Irrigation Acceleration Fund (IAF)

Good Practice GUIDELINES

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Irrigation Acceleration Fund Good Practice Guidelines

Ministry of Agriculture and Forestry

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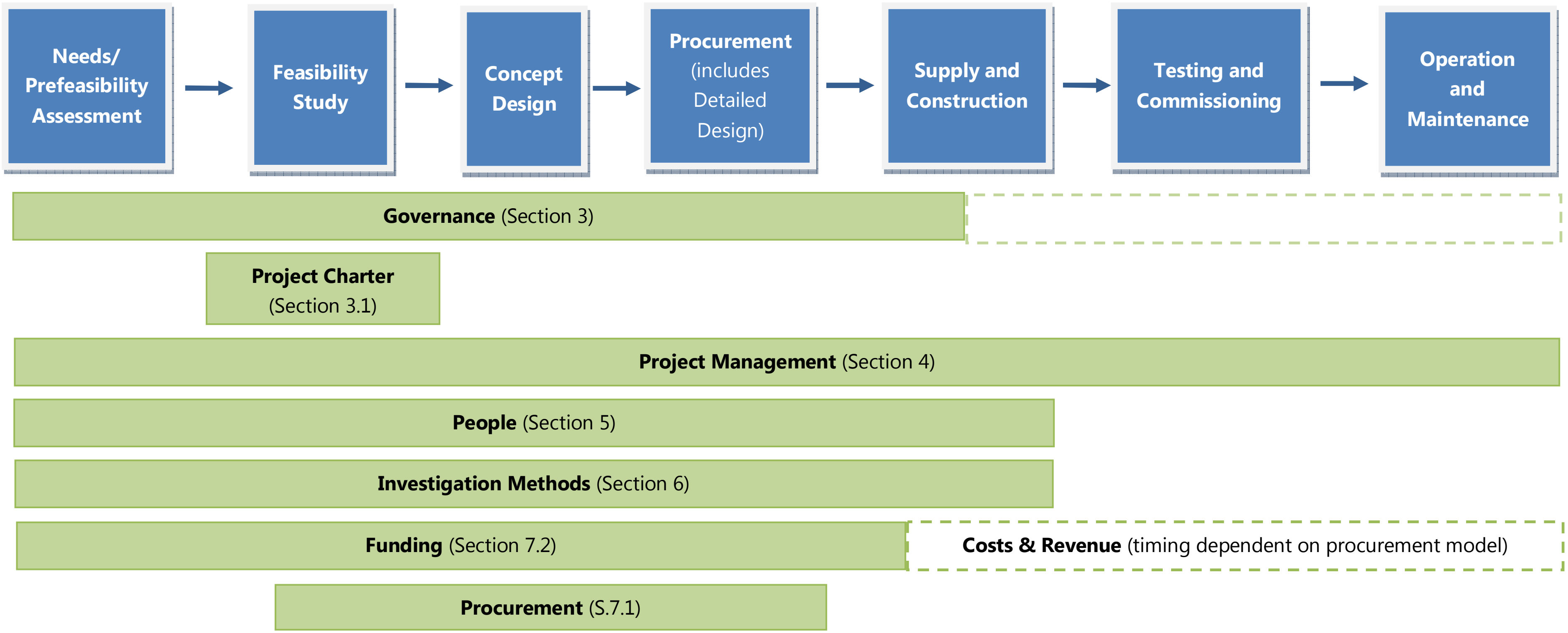
1 Summary

The following diagram provides an indication of how the various sections of these guidelines relate to a typical timeline for an irrigation development project. For example, the project charter development process generally should occur after needs/prefeasibility assessment, and before concept design. The order of the sections do not indicate priority, nor sequence (many factors must be considered in parallel).



Good Practice Guidelines Key Messages

SECTION 1

Governance

- The appropriate form of governance depends on scale and type of the project.
- Establish a governance team with appropriate breadth of leadership skills, experience, traits and stakeholder representation.
- The governance team must examine the project viability (business case) early on, and then at key hold points as more information increases. The business case is a key step in the process of establishing a charter against which all decisions are then tested.
- The governance team must focus on strategic leadership, direction giving, and critical decision making of the project, so that the management team can focus on efficient delivery of project objectives.
- An effective communication pathway needs to be established to involve stakeholders.
- A review process is needed to inform adaptation to change.
- The appropriate business structure for the irrigation scheme entity would depend on the specific requirements of the scheme, the scheme's stage in its lifecycle, the financing method used, procurement pathway, and its profit philosophy.

Project Management

- Project management starts with development of a business/project plan, which cover the tactics, resources and processes to be used to achieve the objectives set out by the project charter.
- The process of managing project risk, both positive and negative, involves planned identification, evaluation based on likelihood and severity, systematic response, and monitoring. Risk management must consider the context of the project objectives.
- Measurement and review of the performance against plan are crucial to adjust tactics if necessary and adapt to changing circumstances.
- It is important to continue good practice once the scheme is in operation, including implementing proper asset management and audited self management.

Good Practice Guidelines Key Messages (continued)

People

- Engagement with all stakeholders throughout the whole process of developing an irrigation scheme is important, as it allows for the scheme to evolve and be shaped by the stakeholder's requirements.
- Collaboration with all stakeholders including *tangata whenua*, landowners and the rest of the community, involves relationship building that must start from the beginning rather than from part way through or only when it is required.
- Successful collaboration with *tangata whenua* starts with genuinely seeking to understand the Māori worldview, and then working with them to incorporate what they value together wherever practical with the values of the rest of the community.
- Early, open and transparent collaboration facilitates relationship building with stakeholders and allows issues to be addressed early in the consent process.
- Understand all property requirements, and issues including how the land is to be held, existing property interests, and what requires a property interest to be acquired for the reticulation route and other infrastructure. Understand statutory requirements. (including any statutory barriers to property rights required), and local authority requirements and issues (including rating liability).

Good Practice Guidelines Key Messages (continued)

SECTION 2

Investigation Methods

- The investigation process must cover the economic, environmental, cultural, social, and technical aspects of the project. Early investment into this process provides the ability to influence whole-of-life costs.
- Economic assessments at key hold points throughout the project are essential to assess based on available information whether an irrigation development project sufficiently increases the overall gross farm income to make irrigation affordable.
- Hydrological investigation primarily involves quantification of water requirements, identification of reliable water sources, assessment of soil hydraulic properties, and assessment of how irrigation should be applied.
- The construction and operation of irrigation infrastructure will respectively result in direct and indirect effects on the ecological environment, including land use and water quality. Together with cultural and social impacts, consideration should be given early in the process to allow for a design to be developed that minimises adverse effects and maximises benefits.
- Social and cultural impact assessments should be strongly interlinked with public engagement.
- Engineering investigations comprise a range of technical studies that must be conducted appropriately to inform the design and procurement process.

