Irrigation Scheme Development

Issues to Consider When Promoting a Water Resource Scheme - Lessons from the Last 125 Years

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Executive Summary

This report has been written in response to the information needs of a number of groups throughout New Zealand who are investigating and promoting communal irrigation schemes. It draws on the experience of the previous 80 years of development of communal irrigation schemes in New Zealand and experience gained in the recent commissioning of communal irrigation schemes.

Communal irrigation schemes are characterised by the grouping together of people to share in the collection and distribution of water into a defined community of interest.

The major lessons learned from the history of irrigation development in New Zealand are:

- There must be a balance between the engineering and on-farm economics as drivers of the assessment of community irrigation schemes.
- Scheme development must include farmers early in the planning process and include an iterative process of feedback to farmers.
- An analysis of the implications on the community and servicing industries.
- Scheme promoters must be able to identify all potential benefits and beneficiaries of a scheme early in the process.
- There is a need for consultation with all stakeholders with an interest in water resource allocation early in the feasibility process.
- Wherever possible, effort should be made to maximise the non-productive benefits of water resource enhancement including other productive uses (electricity generation) environmental, recreational and cultural.
- It is critical to have a lead agent or champion in the initial promotion and feasibility analysis of schemes.
- Provision of information and support to farmers and other beneficiaries to assist decision making on how to manage and maximise the benefits from the resource is essential to encourage rapid uptake and efficient resource use.

ADMINISTRATION PROCESSES

The Role of the Promoter

The promoter of the scheme has three basic functions. They are to:

- Carry out the feasibility study into the physical viability of the scheme
- Educate and communicate at all stages through the feasibility process
- Ensure the economic viability of the scheme is assessed throughout the process.

Project Management

Project management of feasibility studies can be a complicated and time-consuming activity. For the smooth operation of feasibility analysis, it is important that tight project management and time management skills are used. The role encompasses the need to co-ordinate the input from a number of professionals who will be involved in the investigation, as well as the necessary communication with the community of interest.

In many instances, an experienced professional person best carries out the project management role. They can then report progress and findings to a management committee

who provide direction to the project manager and make decisions on how to proceed when necessary.

Ownership Options

This governance structure must provide for management of the financial aspects of the capital development of the scheme as well as provide appropriate ongoing operating, repairs and maintenance, and any further possible scheme development.

Flow-on Impacts

The flow-on impacts achieved are in the form of employment, increased regional output and increased regional value added.

ENGINEERING PROCESSES

Supply Studies

Engineering supply studies are primarily concentrated on the feasibility of the diversion, storage and delivery of water from the water source to the farm gate.

Demand Calculations

Different potential land uses have different levels of water consumption and different timing requirements for the delivery of that water. Therefore, some analysis needs to be made early in the planning process as to the potential or possible land uses in the study area and therefore the potential water demand.

Conflicts of Use

The importance of identifying all people with a potential interest in the water resource and including them in the planning process has been well documented. These include recreational, environmental and cultural groups of interest.

Resource Consent Process

All schemes will need to go through the resource consent process before they can become reality. An important part of the engineering process is the identification of any issues that would have a significant impact on the likelihood of success in the consent application process.

PEOPLE PROCESSES

The very important lesson learnt from the last 80 years of irrigation development in New Zealand has been the importance of the inclusion of information on all aspects of a project as early as possible in the decision-making process. This is vitally important in schemes where farmers will be required to commit to the uptake of water and therefore the increased investment required in both off- and on-farm irrigation development.

During the feasibility or investigation phase of the project, this is most likely to be an iterative process, with communication and information flows, to and from the community on a regular basis, being an important element of both landholder decision-making, as well as the decision-making processes of the promoter of the scheme.

Land Use Options

Most irrigation development requires intensification of land use or complete land use change to justify the investment.

Irrigation Systems

There is a vast array of irrigation systems available to farmers. These vary hugely in their capital costs, labour requirements and water use and delivery characteristics.

On-farm Economics

A business investment decision of this magnitude will require detailed analysis by the landowner. Provision of a decision-making framework to assist individual on-farm decisions is an important part of the information flow.

Uptake Rates

History has shown us that there is a variable level of interest in the uptake of irrigation water in the farming community. This may have a huge impact on whether a scheme can proceed or not.

