials

- Barley variety trial
- Dry edible bean variety trials
- Corn hybrid performance trial
- Hard red spring wheat variety trial
- Onion hybrid performance trial
- Processing potato trial
- Soybean variety trials
- Soybean breeding nursery

Weed Control Studies

- Cover crops and desiccation methods to control weeds in potatoes

Crop Production Management Studies

- Energy beet variety trial
- Corn hybrid and row width study
- Potato variety nitrogen rate study
- Strip-till, corn on corn, nitrogen rate study
- Strip-till, corn on soybean, nitrogen rate study
- Optimum corn stover removal for bio-fuel and the environment

3. Williston (Nesson Irrigation Research Site)

Development of this site began in about 2002 and research activities began in about 2004. The site has four 1260 foot self propelled linear move irrigation systems which have the capability to provide the latest technology in selective irrigation water and fertilizer application. Each system serves a 40-acre site. Computerized controls tied to a GPS system with feedback from wireless sensor stations in the field determine the water and fertilizer requirements for site specific areas or plots. The controllers regulate application of water and fertilizer to each plot based on GPS position and soil, water, temperature and other feedback. These systems are particularly useful for research because of their ability to precisely apply water to any area of a field to exactly match the needs of specific crops and conditions.

These research facilities were funded by numerous state, county, city, federal, REC, and other public and industry cooperators. The USDA Agricultural Research Service from Sidney, MT conducts research on one 40-acre tract.

Objectives (2017-2021)

- Conduct and support research related to irrigated malt barley, sugar beet expansion, potato production, storage facilities, value-added alfalfa production, expanded dry bean production, expanded irrigated durum production, feedlots, dairies, expanded irrigated agriculture, and expanding new food processing and industrial plants in North Dakota.
- Develop irrigated enterprise budgets and improve evaporation/transpiration crop curves for irrigation scheduling to assist irrigation producers in improvement of their irrigation management of water and nutrients to increase income and profitability on a sustainable basis.
- Compare crop responses and water quality relative to the use of water from Lake Sakakawea and the Hofflund Aquifer.
- Provide information in evaluating the effect of specific crop management programs in transition from dryland to irrigated agriculture.
- Develop a multi-agency, multi-state research and development project.
- Assess the environmental impacts of improved management of water, nutrient, chemical applications, and cultural practices in irrigated cropping systems.
- Examine the interaction between irrigation methods and crop rotations and evaluate the effects of crop rotations and tillage on crop yields and quality, and nutrient and water movement.
- Development of alternative cropping systems and a nutrient and pest management plan for irrigable lands.
- Development of water and cultural management strategies for optimal production and water use efficiency of high value crops production and water quality.
- Improvement of the agronomic, and environmental qualities of irrigated row crop production in coarse-textured, well-drained soils by modifying nitrogen management practices, irrigated management practices, and planting configurations.

- Compile enterprise budgets to assist producers in making production decisions.

4. Forest River Research Site

a. **Identification of Critical Research Needs and Funding** – Research projects in the state will be identified and prioritized by working with the NDIA, NDSU Extension personnel, irrigators, GDCD Agriculture and Natural Resources Committee, SBARE, producers and others. Funding for these projects will be supported and pursued by the partners.

A diversity of crops can be grown in North Dakota. A comprehensive research effort must be continued to support existing crops and new alternative crop acreage and to provide the information necessary to expand the utilization of crops within the cropping systems of North Dakota. Crop breeding systems have advanced at an almost exponential rate in recent years which increases the urgency of unbiased testing that is specific to different regions of the state. Additionally, recent research has substantiated the belief that performance of crop cultivars is influenced by production systems within specific eco-systems. These production systems may be defined by irrigation versus dryland or the contrasts of tillage systems. Testing the latest germplasm and providing that information into the producers' hands in a timely fashion is a high priority.

b. **Soil Health Initiatives--** NDSU Extension Service and Experiment Stations have implemented the Soil Health Initiative authorized by the 2011 Legislature. The research results from this program will provide information that will strengthen the informed development and management of irrigation in North Dakota. It is estimated that salinity is a problem on about 12 million acres of land in the state.

4. **Distribution of Research Results** – Results from studies will be published in professional journals, popular press, extension releases and annual reports, posted on the NDSU Website, and presented at meetings field days and tours. On-farm research and demonstration projects will continue to be held. The outreach effort will stress resource and guidance that personnel of the project provide. Researchers involved with a project will be speakers at subject matter workshops throughout the year and provide counsel to growers via telephone and personal visits.