Pathway to Procurement

- Engineering investigations comprise a range of technical studies that must be conducted appropriately to inform the design and procurement process.
- The procurement strategy covers decisions surrounding procurement model, contract type, 'conditions of contract' document used, and the tender process.
- The appropriate procurement strategy depends on the unique priorities of the irrigators – e.g. final cost certainty upfront, timing, quality, flexibility, and timing of funding availability.
- Because capital is required not only for supply/construction, but also for the stages before and after, the appropriate source of funding should consider the stage of the project's life, as well as the different benefits and challenges of each source.

2 Introduction

Background

The Irrigation Acceleration Fund (IAF) is part of the New Zealand government's initial policy response to the Land and Water Forum's recommendations. The IAF, administered by the Ministry of Agriculture and Forestry (MAF), supports the potential for irrigated agriculture to contribute to sustainable economic growth throughout New Zealand. The allocated funding will support the development of irrigation infrastructure proposals to the 'investment-ready' prospectus stage. The funding is intended to provide momentum to the commercialisation process, encouraging private investment into irrigation development projects.

The IAF's primary purpose is to support regional-scale rural water infrastructure proposals. The IAF will also continue support for strategic water management studies and strategies and community irrigation schemes that has to date been available through the Sustainable Farming Fund and the Community Irrigation Fund.

Applicants must demonstrate a commitment to good industry management practice, use of collaborative processes, and that they have a capability to lead and be accountable for any agreed work programme.

All proposals will be assessed against the following assessment criteria:

- The use of collaborative processes in the planning phase
- Fit with regionally agreed approaches to the sustainable use and management of water
- Expected direct and indirect net economic benefits to New Zealand
- Broader benefits
- Ability to deliver the programme
- Work programme that fits with good industry management practice *(as described in this guideline)*
- Programme costings and contributions

The IAF will fund rural water infrastructure development from the pre-feasibility stage through to the 'investment-ready' prospectus stage. The minimum requirement is that a group have identified an irrigation concept that seems feasible, identified the potential beneficiaries and stakeholders and got a financial commitment from them to take the concept forward. Projects that have already passed the pre-feasibility stage can still apply for funding from their current stage through to the 'investment-ready' prospectus stage.

The IAF will, as far as is practicable, adopt a multi-year development programme based approach, subject to achievement of milestones and confirmation that the proposed project continues to be viable. However, in certain circumstances, MAF may decide to fund discrete activities, e.g. scheme upgrades and smaller scale projects. Work programmes will be required to demonstrate good industry management practice in all stages of development and progress. *This document provides guidance for applicants to assist them in preparing concepts and proposals for IAF investment.*

Context/Purpose

MAF commissioned Opus International Consultants (Opus) to lead the development of these Good Practice Guidelines. The purpose of this document is to cover the standards and benchmarks considered to be good practice that applicants are expected to include in their work programmes, not a detailed set of instructions. The IAF will support regional rural water infrastructure, community irrigation schemes, and strategic water management studies; however, these guidelines are more targeted to the first two categories.

This document is a collection of knowledge and experience distilled and amalgamated primarily from a panel of specialist contributors within Opus, with specific inputs received from Goodman Tavendale Reid and MacFarlane Rural Business. A working draft of these guidelines were tested and critiqued in a workshop of practitioners prior to being finalised in order to ensure robustness and wide concurrence.

This Good Practice Guidelines document will be a 'living' document that will continue to be adapted with future developments and experience. It will be used both as a guide in the assessment of applicants' proposals, and for applicants to better gauge whether their proposals are likely to meet expected standards. The systems, processes, and actions described in these guidelines do not all have to be in place before an application can be made, but evidence must be provided to demonstrate a plan and a commitment to put them in place during the work programme.

There has been a recent change in emphasis from developing irrigation-only water infrastructure projects to developing wider community water infrastructure projects that consider multiple uses/interests. It is a shift from "managing the community's other water needs while seeking to develop irrigation" to "working collaboratively with the rest of the community to intentionally achieve beneficial outcomes for all". Therefore, it is with that mindset that these guidelines are to be read.

