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# Foreword

This short report has been prepared as a component in a review of the current status and future direction of irrigation in Alberta. The review is being conducted by Alberta Agriculture, Food and Rural Development (AAFRD), Alberta Irrigation Projects Association, and the 13 irrigation districts. A summary report on the review is in preparation.

The author, J.R. (Dick) Hart, Hart Water Management Consulting, based this report primarily on the work of Dr. Marvin S. Anderson, Marv Anderson & Associates (2000). Editorial review, formatting and layout was provided by Campbell & Associates Ltd. Bonnie Hofer, Irrigation Branch, AAFRD provided the cover design, graphics and photographs.

South Saskatchewan River Basin

# Irrigation into the 21st Century

# Economic Benefits and Opportunities

## Contents



# Key Findings

*5.4 % of cultivated land contributes 18.4% of agri-food GDP.*

Currently, irrigation development occupies 5.4 percent of the cultivated land in Alberta. Considering the increases in primary production due to irrigation and its spinoff agri-food processing, irrigation contributes about $832 million or 18.4 percent to Alberta's agri-food GDP. In addition, irrigation infrastructure provides significant non-irrigation benefits related to municipal and industrial water supplies, recreation and tourism, and wildlife. Use of irrigation and its infrastructure in southern Alberta weave an economic, social and environmental fabric that supports human life.

*Irrigation will contribute to Ag Summit goals.*

With regard to the future, in early 2000 the Alberta government organized AgSummit 2000 as a government/industry consultative process to examine issues, challenges and opportunities in the agri-food industry, and to set in place procedures to ensure industry is well-positioned to face the challenges and global realities of the future. More than 1,500 Albertans took part in the process.

A recent report by AgSummit (2000) identified 10 priority areas for the agri-food industry, namely (in no particular order):

1. diversification and value-adding
2. environmental stewardship
3. future of farm business
4. sustainable rural communities
5. research innovation and technology
6. new business strategies
7. food quality and safety
8. global market development
9. building an entrepreneurial culture
10. public image of agriculture and food industry

A framework for addressing each area has been put in place, and work on meeting these challenges is underway. Irrigation intensification and expansion will contribute positively to meeting most of the 10 challenges. Five areas in particular are noteworthy.

## 1 Growth in Agri-Processing

**The agricultural development strategy in Alberta depends on strong growth in the agri-processing sector.** Dr. Marvin S. Anderson has indicated that to be successful in meeting growth targets, a disproportionate amount of growth must take place in irrigation-dependent southern Alberta. This region now has a high ratio of value-added processing to primary production (2.66 compared with 1.05 for other regions of Alberta). There are several reasons for this high ratio, including the following two key ones:

- Many of the crops that are in demand as processed products must be grown under irrigation in southern Alberta where the longer growing season, high heat units and relatively secure moisture result in stable, high-quality production. In addition, the backward linkages to agricultural suppliers and related industries are well established, and the prerequisite infrastructure is in place.
- There is already a vibrant and growing agri-industrial complex in southern Alberta, which has reached a critical mass capable of substantially more growth, assuming that high-quality primary production is available at internationally competitive prices. The complex is large enough to generate synergies such that one agro-economic activity stimulates the development of yet another.

Irrigation related agri-processing currently adds about $536 million to the agri-food GDP. By 2010, intensification alone will increase that contribution to $711 million (an increase of about 32 percent), and 20 percent expansion would increase it to $853 million (a total increase of about 60 percent).

## 2 Improvement in Quality of Life

**Irrigation can continue to improve the environment and quality of life in Alberta.** Measures are in place or are being developed to protect aquatic ecosystems of the streams that feed irrigation. Given these safeguards, irrigation can have a significant net positive impact on the environment and quality of life in Alberta. Irrigation also sustains the agricultural resource base by increasing land productivity by 250 to 300 percent, and reducing wind and water erosion.