The iterative process in community feedback is very important for promoters of the schemes to gauge the potential or likely uptake of water.

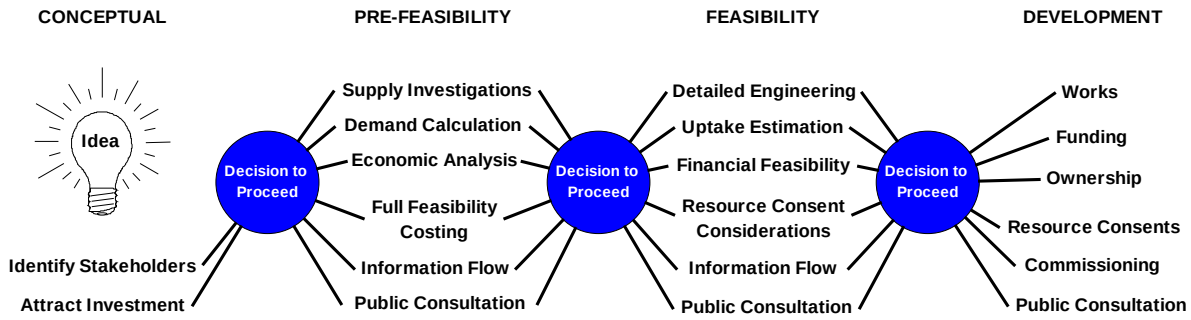
Development Processes

The harvesting and delivery of water to farm gates can be a complicated engineering process. Promoters of current schemes will have to negotiate with private landowners to use or gain access to their land.

Social Impact

Studies of the social impact on communities in which an irrigation development occurs show that there are wide-ranging changes. It also has a big impact on the social make-up of the community, with a significant number of new immigrants changing the social balance.

PROJECT PHASES



1. **Conceptual Phase**. In this phase, an individual or group of people will have identified an opportunity to either take or store water from an existing source and redistribute it to farmers for irrigation.

2. **Pre-feasibility Stage**. The purpose of this phase is to establish whether a project looks likely to happen and calculate the potential cost of carrying out the full feasibility study. It can also serve the purpose of initiating wider public interest.

3. **Feasibility Study**. The purpose of the feasibility study is to explore the project in enough detail for the interested parties and stakeholders to make a commitment to proceed with the development of the project.

Feasibility investigations generally take the following course:

- collate information on crop suitability and the required irrigation management practices for the various soil types in the study area;
- review existing ground water information and then develop an updated conceptual hydrogeological model for the study area, possibly supported with further ground water investigations;
- determine the likely irrigation demand and seasonal water use maps;
- Determine the areas of reliable supply of either surface water or ground water and problem areas;
- identify where irrigation can proceed without the need for a communal irrigation infrastructure and where community water supplies are necessary;
- develop all technical options for matching supply and demand. For example, the amount of storage required for community water supply schemes;
- assess the economic feasibility of irrigation to landowners;
- determine the nature and extent of environmental and other demands on the area's water resources and develop a strategy to ensure land use intensification occurs sustainably;
- analyse all the potential risks that would be associated with irrigation development (technical, economic and business) and assess their relative impact on the irrigation proposals.

4. **Development**. The development phase of the scheme incorporates all activity required to commission the scheme and provide for the delivery of water.

1. Background

This report has been written in response to the information needs of a number of groups throughout New Zealand who are investigating and promoting communal irrigation schemes. It draws on the experience of the previous 80 years of development of communal irrigation schemes in New Zealand and experience gained in the recent commissioning of communal irrigation schemes. At present, communal irrigation schemes are providing irrigation water to farmers over more than 165,000 hectares in New Zealand. These range in size from 500 to 30,000 hectares. Investigations and feasibility reports under way at present have the potential to double the amount of land under communal irrigation schemes.

Communal irrigation schemes are characterised by the grouping together of people to share in the collection and distribution of water into a defined community of interest.

Over the years, the environment in which communal irrigation schemes have been developed has changed significantly from full development by government through to the present day where they are stand alone commercial operations with little government assistance at all. The lessons learnt on how to successfully implement a scheme are seen as an important resource for present irrigation scheme developers.