The partners will assist when possible in the distribution of research results to the irrigators and other users in a timely and useable manner through newsletters, *North Dakota Water* magazine and other means. Follow up to obtain feedback on research results relative to their benefits, use, and application will also be made.

B. Completed Work

1. Attended GDCD Agriculture and Natural Resources Committee quarterly meetings which include discussions on irrigated agriculture in general as well as research performed by the NDSU Experiment Stations.

2. Met periodically and participated in monthly telephone conference call with NDSU research personnel to discuss and provide input and support for funding for needed research related to irrigated agriculture.
3. Attended SBARE meetings and made a presentations to solicit support and funding for research related to drainage and controlling high water tables and salinity and general soil health initiatives on irrigated lands and the Green Vision biofuels project utilizing energy beets (sugar).
4. Wrote articles in the *North Dakota Water* magazine and newsletters supporting research for irrigated agriculture.
5. Supported the NDSU Extension and Experiment Station appropriation bill in the 2011 Legislature which included funding for the Soil Health Initiative Program. This legislation was approved.
6. Attended a demonstration of the installation by a commercial company of a subsurface drain (plastic tubing) about 2 miles west of Edmore, which was sponsored by NDSU.

C. Ongoing Work (2016)

1. Attend GDCD Agriculture and Natural Resources Committee meetings which include discussions and identification of research needs related to irrigated agriculture.
2. Meet or communicate monthly or more frequently with NDSU Extension personnel to identify research and other irrigated agriculture needs in the state. Specific research will be prioritized and the level of financing estimated along with the implementation procedures.
3. Communicate with SBARE and attend meetings as needed to support irrigated agriculture research priorities.
4. Publish articles in the *North Dakota Water* magazine and newsletters in support of irrigation research.
5. Assist and/or disseminate research information to users through various avenues of communication.

D. Future Work (2017-2021)

1. Work with research personnel and others to identify and prioritize research work in the state as identified above, and support and pursue management support for funding and implementation for irrigated agriculture in the state.
2. Determine need for and support legislation related to research for irrigated agriculture in the state.

3. Obtain and provide information to SBARE and others to support research on irrigated agriculture.
4. Continue to attend GDCD's Agricultural and Natural Resources Committee meetings and provide reports and input as appropriate.
5. Publish articles in the Irrigation Frontier section of the WATER magazine related to irrigated research.

V. Energy (project pumping power rates)

A. Goal: Implement “project pumping power” for irrigation of about 56,000 acres of land in the Missouri River Basin as authorized under the Dakota Water Resources Act and for other lands in North Dakota as authorized by the Flood Control Act of 1944.

North Dakota gave up 550,000 acres of land as part of the Pick-Sloan Missouri Basin Program (PSMRP), which, among other things, authorized the construction of five major dams on the Missouri River (Fort Peck Dam was previously constructed). The PSMRP authorized the irrigation of more than 1 million acres of land in North Dakota which never materialized. The generators in these dams, however, produce large amounts of hydropower which is mostly used in other states.

The PSMRP authorized irrigation of the Garrison Diversion Project along with the use of hydropower (project pumping power rates) for pumping of project water. The Act of 1965, authorized the irrigation of 250,000 acres; however, it was eventually amended by the Reformulation Act of 1986 and the Dakota Water Resources Act of 2000 which reduced the authorized non-Indian irrigation acreage to 57,900 acres (Oakes Test Area 5,000 acres, McClusky Canal 10,000 acres, Turtle Lake Irrigation Area 13,700 acres, New Rockford Canal 1,200 acres, undesignated 28,000 acres). While the federal government has not funded the construction of the authorized acres, the use of project pumping power rates for these acres of new irrigation is authorized.

While it is recognized that the long-promised irrigation from the Garrison Diversion project will likely not be realized in the foreseeable future; favorable power rates/benefits should be provided for irrigation development in the state in the form of project pumping or preference power rates as authorized initially under the Pick-Sloan Act and reauthorized for certain lands under DWRA.

Efforts have been ongoing since about 2000 to obtain project pumping power rates for irrigation as authorized under the DWRA; however, most efforts have not been successful. Since these power rates could have a significant effect on increasing irrigation development in North Dakota this issue is a high priority and will be pursued along with other related issues.

Access to power and power rates for irrigation is a problem in many areas. While it is difficult to satisfy all individual needs, efforts should be made to alleviate these problems as much as possible.

1. **Project Pumping Power** – All efforts will be made to implement project pumping power rates as authorized under DWRA by working with state REC’s, Reclamation, irrigation districts, Congressional delegation, and others.

