Technical Annex

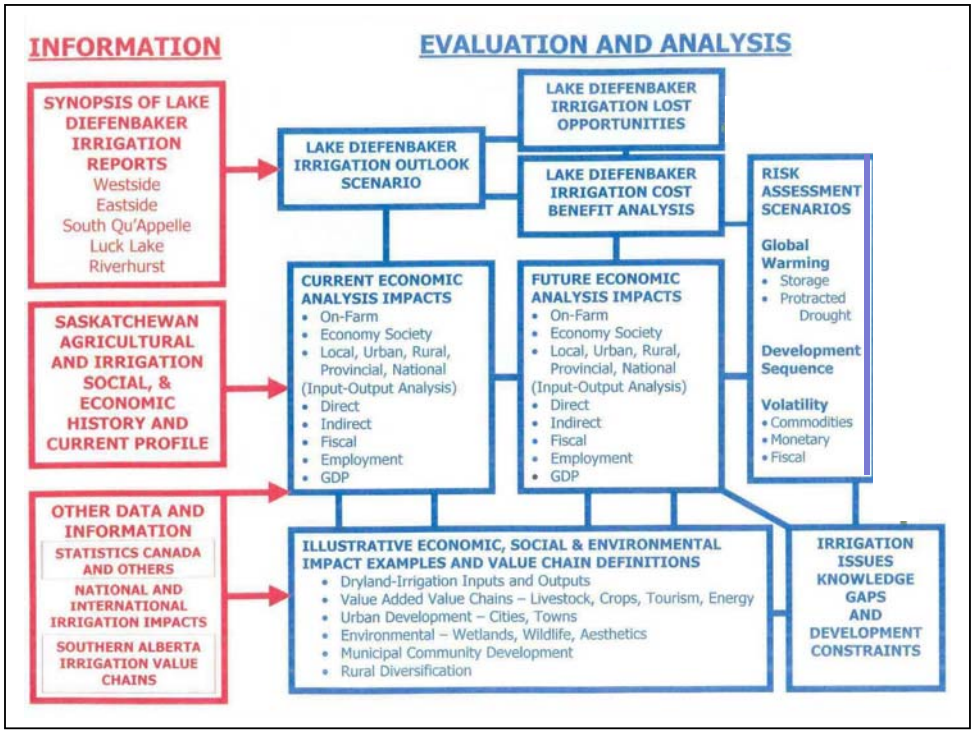
Evaluating Economic Benefits
The Conceptual Framework

Project Approach and Methodology

The irrigation benefits and impact evaluation has been based on the methodological framework shown in Figure A1 that combines information, evaluation and analysis. This approach has used the latest information available from international, national and western provincial sources, developed a series of irrigation outlook scenarios based upon reasonable expectations of future prospects, introduced sensitivity analyses to assess the risk of change and alternative approaches to project development and identified the major barriers and constraints to the developments. Illustrative case studies and examples of critical impact or benefit areas have been highlighted throughout the analysis.

Figure A1

Methodological Framework for the Saskatchewan Irrigation Social, Economic and Environmental Benefits and Evaluation Project



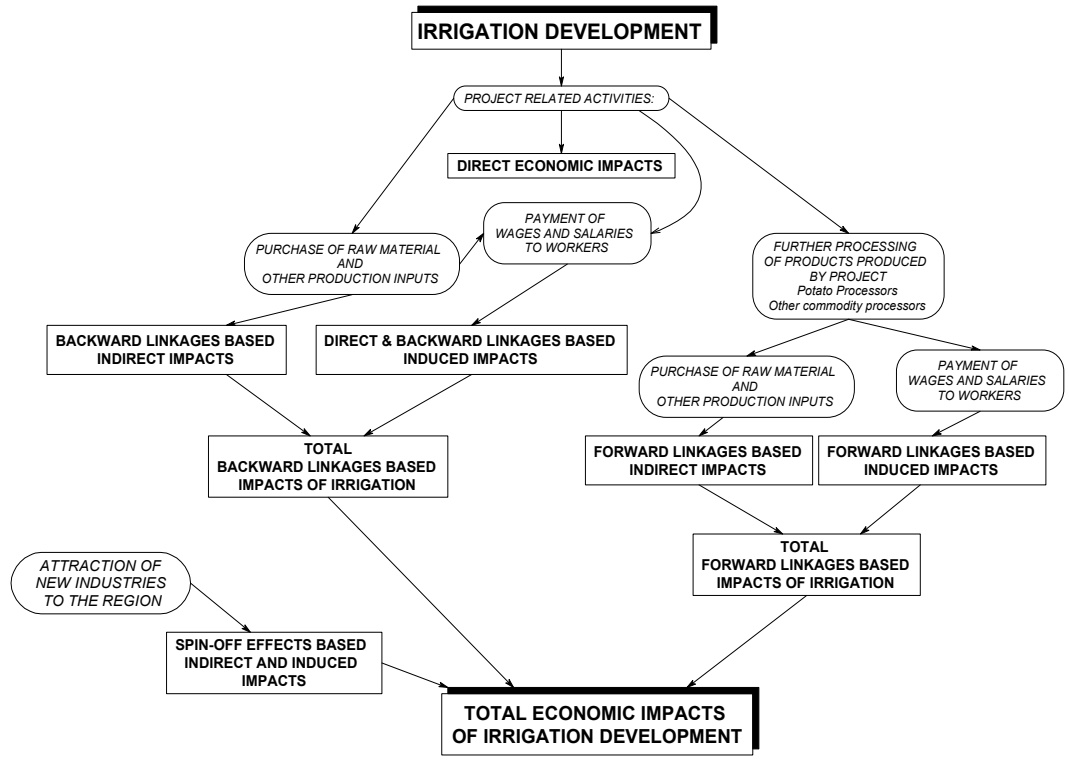
Economic Impact Evaluation Framework

Irrigation investments commonly have effects that extend well beyond the impact on the farm. Water distribution systems often service many farms and the existence of secure supplies of irrigated agricultural products can lead to the development of many further economic expenditures and benefits throughout the agricultural and rural value chain. Not all of these effects are to be found in the irrigation districts and many extend to the larger cities and the rest of Canada. Public expenditures are often used to finance investments in regional irrigation distribution works and at times as contributions to on-farm investments in irrigation equipment and private investments in value added activities.

The evaluation of direct, indirect and indirect effects of the irrigation investments are analyzed in the context of a regional economy. This is shown schematically below and systematically defines the forward, backward, direct, indirect and induced effects of the irrigation investments. These arise from both the agricultural economy, new building blocks in the regional economy and the macro economic effects of the investments and related operations on the labour force and through the wider economy. Input Output Analysis and Cost Benefit provide analytical frameworks that can be used to evaluate the effects of both public and private investments on the wider society at large.

Figure A2

Methodological Framework for Forward and Backward Linkages in the Irrigation Economy



Kulshreshtha and Grant 2002

Concept of Economic Impacts

Economic impacts are created through re-circulation of money in a given economic system. For example, in order to add more area under irrigation, agricultural producers must spend money for purchasing machinery and equipment, on building infrastructure for bringing the needed water from the source to the fields, and for other related activities. These expenditures send a signal to those firms that produce these goods to expand their output in order to meet this new demand. Increased demand for these goods triggers an increase in their respective production, which on one side creates demand for inputs (thereby generating the same type of chain reaction as above), and on the other side, generates more income in the hands of workers employed in these industries. The latter becomes another avenue for more economic changes in the economy. Workers must spend the newly earned income on goods and products of their own necessity and create more demand for goods in the economy. Estimation of all of these types of

changes are targeted in an economic impact assessment of irrigation in the Lake Diefenbaker Development Area (LDDA).