1.1. HISTORY

Pre-1930

Twelve schemes totalling 25,200 hectares were developed and financed by the government in this period. They were primarily designed to take advantage of existing water rights and reclamation of mining land in Central Otago and they did not attempt to involve farmers in the implementation process. Farmers at the time knew little of irrigation technology and their approach to farming systems meant that uptake and use of the water was limited to drought protection strategies.

1930–1950

Development occurred subsequent to the 1928 Public Works Act, which empowered the government to build an irrigation scheme without a vote by landholders and to take the land acquired for a scheme if needed. The Act treated development of communal irrigation schemes as an engineering project and generally provided poorly for the wide ranging changes that had to be made by landholders. Its activity was primarily directed towards large-scale irrigation schemes in Mid Canterbury. The failure to provide little reference to farmers' needs and expectations meant that irrigation development on-farm was completed very slowly and therefore there was under-utilisation of the resource for many years. Nevertheless, during this period, five schemes totalling 72,500 hectares were developed. The majority of these were based on the development of the Rangitata diversion race canal.

1950–1980

Recognition of the problems associated with slow farmer uptake meant that in the mid-1950s, we saw a changed approach to communal irrigation development. This was due to:

1. the slow development and utilisation of schemes by farmers; and
2. the increasing annual costs of early scheme operation and upgrades with an unwillingness of farmers to pay the additional cost.

It became clear that schemes needed prior commitment by farmers and that all beneficiaries should contribute to the cost of development of the schemes. This meant that farmers had to be involved and fully informed of expected financial responsibilities in the future and the possible benefits that they would gain from irrigation. This brought about the active involvement of farmers in the promotion and implementation of schemes. It also brought about the provision of advice and research on irrigation practices and farm management benefits.

A 1960 amendment to the Public Works Act was made. Although this did not require prior notification of a scheme being investigated, it did require that a legal notice of a poll of landholders be held before a scheme would go ahead and also the requirement of the provision of full information to the farmers. The poll required a 60% vote to proceed and this committed all farmers within the scheme area to uptake water and the acceptance of appropriate water charges. Under this regime, five schemes were developed with an area of 29,450 hectares.

In 1967, the Water and Soil Conservation Act transferred the role of communal irrigation scheme development from the Ministry of Works to the National Soil and Water Conservation Authority. Subsequent to the instigation of this Act, there was a review of national irrigation policy in 1970. This recommended (amongst other things) County Councils and Catchment Authorities would be delegated the rights of promotion of irrigation schemes. Amendments to the Act in 1975 made changes that included the requirement for:

- prior public notification of an investigation of an irrigation scheme;
- cost sharing of capital costs between the government and farmers;
- specified 16 procedural steps for development of a scheme;
- financial assistance to farmers for on-farm costs.

The latter was in recognition of the substantial level of on-farm costs required for irrigation development. It also recognised the need to accelerate benefits of irrigation development and did so by providing low interest and suspensory loans to farmers for on-farm development. The 1975 changes also increased the requirement for full engineering, economic and financial reporting of the scheme to the potential farmers involved.

Under this regime, 10 schemes were developed with a total of 33,850 hectares. In the early 1980s, Mr AJ Warrington, who was then Manager of Irrigation and Rural Water Supply Operation of the Water and Soil Division of the Ministry of Works, commented:

> *"Fifty years or more of implementing and managing communal irrigation schemes should have shown us that irrigation is for farmers, and not just an engineering development. The ultimate success of any communal scheme depends on the vast majority of the individual farmers wanting irrigation and being able to make the changes necessary to utilise the increased production that it allows.*
>
> *To achieve this, farmers must be actively involved, individually and through scheme committees, in the implementation of the scheme. As the work proceeds, the required scientific information must be available and used to increase farmers' knowledge of irrigation processes through discussion and demonstration. The necessary physical and financial resources must be available to allow the development and adaptation of the knowledge to meet their needs and abilities in the management of their farms."*

1980s–present

This period saw very little communal irrigation development, primarily as a result of the government economic reforms undertaken at the time. These had far-reaching impacts on all parties previously involved in the promotion of communal irrigation schemes. These reforms included:

- the removal of all subsidies and concessionary loans to farmers and the sale of the Rural Banking and Finance Corporation;
- withdrawal of central government as a funder of community irrigation scheme development; and
- local body reform in both District Council and Catchment Authority level seeing the establishment of wider regional councils with responsibility over resource management and an amalgamation and contraction of local government activities.