2. **Alternative Power Sources** – There are several power sources for running irrigation systems including electric, diesel, and others, most of which are becoming quite expensive. It would be helpful to the irrigator to be aware of these costs in a timely manner in order to choose the best option(s) for their conditions. This information will be distributed to irrigators and potential irrigators as appropriate.

B. Completed Work

1. Pursued the implementation of project pumping power rates during the past several years as authorized in the Dakota Water Resources Act by meeting and working with Reclamation, Horsehead and Turtle Lake Irrigation Districts, RECs, GDCD, legislative personnel, and others involved in this long, tedious process. This remains an ongoing goal of NDIA.

2. Worked with representatives of the Upper Missouri Water Association to obtain project pumping power rates for irrigation as authorized by the Flood Control Act of 1944 (Pick-Sloan Act).

3. Met with the REC representatives to discuss and seek support for implementing Project pumping power as authorized under DWRA and followed up with agreed upon issues.

4. GDCD and Reclamation have signed a 40 year agreement for irrigating from the McClusky Canal which includes the use of “project pumping power”.

C. Ongoing Work (2016)

1. Pursue project pumping power rate implementation as authorized by the Dakota Water Resources Act.

2. GDCD and Reclamation continues to develop irrigation with water from the McClusky Canal. The utilization of “project pumping power” for irrigation will be part of this process. NDIA will support this process and participate as appropriate.

D. Future Work (2017-2021)

1. Work with Reclamation and others to obtain “project pumping power” rates as authorized under the DWRA legislation. Meet with the “Innovative Energy Alliance” to pursue project pumping power.

2. Develop and provide up-to-date information on alternative power sources for irrigation.

3. Support the development of a long term contracts for irrigation from the McClusky Canal with Reclamation including project pumping power implementation.

VI. COMMUNICATION AND COORDINATION

A. Goal: Provide information from the first five work elements in this plan to existing and potential irrigators, and other interested persons.

Providing information on questions, issues, and problems related to irrigation is an essential function of the partners. To realize benefits from the first five work elements, the outcome must be conveyed to the irrigation community. The flow and exchange of information is the best way an efficient and effective process can be established and maintained to expand and strengthen irrigation in North Dakota. In many ways the NDIA serves in the role of facilitator to the irrigation industry. This process is accomplished in a variety of ways.

1. **Supporters** – Excellent working relationships have been established with many government agencies, other organizations, and individuals having an interest in irrigation. They include the U. S. Bureau of Reclamation, NRCS, NDSU Extension Service, North Dakota Governor’s Office, State Water Commission, Garrison Diversion Conservancy District, Missouri Slope Irrigation Development Association, irrigation districts, irrigation equipment dealers, businesses, financial institutions, and individual irrigators. Communicating periodically with people involved in the organizations as well as the irrigators helps provide a more united effort to better understand the questions and issues faced by those operating the industry.

Each month, a conference call takes place between NDSU Extension, State Water Commission, Bureau of Reclamation, and NDIA personnel. Each person reports on their irrigation- related activities for the previous month and pertinent issues are discussed. Through this call, activities are coordinated and everyone is brought up to date on the events of the previous month. A summary of the reports is prepared and provided to group members, NDIA directors and others who are involved in irrigation.

2. **Workshops** – Irrigation workshops have been held annually in Bismarck and recently in Williston; other workshops are periodically held depending on local interest. These workshops are an effective way of providing information on many topics important to successful irrigation. Typically, the talks at workshops present information on the latest research on certain irrigated crops, irrigation water management, equipment technology, soils, irrigated crop budgets, special projects, and water rights issues, to name a few. Each August or September, representatives from NDSU Extension, NDIA and others meet to plan the workshops to be held that fall and early winter to prepare a list of topics on which information should be presented and select tentative locations.

The Irrigation Expo is held in conjunction with the annual North Dakota Water Users convention, which takes place in early December in Bismarck. An irrigation workshop sponsored by NDSU Extension Service is held during the convention. In addition, irrigation equipment suppliers, water agencies, engineering firms, and agricultural suppliers have booths at which representatives are available to provide pertinent information. This gives those with irrigation interests an opportunity to obtain information, exchange ideas and coordinate activities.

3. **Publications** – Information must also be disseminated through the print media. A two-page article pertaining to a timely topic on irrigation is written by NDIA personnel and included in the “Irrigation Frontier” section of the *North Dakota Water* magazine which is published ten months each year. One or two newsletters may be prepared by NDIA during the winter months, when the NDSU Extension Service’s publication “Water Spouts” is not published. They convey information on activities and events that are of interest to the irrigation community.