## 3 Reduction of Farm Risks

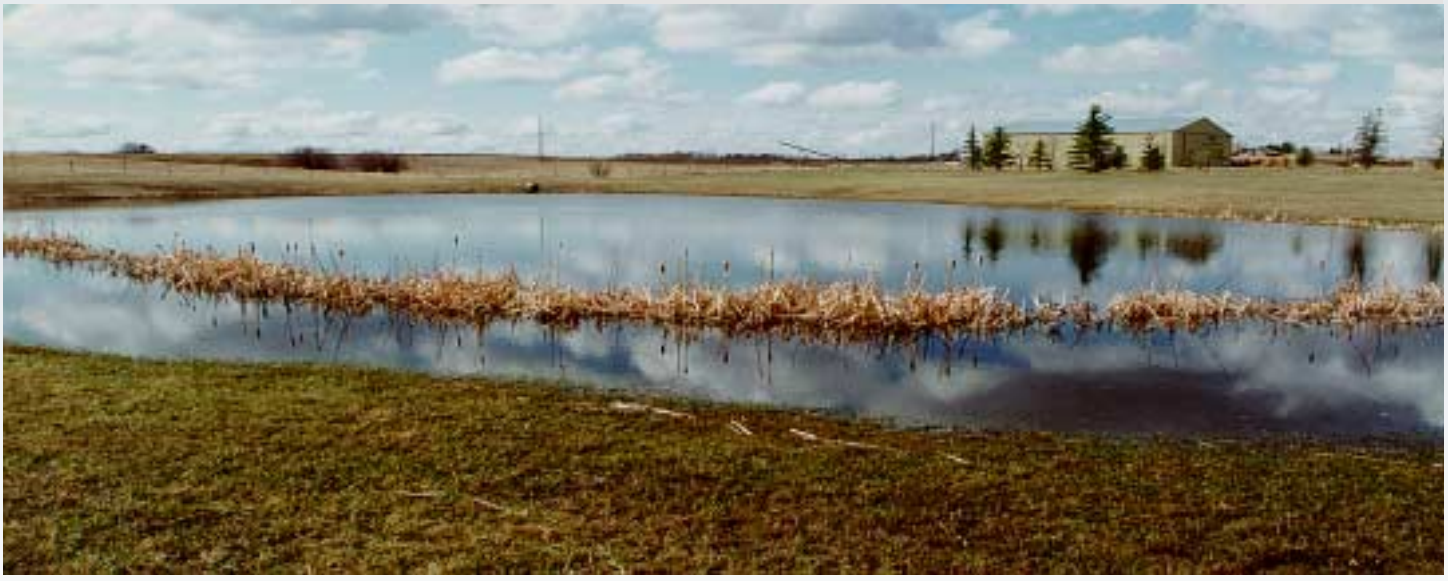
**Irrigation development reduces farm risks and the need for government and private safety nets, fosters on-farm diversity, and increases profit margins.** The trend toward consolidation of farming enterprises, increased input costs, reduced profit margins and increased risks poses a threat to the family farm business and the sustainability of rural communities. Irrigation development improves the long-term sustainability of smaller farm units.

## 4 Support of Agri-Business

**The requirement for irrigation supplies and services supports rural agri-business enterprises.** Higher labour requirements for primary production on irrigated land, for the agricultural service sector and for irrigation induced post-primary processing would increase rural populations and contribute to more vibrant communities and infrastructure development.

## 5 Influx of New Ideas and Resources

**The capacity for industry-led research, which will increase industry success, has greatly increased**, and will continue to grow. Research, innovation and technology are critical to long-term success in value-added processing. The addition of several multi-national agri-processors in the irrigated area of Alberta (e.g., McCain, Lamb Weston, Cargill) has brought new ideas, new resources, and greater potential for synergies where agriculture invests in agriculture.



# Introduction

The irrigation districts in southern Alberta, with their extensive networks of canals, pipelines, drains and reservoirs, have a profound impact on the entire region – an impact that extends well beyond the farm gate. Secure supplies of good-quality water have always been a concern to farmers and ranchers in southern Alberta. Urban communities face similar concerns. Local surface water supplies are usually unreliable; groundwater supplies, where adequate quantity can be found, are often of poor quality.

*Irrigation has a profound effect on Southern Alberta.*

Although the initial development of water diversions and irrigation infrastructure was predicated upon increasing and stabilizing crop production, the irrigation distribution works soon became a supplemental source, and often the sole source, of good-quality water for domestic, stock watering, municipal and industrial uses in southern Alberta. Dependencies on the irrigation infrastructure for non-irrigation uses of water became entrenched.