Economic impacts from irrigation development activities can be classified under various categories. Three most common categories of economic impacts are Direct Impacts; Indirect Impacts and Induced Impacts

The most obvious impacts of an irrigation development are the direct impacts. These are the economic activities that are undertaken by those who are directly related to the project itself. In the context of irrigation, these would include various types of expenditures incurred for off-farm works, on-farm investment in machinery and equipment to use water for various crops, and purchase of inputs for production of various crops.

Indirect impacts result from the actions that are undertaken by those economic agents in the direct impact generation. Since applying water to crops on farms requires some investment in machinery and equipment, and production of crops under irrigated conditions require certain inputs, these decisions lead to higher demand for these products. Newly created demand level triggers production of these goods by other industries in the region or elsewhere, which in turn, creates demand for their own inputs to be produced by other industries. This process continues until all the goods needed for this expansion are produced and delivered to the project. A sum of all these economic changes is called indirect impacts.

The third type of economic impacts is realized through actions of the people who receive compensation for their contribution to either at the direct impact level or indirect level. Consumers are owners of labor resources that are employed through various activities related to the irrigation projects. Thus, as an economic activity takes place, a portion of the gross sales is received by workers and management as wages or profits. This newly earned income fuels demand for consumer goods and services. Except for savings and direct taxes, all this income thus earned is spent. These expenditures create new demand for products, which are now produced by various sectors in the economic system, thereby, creating another round of economic impacts. These impacts are called 'consumer-induced' or just induced economic impacts.

Although direct impacts are specific to the project, indirect and induced effects can be identified through various linkages that develop over time with the irrigation development project. Three types of linkages that can be identified include: Backward-Linkages; Forward-Linkages and Agglomeration Economies Linkages.

Backward linkages are formed through purchase of inputs needed for the production process of the project. These linkages create both indirect and induced economic impacts, as described above. Forward-linkages are formed as the project produces goods that are used as inputs by some other industries for further processing or value-added. Again, these linkages also generate the above two types of economic impacts – indirect and induced. The third type of change – agglomeration economies related linkages, are experienced in the long run. On account of changing economic environment, other industries may find the project region attractive for conducting their own business. Some of these may be partially related to irrigation development, while others may be related to consumer goods and services. These new industries either sell goods to the irrigation project or to the industries that have backward and Forward-linkages with the irrigation project. These changes also generate both indirect and induced economic impacts.

An overview of these economic impacts is shown in Figure A3. Total economic impacts of a project are a result of all direct, indirect and induced changes described above. All changes are additive in nature.

Scoping of Economic Impacts of Irrigation

Since indirect and induced impacts are triggered by direct impacts, estimation of economic impacts of irrigation development requires identification of various economic activities that may lead to total economic impacts. This requires identification of various direct activities associated with irrigation development in the region. For the sake of clarity, total economic impact of irrigation development is categorized under nine separate types of development activities.

Direct Impacts of Irrigation Activities

Investment Phase:

- Development of needed water delivery infrastructure from source of water to the fields.
- Development of on-farm water delivery equipment.
- Purchases of farm machinery and equipment.

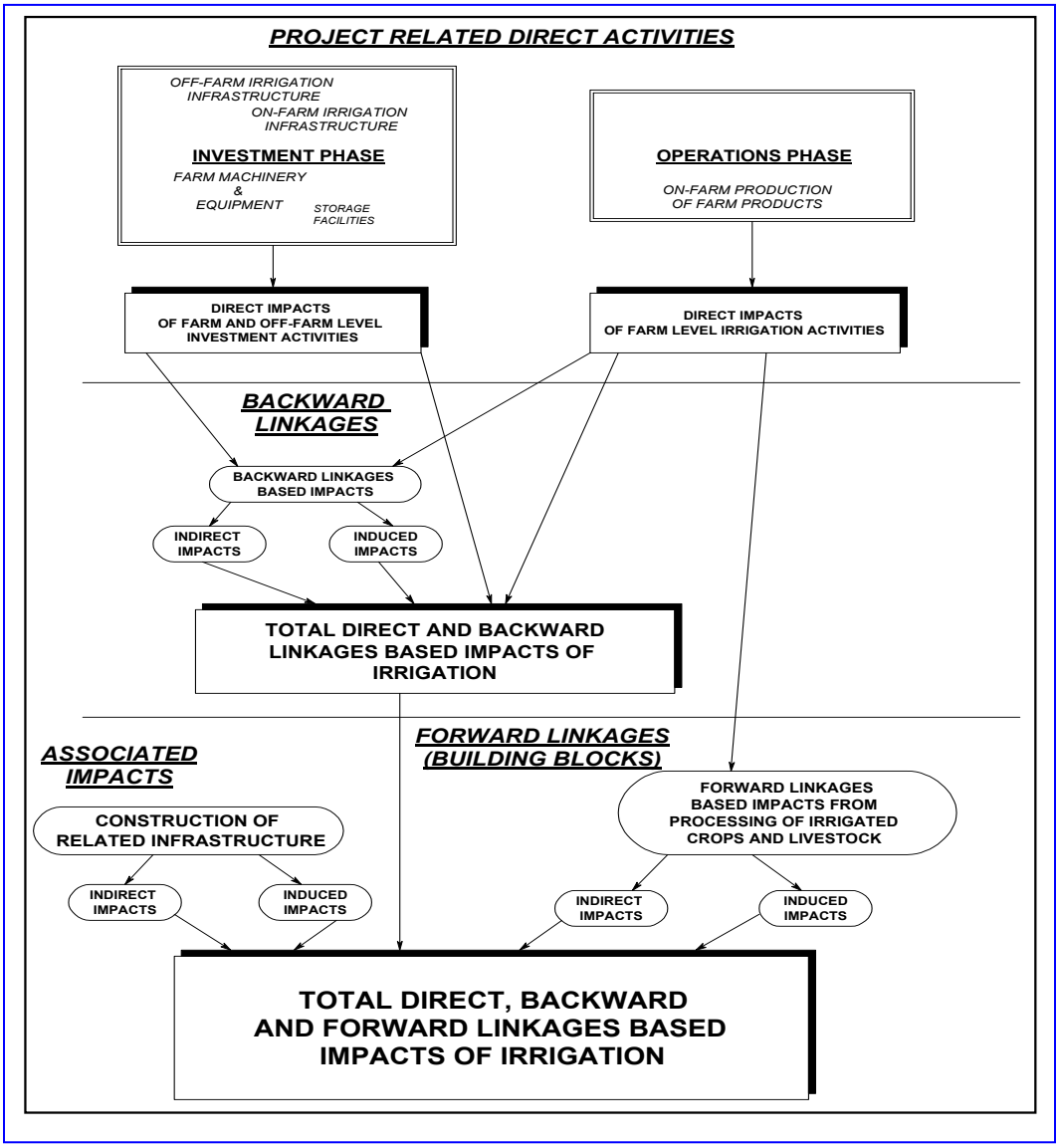
- Construction of farm level storage for products of irrigation origin, particularly cold storage shed for perishable vegetables and potatoes.

Operations Phase:

- Agricultural production activities with irrigation.
- Purchase of farm inputs needed for irrigated production.
- Higher net farm income in the hands of landowners and hired workers.