SECTION 1

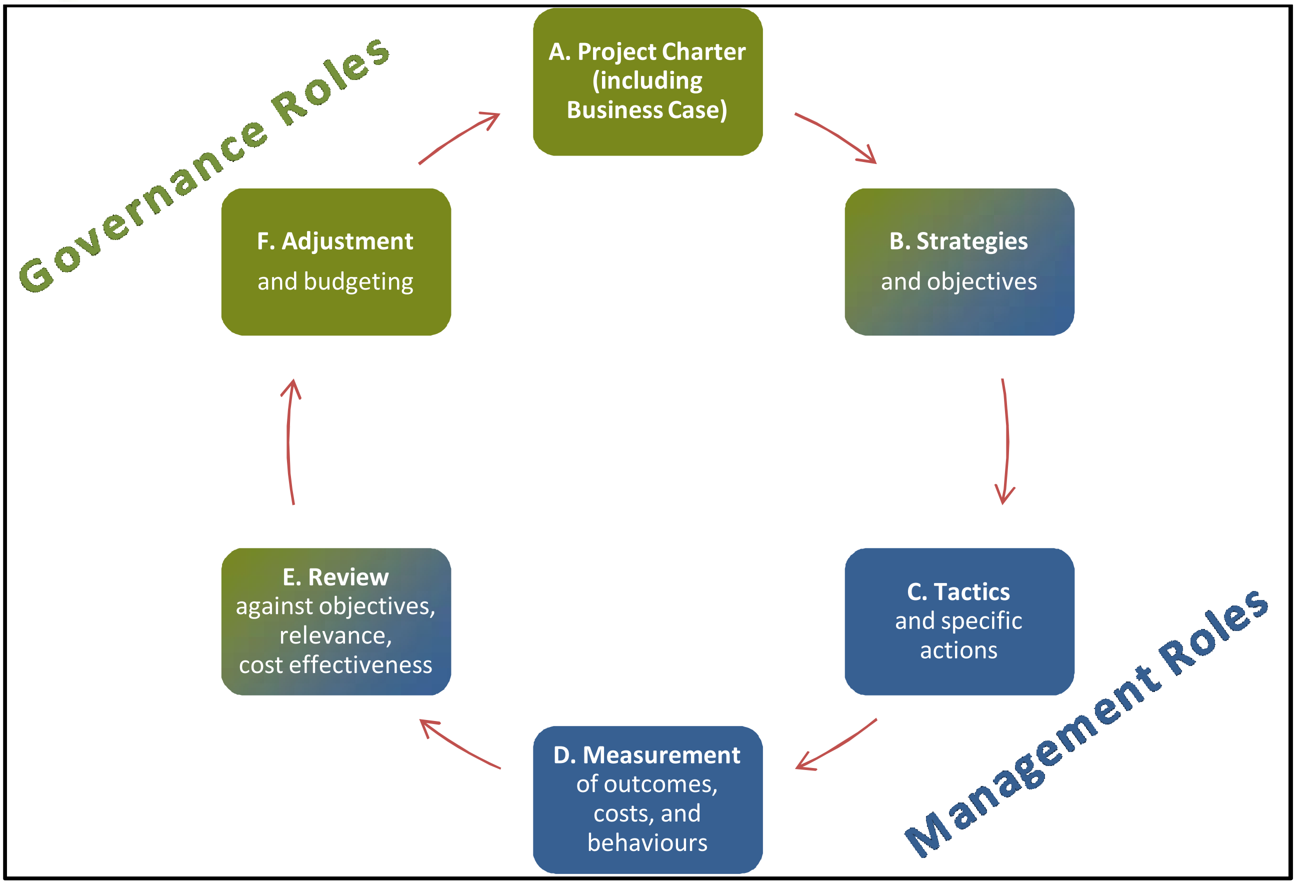
3 Governance

Key Messages

- The appropriate form of governance depends on scale and type of the project.
- Establish a governance team with appropriate breadth of leadership skills, experience, traits and stakeholder representation.
- The governance team must examine the project viability (business case) early on, and then at key hold points as more information increases. The business case is a key step in the process of establishing a charter against which all decisions are then tested.
- The governance team must focus on strategic leadership, direction giving, and critical decision making of the project, so that the management team can focus on efficient delivery of project objectives.
- An effective communication pathway needs to be established to involve stakeholders.
- A review process is needed to inform adaptation to change.
- The appropriate business structure for the irrigation scheme entity would depend on the specific requirements of the scheme, the scheme's stage in its lifecycle, the financing method used, procurement pathway, and its profit philosophy.

Governance in this context refers to the high-level leadership of the irrigation development project entity which makes decisions and policies to safeguard the interests of all the members of the entity. It is distinct from management which then coordinates the activities of the entity to implement those decisions and policies as efficiently as possible.

The form of governance for the irrigation development project must be appropriate for the scale and type of project, i.e. regional-scale rural water infrastructure projects are likely to require a different form of governance compared to community irrigation schemes.



The process cycle chart above illustrates how governance and management are linked. The process starts with a project charter that flows on to strategies and tactics, which are then measured and reviewed to assess the need for adjustment/adaptation, closing the feedback loop. Parts A and F are governance roles, whereas parts C and D are largely the roles of management and staff (Section 4), which are to be resourced through a costed work programme. There is some collaborative overlap of governance and management roles in B and E. The amount of detail increases as a project charter is used to form strategies and objectives, and again as these strategies and objectives are subsequently used to form tactics and specific actions.

The measurement (D) and review (E) processes relate to the project charter (A), strategies (B) and tactics (C), but different frequencies are appropriate:

- The project charter, being a foundational document, would be infrequently measured against and reviewed.
- The strategies would be regularly and proactively measured against and reviewed.
- The tactics would be measured against and reviewed very frequently, and often reactively.

Stakeholders, including the wider group of irrigators, would be informed and consulted with during the measurement and review processes.

Apart from the measurement and review of the means used to accomplish project objectives that has just been described, there should also be a process of review at key hold points to re-assess the viability of the project based on all the information obtained to date. This assessment provides the basis for a "go or no go" decision by the governance team, ensuring that sunk costs (everything already invested to date) do not improperly influence the decision, and the project only proceeds if it is still truly viable.

3.1 Project charter

A key step early in the governance process involves the formation of a governance team which then develops charter documents for the organisation (if not already developed) and specifically for the irrigation development project. The project charter document sets the overall vision/direction and objectives of the project, and formally bestows authority to the management/implementation team to apply resources to meet the objectives of the project.

The management/implementation team, which may consist of scheme employees and/or a contracted project team such as a consultant, is kept accountable based on this charter and makes decisions that are tested against this charter. The charter and the response of both the governance team and the implementation/management team needs to have a review function to maintain appropriateness to the overall objectives, i.e. long-term flexibility and adaptability.

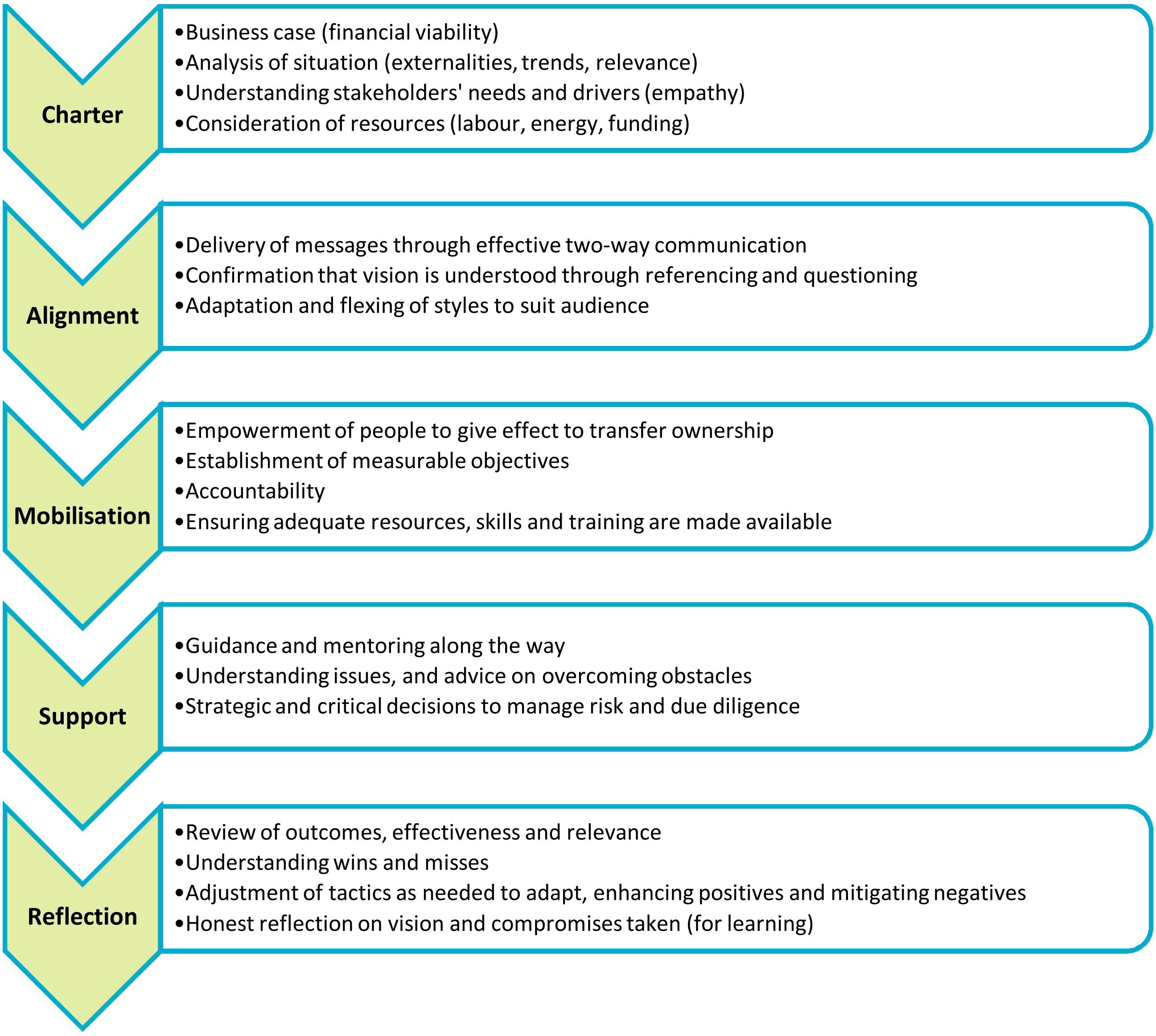
Before a project can be chartered, a needs assessment and/or a prefeasibility study must be conducted to assess the business case (financial viability/affordability) and identify any obvious show-stoppers. Only with this foundation put in place can the project charter be developed. The project charter records the justification and purpose for the project, as well as the key project boundaries, including:

- the needs, wants, and expectations of the irrigators and any other stakeholders;
- the people engagement plan;
- current understanding of the project requirements to satisfy, and the outcomes intended to satisfy those requirements;assumptions and constraints;
- the business case supporting the project, and financial budgeting;
- the project philosophy with regards to profit;
- assigned roles and authority levels; and
- timeline highlighting proposed project milestones.

3.2 Leadership Functions for Governance

The governance functions grow as the project progresses:

- Developing the charter to launch the project;
- Communicating to ensure alignment of the management team with the charter;
- Mobilising the management team with what it needs;
- Supporting the management team through critical decisions or advice;
- Reflection at planned hold points to adjust and adapt as necessary.



3.3 Structure

The governance team needs to clearly set the roles and responsibilities for themselves and for the management team. Governance teams need to avoid the tendency to get caught up with trivial which distracts them from their role to influence strategic decisions.

If the governance team wants to ensure that it stays focused on the strategic leadership, direction giving, and critical decision making of the project, while the management team is freed up to focus on the day-to-day implementation and coordination of the project, there must be an intentional decision and clear communication to operate using this structure.

3.4 People

The composition of the governance team should be appropriate for the particular irrigation development project. For example, a regional-scale rural water infrastructure project should have a multi-stakeholder governance team consisting of representatives of all interested parties. However, it is likely that the governance team for a small community irrigation scheme would more suitably consist only of representatives of the irrigators.

The right breadth of skills and experience in the governance and management teams are essential for effective governance. The right personality traits also matter. While governance team members generally need to be visionary, whereas management team members generally need to be process-oriented and able to turn abstract concepts into practical reality, there also needs to be a mix to ensure that they can both understand and constructively challenge each other. The governance team also needs to be technically able to ask the right questions of management/staff and external specialists. The inclusion of external stakeholders with different skills and experience can enhance outcomes for the scheme development if they are brought in a way that adds to collaborative decision-making.

3.5 Information flow

The process cycle chart and the accompanying description at the start of this section provide a good overview of the information flow that is required for good governance:

- The project charter and the strategies must flow from the governance team to the management team.
- The tactics and specific coordination direction must flow from the management team to staff.
- The results of measurement must flow from the management team to governance and stakeholders.

- The results of review must flow from the governance team to stakeholders.
- If the results of review lead to adjustments, then these must flow from the governance team to the management team.

3.6 Business structure

There are a number of different structures that can be used for irrigation schemes ("schemes"), ranging from a limited liability company, co-operative, trust through to limited partnership. A flow diagram "Questions for Deciding on Business Structure" is presented at the end of this section to help irrigators identify what stage they are at, and the appropriate structure for their group. In addition to this, a schedule of "Possible Structures for Irrigation Scheme Entities", together with a summary of the nature of the structure, duties and liabilities, administrative requirements, and the treatment of profits and taxation, has been included in the appendix (Section 9.1)

The most appropriate entity may vary depending on *specific requirements of the scheme*, and the relative pros and cons of each entity. The appropriate structure will also depend on the point which the irrigation scheme is at in its *lifecycle*. For example, the structure used in the early stages may vary from the structure that is ultimately used once the scheme is operational.

Another key aspect to consider when determining the structure, is how the scheme may be *financed*. For example, if the scheme is essentially going to be financed by a local authority which will then seek to recover costs from the irrigators through the rating layer, then the structure can be relatively simple. If, however, it is anticipated that a large proportion of the capital be raised from the irrigators themselves as shareholders, then a more sophisticated structure will be required and some issues will arise under the Securities Act 1978, e.g. the issuing of shares to the public.

The Securities Act issues are an important aspect to consider in any water project regardless of the stage at which the scheme may be. Issues can arise at an early stage with farmers seeking to raise initial money for feasibility studies and investigations, right through to the latter stages of the project where substantial sums of capital are needed to build infrastructure.

Care needs to be taken to ensure compliance with the Securities Act and if possible to avoid the need for a prospectus in the early stages, as legal and accounting costs may be disproportionate to the benefit at this point in the scheme's lifecycle, e.g. it may not be sensible to issue a prospectus when the intention is only to raise a couple of hundred thousand dollars for the initial feasibility studies.

The Securities Act will also have a significant impact on the structure that is used in the early stages. For example, it may be prudent to use a trust or incorporated society in any stage if irrigators wish to raise money from a number of interested parties, to avoid the application of the

Securities Act, e.g. subscription by the members of a society is not the issuing of a security under that Act.

It is important to note, however, that Securities Act is currently being reviewed and that some structures not currently covered (or at least clearly covered) by the Act may be covered in the future. Further, the Financial Markets Authority will have "call-in" powers under the new legislation, which means that it will be able designate a product as a security regardless of whether it meets normal definitional requirements.