However, the most significant reform in this period was the implementation of the Resource Management Act in 1991. This framed a completely different planning environment on the use of water as a resource. It incorporated the requirement for a balanced approach to the issue of water resource allocation including a consents process which gave a much greater involvement and influence on the process from other stakeholders with a wider interest in resource use other than those primarily proposing its use for irrigation.

These wide-ranging changes had the impact of virtually halting the development of communal irrigation schemes. However, a number of schemes which had started feasibility investigations under the old legislative regime were able to continue development of their processes in a private rather than a public capacity.

1.2. PRESENT

The period of slow development mentioned in the previous section has two major schemes that came to fruition. These were the development of an 11,000-hectare scheme in the Waimakariri area and the development of the 16,000-hectare Opihi augmentation scheme in South Canterbury. These schemes both had significant elements that provide lessons for those wishing to carry out communal irrigation development in the present environment.

In the case of the Waimakariri scheme, it was promoted by a private irrigation development company but strongly supported by the Waimakariri District Council. The tight financial conditions of farming through the late ‘80s and early ‘90s meant that many farmers in the area were not in a position to make the required capital contribution or the commitment to uptake of water and ongoing payment of the costs of the provision of that water. Consequently, the scheme took approximately 10 years to achieve the required subscription rate of farmers to allow it to proceed. During this time, the scheme continued to be promoted by a small band of individuals who were convinced of the financial benefits that could be gained from it. It also gained ongoing support from the Waimakariri District Council (including financial underwriting) who recognised the flow-on impacts of irrigation development to the communities in the Waimakariri District at large.

In the case of the development of the Opihi Augmentation Scheme with the development of the Opuha Dam, there were two important elements:

1. a group of promoters or “champions” who treated the development of the scheme as a business operation; and
2. the multiple benefits achieved through enhancement of flows of water in the Opihi River.

The latter was significant, as the scheme was able to provide not only irrigation water for 16,000 hectares but also a small electrical power generation capacity at the dam. Thirdly, and most importantly, it provided augmentation of the flow of the Opihi River to greatly enhance the in-stream environmental and recreational values of the river. All of these elements were able to contribute financially to the development of the scheme.

In 1998, government became aware of growing interest in water development projects for irrigation in the summer dry areas of both islands. A need for seeding finance to help initiate investigations was recognised.

To help facilitate these investigations and feasibility studies, government jointly with Agmardt established a Contestable Water Studies Fund of $2.25 million. This fund has had considerable success in encouraging studies to help fill the gaps in knowledge on surface and ground water supplies and their possible use for community water needs including irrigation.

In 2000/2001, the fund was nearly fully subscribed and government provided an additional $1.35 million which is being administered by MAF. Further opportunities for new water development projects will be considered by the Sustainable Farming Fund.

The $2.25 million joint fund with Agmardt and the additional $1.35 million are assisting approximately 45 water projects. The level of funding provided has generally been 60% to 75% of the project cost. Funds are for investigations, not capital works.

1.3. LESSONS LEARNED

The major lessons learned from the history of irrigation development in New Zealand are:

- There must be a balance between the engineering and on-farm economics as drivers of the assessment of community irrigation schemes.
- Scheme development must include farmers early in the planning process and include an iterative process of feedback to farmers.
- An analysis of the implications on the community and servicing industries.
- Scheme promoters must be able to identify all potential benefits and beneficiaries of a scheme early in the process.
- There is a need for consultation with all stakeholders with an interest in water resource allocation early in the feasibility process.
- Wherever possible, effort should be made to maximise the non-productive benefits of water resource enhancement including other productive uses (electricity generation) environmental, recreational and cultural.
- It is critical to have a lead agent or champion in the initial promotion and feasibility analysis of schemes.
- Provision of information and support to farmers and other beneficiaries to assist decision making on how to manage and maximise the benefits from the resource is essential to encourage rapid uptake and efficient resource use.

2. Processes

The processes of investigation, promotion and development of a communal irrigation scheme can be divided into three sectors:

Administration Processes

Engineering Processes

People Processes

2.1. ADMINISTRATION PROCESSES

The administration processes can be quite significant considering the need to communicate with a large number of potential stakeholders as well as the administration involved in the provision of funds and managing the study process.