4. **Membership** – In December 2016, the NDIA had 118 members compared to 128 in 2015. There are several hundred irrigators in North Dakota and many businesses providing services for irrigation who are not members of the NDIA. Efforts must be continued to solicit their membership. A plan should be prepared for proceeding with the membership drive that identifies the approach and means of reaching out to prospective members. It is suggested that board members assist in the solicitation of new members in their respective home areas. It is the board’s goal to increase membership each year.

5. **Website** – The internet also provides a means of making information on irrigation widely accessible through the personal computer. NDIA is a part of the website for the North Dakota Water Users Association. The website upgrade was completed in 2014. It can be accessed at <http://www.ndwater.com>. Click on “programs” to bring up the NDIA link. Information will be added to the website periodically as needed.

6. **Outreach and education** – Staff of the NDIA and various partners participate in water tours and NDSU research station field days when the program is related to irrigation or water related issues. The tours are conducted by the North Dakota Water Education Foundation are often attended by NDIA personnel because water is the common theme. In addition, some organizations periodically hold tours to view irrigation facilities in North Dakota which are attended if appropriate. An irrigation tour is held annually in different geographical areas of the state to discuss and illustrate irrigation on a state-wide basis. These tours are planned and conducted by WEF and NDIA personnel.

7. **North Dakota Missouri River Advisory Council** - During the past 2 years (2014-2016), efforts have been ongoing to form a grass roots organization to identify and protect North Dakota’s interests in the Missouri River. NDIA has been involved in this efforts and has representation on the executive committee and is a member of the organization.

B. Completed Work

1. Assisted in planning, attended, and participated in workshops that emphasized high-value and other irrigated crops in Bismarck, Williston and other cities and area throughout the state. Attended many other workshops, seminars and activities which dealt with high-value crops development, financing and marketing or related issues.

2. Met with representatives and toured facilities of the malt barley, ethanol, alfalfa, onion and other industries to become acquainted with these industries and support price premiums and irrigation for those crops.

3. Participated in monthly conference calls between staff members of NDSU Extension Service, Bureau of Reclamation, and the State Water Commission.
4. Sent letters and information to approximately 200 irrigators inviting them to become members of NDIA.
5. Prepared 10 articles for the “Irrigation Frontier” section of the *North Dakota Water* magazine each year, covering a variety of topics relevant to irrigation in North Dakota and prepared and distributed to members, newsletters related to irrigation activities.
6. Participated in North Dakota Water Education Foundation tours to discuss irrigation and other water resource issues with tour participants. Planned and conducted an annual irrigation tour with the Water Education Foundation in various parts of the state.
7. Prepared and published, in cooperation with NDSU Extension Service, grower guides for enhancing irrigation development in North Dakota. These included grower and irrigation management guides for corn and malt barley and guidelines and benefits for irrigation district development and irrigation financing.
8. NDIA, North Dakota Water Users Association, NDSU Extension Service and Missouri Slope Irrigation Development Association annually sponsor the North Dakota Irrigation Expo. The two-day event is held in conjunction with the annual North Dakota Water Convention in Bismarck.
9. Updated the “Comprehensive Strategic Plan for Irrigation in North Dakota”.
10. Completed upgrade of North Dakota Water Users website of which NDIA is a part.

C. Ongoing Work (2016)

1. Prepare 10 articles (yearly) for the “Irrigation Frontier” section of the *North Dakota Water* magazine.
2. Participate in the monthly conference calls with representatives of NDSU Extension Service, Bureau of Reclamation, and the State Water Commission.
3. Participate in numerous workshops, tours, and meetings relevant to irrigation.
4. Respond to requests for information from irrigators, potential irrigators, and others as needed.
5. Attend meetings of the State Water Commission, Garrison Diversion Conservancy District and other relevant water organizations board of directors as appropriate.
6. Develop a plan in coordination with the Board of Directors to increase NDIA membership.

7. Represent the use of water for irrigation on the North Dakota Missouri River Advisory Council

8. Plan and conduct an annual irrigation tour in conjunction with the Water Education Foundation.

D. Future Work (2017-2021)

1. Continue to work on way to increase the membership of the NDIA to gain more statewide support for irrigation development. Develop a plan to accomplish this in consultation with the board of directors or committee thereof.

2. In cooperation with NDSU, GDCD, the State Water Commission and others, update the ‘Comprehensive Strategic Plan for Irrigation in North Dakota’ to provide direction and guidance for irrigation development in North Dakota.

3. Assist in planning and participating in two or more irrigation workshops annually and/or discuss alternatives for providing information to irrigators, potential irrigators, and related organizations. Participate in tours, meetings, and other activities to promote irrigation in North Dakota.