The type and structure of governance may also vary depending on the type of engineering of the project, or the *procurement pathway* used. For example, if a project is a BOOT (Build, Own, Operate, Transfer) then the structure may vary considerably from the early stages when the water users are simply contracting for that water service, to the later stages when the water users take ownership from the BOOT operator.

Lastly, the structure may vary depending on the *philosophy* taken by the promoters of the scheme. Is it intended to make a financial return and reward investors for their capital, or is the project simply going to be a cost recovery exercise with the farmers making their profits on-farm rather than by their investment in the scheme?

It is important that irrigators ask the right questions to determine what the structure should be during the lifecycle of the scheme. The issues, however, are complex and it will be important to obtain expert legal and accounting advice.

Questions for Deciding on Business Structure

Structure & Purpose

Are there any physical characteristics of the catchment area that are relevant?

- Physical boundaries
- Land/water use

What will the members of the group get in return for their investment?

- Shares?
- Rights to water?

What structure is best suited to the group (See Section 9.1)?

- Limited Liability Company
- Incorporated Society
- Informal committee / society
- Trust
- Co-operative Company
- Limited Partnership

What is the purpose of the group? E.g.

- Lobbying
- Owning assets (i.e. infrastructure, land)
- Building & operating water distribution network
- Holding or managing resource consents
- Environmental

Who will the members of the group be?

- Farmers/irrigators (how many farmers/ consent holders are involved?)
- Regional & local councils
- Community organisations
- Environmental organisations
- *Iwi*
- Associated businesses

Funding

What level of funding is needed?

- Initially
- Ongoing

Personnel & Governance

Is there a "champion" leading the group?

Previous involvement of individuals

Appointed or natural progression?

Requirements of Personnel (i.e. skill set, time availability)

Is the full complement of skill available in the people involved?

If not, where are the gaps & how will they be filled? Partners or associated parties?

Is there a need to import skills?

Who is the group going to be dealing with?

Is there a need for outside support and facilitation (i.e. for establishment, ongoing funding)?

What offices are needed? Chair, secretary, treasurer, committee members?

Who will hold the offices? Farms? Irrigators? Community members? Council representatives?

Does there need to be a tiered arrangement of responsibility and/or accountability? Consider the size of the group, purpose, leadership/ management styles.

Professional Advisors

What level of professional advice and assistance is required?

- Legal?
- Financial?
- Technical / hydrological?

Other Considerations

Does there need to be any ongoing support and coordination from territorial authorities or other organisations?

What is the future role of the group going to be?

Are there other benefits as a consequence of collaboration?

Where are the gaps in the knowledge?

How much knowledge is there of the resource?

- Catchment
- River / stream
- Takes
- Metering

What are the issues facing irrigators?

- Regulatory
- Environmental
- Financial
- Competitive
- Other users of water (i.e. industrial, municipal, environmental)

4 Project Management

Key Messages

- Project management starts with development of a business/project plan, which covers the tactics, resources and processes to be used to achieve the objectives set out by the project charter.
- The process of managing project risk, both positive and negative, involves planned identification, evaluation based on likelihood and severity, systematic response, and monitoring. Risk management must consider the context of the project objectives.
- Measurement and review of the performance against plan are crucial to adjust tactics if necessary and adapt to changing circumstances.
- It is important to continue good practice once the scheme is in operation, including implementing proper asset management and audited self management.

To ensure the success of an irrigation scheme development project, it is important that effective project management is used. Project management can be defined as the application of knowledge, skills, tools and techniques to project activities to meet the wider project requirements.

4.1 Business Plan

With the authority from the project charter (Section 3.1), the management/implementation team can initiate the project. Project initiation should begin with the development of a business plan (sometimes referred to as a project plan). While a business case answers the question “Do we have a viable project?”, a business plan answers the question “How do we work towards the objectives of the project now that we know it is viable?” The business plan should reflect the size and scope of the irrigation scheme being developed and cover the full duration of the project. The following outlines the basic requirements that should be included in a business plan for the development of an irrigation scheme.

Business Plan

HOW? How is the project going to be done? A methodology for the progression of the project should be developed.

↓

WHAT? What inputs need to be produced to support the project?

↓

WHO? What resources are required? Who is going to provide specialist technical knowledge and skills for each of the specific inputs to the project? The roles and responsibilities of all participants must be clearly defined at this stage.

↓

WHEN? A timetable needs to be developed outlining the proposed start and completion dates of all activities for the duration of the project.

↓

HOW MUCH? A budget needs to be developed to cover the estimated costs of preparing the necessary inputs to the project.

↓

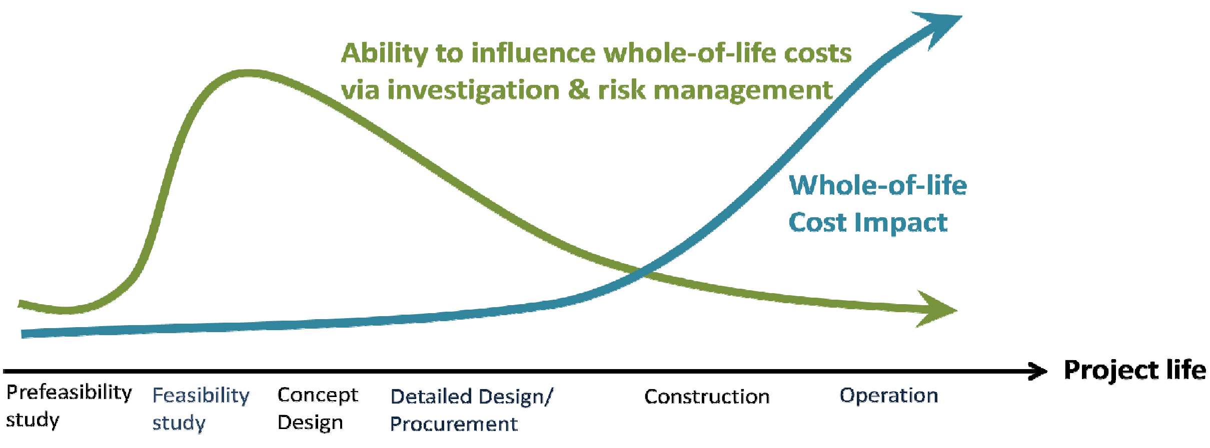
COMMUNICATION? What method (email, meetings, teleconferences, etc.) and how often will communication with stakeholders occur? Will communication specialists be required for external communication, e.g. to ensure clear, consistent message to the media?

4.2 Risk Management

Risk Management is the part of project management that deals with the processes of identifying, quantifying, responding to, and controlling risks inherent in a project. A risk can be defined as an uncertain event or condition that, if it occurs, has a positive or negative effect on a project's objectives. Uncertainties are not to be avoided, they are to be managed to provide the best outcome.