*There would be few water bodies in southern Alberta if it weren't for irrigation.*

Without irrigation reservoirs or supplements to natural water bodies by irrigation diversions, there would be very few permanent water bodies in southern Alberta. Municipalities and the province have developed parks and recreation areas on these water bodies to provide water-based recreational opportunities, which otherwise would not have been possible. These recreation areas have become very popular over the years.

Irrigation diversions also are used to create habitat for wildlife. Prior to the 1970s, these projects were often in association with uncontrolled seepage from irrigation canals. However, as irrigation districts have improved irrigation efficiency over the years through rehabilitating canals or replacing them with pipelines, seepage has essentially been eliminated. Most of the wildlife habitat projects are now supported by controlled releases from the irrigation distribution system. New wildlife projects have

been developed as districts make conscious efforts to address quality of life and environmental sustainability issues.

*Irrigation is now an integral component of the economic, environmental and social fabric of southern Alberta.*

Irrigation is now an integral component of the economic, environmental and social fabric of southern Alberta. There are many direct and indirect benefits of the irrigation infrastructure, and promising prospects for the future with intensification of irrigation, increases in agri-food processing, and expansion of the irrigated area.

# Benefits of Irrigation

## Primary Agricultural Production

The approximately 1.3 million acres of irrigation is 5.4 percent of the cultivated land in Alberta, and is farmed by about 8.3 percent of Alberta's farmers. Irrigation benefits farm production in four important ways:

1. **Increased yields** – Yields of conventional crops (crops that are grown on both dryland and irrigated land) are commonly increased two to three-fold, and even more in arid regions of southeastern Alberta.
2. **New crops** – Irrigation makes possible the production of "new crops" (crops that are generally not viable under dryland agriculture), such as corn, beans, peas, sugar beets and potatoes. These are typically higher value crops than conventional crops.
3. **Stability** – Irrigated crop yields are more stable and reliable, resulting

*The irrigated southern part of Alberta is attractive for agri-processing industries.*

in greater income stability, reduced crop insurance costs, and greater assurance in meeting production targets and marketing contracts.

4. **Diversity** – Irrigation fosters diversity in farm production. For instance, nearly 60 percent of all Alberta beef is fattened in southern Alberta's irrigation areas, creating employment and adding value to forage crop production.

The increases in primary production from irrigating 1.3 million acres of land in 1999 are shown in Table 1.

*Irrigation creates economic ripples that generate additional employment and income.*

**Table 1: Increases in Primary Production of Crops and Livestock Resulting from Irrigation (1999)**

| Economic Indicator | | Primary Benefit | | Incremental Irrigation Benefits |
|---|---|---|---|---|
| | | Irrigation | Dryland | |
| **Gross sales ($ million)** | Crops | 298 | 59 | 239 |
| | Livestock | 562 | 78 | 484 |
| | Total | 860 | 137 | 723 |
| **Value-added ($ million)[1]** | Crops | 163 | 31 | 132 |
| | Livestock | 95 | 16 | 79 |
| | Total | 258 | 47 | 211 |
| **Employment (full-time equivalent)** | Crops | 3,142 | 881 | 2,261 |
| | Livestock | 1,821 | 464 | 1,357 |
| | Total | 4,963 | 1,345 | 3,618 |

[1]Value-added is the return to labour, land, management and capital requirements. It is approximately the same as the computations underlying the Gross Domestic Product (Marv Anderson 2000).

The impact on Alberta's economy from these increases in primary production contribute much more than the area of irrigation would suggest. Although only about 5.4 percent of the cropland is irrigated, it generates over 14 percent of farm cash receipts, about 11 percent of the agricultural value-added receipts and 19 percent of direct agricultural employment.

## Farm Supply Implications

Compared to dryland agriculture, irrigation requires increased inputs and expenditures to realize the primary benefits – inputs such as fertilizers, pesticides, irrigation equipment and special crop harvesting equipment. These 'backward linkages' create economic activities that ripple through the economy to generate additional employment and incomes.