4. Solicit topics for “Irrigation Frontier” articles from the irrigation community and provide information as needed.

5. Evaluate NDIA website periodically and update as appropriate.

6. Evaluate annually the need for new brochures and/or the revision of existing ones.

7. Attend and participate in Water Education Foundation tours, research site field demonstrations, and other site visits related to irrigated agriculture.

8. Sponsor the North Dakota Irrigation Expo in cooperation with North Dakota Water Users, North Dakota State University Extension Service and the Missouri Slope Development Association held in conjunction with the annual North Dakota Water Convention in Bismarck.

9. Appoint a group of water experts to evaluate all aspects of irrigation in North Dakota, including its interaction with national and global activities and develop a list of action items that should be pursued as we look into the future of irrigated agriculture

10. Work with federal agencies such as the Corps of Engineers and Bureau of Reclamation and others to identify and enhance water management and development (such as water from federal reservoirs, institute more workable regulations for development, wetland issues)

A LOOK INTO THE FUTURE

GENERAL BACKGROUND AND NEED

The “Comprehensive Strategic Plan for Irrigation in North Dakota” (Strategic Plan) discusses the near future of irrigation by addressing work items for 2016 and for 2017-2021. However, it does not present a view of a longer-term future for irrigation in North Dakota and its role in the local, state, national, and global economy. It is important to determine the long-term potential for irrigation development in the state to obtain a reasonable perspective on how to better prepare for and achieve this development. This would also help to accomplish the mission of the North Dakota Irrigation Association and its partners which is to strengthen and expand irrigation to build and diversify our economy.

Future population projections for the next 25 years in North Dakota, the United States, and the world vary considerably, but a reasonable estimate may fall in the range of 1 million, 400 million, and 9 billion, respectively. This will greatly increase the demand for additional food and fiber on a state, national, and global basis which will be very difficult to meet. Some of these needs can and should be met by agricultural producers in North Dakota.

The following discussion will set forth ideas for meeting some of these demands by the future development of irrigated agriculture in North Dakota taking into consideration state, national, and global needs. Obviously there are many unknowns, but hopefully this will provide a basis for further discussion and ideas for future actions.

Many of the benefits of irrigation in North Dakota are discussed in various parts of the above Strategic Plan; however, for ready access and clarity they are summarized below:

- Certain high value crops require irrigation to achieve the yield and quality required by the users.
- On the average, irrigated agriculture provides at least a 3:1 economic benefit over dryland farming.
- “Dry” hydrologic cycles in North Dakota can and have resulted in marginal income on non-irrigated lands due to decreased crop production and quality.
- Irrigation development has high potential to preserve and provide more thriving rural economic development.
- An ever-increasing national and world population will require a greater food supply and North Dakota, through increased irrigation development, is in a position to contribute significantly toward that effort.
- A significant amount of irrigated land in the arid western United States is being displaced by industrial and municipal development. North Dakota is in a good position to play a significant role to replace a portion of this production through irrigation because of its abundant and available high-quality land and water resources.
- North Dakota is in a strategic geographic location to provide irrigated products to East Coast and perhaps some Canadian markets at a lower cost than western producers.
- Water and suitable land for irrigation is generally more available and less costly in North Dakota.

- The need for additional crop production will be required as feedstock for producing biofuels; irrigation can and should help fill this gap.

North Dakota has the lowest acreage of irrigated land in the 17 western states for a variety of reasons. These reasons include the occurrence of periods with sufficient rainfall to support successful dryland agriculture, the failure to develop a large federal irrigation project, a history of dryland farming, federal crop support programs, lack of reliable markets for irrigated agriculture products, and others. Despite this, irrigation has continued to increase in the state at a consistent (but rather slow) pace. About 275,000 acres of land were irrigated in 2016 with an annual increase of less than 2,000 acres during the past several years. Since this was a “wet” hydrologic cycle, a “dry” cycle will likely result in a greater increase of new irrigated acres.

Great strides have been made in the past by the irrigated agriculture research community to develop new and improved crop varieties and methods, and it is very likely that this trend will continue. New and better crop varieties will be developed that are more disease and drought resistant, have greater yield potential, and have higher quality to better meet user needs.

Irrigation engineers and others have developed improved methods of water application, conservation, fertilizer and seed protectants, GPS, and other improved technologies. Future work will continue to improve this technology and other techniques to enhance management and reduce labor and water requirements for irrigation.

Legislation and administration decisions made in the past have not always been beneficial to irrigated agriculture. Some examples are the Endangered Species Act, wetlands regulations, and water quality regulations. Proposed legislation and the activities of regulatory agencies must be monitored and supported in a way that balances the best interests of irrigated agriculture and conservation are considered in the respective processes.