2.1.1. The Role of the Promoter

The promoter of the scheme has three basic functions. They are to:

- carry out the feasibility study into the physical viability of the scheme;
- educate and communicate at all stages through the feasibility process;
- ensure the economic viability of the scheme is assessed throughout the process.

2.1.2. Project Management

Project management of feasibility studies can be a complicated and time-consuming activity. For the smooth operation of feasibility analysis, it is important that tight project management and time management skills are used. The role encompasses the need to co-ordinate the input from a number of professionals who will be involved in the investigation, as well as the necessary communication with the community of interest.

In many instances, an experienced professional person best carries out the project management role. They can then report progress and findings to a management committee who provide direction to the project manager and make decisions on how to proceed when necessary.

2.1.3. Ownership Options

In most instances, the promoter of the scheme will not be the eventual commercial owner of the scheme. This is generally put in the ownership of the beneficiaries of the scheme, with an appropriate governance structure. This governance structure must provide for management of the financial aspects of the capital development of the scheme as well as provide appropriate ongoing operating, repairs and maintenance, and any further possible scheme development.

Funding of schemes depends very much on the relative capital cost of the development per hectare of irrigation. Depending on the level of this capital cost, it will be able to determine an appropriate level of up-front capital contribution by beneficiaries or ongoing funding by debt at an appropriate and affordable level. This decision must be based on the relative economic benefits that can be attained by water users.

2.1.4. Flow-on Impacts

Recent studies into the potential economic impact of proposed irrigation schemes in Canterbury have identified that the potential flow-on impacts past the farm gate are greater than those able to be achieved on-farm. The flow-on impacts achieved are in the form of employment, increased regional output and increased regional value added. The multiplier effect of flow-on impacts means that the community at large is a significant economic beneficiary from the development of irrigation schemes. This is primarily as a result of the intensification and change of land use that occurs under irrigation.

2.2. ENGINEERING PROCESSES

Engineering processes are primarily governed by potential water supply options, potential demand requirements and the interests of other stakeholders in water resources.

2.2.1. Supply Studies

Engineering supply studies are primarily concentrated on the feasibility of the diversion, storage and delivery of water from the water source to the farm gate. Depending on the nature of the potential water supply or the size of storage and delivery requirements, these can be quite detailed and quite expensive. Therefore, it is becoming increasingly common to at least stage these studies into a pre-feasibility study and then a full feasibility investigation. Even then, it is possible to have various phases of a feasibility study where there are multiple options which provide for decision-making as to whether to proceed or preferred options during the feasibility study process. These decisions are primarily based on the physical feasibility of delivery of water.

2.2.2. Demand Calculations

Different potential land uses have different levels of water consumption and different timing requirements for the delivery of that water. Therefore, some analysis needs to be made early in the planning process as to the potential or possible land uses in the study area and therefore the potential water demand. History has shown that a vital element in the water demand calculation is the reliability of water supply. As irrigation has moved away from being a drought insurance tool to a productive necessity, the volume and reliability of water supply have become very important. Current experience shows that a water supply reliability of up to 98% is required to justify the very high capital investment required of some new farming systems.

It is also recognised that there is a need to fully explore potential future land uses and their water demands so as not to preclude any future options for landowners. As an example, the current high water demands of dairy farmers have put pressure on old irrigation schemes that were designed to provide less volume and less reliable water supplies as required by traditional sheep farming options.

2.2.3. Conflicts of Use

The importance of identifying all people with a potential interest in the water resource and including them in the planning process has been well documented. These include recreational, environmental and cultural groups of interest. The ability to be able to accommodate all conflicts early in the process has been proven to be an important part of the successful development of a scheme.

2.2.4. Resource Consent Process

All schemes will need to go through the resource consent process before they can become reality. This is both an expensive and time-consuming activity. Therefore, an important part of the engineering process is the identification of any issues that would have a significant

impact on the likelihood of success in the consent application process. These include the necessity to work within current or future regional water plans as well as the ability to adopt a balanced approach to water use with provision of as wide a range of benefits as possible incorporated into the design of the scheme.