Figure A3

Conceptual Economic Impacts of Irrigation Developments in the Lake Diefenbaker Development Area



Indirect Impacts through Backward Linkages of Irrigation Activities

- Purchase of raw materials and other farm inputs from various suppliers.
    - Increased production of directly impacts backward linked industries.
    - Increased sales of other industries in the region triggered by irrigation development more indirectly.
    - Increase in the local employment.
    - Support of the local communities.

Induced Impacts of Income Received by Producers from Direct Project Activities

- Re-spending of the income and resulting increased economic activities.
- Support the local communities.

Induced Impacts of Backward Linkages of Irrigation Activities

- Re-spending of earned income from irrigation development, by those engaged in the provision of farm inputs.
- Increase in local employment.
- Support of local community.

Forward-Linkages of Irrigated Production (Direct Impacts)

- Investment Phase
    - Development of new processing infrastructure for products produced under irrigation.
    - Development of new wholesaling and distribution establishments for such products.
- Operations Phase
    - Production activities and purchase of inputs for production.
    - Employment of workers for such facilities.

Indirect Impacts of Forward-Linkages of Irrigated Production

- Purchases of raw materials (except from farm level activities) for such activities.
- Vertical integration of some aspects of marketing chains in selected products.
- Employment of workers for such activities.

Induced Impacts of Forward-Linkages of Irrigated Production

- Re-spending of income earned by workers in the processing industries.
- Re-spending of income in the warehousing and distribution establishments.

Associated Development Impacts

- Capital expenditures on related infrastructure, such as roads, water treatment and sewage facilities.
- Indirect and induced impacts of these developments.

Agglomeration (Future Spin-Offs) Impacts of Irrigation

- Attracting new industries in the region for secondary processing.
- Attracting new input supplying industries for irrigation, processing and other economic activities.
- Indirect and induced impacts of the developments.

Many of these impacts are interrelated and occur at different intervals over time. Economic activities related to irrigation development typically contains two major phases: One, a short-lived construction or capital works program phase, and two, a more sustained and long-run operations phase, including various economic activities related to maintenance and farm level operations. A distinction between the one-time effects from investment phase vs. recurring effects during the operations phase needs to be taken into account in the estimation of total economic impacts of irrigation development in the LDDA.

Estimated Economic Impacts of Irrigation

Many of the above-listed economic impacts are not easy to conceptualize and even more difficult to measure empirically. These were therefore, not included in this study. A list of excluded economic impacts included the following:

Community Level Impacts

Community level economic impacts require analysis of changes at individual community level. In order to undertake this type of impact assessment, various communities need to be looked at in details. This was considered not feasible; thus, study impacts are limited to sub-regional level.

Agglomeration Effects of Irrigation Development

Agglomeration effects of irrigation development, although real, are more dynamic in nature. In addition, these changes are felt in a more distant future. Furthermore, factors such as changes in public policies, changing rates for utility services, and a changing attitude by the populace for different lifestyles may affect the nature and extent of these future developments typically included under this category. Even their estimation based on existing changes requires primary data collection, which was not considered feasible for this project. For these reasons, these economic impacts are not included in the study.

Associated Infrastructure Related Impacts

In many smaller communities and rural areas, infrastructure may not be adequate for supporting irrigation development and /or Forward-linkages. Changes in power distribution system, road networks, rail transportation links, or waste assimilation facility may be required for attracting some of these industries. This requires examination of site-specific situation. In the context of this project it ran into two problems: One, sites for various building blocks is not clearly identified; two, examination of adequacy of supporting infrastructure was considered to be beyond the scope of this project.

Other Environmental and Socio Economic Consequences of Irrigation Developments.

In addition to the statistical analysis of economic impacts, there remain areas of significance for the evaluation of irrigation benefits. Many of the water systems developed initially for irrigation and financed

by irrigation districts benefits groups outside of the farm. They include for example, the wetlands that are created along the regional water distribution systems, the municipal water supply networks, potash mines with access to previously unavailable water resources and golf courses kept green by the irrigation waters. However, perhaps one of the largest groups of non-irrigator users of agricultural waters are the tourists who flock from the cities into Lake Diefenbaker to play and fish in the waters and to hunt waterfowl around the lake. Large numbers of urban residents return to the country each summer to stay in one of the many campgrounds on the shores of Lake Diefenbaker and along the Qu'Appelle Valley. Cottages line the shores of most of the major water storage reservoirs and related waterways and pay large premiums for waterfront property.
Together, all of these uses provide important additional benefits that are derived directly from the irrigation economy.

Methodological Approaches to Evaluating Irrigation Impacts

Input Output Analysis

Selection of the Methodology

Among the various approaches available to estimate economic impacts of development projects, the following ones are noteworthy: Economic Base models, Income-Expenditure Accounting methods, Computable General Equilibrium models, and Input-Output models.

The Economic/Export Base models are used for relatively simple economies where fewer economic sectors produce and export goods to the outside region. The remaining economic sectors depend upon the export sector. A region grows as export levels increase over time. The non-export economic sectors are assumed to support the export base sector and grow proportionately. This type of economic impact assessment methodology is perhaps applicable to a single community within the LDDA, but not for the entire province. Besides, this approach does not permit estimation of economic impacts if there are more than one export sector. For these reasons, this approach was not selected for this study.

In the Income - Expenditures approach, details are obtained on how the earned income is spent. Leakages within the region from income earned are taken out first, then expenditures incurred on imported products or outside the region are taken into account. The resulting estimates show the re-circulation of the income within the region of interest. Similar to the Economic Base models, this technique is also more suitable for simpler and smaller regions. For this reason, it was not used for the estimation of economic impacts of irrigation in the LDDA.

Computable General Equilibrium (CGE) models are very appropriate where economies are complex and changes brought about by activities in one sector affect not only the level of economic activity elsewhere, but also market mechanism through prices, external trade through relative prices changes and payments for resources. These models are relatively more complex to build and the data requirements are very intensive. Furthermore, level of aggregation in these models is limited to smaller number of sectors and many simplifying assumptions need to be made with respect to the nature of production and consumption functions. Since for irrigation development, major changes in the LDDA or Saskatchewan economy were not envisaged and since the provincial economic activities operate within the Canadian market mechanisms, need to undertake a complex set of models, such as the CGE, was not considered appropriate.

An Input-Output (I-O) model divides the economy into various goods producing sectors. Each sector is allowed to produce one or more commodities. All trades (within the region or with rest of the world) take place in commodity format. These trades are called transactions. A transactions table for the region of interest (in this case for the Province of Saskatchewan) is prepared. Various transactions are divided into

intermediate demand and final demand. Model is scaled to show change in the level of economic activity as final demand for a commodity changes.

The I-O model was considered to be suitable for estimating the economic impacts of irrigation in the LDDA. This conclusion is supported by the following observations:

1. The I-O model is demand driven. Irrigation development in the LDDA is also based on the fact that demand for various inputs required for irrigation would increase, thereby resulting in further economic development.
2. I-O models are capable of estimating indirect as well as induced impacts of a change in demand for a particular good or service.
3. Economic impacts of Forward-linkages can be estimated using these models.
4. Imports from other parts of the world are taken into account explicitly, thereby providing estimates of local demand satisfied by other regions. This information could be used to approximate economic impacts on other regions.

For the above set of reasons, the study methodology involved the use of an I-O model for the province of Saskatchewan.

Economic Indicators

Economic development indicators of interest in this study included household income, gross domestic product, and employment. Since there was an interest in estimating these impacts at various levels, the number of economic indicators selected for the study included those shown in Table A1.