Based on the above discussion, it is obvious that there is significant opportunity for enhanced irrigation development which would not only benefit North Dakota, but would also assist in meeting the ever-increasing future national and global food, energy, and other related needs.

EXISTING IRRIGATION AND POTENTIAL FUTURE DEVELOPMENT

The annual increase in irrigation development has occurred within a rather stable environment related to the irrigation industry and favorable weather conditions for dryland agriculture. A significant change in conditions in the industry will likely be needed for a significant spike in the present rate of increase in irrigated acres. Examples of this may be increased or new markets, a general drier weather pattern, and/or a combination of the factors mentioned below.

Studies and experience show that at least 500,000-600,000 acres of additional land is suitable for irrigation development in the state. These lands were judged to have soil and water resources, geographic location, and favorable engineering and related criteria which make them suitable for development without expected significant management or excessive cost problems. Factors such as weather, reliable markets especially for high value crops, state of the agricultural industry, availability of economical power, funding assistance for construction of pumping and distribution facilities, individual desires, political impediments, environmental concerns and related factors will

determine the rate of development. It should be noted that many of the aquifers of glacial origin in the state are at or near full allocation and the potential for additional allocations from groundwater is quite limited.

There are several million acres of additional irrigable land in the state; however, they have limitations related to soils, suitable water, relative locations of soil and water, drainage, surface slopes, salinity and sodic problems, geographic location, and other factors which make them less suitable and feasible for irrigation. A study by NDSU (Omodt 1982) in 18 counties in central North Dakota (see attached map) based on soil suitability assessment alone, identified about 8.5 million acres which might be irrigated. About 6.5 million of these acres have some or all of the limitations mentioned above; however, the other 2.5 million would be suitable for irrigation development without significant problems, provided suitable water is available.

The 1995 study, "Inventory of Potential Irrigation Development in Central North Dakota" was completed by the State Water Commission (Olson, Schuh) in 18 counties in central North Dakota (see attached map). The purpose of this report was to evaluate and identify lands in this part of the state that had potential for irrigation development. The study showed that about 310,000 acres have good potential for development without excessive management, cost, or political impediments. This is considered a conservative estimate and with more favorable conditions, could be as high as 500,000 acres. The following criteria were generally applied to this study: lands must be classified as irrigable or conditionally irrigable with less than 3percent slope, subsurface drainage is not generally required, irrigable land must directly overlie groundwater aquifers, irrigation must be within a proximity of 5 miles of the surface water source, static lift for transport of water must not exceed 260 feet, and the maximum distance of irrigable land area not to be more than 7-10 miles from the source, depending on size.

The attached map "North Dakota Irrigated Acreage and Potential Irrigation Development" and table "Actual and Estimated Potential Irrigation Development for North Dakota" shows the actual irrigated acres in 2010 and the estimated potential irrigation development for North Dakota in the future. The potential irrigation development comes from a variety of sources (studies, past experiences of irrigation personnel, soil and water and related data, etc.) and is presented as a general estimate. Please keep in mind that some or all of the factors affecting irrigation development mentioned above could significantly change the information presented below.

NORTHWEST AREA

This area had about 54,000 acres of irrigated land in 2010. Most of this irrigation is in Williams and McKenzie counties. Additional potential for additional irrigation development in Williams, McKenzie, and Mountrail counties is significant, mostly from surface water (Missouri River) supplies. It is estimated that the additional development potential could be 100,000 acres or more, primarily in Williams, McKenzie, and Mountrail counties.

NORTH CENTRAL

In 2010, there were about 10,000 acres irrigated in this area. The potential for additional irrigation development in this area is quite low. There may be small areas in Ward County where ground and/or surface water supplies are available for irrigation development. McHenry County

had about 9,000 acres of irrigation in 2010. Additional potential, mostly from groundwater, in Ward and McHenry counties is estimated to be about 10,000 acres.

NORTH CENTRAL/NORTHEAST

The irrigated acreage in this area in 2010 was about 6,000 acres. Most of the recent irrigation has been limited and scattered in Benson, Ramsey, and Rolette counties. Irrigation development in this area has been quite limited due to limited reliable water supplies and limited suitable irrigable soils. Historically, irrigation development in this area has been limited and development in the future will likely be 10,000 acres or less.

NORTHEAST/EAST CENTRAL

There were about 36,000 acres of land irrigated in this area in 2010 with the majority of it being in Grand Forks (about 22,000 acres) and Griggs (about 6,000 acres) counties. The other counties had irrigated acreages up to about 1,900 acres. The rate of development has been gradual in recent years and it appears that development will continue at somewhere around this rate with a future potential for development of about 35,000 acres.