2.3. PEOPLE PROCESSES

The very important lesson learnt from the last 80 years of irrigation development in New Zealand has been the importance of the inclusion of information on all aspects of a project as early as possible in the decision-making process. This is vitally important in schemes where farmers will be required to commit to the uptake of water and therefore the increased investment required in both off- and on-farm irrigation development. Recent feasibility studies have shown that in many cases, the on-farm costs of irrigation development and intensification of land use are significantly higher than off-farm scheme costs involved in the delivery of water. This means that irrigators are required to commit to a significant business investment decision. Like all businessmen, farmers require a certain amount of time and a great deal of information to help them with this decision. Therefore, the people processes involved in community irrigation schemes are strongly driven by the open and free provision of information.

During the feasibility or investigation phase of the project, this is most likely to be an iterative process, with communication and information flows to and from the community on a regular basis being an important element of both landholder decision-making as well as the decision-making processes of the promoter of the scheme.

There are a significant number of information requirements.

2.3.1. Land Use Options

Most irrigation development requires intensification of land use or complete land use change to justify the investment. Therefore, present landowners need to investigate the full range of land use options available to them and the likely costs and benefits from each of those land users. In this way, they will weigh up which best meets their requirements.

2.3.2. Irrigation Systems

There is a vast array of irrigation systems available to farmers. These vary hugely in their capital costs, labour requirements and water use and delivery characteristics. Therefore, there is a need for farmers to evaluate a wide range of irrigation system options, based not only on the land use which they propose to adopt, but also the technical operation characteristics of the irrigation scheme and the relative efficiency of delivery of water according to the proposed land use. These factors need to be traded off against the different capital costs and labour efficiencies of the various systems.

2.3.3. On-farm Economics

As already discussed, irrigation development and associated land use change may require capital investment ranging from $2,000/ha up to $13,500/ha for dairy farm development. A business investment decision of this magnitude will require detailed analysis by the landowner. Provision of a decision-making framework to assist individual on-farm decisions is an important part of the information flow.

History has shown us that there is a variable level of interest in the uptake of irrigation water in the farming community. This may have a huge impact on whether a scheme can proceed or not. Some schemes may require 100% commitment to uptake of water before the engineering works can proceed. Other schemes may be able to proceed with a lower level of uptake of

farmers with some shares able to be taken up in the future as farms change hands and new farmers come on stream. The iterative process in community feedback is very important for promoters of the schemes to gauge the potential or likely uptake of water. This can have a huge impact on decisions whether to proceed further through the feasibility study process or not.

2.3.4. Development Processes

The harvesting and delivery of water to farm gates can be a complicated engineering process. Generally, it requires access through private farmland for delivery canals or pipes or even the flooding of farmland for water storage and dam facilities. Promoters of current schemes will have to negotiate with private landowners to use or gain access to their land. History shows that consultation as early as possible in the feasibility stages with affected landowners is an important aspect in gaining approval to do so.