Effects of backward linkages on the economy and employment have been estimated using multipliers (scaling factors) of primary benefits (Table 2).

**Table 2: Backward Linkages from Irrigated and Dryland Primary Production of Crops and Livestock**

| Economic Indicator | Backward Linkage | | Incremental Irrigation Benefits |
|---|---|---|---|
| | Irrigation | Dryland | |
| **Gross sales ($ million)** | 860 | 137 | 723 |
| **Value-added ($ million)** | 215 | 34 | 181 |
| **Employment (full-time equiv.)** | 2,150 | 343 | 1,807 |

## Agri-processing Implications

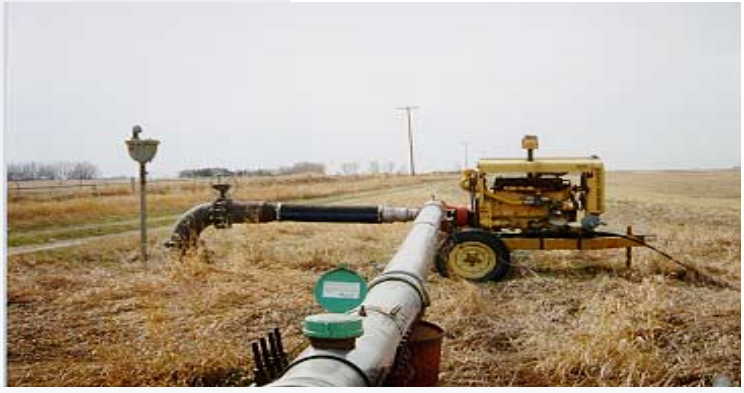
Irrigation stimulates post-primary economic activities (forward linkages) such as storage, transportation, and meat and vegetable processing. A 1996 profile of Alberta's rapidly growing agri-processing industry

indicates that it was a $6.8 billion business with nearly 18,000 employees. It had a large meat and poultry component (33%), followed in size by beverages (11%), dairy products and vegetables (each 9%), and flour products (8%). In-province value-adding processing of agricultural produce allows Albertans to capture additional incomes and employment from primary production, rather than exporting raw produce, as has been the predominant historical pattern.

*$927 million value is added annually to Alberta's economy by irrigation.*

Agri-processing is largely concentrated in the irrigation-dependent southern part of the province. The ratio between the value of agri-processing shipments and farm receipts from primary production is 2.66 in the irrigated south, compared with 1.05 for other parts of Alberta. The socio-economic factors that make Alberta in general, and the irrigated southern part of Alberta in particular, attractive for agri-processing activities include:

- adequate quantity and quality water for the processing activity
- reliable supply of high quality raw material at a relatively low cost
- technologically advanced, skilled and motivated workers
- strong institutions with a focus on the environment and long-term sustainability
- excellent physical infrastructure (roads, power, water, natural gas)
- excellent social infrastructure (schools, hospitals, recreational facilities, religious freedom)
- proximity to markets
- business friendly tax structure, and political and social environment



The estimated post-primary production impacts of 1.3 million acres of irrigated agriculture in 1999 were as follows (Table 3):

*About 42,000 people in 47 southern Alberta communities rely on irrigation districts for their water supplies.*

**Table 3: Post-Production Impacts of Irrigation on Sales and Employment (1999)**

| Economic Indicator | Forward Linkage | | Incremental Irrigation Benefits |
|---|---|---|---|
| | Irrigation | Dryland | |
| **Gross sales ($ million)** | 2,266 | 144 | 2,122 |
| **Value-added ($ million)** | 574 | 38 | 536 |
| **Employment (full-time equiv.)** | 5,971 | 308 | 5,663 |

## Total Agricultural Impacts

The total agricultural impacts of irrigation, both direct and indirect, in 1999 are estimated in Table 4.