SOUTHEAST

This area has one of the highest concentrations of irrigation development in the state. Cass, Ransom, Richland, Sargent, LaMoure, and Dickey counties had about 86,000 acres of irrigated acres in 2010. Most of the irrigation is from groundwater and it is expected that future development may be about 40,000 acres, primarily from groundwater sources, although this supply is somewhat limited. The Dickey-Sargent Irrigation District, with the assistance of the Garrison Diversion Conservancy District, is in the process of developing a more firm water supply for the Oakes Test Area, which has an existing infrastructure for additional development. This could result in a permanent irrigation development of 5,000-8,000 acres. There are several irrigation dealerships and many farmers in this area who are experienced irrigators and will perhaps expand their irrigation and also influence others if conditions are favorable.

CENTRAL-SOUTH CENTRAL

There were about 38,000 acres irrigated in this area in 2010 with about 25,000 acres located in Kidder County. A majority of the irrigation is from groundwater; future irrigation development in this area will likely be a combination of ground and surface water. Additional potential exists for irrigation development in Sheridan, Wells, Eddy, Foster, Stutsman, McIntosh, and Logan counties for up to 50,000 acres. A huge potential also exists in western Kidder County (Missouri River Basin) which has an excellent land resource of 60,000 acres or more. Development of this land for irrigation would require conveying water from the Missouri River. The McClusky Canal, along with additional infrastructure, could be utilized for this purpose.

MISSOURI RIVER (EAST)

There were about 19,000 acres irrigated in McLean, Burleigh, and Emmons counties in 2010. The majority of this land is irrigated with water from the Missouri River. There are substantial areas with soils well suited for irrigation in these counties with an estimated 170,000 acres having good potential for irrigation development. About 75 percent of this acreage could be irrigated with Missouri River water or from adjacent streams with the rest being irrigated with

groundwater. A substantial investment would be required to construct the infrastructure required to develop much of this land for irrigation.

MISSOURI RIVER (WEST)

There were about 19,000 acres irrigated in this area in 2010. There is considerable potential for additional development from primarily the Missouri River and other surface sources; some groundwater is also available for additional development. It is estimated that about **60,000 additional acres** could be developed from both surface and groundwater sources. Considerable funding would be required to construct an infrastructure to transport and distribute the surface water to the irrigable lands.

SOUTHWEST

Historically, irrigation has been quite limited in this area with about 5,000 acres being irrigated in 2010 in separate areas. Limited water supplies along with a lack of irrigable blocks of land have limited irrigation development. Agriculture in this area is primarily cattle ranching, which has not encouraged irrigation development. For these reasons, it appears that additional irrigation development in these counties will be quite limited.

WHAT IS NEEDED TO OPTIMIZE IRRIGATION DEVELOPMENT IN THE FUTURE?

Many of the key needs for optimal enhancement of irrigated agriculture have been discussed in the Strategic Plan; however, some of the key elements are repeated below to emphasize their importance.

Research

Irrigation research must be well planned with clearly stated goals. Leadership and adequate funding and facilities are essential for effective and long-term research to meet modern-day needs. Projects will likely involve several disciplines as new information increases our understanding of the ecosystem in which crops are produced. The ultimate goal is to increase crop yield and quality within economic limits. Major research elements include:

- Disease-resistant crop varieties
- Genetically modified crops
- Weather conditions, modification, and forecasting
- Soil health and management
- Crop rotation
- Development of techniques to preserve/enhance our natural resources (water and soil)
- Development of non-traditional crops (herbs, shrubs, trees, fruits)
- Control of crop pests
- Water quality
- Outreach
- No-till, minimum till, cover crops, and strip tillage
- Development of rotational weed control procedures and new herbicides

Equipment

Technology improvements in irrigation equipment have been significant during the past 10-15 years. Many improvements have been made in water application efficiencies by converting from

gravity to sprinkler irrigation systems, using low-pressure systems, use of drip systems, water measurement, and variable rate irrigation. More needs to be pursued. Refinements in the development of irrigation pivot systems have been significant, GPS technology, and variable speed drives among others have contributed to these improvements. Incentives to improve these developments have been provided by federal, state, and local entities and should continue and perhaps be broadened in scope. Some improvements will continue naturally, but a more proactive approach should be taken on selected technologies. Some of these are listed below.