Table A1 - Economic Indicators for the Study

Particulars	Farm Level	Provincial Level
Gross Sales of Various Industries	X	X
Income	X	X
Gross Domestic Product		X
Employment	X	X

Income indicator refers to a sum of wages and salaries and income of unincorporated farm and non-farm businesses; thus, money paid to hired workers, as well as return to owned capital and labor, including management is included in this indicator. The Gross Domestic Product (GDP) indicator is a sum of personal income (reflected in the Income indicator), other operating surplus and indirect taxes minus subsidies. This reflects the accounting of GDP in market prices. The Employment indicator shows the new jobs created by the newly created demand for goods and services. These are measured in full-time equivalent number of workers.

Formation of an Evaluation Model

The analytical model used for the estimation of economic impacts was a combined input-output and employment model. It would be referred to as the Saskatchewan Input-Output and Employment Model – SIOEM. The model is a disaggregated regional representation of the provincial economy using the rectangular input-output accounting system. The model was developed using the following steps:

1. A set of transactions table data was purchased from the Input-Output Division of Statistics Canada. This set included: (i) an input matrix; (ii) a make matrix; and (iii) a final demand matrix. The transactions in this data set referred to the period 2003.
2. Inter-provincial trade table for major commodities produced in the province was purchased from Statistics Canada.
3. Since the data contained no disaggregation of agriculture it was treated as a single sector, as was manufacturing. Further disaggregation was necessary. The process of undertaking this step is described below.
4. Various transactions in the revised models were balanced and converted into a format for impact analysis.
5. Mathematical routines were developed to undertake impact analysis. These programs were linked together to develop an impact assessment program using Excel software. The program creates a set of tables, showing a disaggregated sectoral impact of the selected change in final demand.

Further details on the sectors included in the model are described below.

Disaggregation of Statistics Canada Sectors

Since in the Statistics Canada's transactions table for Saskatchewan, agriculture was treated as a single sector, it was considered appropriate to disaggregate the single sector into a number of relevant sub-sectors. Livestock production (hogs and cattle) were separated pout of total agricultural production, leaving the rest as Other Agricultural Production sectors. The latter sector is primarily crop production and included irrigation. Since the agriculture sector could purchase any of the 65 commodities included in the model, some criteria for distributing these purchases to the four sub-sectors had to be devised. This was done in the following manner: Budgets for these enterprises were obtained. Using these budget data, purchases of all goods and services were estimated for the four sub-sectors.

The manufacturing sector of the model was also treated as a single economic sector in the Statistics Canada's transactions table. In order to identify the impact of certain type of processing plants, it was necessary to split this sector further. This sector was split into three sub-sectors: Meat and meat processors, animal feeds manufacturing, and Other Manufacturing sectors. Purchases by these sub-sectors were based on the transactions table for Canada.

Impact Sectors

The SIOEM contains a total of 30 goods and services producing economic sectors. These are listed in Table A2. All other sectors, other than agriculture and manufacturing are standard Statistics Canada sectors for input-output analysis. As noted above, the agriculture sector was split into four sub-sectors. The list of sectors is used for the presentation of output of the SIOEM for any given scenario. Similarly, the model included a total of 65 commodities. These are listed in Table A3.

Employment Impacts

Since the interest of this study was to estimate both economic activities related impacts as well as employment impacts of selected irrigation scenarios, an employment module was added to the SIOEM as described above. The employment module contained the employment coefficient based on Leontieff employment function. It was a ratio of employment in that sector divided by the total sales (output) of that sector.

Types of Impacts Generated

The SIEOM generates two types of economic impacts of an economic development activity:

Type I economic impacts, which include direct changes plus indirect changes (through the sale of goods and services to the direct impact sector) in various sectors of the economy. In this model, household income is exogenous and is not assumed to be spent within the economy.

Type II economic impacts, which include direct, indirect and induced effects from the aforesaid economic activity. Here, the assumption is that the households earn wages and salaries (plus other sources of income), which is spent concurrently within the economy.

In order to endogenize the households in the SIOEM, it was necessary to obtain an estimate of propensity to consume. This propensity measures the proportion of total income earned that is spent by households within a given time period (typically a 12-month period). Propensity can be measured as an average or on the margin. In order to estimate the marginal propensity to consume, data for the 1986 to 2006 period were collected from Saskatchewan Bureau of Statistics (2007) on various sources of income and personal expenditures. In this study, an attempt was first made to estimate the marginal propensity to consume. The estimated marginal propensity to consume was greater than one. Since this reflected a situation that could not be sustained in the long run, this marginal propensity to consume estimate was not used. As an alternative, average propensity to consume was estimated. During 2002 to 2006 period, average propensity to consume was estimated to be 0.85. This estimate was used in the calculation of induced impacts from irrigation development in the province.

Table A2 List of Study Sectors in the SIOEM

Sector No.	Sector Description
1	Hog farms - Farrowing
2	Hog farms - Feeder to Finish
3	Cattle farms
4	Other Agricultural Production
5	Forestry and Logging
6	Fishing, Hunting and Trapping
7	Support Activities for Agriculture and forestry
8	Mining and Oil and Gas Extraction
9	Utilities
10	Construction
11	Animal Slaughtering and Meat processing
12	Animal Feed
13	Other Manufacturing
14	Wholesale Trade
15	Retail Trade
16	Transportation and Warehousing
17	Information and Cultural Industries
18	Finance, Insurance, Real Estate and Rental and Leasing
19	Professional, Scientific and Technical Services
20	Administrative and Support, Waste Management and Remediation Services
21	Educational Services
22	Health Care and Social Assistance
23	Arts, Entertainment and Recreation
24	Accommodation and Food Services
25	Other Services (Except Public Administration)
26	Operating, Office, Cafeteria and Laboratory Supplies
27	Travel, Entertainment, Advertising and Promotion
28	Transportation Margins
29	Non-Profit Institutions Serving Households
30	Government Sector

Table A3 - List of Commodities in the Study Model -- SIOEM

Commodity No.	Commodity Description	Commodity No.	Commodity Description
1	Grains	34	Miscellaneous manufactured products
2	Hogs	35	Residential building construction
3	Cattle	36	Non-residential construction
4	Other agricultural products	37	Repair construction
5	Forestry products	38	Transportation and storage
6	Fish & seafood; hunting &trapping	39	Communications services
7	Metal ores and concentrates	41	Wholesaling margins
8	Mineral fuels	42	Retailing margins and services
9	Non-metallic minerals	43	Gross imputed rent
10	Services incidental to mining	44	Finance, insurance, and real estate services
11	Meat, fish and dairy products	45	Business and computer services
12	Meat and Meat Products	46	Education, tuition and other fees services
13	Dairy Products	47	Health and social services
14	Fish Products	48	Accommodation services and meals
15	Feeds	49	Other services
16	Other food products	50	Transportation margins
17	Soft drinks and alcoholic beverages	51	Operating, office, cafeteria and laboratory supplies
18	Tobacco and tobacco products	52	Travel, entertainment, advertising and promotion
19	Leather, rubber, and plastic products	53	Services provided by non-profit institutions serving households
20	Textile products	54	Government sector services
21	Hosiery, clothing and accessories	55	Non-competing imports
22	Lumber and wood products	56	Unallocated imports and exports
23	Furniture and fixtures	57	Sales of other government services
24	Wood pulp, paper and paper products	58	Indirect taxes on products
25	Printing and publishing	59	Subsidies on products
26	Primary metal products	60	Other subsidies on production
27	Fabricated metal products	61	Other indirect taxes on production
28	Machinery	62	Wages and salaries
29	Motor vehicles, other transportation equipment and parts	63	Supplementary labor income
30	Electrical, electronic and communication products	64	Mixed income
31	Non-metallic mineral products	65	Other operating surplus
32	Petroleum and coal products	39	Communications services
33	Chemicals, pharmaceuticals and chemical products		