The value-added estimate of $927 million approximates the incremental contribution of irrigation to the agri-food GDP, considering primary production and both backward and forward linkages. The 1999 agri-food GDP for all Alberta has been determined by Alberta Agriculture, Food and Rural Development (AAFRD) to be $4.52 billion[2], considering only primary production and forward linkages (AAFRD. 2000). In 1999 the incremental irrigation-based component

**Table 4: Total Agricultural Benefits of Agriculture from Irrigation (1999)**

| Economic Indicator | Backward Linkage | | Incremental Irrigation Benefits |
|---|---|---|---|
| | Irrigation | Dryland | |
| **Gross sales ($ million)** | 3,986 | 418 | 3,568 |
| **Value-added ($ million)** | 1,047 | 120 | 927 |
| **Employment (full-time equiv.)** | 13,084 | 1,996 | 11,088 |

represented about 16.5 percent[3] of the agri-food GDP for all Alberta.

[2]Agri-Food GDP determined at factor cost in constant 1992 dollars. AAFRD excludes backward linkages from their computations.

[3]Excluding backward linkages to be consistent with the Agri-Food GDP, the ratio of the irrigation GDP to the Agri-Food GDP is equal to (0.927 - 0.181) / 4.53 = 0.165.

## Non-Agricultural Benefits of Irrigation Infrastructure

In addition to the direct and indirect agricultural benefits from irrigation, there are significant additional benefits related to municipal and industrial water supplies, recreation and tourism, and wildlife.

Irrigation development benefits municipalities and industries by providing raw and potable water, and by providing a means of disposing of wastewater. About 42,000 people in 47 southern Alberta communities rely on irrigation districts for their water supplies–and the list is growing. Twelve major industrial users (in addition to those within the communities) use water directly from irrigation infrastructure. A number of communities and industries rely on effluent irrigation for disposal of their wastewater.

*About 20 irrigation reservoirs provide an estimated 250,000 angler-days of recreational fishing.*

About 89 major water bodies in the irrigation area support recreational activities. Recreational pursuits include water-based activities such as boating, angling, swimming and water skiing, as well as camping, hunting, and wildlife watching and photography. There are 7 provincial parks, 26 municipal parks and 13 day-use recreational areas on or nearby irrigation reservoirs or canals. The number of user-days is in the order of 400,000 per year.

More than 20 irrigation reservoirs provide an estimated 250,000 angler-days of recreational fishing for species such as whitefish, northern pike and walleye. In addition, commercial fishing typically yields about 300 tonnes annually, valued at about $500,000.

*Irrigation water is used for beef feedlots, stock watering, domestic uses, market gardens, golf courses, tree farms and sod farms.*

About 80,000 acres of wetland habitat has been created or enhanced by irrigation development. The wetlands provide habitat to a variety of waterfowl, shorebirds, amphibians and reptiles, including several species of special concern due to declining populations. Improved upland habitat adjacent to the wetlands enhances conditions for wildlife species such as foxes, weasels, badgers, sharp-tailed grouse, hawks, owls deer and antelope. Over 60 percent of the province's pheasant population exists within the irrigation districts. Trail systems such as the Kinbrook Marsh Nature Trail in the Eastern Irrigation District have become very popular for recreational and educational purposes.

As well as being used by Albertans, recreational facilities in the irrigation areas attract out-of-province visitors. Tourists spend about $2 million per year on water-based recreation in southern Alberta. The monetary impact of recreational activities on the regional economy is estimated to be in

*Alberta's agri-food sector challenge: $10 billion in primary production and $20 billion in value-added manufacturing by 2005.*

*Achieving the value-added processing target will be challenging and will require new ideas, new products and new businesses.*