- Selective irrigation using GPS techniques
- New irrigation methods and management
- Development and management of high-technology equipment
- Remote electronic control of systems
- Development of farm equipment to meet future needs (i.e. minimum/strip tillage equipment)
- Development of improved procedures and methods for more efficient use of water
- New system development
- Drainage installation techniques and equipment
- Drip irrigation
- Greenhouses and high tunnel use for high-value crops
- Drones

The above look at the future of irrigated agriculture for the period 2016 and beyond is obviously very subjective and maybe limited in nature; however, some of the issues discussed are appropriate for any time period and should/will likely be pursued on an ongoing basis. Institutional, legislative, and management issues are important to this subject and perhaps should be evaluated and appropriate actions instituted. For example, legislated farm programs have been instrumental in implementing efficient and economic procedures, which have led to general improvement in irrigated agriculture. There is no doubt that the issues discussed above will greatly affect irrigated agriculture development in the next 30 years. Those who work in this area must be vigilant to those changes and take appropriate actions to keep pace and maintain optimum progress and efficiency in this industry.

Institutional, Legislation and Management Issues

The competition and demand for water gets greater and greater as our population increases and as we continually strive for a higher standard of living, which includes higher water usage and higher quality of water. Among the typical uses of water, irrigation is one of the highest users; therefore, efficiency in water application and plant use versus potential yield must be carefully balanced. Institutional, legislative, and management actions will be critical to the determination of methods to best use this vital resource.

The management of our future water resources should be evaluated critically by an experienced group of water experts to determine what changes can or should be made to manage and develop our water resources in the most efficient and effective manner (see VI. D.9. of the Strategic Plan). These issues should be monitored consistently and needed changes identified. Actions should then be taken to strive for achievement of the most effective methods while maintaining a balance among all uses. Some issues that are being considered and perhaps should have increased emphasis along with new initiatives are listed below:

- Continue to track state and federal legislation and regulations to assure actions are beneficial to irrigation development
- Be proactive in introducing and proposing new legislation and regulations which would enhance irrigation management and development
- Evaluate and remove existing irrigation rules and regulations which no longer apply and/or inhibit development
- Continue to seek out new markets and enhance existing ones to promote irrigation development
- Evaluate and promote irrigation for the production of biofuels such as energy beets.
- Continue to evaluate management practices associated with irrigated agriculture to determine and implement best practices
- Develop procedures within North Dakota so that all agencies, entities, and others involved in irrigated agriculture continue to work together closely on a cooperative basis to achieve common goals
- Investigate and identify new lands for irrigation development
- Evaluate existing incentives for water conservation, irrigation development, and other related aspects and identify others which could enhance development
- Consider legislation to implement water savings measures
- Develop programs which would encourage changing diets to foods which require less water to produce and also promote health (eat less and healthier food)
- Fund research to enhance production, both quantity and variety
- Develop and promote programs to more appropriately utilize and retain irrigated and irrigable land for that purpose
- Implement technology to irrigate lawns more efficiently
- Curtail the practice of growing lawns; replace lawns with gardens

SUMMARY

Future population growth on a local, state, national, and global basis will dictate the need for the production of more food and fiber. North Dakota is contributing significantly to this effort and can and should enhance this effort in the future both from dryland and irrigated production. Of the 17 western states, North Dakota has the least irrigated land and the expansion of irrigation development in recent years has increased at a rather slow pace. Soil and water resources in the state are available to increase irrigation development at a much faster pace, which would enhance rural economic development as well as significantly increase production. On the average, it takes about three dryland acres to equal the production of one irrigated acre.

In 2014, there were about 275,000 acres irrigated in North Dakota. As described above, the potential for future irrigation development in the state is at least 550,000 acres. These lands have soil and water resources, geographic location, and favorable engineering and related criteria, which make them suitable for development without significant management or excessive cost problems. The attached map and table show acres irrigated in 2010 and potential irrigation development in selected areas of the state.

Groundwater resources are somewhat limited in some areas of the state because the aquifers are at or near full allocation; however, some additional groundwater is available for irrigation development as shown in the study. Surface water, especially from the Missouri River, is available for significant

irrigation development. This would require considerable funding for the infrastructure for irrigation development. Management and funding mechanisms and assistance would be required to complete the required irrigation works (pumps, distribution works, etc). Some public funding would also be required to complete this work.

Measures should be taken to protect our greatest source of fresh water in the state; the Missouri River represents about 96 percent of our fresh water supply in the state—we need to assure that we get our share and that it is not exported to out-of-basin interests.

It will require a united effort by the NDIA and all those involved in irrigation to achieve its mission, which is to “strengthen and expand irrigation to build and diversify our economy.” The potential for irrigation development in the state is significant. It is up to those involved in this activity to achieve that potential.