The risks for an irrigation development project include not only technical engineering risks, but also those surrounding the business case, the concept, governance, regulatory framework, people/collaboration, funding/financing, procurement and implementation. An example of negative environmental risk is water quality deterioration as land use changes, whereas an example of positive environmental risk/opportunity is the ability to achieve greater instream flows as water abstraction is reduced through increased water use efficiency.

While the period of highest whole-of-life cost impact occurs during construction and operation, the period of highest ability to influence these risks occurs during the early stages of the feasibility study, conceptual design and procurement/detailed design. Therefore, risk management and investigation to build knowledge (Section 6) work hand-in-hand to achieve the desired outcome of minimum whole-of-life costs.



While risk management happens throughout the project life, there should be planned points in the work programme timeline for robust assessment of risk/opportunities. This assessment informs the "go or no go" hold-point decisions (described in Section 3), and provides the basis for proper risk management if the project proceeds. For each risk identified for the irrigation development project, there are two key questions that should be asked:

- What is the probability of the risk event actually occurring?
- What would be the impact of the risk on the project if it did happen?

The answers to these two questions allow for all the risks identified to be prioritised, which is an important step, as it is unlikely that irrigators will have the resources to be able to manage every risk.

The flow diagram below outlines the Risk Management process:

The ways of managing risks to reduce negative impacts and maximise positive opportunities include:

Risk Response Strategies	
Negative Risk	**Positive Risk / Opportunity**
Accept – In some cases, accepting the risk and not changing the business plan may be the best option. A contingency in the budget and/or plan should be included to accommodate the risk if it does occur.	**Accept** – The same as for a negative risk. Allowance in the budget and/or plan should be made to allow the opportunity to be seized if possible.
Mitigate/Minimise – Taking steps to reduce the likelihood/consequence of a risk occurring.	**Enhance** - Taking additional steps to increase the likelihood or consequence of a risk occurring.
Transfer/Isolate – Shifting of all or some of the risk onto a third party, usually through contract provisions. E.g. Insurance cover.	**Share** – Sharing the benefit of an opportunity with a third party who will maximise the likelihood of realising the opportunity.
Avoid/Eliminate – This strategy involves changing the project plan to eliminate the risk and protect the project objectives. In some cases, the risk may be a 'fatal flaw' where abandoning the project may be best.	**Exploit** – Seeking to eliminate the uncertainty associated with an opportunity.

4.3 Project Selection

Project selection in this context is the process that typically involves choosing the most suitable project option to pursue in light of the objective of developing an irrigation scheme, given the finite resources the irrigators have. For a comprehensive and informed decision to be made, some initial investigation work must be completed upfront. It is important that key "hold" or "check" points are scheduled into the plan for such investigative work. These allow for critical decisions to be made with stakeholders, based on work already completed, ensuring that money and time are not wasted completing further investigations for options or projects that are ultimately unfeasible.

For example, irrigators looking to develop an irrigation scheme need to find a suitable source of water. A hold point should be programmed after the completion of a hydrological assessment of the potential water sources. If this assessment finds that the local groundwater is of unsuitable quality or quantity to support the irrigation scheme, then an informed decision can be made to abandon groundwater as a potential option and pursue further investigation of surface water options in the area.

Often the decision is not as clear-cut or simple as the example given above and selection tools may be used to help differentiate between the options. These are some selection factors/tools:

Qualitative:

- Stakeholder bias
- Organisational fit
- Risk analysis
- Multi-criteria scoring models

Quantitative:

- **Net present value (NPV)** method, which calculates the sum of the present values of costs and benefits/revenue, based on a discount rate which represents the average cost of capital weighted by the funding mix used (Section 7.2). There is potential to add value if NPV>0.
- **Internal rate of return (IRR)** method which calculates the discount rate at which the present value of costs equals the present value of benefits/revenue. The IRR is a rate of return that can be assessed against other projects' rates or a minimum acceptable rate.
- **Benefit-cost ratio (BCR)** method, which estimates the value for money by calculating the ratio of the present value of benefits/revenue to the present value of costs, based on the average cost of capital weighted by the funding mix used.
- **Payback period** method, which estimates the time period required for benefits/revenue to fund the costs, without accounting for the time value of money.
- **Return on capital/investment** methods, which calculate the percentage of total profit over total capital invested, or additional profit from irrigation over additional capital invested for irrigation (described in Section 6.1).

4.4 Resource Planning

A project is reliant on having suitable resources available at the right time. For the development of an irrigation scheme, the most important resource will be the people required to complete the work. It is important to ensure that the people involved have the necessary skills and knowledge and are available at the times they are needed.

Time must also be well planned, taking into consideration key hold points and all project-specific constraints. A well-thought-out timeline would identify the critical path, i.e. the steps that drive the project completion date regardless of how fast other steps occur. This allows identification of potential bottle-neck risks to timeliness, and assessment of opportunities to speed up the process. To inform this process and to ensure that sufficient time is allowed for, it is worth finding out the expected timeframes for the project's various component steps, including consenting authority's timeframes for assessment and approval.

4.5 Documentation

It is essential that good record keeping is maintained for the duration of a project. This includes both electronic and hard files and all incoming and outgoing communications with the project team and stakeholders.

4.6 Engagement Plan

An engagement plan needs to be developed, authorised, and actively implemented. The IAP2 guidelines referenced in the appendix (Section 9.4) are useful for this. This plan is to be a 'living' document that is updated as required during the course of the irrigation development project.

4.7 Monitoring & Reporting Progress

As a project progresses, it is important to monitor the progress against the planned timeframes outlined in the Business Plan. This allows for the project team to make adjustments where necessary to ensure the project performance is maintained. Monitoring project performance involves the following steps:

- Comparison of actual results with the baseline in the Business Plan for the three indicators of cost, time and scope,
- Identify any variance for those three indicators,
- React if and as necessary.

The project progress should also be communicated with stakeholders at stages throughout the project. It is important to inform your stakeholders while taking care not to burden them with too much detail or information. The format (verbal presentation, report etc) should be chosen based on your audience, and the same format should be used with each update to help avoid confusion. A progress report should contain the following key pieces of information:

- Current status/progress since the last report;

- Forecast progress, anticipated problems, possible recommendations; and
- Other relevant information, e.g. upcoming milestones, milestones that have/have not been met.

4.8 Continuing Good Practice

Asset Management

A proper testing and commissioning programme at the end of the construction phase must be planned for and implemented for quality assurance and for successful irrigation scheme operation. However, good practice ought not to end with the start of operation. The end of asset development marks the start of asset management, which is crucial not only to safeguard the initial capital cost investment, but also to minimise ongoing costs and unplanned disruption to water availability. This includes planned maintenance, refurbishment, and condition assessments to inform an optimised replacement schedule.