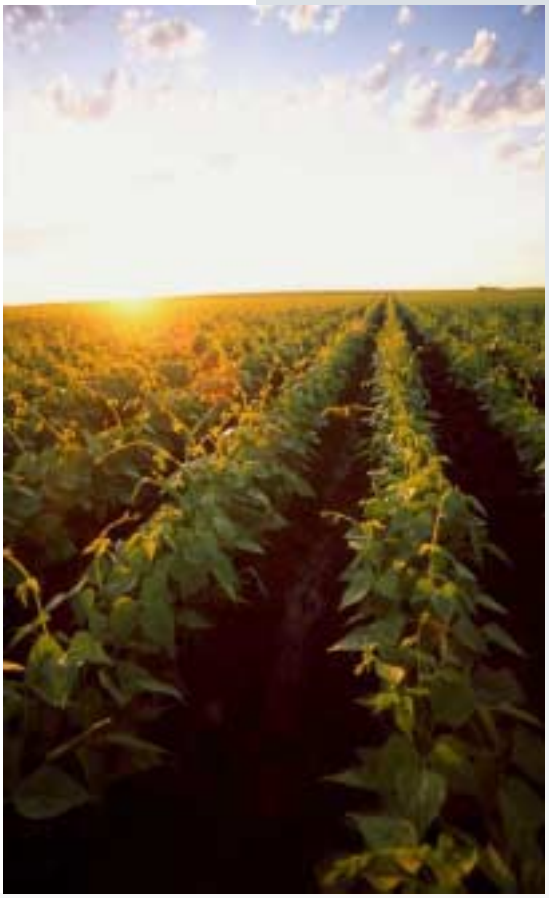
the order of $29 million per year – a value that equals 3 to 4 percent of farm cash receipts.

Other non-irrigation uses of irrigation works include water supply for beef feedlots, stock watering and domestic uses, market gardens, golf courses, tree farms and sod farms. Irrigation works provide the source of domestic and stock water for at least 15 rural co-operative water supply projects.

The dense green biomass produced in the irrigation areas, and the resulting evaporation and transpiration of water is believed to have a moderating effect on the climate, by reducing temperature fluctuations and increasing precipitation. Also, the additional vegetation reduces wind and water erosion of fertile topsoil. For local residents, these benefits are real and significant.

## Opportunities for the Future

In 1995, AAFRD challenged Alberta's agri-food sector to strive for $10 billion in primary production and $20 billion in value-added manufacturing by 2005. The ministry retained Toma and Bouma Management Consultants to identify and explore various scenarios for meeting the challenge. The consultants concluded that the primary production target could likely be achieved though a crop/livestock diversification strategy. Achieving the value-



*The meat processing industry in the irrigated south is expected to increase by 50% by 2010.*

added processing target would be more challenging and would require new ideas, new products and new businesses.

*Forage production will continue to increase, resulting in a continual shift away from cereals.*

The Alberta government, particularly AAFRD, has established economic and job creation goals that focus largely on the need to add value to all raw materials produced within the province (AAFRD 1999). An intensified and expanded irrigation industry is central to the agri-food industry successfully implementing both a crop and livestock diversification strategy and expanding its value-added processing sector.

Following is a brief overview of the likely evolution in the irrigation industry over the next 10 years, with and without expansion of the irrigated area from the current 1.3 million acres (Anderson 2000).

## Livestock

Additional beef production, beef finishing and slaughter operations in Alberta, and particularly southeastern Alberta, is expected to serve western Canada and, increasingly, the United States Pacific northwest. A 50 percent increase in the meat processing industry in the irrigation dependent south is expected by 2010. Feedlot capacity would also have to expand and become more dispersed throughout the irrigated areas.

*Alberta beef production, finishing and slaughter operations are expected to serve Western Canada and beyond.*

Forage production will continue to increase. Irrigated barley and corn silage are key feed ingredients for feedlots in southern Alberta. By 2010 it is expected that the acreage of forage production will comprise almost one half of the irrigated land. This will result in a continual shift away from cereal grain crops.

## Agri-Processing

Based on recent trends and predictions from the irrigation and agri-processing industries:

*The agri-processing sector in Alberta is expected to grow at more than 4% per year in irrigated areas.*

- The agri-processing sector in Alberta is expected to grow at about 4 percent per year. The growth rate in the irrigation areas is expected to be slightly higher.
- The irrigation sector currently accounts for about 30 percent of agri-processing shipments. This share is expected to climb slightly over time to about 32 percent by 2010. The value-added component is expected to increase from a current 26 percent to 29 percent. Employment is expected to remain flat at about 30 percent.
- Vegetable processing in Alberta, which is tied to irrigated farm production, is expected to become more concentrated in the irrigation areas.
- The crop requirements of the agri-processing industry will increasingly impact primary production patterns and the marketing structure in irrigated areas. Producer-industry commodity contracts will become more common.
- The oilseed acreage, particularly canola, is expected to increase from the current 130,000 acres to about 200,000 acres.
- The acreage of cereal crops will decrease, gradually shifting to grains that can be processed locally – feed barley for the livestock industry and wheat for the local flour milling industry (Ellison Milling Company).