Cost Benefit Analysis

Methodological Framework

Cost benefit analysis (CBA) is an economic assessment tool. By quantifying all costs and benefits in monetary terms and evaluating their impact over a period of time through discounting, it is possible to measure the net effect of a proposal in current dollars. This has become a useful procedure to rank alternative proposals that are competing for scarce financial resources. The underlying purpose of cost benefit analysis is to attempt to measure the effect of the investment *on the economy as a whole, with the welfare of a defined society, and not any smaller part of it. The procedures therefore address the evaluation issue that what counts as a benefit or a loss to one part of an economy or to one or more persons or groups – does not necessarily count as a benefit or loss to the economy as a whole.* E.J.Mishan (1976) cost benefit analysis therefore provides an analytical procedure to make economic choices between:

1. Maintaining the status quo.
2. A given proposal and/or.
3. Alternative proposals or combinations of proposals.

CBA has been adopted by many organizations and governments as a consistent basis for assessing proposals and to obtain a rationale framework for the allocation of scarce economic and financial resources in society. CBA has five main elements:

1. The Definition & Characteristics of the Project and its Objectives.
2. The Identification of Project Options for evaluation designed to meet the objective.
3. The Evaluation of Direct and Indirect Benefits and Costs over the life of the project for each of the Project Options and the Status Quo.
4. Decision Making Frameworks including the Calculation of the Net Present Value of costs and benefits over a period of time and the measurement of Cost Benefit Ratios as a guide to project investment.
5. Sensitivity Analysis and Risk Assessment.

Since large water projects have commonly involved varying degrees of government funding, governments are interested in whether the allocation of their funds to a project will be an efficient allocation of public spending. In 1982, the Federal Treasury Board noted that: *In examining the efficiency of government projects, the objective of benefit-cost analysis is to measure what total production and consumption opportunities would be with and without these public expenditures. Efficiency or allocative benefits are those favourable consequences of projects which represent opportunities to increase production or consumption; the allocative costs are the opportunities for production or consumption foregone because of projects undertaken. It is considered that project is efficient and should be undertaken it is allocative benefits exceed its allocative costs.* [70]

The Definition & Characteristics of the Project and its Objectives

Water projects are commonly undertaken for reasons that extend beyond a single narrow investment rationale that can be evaluated with simple financial analysis. The five Lake Diefenbaker projects under review have the potential to transform the regional economy of central Saskatchewan with a combination of irrigated agriculture and supply, food processing, tourism, the environment and water supply. Unlike many other regions of Saskatchewan where energy, mining or urban economies are today leading economic growth, this has not been the case in central Saskatchewan. The project objectives of the Lake Diefenbaker investments are seen in terms of the sustainable regional development of the large dryland agricultural rural region that lies between Saskatoon, Regina, Moose Jaw and Swift Current, rather than the impact on the irrigated acres alone.

Water projects also have special characteristics that have been identified by the Asia Development Bank[71] to include:

[70] Treasury Board of Canada (1982), p.9
[71] Asia Development Bank (2000), p.5.

1. Water is a location specific resource and mostly a non-tradable output.
2. Markets for water are subject to imperfections due to high investment costs for specific applications, complex institutional structures and concerns over resource sustainability.
3. Water and irrigation investments occur over long periods of time, have long investment lives and the full benefits are only realized over even longer time periods.
4. Water is vital for human life as a commodity in its own right and as the essential ingredient for food production.
5. Economies of scale in water supply projects are moderate in production and transmission, but rather low in the distribution of water.
6. Pricing of water between all users is inefficient.

Multi purpose water projects like Lake Diefenbaker irrigation have effects and benefits that do not always fall within the simple monetary framework for measurement. It is therefore important that the full scope of the project options be defined. In the present case, this includes the benefits that would fall to recreation and the environment beyond the agricultural value chain, to municipalities urban and rural, and to regions outside of the immediate location of the irrigation projects around the Lake.

The development project must also be seen in the context of the market realities for the increased production and economic activity that will be generated by the project. Thus a clear understanding of the potential market outlets, prices and trends can offer a reasonable prospect that the tradeable products that arise from the investments can be sold.

The Identification of Project Options

Project options are defined at a number of levels within the project. Three broad options are available for evaluation:

Option 1 Status Quo represents the existing agricultural situation in which dryland farming prevails and further irrigation development proceeds at the slow pace of the previous century. Under this scenario that is described in more detail below, the dryland farm economy prevails through most of the region and remains vulnerable periodic drought, fluctuations in prices and the level of value chain development is limited.

Option 2 Irrigation Expansion represents the implementation of all five irrigation infill and expansion projects as defined in Chapter 3. This option provides the agricultural production benefit that occurs from a shift from a dryland to an irrigated crop mix and a reduced vulnerability to drought.

Option 3 Irrigated Value Chain builds a larger value chain around the irrigation water supply and distribution schemes in Option 2 to include the introduction of an expanded agricultural value chain, related municipal water supply investments, tourism developments and environmental expansion.

These options are shown schematically below in Figure A-4.

Figure A-4 - Conceptual Framework of Direct and Indirect Impact Areas for Three Irrigation Development Options

OPTIONS FOR EVALUATION	DIRECT AND INDIRECT IMPACT AREAS									
	AGRICULTURE		WATER SUPPLY	FARM	MANUFACTURING & SERVICE	BUILDING BLOCKS		MUNICIPAL EFFECTS	ENVIRON-MENTAL EFFECTS	INDIRECT & INDUCED EFFECTS
	DRYLAND	IRRIGATED	PROJECT INVESTMENT AND OPERATIONS	INVESTMENT & OPERATION	IRRIGATED SUPPLY	AG VALUE CHAIN	OTHER MULTI PURPOSE WATER VALUE CHAIN ELEMENTS			
Option 1 STATUS QUO										
Option 2 IRRIGATED AGRICULTURE										
Option 3 MULTI PURPOSE DEVELOPMENT										

The Evaluation of Direct and Indirect Benefits and Costs

Economic benefits and costs relate to actual resource use in the economy and reflect the best alternative uses that the resources could be put to (i.e. the opportunity costs). It is important to explore what alternative opportunities may exist for both the use of the irrigated land and with the increased production that arises from irrigated agriculture.

An economic benefit is any gain in the welfare of society or the individuals that is clearly associated with the proposal under consideration. The benefits of a project may be monetary or non-monetary, qualitative, or quantitative. Accordingly, benefits from the irrigation infill and expansion investments will emerge in a number of areas including:

- Increased Agricultural Productivity.
- Expanded elements in an agricultural value chain including increased numbers of animals, feedlots and processing plants.
- Expanded services to both irrigated agriculture and to the value chain.
- Increased uses of the irrigation water supply systems, including municipal water supply, tourism and the environment.
- Welfare improvements to society from the increased income and employment generated within the region and the high tax base for the provision of services.
- The stabilization of incomes on the farm and in the rural areas by removing the uncertainty of moisture provision for the irrigated agricultural economy.
- Increased rural employment and population with a changing rural age structure to the rural population.