Auditable Self Management

While the environmental impacts of the irrigation development project needs to be assessed early on (covered in Section 6.3), there is also the responsibility to manage environmental impacts during the operational stage. Auditable Self Management (ASM) is becoming more commonplace as the preferred environmental management process. In this context, ASM refers to the process in which a regional council can delegate some responsibilities for consent monitoring and land management under the RMA to irrigators under agreed terms (the self-management aspect), subject to audit of processes and outcomes by the regional council (the audit aspect). Taking this approach has implications for the design, governance, monitoring and consent reporting for rural water infrastructure. While the means to successful and acceptable ASM varies for each entity, there are common requirements to be achieved:

a) robust data to be collected for management and decision making for community confidence;

b) data and derived information to be accessible to all stakeholders, with detail appropriate to the issue of interest;

c) an open and regular communication process between those responsible and those affected;

d) governance arrangements that reflect democratic values instead of being controlled by powerful interest groups; and

e) from the start, clear definition of the roles and responsibilities of all involved, especially those responsible for consent compliance.

5 People

Key Messages

- Engagement with all stakeholders throughout the whole process of developing an irrigation scheme is important, as it allows for the scheme to evolve and be shaped by the stakeholder's requirements.
- Collaboration with all stakeholders including *tangata whenua,* landowners and the rest of the community, involves relationship building that must start from the beginning rather than from part way through or only when it is required.
- Successful collaboration with *tangata whenua* starts with genuinely seeking to understand the Māori worldview, and then working with them to incorporate what they value together wherever practical with the values of the rest of the community.
- Early, open and transparent collaboration facilitates relationship building with stakeholders and allows issues to be addressed early in the consent process.
- Understand all property requirements, and issues including how the land is to be held, existing property interests, and what requires a property interest to be acquired for the reticulation route and other infrastructure. Understand statutory requirements (including any statutory barriers to property rights required), and local authority requirements and issues (including rating liability).

An irrigation scheme has the ability to affect people both positively and negatively, potentially across an area much wider than is covered by the scheme itself. Engagement with all stakeholders throughout the whole process of developing an irrigation scheme is important, as it allows for the scheme to evolve and be shaped by the stakeholder's requirements. Involvement of stakeholders from the start has the benefit of avoiding unnecessary fear and angst within the community. It is also much easier (and less costly) to amend the scheme design to address concerns raised by stakeholders at the feasibility and concept stage.

An irrigation development project should be consistent with regional water strategies where these exist, because these consider the multiple stakeholders in the region and provide direction with regard to the appropriate stakeholder engagement process.

Engagement with stakeholders has a multitude of benefits for every project other than for the Resource Management Act (RMA) 1991 consenting aspects. Options that might not have been available can present themselves, and options that might have been considered feasible can be dismissed. This process is invaluable and the importance of engagement from the beginning should not be under-estimated.

Determining the finer details of "who, when, how and why" of engagement occurs is important. Defining terminology to be used from the beginning is also critical to ensure that everyone has a clear understanding and delivers consistent messages. Engagement can be a long-term process that serves many purposes.

The following outlines various aspects of engagement specific to the various parties being engaged with.

5.1 Community Engagement

Some key information needs to be worked out prior to engagement commencing. This includes the why, what, who, how and when basic categories.

- **Why** – determine why engagement is taking place and **what** is trying to be achieved at each stage – is it informing, getting feedback or approvals, getting input into the concept or design? The reasons for undertaking engagement are key drivers for how the engagement progresses.

- **Who** is going to be engaged with e.g. *iwi*, councils, non-governmental organisations, community groups, land owners and occupiers, interest groups, other irrigation schemes nearby, and infrastructure companies? Is there going to be engagement with certain groups or parties, with all, or with no one? In addition, who is going to be doing the engagement also needs to be determined. This should not be just anyone, and while assistance can be provided from technical experts, technical experts should not be leading the engagement simply to ensure that people understand what they are being told rather than the risk of misunderstanding arising from the use of technical language.

- **How** are you going to engage with these parties/people e.g. letters, phone calls, emails, face to face meetings, open days, workshops, public meetings. Also consider where the engagement should take place – should you go to them, should they come to you, or should it be somewhere neutral?

- **When** engagement occurs will depend on each specific project, and will influence each of the 'why' 'who' and 'how' aspects. Stages that engagement can occur in for infrastructure projects includes at the concept investigation phase, during the detailed design phase, during the construction phase and during the establishment or commissioning phase.

The 'why' in each phase could vary depending on the 'who' that is being engaged with. Different parties will have different levels of influence over the project, i.e. the reason for engagement with Council is different to the reason engaging with land owners occurs, which is different again from the reason interested or community groups are engaged with.

The ‘how’ will also vary depending on what the ‘why’ is. The ‘how’ should also vary depending on the ‘who’ to ensure that appropriate means of communicating with different people/groups is used. If you are simply telling people things, then the means of doing this should not convey to them that they have the ability to respond or supply feedback. If you are asking people to design what they think would be best then don’t present the project as if that has already occurred. While this might seem clear, it is very easy to mix up messages and confuse the people being engaged with as to what input they can have and what you are asking from them.

Prior to starting engagement, it is important to have worked out why this is occurring and what is trying to be achieved, and that this is documented in an engagement strategy. This strategy should set out the ‘when’, the ‘how’ and the ‘who’ so from the beginning all those involved have a clear understanding of what the purpose of the engagement is. The strategy should be a living document, with results of engagement included and with changing approaches, timelines, and detail being included.

Engagement should be staged to allow for sufficient time to undertake the engagement, review the feedback and disseminate it to the required parties for inclusion in the next phase of the project, all before commencing the next phase of engagement. Feedback should be considered, and a detailed evaluation process recorded as to how the feedback has affected the project, whether it occurs through any number of aspects such as design, mitigation measures used, location, or scale.