*Virtually all the anticipated shifts in production will support value-added processing.*

Virtually all the anticipated shifts in production will support more value-added processing within Alberta. Land use intensities and input requirements will increase.

*By 2010, crop intensification will increase value-added impact by 27% over current level.*

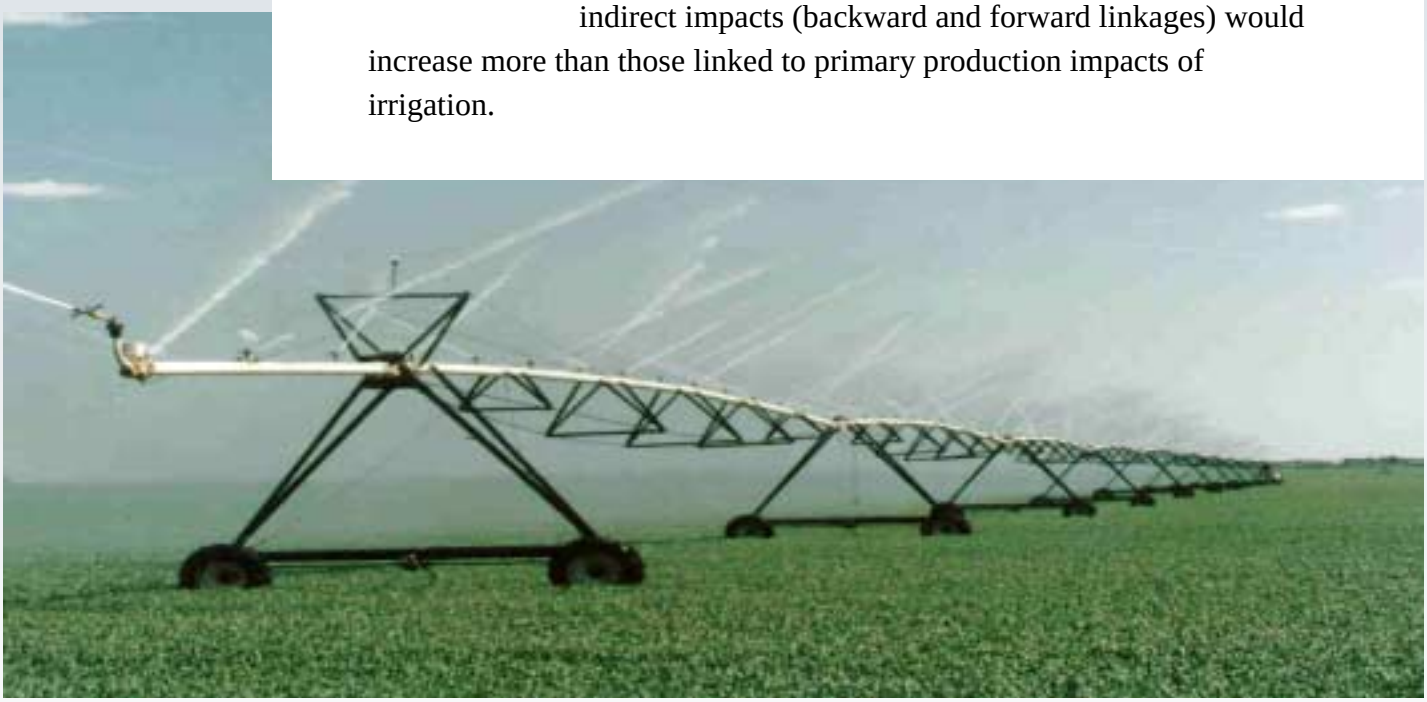
## Impacts of Intensification and Expansion of Irrigation

The impacts of intensification and two levels of expansion, 10 and 20 percent, are summarized in Tables 5 and 6.