Costs of the irrigated economy will also be seen in a wide number of areas including:

- Capital construction and operating costs for both regional distribution and on-farm irrigation equipment works.
- Capital and operating costs for other value chain development that emerge along and around the irrigation value chain.
- Alternative opportunity costs for the use of water supplies that could include the generation of hydro-electric power and the application to wetland habitats.
- Inefficiency losses associated with water losses in existing irrigation canals and the low rate of irrigation development.
- Drought losses for dryland agriculture associated with both the historic and prospective frequency of drought in the region.

External Costs and Benefits

Not all costs and benefits can easily be measured in monetary terms. For example, changes to the aesthetic environment, improvements to the natural ecology or the restructuring of the age structure of an aging rural population cannot easily be valued from financial market measurements. These are external costs and benefits and can be included within the broad decision making framework, even though not included with the accounting within the input-output or the cost benefit measurements. It is very important to avoid double counting costs or benefits. Often external costs/benefits are no more than transfers of internal costs/benefits, which should not be included as this would be double counting. Often factors that could give rise to externalities are built into market prices and have therefore already been accounted for (the exception is where transaction costs are very high).

Decision Making Frameworks

Investment decisions made today are made on the expectation of a future flow of capital and operating costs and revenues. Since the future is less certain than the present and since society values costs and benefits that are realized today more highly than it values costs and benefits in the future, it is necessary to use discount rates to convert current and future costs and benefits into a present value for the evaluation of investments. Future costs and benefits are less valuable than current costs and benefits since the funds employed are not available for immediate consumption or investment and could be invested at some rate of return.

The Calculation of the Net Present Value

Those costs and benefits that can be quantified in monetary terms over the defined life of the project provide the basis to measure net present values. The NPV is the sum of the discounted net cash flows

over the period and provides an estimate of the improvement in national wealth that will result from the project. Once calculated, the NPV also provides the foundation for comparing different projects and alternative implementation schedules; thus, contribution of an irrigation development spread over a long period or concentrated into a shorter implementation period can be compared. Projects with negative NPVs do not always rule out proceeding with a project. External costs and benefits and non-monetary effects should also be included into the decision making framework.

The Social Discount Rate

The discount rate is a financial concept based on the future cash flow in lieu of the present value of the cash flow. More precisely the costs and benefits occurring in future years are multiplied by the discount rate $1/(1+i)j$

Where: i= the social discount rate per year and

j = the index of the year in which the cost or benefit will occur.

As j gets larger and is further away in the future, the benefits and costs fall and the smaller the discount rate and the value of present benefits. The larger the discount rate, the smaller the present value of costs and benefits occurring in any future year.

Three bases are generally offered for the value of the social discount rate. The first is the social opportunity cost of money which considers the return available from investing the same funds in the private market. The second approach is the social time preference rate, that is generally lower that suggests that the public are often willing to invest at lower rates of return if they can see longer term public benefits in the investments. The third is to set a benchmark standard discount rate reflecting the expected real growth in the economy.

The social discount rate in the economic analysis of investment projects attempts to reflect the social view on how future benefits and cost should be valued against present ones. It may differ from the financial discount rate when the capital market is imperfect or when there are large non-monetary or external effects. This is particularly true of projects that have very long lives or large intangible benefits such as large water projects or projects that take many years to develop. Thus the effect of a secure water supply to municipalities and the environment, particularly during drought periods may be seen as benefits of a project and require including a different social discount rate than that provided by the financial markets.

For very long-lived proposals and particularly where a substantial proportion of the benefits occur well into the future, the use of discounting with a standard discount rate is likely to create a bias against project acceptance. For example, with a discount rate of 10% per annum, only five percent of any benefits occurring in the thirtieth year will be added to the project benefits measured by the Net Present Value. Both the UK Overseas Development Institute and the Netherlands Department of International Development note: *The discount rate aims to make the costs and benefits of future activities comparable with current ones. Discount rates based on private interest rates may reflect a 'dictatorship of the present' and are often too high to account for the public interest in long-term resource conservation.*[72] In a commercial setting, the low weight given to distant cash flows reflects the desire of investors to achieve a return sooner rather than later. Accordingly, lower discount rates that reflect these values and interests may be used for very long multi-dimensional proposals.

The UK Treasury provide further guidance on discount rates for long term projects noting[73]: *Where the appraisal of a proposal depends materially upon the discounting of effects in the very long term, the received view is that a lower discount rate for the longer term (beyond 30 years) should be used.*[74] *The main rationale for declining long-term discount rates results from uncertainty about the future. This uncertainty can be shown to cause declining discount rates over time.*[75]

Theoretical literature and international practice shows a wide range of approaches in interpreting and choosing the value of the social discount rate to be adopted. The World Bank has recently required an

[72] Netherlands Ministry of Foreign Affairs, Department for Sustainable Economic Development, Department for International Development, Fact Sheet 10 Sustainable Agriculture Policy Division,
[73] UK Department of Treasury, Green Book, 2008.
[74] Oxford Economic Research Association (2002), A Social Time Preference Rate for Use in Long-Term Discounting, Oxford.
[75] Weitzman (1998, 2001) and Gollier (2002).

economic rate of return of 10% that has been criticized as too high. National governments commonly set the rate lower than international financing rates. In the UK, the social opportunity cost of capital is seen as the cost due to the displaced private consumption and production. This has recently been seen as 6%, although levels have been used on a 'case by case' basis. In dry Spain, the discount rate has varied by sector with a 6% rate for transport projects and a 4% rate for water projects. In Italy, the rate is set at 5%. The U.S. Office of Budget Management also uses variable rates. A summary of some current domestic and international discount rates is shown in Table A4.

For the purposes of this project, a 3% discount rate has been used as a reasonable approximation of all three rationales for rate setting that is consistent with recent practice, reflects world financial markets, takes into account the long term water nature of a water project with social objectives. A sensitivity evaluation has also been included around this rate.

The Measurement of Cost Benefit Ratios

The benefit-cost ratio (BCR) provides an economic summary of the future stream of costs and benefits today. BCR is calculated from:

$$\frac{\text{sum of present values of benefits}}{\text{sum of present values of costs}}$$

A BCR above one implies an NPV greater than zero. The BCR identifies projects with high net present values and provides a rationale for selecting between projects when funding sources are scarce.

Table A4 - An Overview of Recent Discounting Practices and Rates

GOVERNMENT/AGENCY	DISCOUNTING PRACTICE
CANADA	
Environment Canada	7.5% (Average Rate for EIA Statements)
Treasury Board	10% +/- 5%
CIDA	Country specific market rates
Natural Resources Canada	7% +/- 3%(in studies reviewed)
Province of British Colombia	5% real and 8% nominal(in studies reviewed)
Province of Alberta	2% to 3%(in studies reviewed)
Province of Saskatchewan	4%(in studies reviewed)
Province of Manitoba	Gov. Long Term borrowing rate with sensitivity analysis
Ontario Natural Resources	4% & 5% with exceptions (e.g. Old Growth Forest has no discounting)
Ontario Environment	4% for air issues
Province of New Brunswick	2% to 3% (in studies reviewed)
INTERNATIONAL	
Environmental Valuation Reference Inventory	Range 5.9% (central), median range for sensitivity testing from 3% (low) to 10% (high)
US Environmental Protection Agency	7% +/- 2%
US Office of Management and Budget	Variable Rates on Project
US Congressional Budget Office	2% real with 2% sensitivity
US General Accounting Office	2% real with 2% sensitivity
UK Treasury	6%
British Forestry Commission	3% land acquisition; 1% projects with social objectives
UK Department of Environment, Transport and the Regions	6% (in studies reviewed)
Norway Ministry of Finance	7%
Australian Department of Finance	10%
United National Environment Programme.	5% (in studies reviewed)
Government of Spain	6% rate for transport projects and a 4% rate for water projects
World Bank	Up to 10% with lower rates for longer term projects
Government of Italy	5%
Source: Environment Canada (2005) and Country Reviews.	