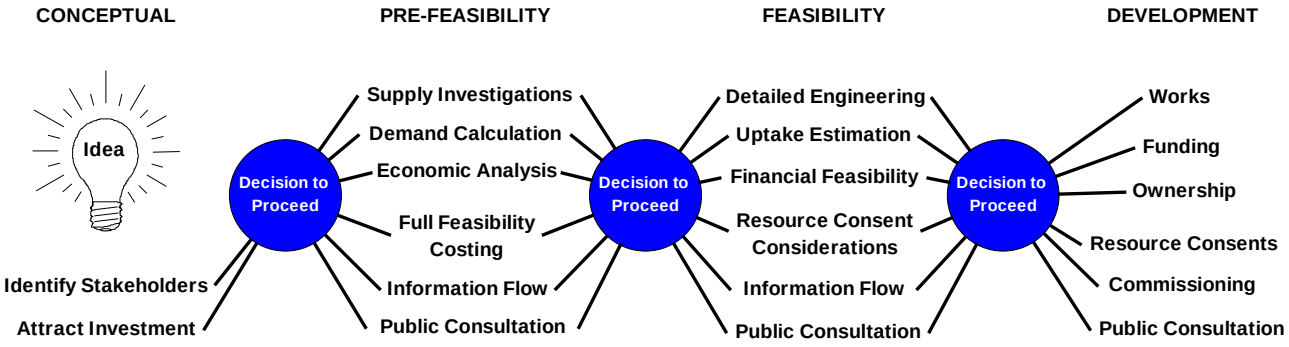
2.3.5. Social Impact

Studies of the social impact on communities in which an irrigation development occurs show that there are wide-ranging changes. The economic and employment impacts of the intensification of land use have a wide-ranging impact on rural populations. Studies have shown that irrigation development has had the benefit of increasing rural populations, with a significant proportion of that increase being in either single workers or young families. This has a significant flow-on impact to community facilities such as sports clubs, schooling and provision of health facilities. It also has a big impact on the social make-up of the community, with a significant number of new immigrants changing the social balance. In many instances, this is the reversing of the current trend of rural depopulation and helps gain the support of a community for irrigation development schemes. The communication of these potential changes to the wider community is an important part of the process.

3. Project Phases

The translation of a communal irrigation scheme from a good idea that is thought up by an individual into the commissioning of the delivery of water to the farm gate has four distinct phases. These are depicted in Diagram 1.

Diagram 1: Project Phases



1. **Conceptual Phase**. In this phase, an individual or group of people will have identified an opportunity to either take or store water from an existing source and redistribute it to farmers for irrigation. Generally, the idea is a concept that seems feasible and at this stage, the individuals need to identify the potential beneficiaries and stakeholders in the use of that water resource and attract investment from them to take the concept through to the next stage.

2. **Pre-feasibility Stage**. The purpose of this phase is to establish whether a project looks likely to happen and calculate the potential cost of carrying out the full feasibility study. It can also serve the purpose of initiating wider public interest.

   The degree of detail carried out in the pre-feasibility study will be very dependent on the nature and type of the scheme. However, as shown in Diagram 1, it must contain the essential elements of supply and demand calculations with resultant economic analysis and have the important elements of information flow to potential beneficiaries and public involvement throughout the process.

   At the end of the pre-feasibility stage, the promoting organisation will be forced to make a decision on whether to proceed to the full feasibility study phase and will have the job of raising investment to carry this out.

4. **Feasibility Study**. The purpose of the feasibility study is to explore the project in enough detail for the interested parties and stakeholders to make a commitment to proceed with the development of the project.

   As shown in Diagram 1, this will incorporate the important elements of detailed engineering investigations, with a much firmer commitment of likely uptake and land use. Full financial feasibility will need to be calculated, as well as an estimation of the impacts and requirements of going through the resource consents process. The eventual success of the scheme will depend significantly on the increased information flow and public involvement as described in People Processes in Section 2.3.

Feasibility investigations generally take the following course:

- collate information on crop suitability and the required irrigation management practices for the various soil types in the study area;
- review existing ground water information and then develop an updated conceptual hydrogeological model for the study area, possibly supported with further ground water investigations;
- determine the likely irrigation demand and seasonal water use maps;
- determine the areas of reliable supply of either surface water or ground water and problem areas;
- identify where irrigation can proceed without the need for a communal irrigation infrastructure and where community water supplies are necessary;
- develop all technical options for matching supply and demand. For example, the amount of storage required for community water supply schemes;
- assess the economic feasibility of irrigation to landowners;
- determine the nature and extent of environmental and other demands on the area's water resources and develop a strategy to ensure land use intensification occurs sustainably;
- analyse all the potential risks that would be associated with irrigation development (technical, economic and business) and assess their relative impact on the irrigation proposals.
- again, at the end of the feasibility study, the promoter will make a decision on whether to proceed with full project development.

4. **Devopment**. The development phase of the scheme incorporates all activity required to commission the scheme and provide for the delivery of water.

   This includes the carrying out of any works which are required as well as the administrative functions of arranging funding and ownership structures and going through the resource consent process. It is still essential in this phase to continue with the information flow and public involvement to ensure that the maximum benefits from the scheme are achieved as early as possible and that the communities are prepared for the implications of the development scheme.

   The mix of activities and the timing of when they will occur will vary according to the requirements of individual schemes. The role of the project champion or leader will also change over time as the project progresses through the various stages. At about the time the project progresses from the feasibility stage to the development stage, there is a large change in the leadership role from that of promoter and developer of the project to that of management of the ongoing development and operation of the project. In many instances, leadership of the scheme transfers at that stage from the investigatory committee to the future ownership organisation of the project. The activities of arranging funding and ownership may occur during the feasibility stage with the initial promoters of the scheme and be finalised before the development activity takes over.