The 2005 and 2010 intensification scenarios track the economic impacts of a change in cropping patterns – a change particularly in two areas: a shift from cereals to forage to support the livestock industry, and to specialty crops to support the agri-processing industry. By 2010 the total provincial value-added impact (direct and indirect) would be about $248 million, an increase of 27 percent over the current value-added contribution of irrigation. Employment would increase by almost 2,400 jobs, an increase of 21 percent over current irrigation-related employment.

*By 2010, irrigation expansion will double the impact of crop production shifts, adding an additional $483 million to Alberta's agri-food GDP.*

Irrigation expansion by 10 or 20 percent would additionally stimulate the Alberta economy. A 20 percent expansion by 2010 would approximately double the impact of the demand-driven crop shifts, increasing it from 27 percent to 52 percent over current levels. The value would reach $483 million — equal to an approximate 10 percent increase in Alberta's total agri-food GDP. Total direct and indirect employment would increase by more than 5,000 person-years. The total indirect impacts (backward and forward linkages) would increase more than those linked to primary production impacts of irrigation.



## Table 5: Projected Impacts of Irrigation Intensification

| Impact | Base Case 1999 – 1.3 million acres | | | Intensification Only (no expansion) 2005 – 1.3 million acres | | | 2010 – 1.3 million acres | | |
|---|---|---|---|---|---|---|---|---|---|
| | Gross Sales ($million) | Value-Added ($million) | Employ-ment (FTE) | Gross Sales ($million) | Value-Added ($million) | Employ-ment (FTE) | Gross Sales ($million) | Value-Added ($million) | Employ-ment (FTE) |
| **Direct (crops and live-stock)** | 723 | 211 | 3,618 | 811 | 230 | 3,853 | 881 | 244 | 4,067 |
| **Backward linkages (suppliers)** | 723 | 181 | 1,807 | 811 | 203 | 2,026 | 881 | 220 | 2,203 |
| **Forward linkages (processors)** | 2,122 | 536 | 5,663 | 2,534 | 644 | 6,528 | 2787 | 711 | 7,191 |
| **Total (direct and indi-rect)** | 3,568 | 927 | 11,088 | 4,155 | 1,078 | 1,2407 | 4,550 | 1,175 | 13,461 |
| **Increase from 1999 base case** | -- | -- | -- | 587 (16%) | 150 (16%) | 1,319 (12%) | 982 (28%) | 248 (27%) | 2,374 (21%) |

## Table 6: Projected Impacts of Irrigation Intensification and Expansion

| Impact | Base Case 1999 – 1.3 million acres | | | Intensification + 10% Expansion 2005 – 1.3 million acres | | | Intensification + 20% Expansion 2010 – 1.3 million acres | | |
|---|---|---|---|---|---|---|---|---|---|
| | Gross Sales | Value-Added | Employ-ment | Gross Sales | Value-Added | Employ-ment | Gross Sales | Value-Added | Employ-ment |
| **Direct (crops and** | 723 | 211 | 3,618 | 892 | 253 | 4,239 | 1,058 | 293 | 4,881 |
| **Backward linkages** | 723 | 181 | 1,807 | 892 | 223 | 2,229 | 1,058 | 264 | 2,644 |
| **Forward linkages** | 2,122 | 536 | 5,663 | 2,788 | 709 | 7,181 | 3,345 | 853 | 8,629 |
| **Total (direct and** | 3,568 | 927 | 11,088 | 4,571 | 1,185 | 13,649 | 5,460 | 1,411 | 16,154 |
| **Increase from 1999 base** | -- | -- | -- | 1,003 | 258 | 1,319 | 1,892 | 483 | 5,067 |
| **Increase due to 10 %** | | | | 416 | 108 | 1,243 | | | |
| **Increase due to 20 % expansion only** | | | | | | | 910 (25%) | 235 (25%) | 2,693 (24%) |

1. All figures in Tables 5 and 6 represent incremental values over dryland agriculture on the same areas.
2. Value-added estimate (direct and indirect) is approximately equal to the contribution to the Agri-Food GDP.
3. Employment based on 1.0 person-year per $100,000 in direct sales and assumes a 1.0 FTE equivalent equals 1880 person-hours.
4. Expansion-only benefits are the difference between the expansion-plus-intensification scenario and the intensification-only scenario.

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