Technical Appendix to Economic Impact Analysis

Table B1 Discounted Value of Total Economic Impacts on Sales of All Industries in Saskatchewan from Capital Investment Phase of Lake Diefenbaker Irrigation Development and Associated Infrastructure, Total for 40 Year Period, Million Dollars

Investment Type	Direct	Indirect	Induced	Total
	Net Present value at 1% Discount Rate			
Off-farm Water Supply	$2,636	$3,310	$709	$6,655
On-farm Investment	$68	$25	$22	$115
Farm Level Forward-Linkages	$423	$425	$96	$944
Non-farm Level Forward-Linkages	$219	$195	$40	$454
Total Project Operations and Maintenance	$3,345	$3,955	$868	$8,168
	Net Present value at 3% Discount Rate			
Off-farm Water Supply	$2,250	$2,826	$605	$5,682
On-farm Investment	$49	$18	$16	$83
Farm Level Forward-Linkages	$336	$346	$77	$759
Non-farm Level Forward-Linkages	$186	$167	$34	$387
Total Project Operations and Maintenance	$2,821	$3,357	$733	$6,911
	Net Present value at 5% Discount Rate			
Off-farm Water Supply	$1,945	$2,443	$523	$4,911
On-farm Investment	$37	$13	$12	$62
Farm Level Forward-Linkages	$277	$291	$64	$631
Non-farm Level Forward-Linkages	$160	$145	$30	$335
Total Project Operations and Maintenance	$2,419	$2,892	$629	$5,940

Table B2 Discounted Value of Total Economic Impacts on Gross Domestic Product of Saskatchewan from Capital Investment Phase of Lake Diefenbaker Irrigation Development and Associated Infrastructure, Total for 40 Year Period, Million Dollars

Investment Type	Direct	Indirect	Induced	Total
	Net Present value at 1% Discount Rate			
Off-farm Water Supply	$93	$1,351	$504	$1,855
On-farm Investment	$20	$13	$13	$46
Farm Level Forward-Linkages	$22	$164	$66	$252
Non-farm Level Forward-Linkages	$8	$87	$23	$119
Total Project Operations and Maintenance	$143	$1,614	$607	$2,272
	Net Present value at 3% Discount Rate			
Off-farm Water Supply	$79	$1,153	$431	$1,584
On-farm Investment	$14	$9	$9	$33
Farm Level Forward-Linkages	$16	$132	$54	$202
Non-farm Level Forward-Linkages	$7	$74	$20	$101
Total Project Operations and Maintenance	$117	$1,368	$514	$1,920
	Net Present value at 5% Discount Rate			
Off-farm Water Supply	$69	$997	$372	$1,369
On-farm Investment	$11	$7	$7	$25
Farm Level Forward-Linkages	$12	$110	$46	$167
Non-farm Level Forward-Linkages	$6	$65	$17	$88
Total Project Operations and Maintenance	$98	$1,178	$442	$1,649

Table B3 Discounted Value of Total Economic Impacts on Household income in Saskatchewan from Capital Investment Phase of Lake Diefenbaker Irrigation Development and Associated Infrastructure, Total for 40 Year Period, Million Dollars

Investment Type	Direct	Indirect	Induced	Total
	Net Present value at 1% Discount Rate			
Off-farm Water Supply	$0.0	$799.9	$226.9	$1,026.9
On-farm Investment	$15.3	$7.1	$7.1	$29.6
Farm Level Forward-Linkages	$6.9	$100.1	$30.7	$137.6
Non-farm Level Forward-Linkages	$0.1	$49.5	$14.1	$63.7
Total Project Operations and Maintenance	$22.3	$952.5	$277.6	$1,252.5
	Net Present value at 3% Discount Rate			
Off-farm Water Supply	$0.0	$683.0	$193.8	$876.7
On-farm Investment	$11.1	$5.2	$5.1	$21.4
Farm Level Forward-Linkages	$4.9	$81.0	$24.6	$110.6
Non-farm Level Forward-Linkages	$0.1	$38.7	$11.0	$49.8
Total Project Operations and Maintenance	$16.1	$807.9	$234.5	$1,058.5
	Net Present value at 5% Discount Rate			
Off-farm Water Supply	$0.0	$590.4	$167.5	$757.8
On-farm Investment	$8.3	$3.9	$3.9	$16.1
Farm Level Forward-Linkages	$3.7	$67.9	$20.5	$92.0
Non-farm Level Forward-Linkages	$0.1	$33.6	$9.6	$43.2
Total Project Operations and Maintenance	$12.1	$695.7	$201.4	$909.1

Table B4 Discounted Value of Total Economic Impacts on Sales of All Industries in Saskatchewan from Operations Phase of Lake Diefenbaker Irrigation Development and Associated Activities, Total for 40 Year Period, Million Dollars

Type of Operations	Direct	Indirect	Induced	Total
	Net Present value at 1% Discount Rate			
Off-farm Water Supply	$32	$39	$8	$79
On-farm Investment	$4,399	$1,449	$2,224	$8,071
Farm Level Forward-Linkages	$7,958	$6,559	$2,864	$17,381
Non-farm Level Forward-Linkages	$17,172	$1,012	$1,692	$19,875
Total Project Operations and Maintenance	$29,561	$9,058	$6,787	$45,406
	Net Present value at 3% Discount Rate			
Off-farm Water Supply	$20	$23	$5	$48
On-farm Investment	$2,654	$875	$1,341	$4,870
Farm Level Forward-Linkages	$4,838	$3,959	$1,736	$10,532
Non-farm Level Forward-Linkages	$11,263	$640	$1,099	$13,002
Total Project Operations and Maintenance	$18,774	$5,498	$4,180	$28,452
	Net Present value at 5% Discount Rate			
Off-farm Water Supply	$12	$15	$3	$30
On-farm Investment	$1,666	$550	$842	$3,057
Farm Level Forward-Linkages	$3,072	$2,493	$1,098	$6,663
Non-farm Level Forward-Linkages	$7,764	$423	$750	$8,937
Total Project Operations and Maintenance	$12,514	$3,481	$2,692	$18,687

Table B5 Discounted Value of Total Economic Impacts on Gross Domestic Product of Saskatchewan from Operations Phase of Lake Diefenbaker Irrigation Development and Associated Activities, Total for 40 Year Period, Million Dollars

Type of Operations	Direct	Indirect	Induced	Total
	Net Present value at 1% Discount Rate			
Off-farm Water Supply	$3	$19	$4	$27
On-farm Investment	$2,575	$725	$1,310	$4,610
Farm Level Forward-Linkages	$2,610	$2,566	$1,660	$6,835
Non-farm Level Forward-Linkages	$12,594	$521	$1,336	$14,451
Total Project Operations and Maintenance	$17,782	$3,832	$4,310	$25,923
	Net Present value at 3% Discount Rate			
Off-farm Water Supply	$2	$12	$3	$16
On-farm Investment	$2,575	$725	$1,310	$4,610
Farm Level Forward-Linkages	$1,604	$1,556	$1,006	$4,165
Non-farm Level Forward-Linkages	$8,381	$333	$875	$9,589
Total Project Operations and Maintenance	$11,539	$2,338	$2,673	$16,549
	Net Present value at 5% Discount Rate			
Off-farm Water Supply	$1	$8	$2	$10
On-farm Investment	$973	$275	$495	$1,743
Farm Level Forward-Linkages	$1,032	$985	$636	$2,652
Non-farm Level Forward-Linkages	$5,867	$222	$602	$6,692
Total Project Operations and Maintenance	$7,873	$1,490	$1,735	$11,097

Table B6 Total Economic Impacts on Household Income in Saskatchewan from Operations Phase of Lake Diefenbaker Irrigation Development and Associated Activities, Total for 40 Year Period, Million Dollars

Type of Operations	Direct	Indirect	Induced	Total
	Nominal Value Total			
Off-farm Water Supply Operations	$1	$10	$3	$14
On-farm Production	$2,465	$399	$938	$3,793
Farm Level Forward-Linkages Operations	$2,415	$1,392	$1,197	$5,003
Non-farm Level Forward-Linkages Operations	$1,816	$288	$685	$2,789
Total Project Operations and Maintenance	$6,696	$2,089	$2,823	$11,600
	Net Present value at 1% Discount Rate			
Off-farm Water Supply	$0	$8	$2	$11
On-farm Investment	$1,885	$305	$718	$2,902
Farm Level Forward-Linkages	$1,849	$1,067	$917	$3,833
Non-farm Level Forward-Linkages	$1,438	$226	$541	$2,205
Total Project Operations and Maintenance	$5,173	$1,606	$2,179	$8,951
	Net Present value at 3% Discount Rate			
Off-farm Water Supply	$0	$5	$1	$7
On-farm Investment	$1,137	$17	$40	$165
Farm Level Forward-Linkages	$1,120	$647	$556	$2,323
Non-farm Level Forward-Linkages	$937	$143	$352	$1,432
Total Project Operations and Maintenance	$3,194	$981	$1,343	$5,512
	Net Present value at 5% Discount Rate			
Off-farm Water Supply	$0	$3	$1	$4
On-farm Investment	$714	$116	$273	$1,099
Farm Level Forward-Linkages	$708	$410	$352	$1,470
Non-farm Level Forward-Linkages	$641	$95	$240	$977
Total Project Operations and Maintenance	$2,063	$625	$865	$3,550

Table B7 Cost Benefit Analysis of Irrigation Development Costs and Benefits for Direct and Total Benefits (including Indirect and Induced Effects) for a Saskatchewan Agricultural Irrigation Scenario and Combined Agricultural Irrigation and Agricultural Value Added Development Scenario at a 1% Discount Rate for A 40 Year Period and a 40 Year Irrigation Adoption Assumption as Compared to Dryland Agriculture

CBA of the Project Based On Irrigated Agriculture			
Costs	**Direct**	**Indirect Induced**	**Total**
Regional Water Works			
Capital	$2,636		$2,636
Operating	$32		$32
Total Costs	$2,668		$2,668
Benefits			
Regional Water Works			
Capital		$4,019	$4,019
Operating		$3,673	$3,673
On Farm Investments			$0
Capital	$68	$47	$115
Operating	$4,399	$3,673	$8,072
Total Benefits	$4,467		$15,879
Cost Benefit Ratio	**1.67**		**5.95**

CBA of the Project with Full Development and Benefits			
Costs	**Direct**	**Indirect Induced**	**Total**
Regional Water Works			
Capital	$2,636		$2,636
Operating	$32		$32
Total Costs	$2,668		$2,668
Benefits			
Regional Water Works			
Capital		$4,019	$4,019
Operating		$3,673	$3,673
On Farm Investments			$0
Capital	$68	$47	$115
O&M	$4,399	$3,673	$8,072
Farm Level Forward-Linkages			
Capital	$423	$521	$944
O&M	$7,958	$9,423	$17,381
Non-farm Level Forward-Linkages			$0
Capital	$219	$236	$454
O&M	$17,172	$2,703	$19,875
Total Benefits	$30,238		$59,869
Cost Benefit Ratio	11.33		22.44

Table B8 Cost Benefit Analysis of Irrigation Development Costs and Benefits for Direct and Total Benefits (including Indirect and Induced Effects) for a Saskatchewan Agricultural Irrigation Scenario and Combined Agricultural Irrigation and Agricultural Value Added Development Scenario at a 3% Discount Rate for A 40 Year Period and a 40 Year Irrigation Adoption Assumption as Compared to Dryland Agriculture

CBA of the Project Based On Irrigated Agriculture			
Costs	**Direct**	**Indirect Induced**	**Total**
Regional Water Works			
Capital	$2,250		$2,250
Operating	$20		$20
Total Costs		$2,270	$2,270
Benefits			
Regional Water Works			
Capital		$3,432	$3,432
Operating		$2,217	$2,217
On Farm Investments			
Capital	$49	$34	$83
Operating	$2,654	$2,217	$4,871
Total Benefits	$2,703		$10,602
Cost Benefit Ratio	**1.19**		**4.67**
CBA of the Project with Full Development and Benefits			
Costs	**Direct**	**Indirect Induced**	**Total**
Regional Water Works			
Capital	$2,250		$2,250
Operating	$20		$20
Total Costs	$2,270		
Benefits			
Regional Water Works			
Capital		$3,432	$3,432
Operating		$2,217	$2,217
On Farm Investments			
Capital	$49	$34	$83
O&M	$2,654	$2,217	$4,871
Farm Level Forward-Linkages			
Capital	$336	$423	$759
O&M	$4,838	$5,695	$10,532
Non-farm Level Forward-Linkages			
Capital	$186	$201	$387
O&M	$11,263	$1,739	$13,002
Total Benefits	$19,325		$39,822
Cost Benefit Ratio	**8.51**		**17.54**

Table B9 Cost Benefit Analysis of Irrigation Development Costs and Benefits for Direct and Total Benefits (including Indirect and Induced Effects) for a Saskatchewan

Agricultural Irrigation Scenario and Combined Agricultural Irrigation and Agricultural Value Added Development Scenario at a 5% Discount Rate for A 40 Year Period and a 40 Year Irrigation Adoption Assumption as Compared to Dryland Agriculture

CBA of the Project Based On Irrigated Agriculture				
Costs		**Direct**	**Indirect Induced**	**Total**
Regional Water Works				
	Capital	$1,945		$1,945
	Operating	$12		$12
Total Costs		$1,958		$1,958
Benefits				
Regional Water Works				
	Capital		$2,966	$2,966
	Operating		$1,392	$1,392
On Farm Investments				
	Capital	$37	$26	$62
	Operating	$1,666	$1,392	$3,058
Total Benefits		1,708		$7,478
Cost Benefit Ratio		**0.87**		**3.82**
CBA of the Project with Full Development and Benefits				
Costs		**Direct**	**Indirect Induced**	**Total**
Regional Water Works				
	Capital	$1,945		$1,945
	Operating	$12		$12
Total Costs			$1,958	
Benefits				
Regional Water Works				
	Capital		$2,966	$2,966
	Operating		$1,392	$1,392
On Farm Investments				
	Capital	$37	$26	$62
	O&M	$1,666	$1,392	$3,058
Farm Level Forward-Linkages				
	Capital	$277	$355	$631
	O&M	$3,072	$3,591	$6,663
Non-farm Level Forward-Linkages				
	Capital	$160	$175	$335
	O&M	$7,764	$1,172	$8,937
Total Benefits		$12,976		$27,959
Cost Benefit Ratio		**6.63**		**14.28**