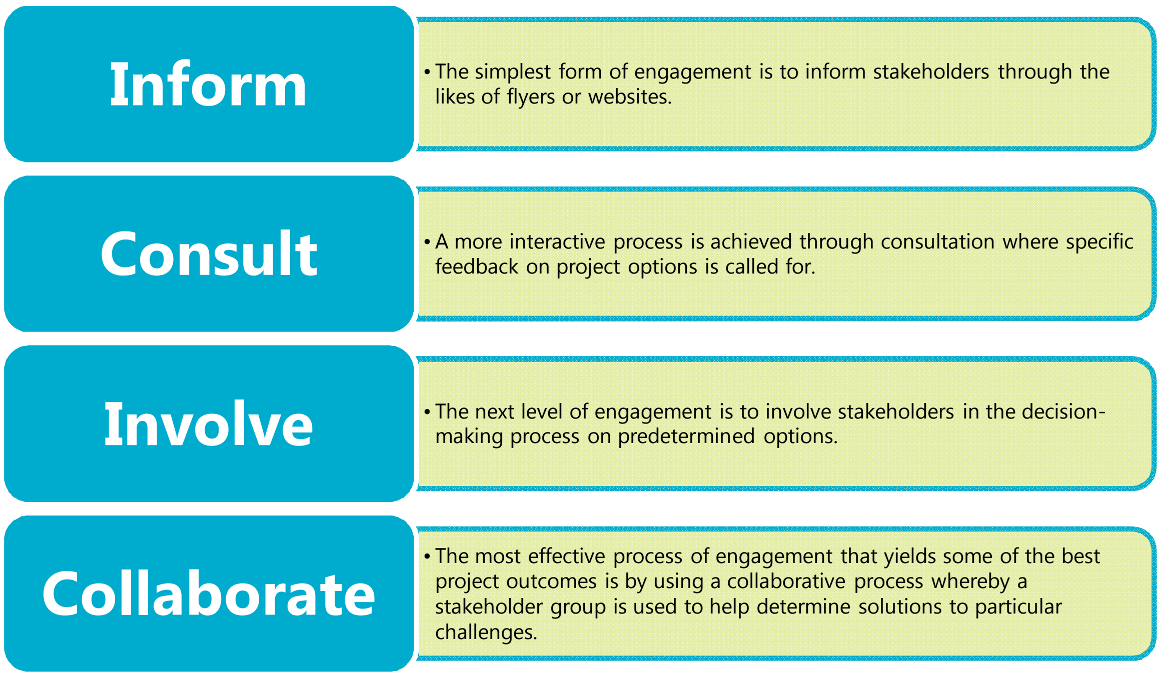
Linkages between the engagement and consenting strategies for projects are important to ensure that when resource consents are prepared, the ‘who’ being engaged with is aware of what their comments and feedback are to be used for. Early engagement with the local and regional authorities will also ensure that all consenting issues are clearly understood from the concept investigation phases to ensure show stoppers are identified. Engagement is not only for RMA purposes, so while there are linkages that can be achieved, the engagement should not be solely restricted to the RMA context and phase of the project.

Section 5.3 covers the iwi interests and values that need to be considered when engaging with *tangata whenua*. Engaging with farmers also requires a tailored approach. For example, choosing a method of engaging with them should recognise that they may be too busy to attend a public meeting, particularly at certain times of the year, and therefore, a personal visit to each farm may be required. Building the relationship and trust is a crucial driver in encouraging buy-in from the farmers to support and invest into the irrigation development project.

5.2 The Spectrum of Engagement

Following the process set out in Section 7.1 should reveal how each set of stakeholders will be engaged with at different stages of the project development timeline.

The following diagram sets out the fundamental principles of the IAP2 spectrum of engagement as referenced in this document.



> *Note*: A further level of engagement is sometimes referenced, called "Empower", where particular projects are handed to the general public to set objectives, decision frameworks, and implementation stages. These projects are generally restricted to where the decision skill set rests entirely within the capability of the community.

Collaboration is about relationship building. A fully collaborative process with stakeholders adopted from the beginning, rather than from part way through, often improves the stakeholder relationship, promotes success and achieves better outcomes for all.

An engagement strategy may recognise, however, that some parties may be satisfied with just informative and consultative processes, and for smaller scale community projects, the stakeholder group is small enough that they are already involved in decision-making processes.

5.3 *Iwi* Interest & Issues

Māori World View

Based on the Māori world view, *tangata whenu*a consider themselves the *kaitiaki* or guardians who have a duty of care to look after land, water, and the well-being of the environment for future generations.

Tikanga (rules, customs, and the right way) is based on *Matauranga Māori*, ancestral knowledge built up over time, and is the vehicle of management built into custom, traditions, rituals and *karakia*/sacred ceremonies of Māori culture. Balance was the purpose and objective of existence.

Some principles informing the way Māori do business or live life are as follows:

- *Kaitiakitanga* – Guardianship, stewardship; responsibility to the environment and to leave that environment in a better state for the next generations
- *Wairua* – Spirituality as the essence of being
- *Kotahitanga* – Being of one mind to achieve common goals
- *Rangatiratanga* – Chieftainship, independence of will
- *Ukaipo* – Land as sustenance for people
- *Whanaungatanga* – Relationships
- *Manaakitanga* – Caring for others
- *Pukenga* – Being accomplished or skilled

All of these principles recognise inter-connectedness – therefore a Māori world view does not conceptually separate concepts within the environment, nor people from the environment. A basic understanding of these concepts will aid engagement with *tangata whenua*.

The kind of issues that *tangata whenua* are concerned with are normally the following:

- Any activities or development that can affect the *mauri* (spirit or life force) of water (fresh or salt) e.g. groundwater or surface takes, taking, damming or diverting water;
- Any activities or development that disturb indigenous plants or animals, e.g. clearance of vegetation or damming or diverting water;

- Discharges to water;
- Activities or development that can affect food sources, food gathering areas or limit access to these areas e.g. discharges or placement of structures;
- Any development or activities that affect access to natural resources (flax, timber, food gathering areas etc.);
- Activities or development around *marae* or *tangata whenua* housing settlements (*papakainga*); and
- Activities or development that affect sacred sites (*waahi tapu*) e.g. burial grounds, *pa*, battlefields etc.

When undertaking an application for resource consent for an irrigation scheme, water takes, discharges or land disturbance and many of the activities highlighted above are of concern to *tangata whenua*.

Why do you need to consult with *tangata whenua*?

There is a changing political and environmental landscape that irrigators in future will need to work in. The four primary factors are:

- The Treaty of Waitangi (*Te Tiriti O Waitangi*) forms the underlying foundation of the Crown-Māori relationship with regard to freshwater resources. The association of *tangata whenua* with their traditional resources is also recognised under the RMA. As soon as you have a project of magnitude, iwi will be considered an affected party under the RMA process. All irrigation development projects will need resource consent.
- Nature of Treaty Settlements – Whole range of Treaty settlements around rivers and lakes e.g. Waikato-Tainui River Settlement (from Karapiro to Port Waikato) results in a co-management regime with Raukawa, Maniopoto/Tuwharetoa from Lake Taupo to Karapiro, Tuwharetoa ownership of lake bed at Taupo, Ngati Porou ownership of river beds on the East Coast. As the Treaty process continues there is a strong likelihood of co-management with tangata whenua and a changing regime of ownership. This will impact on the consenting process and on future policy.
- Next generation of Regional Water Plans are tightening up on water allocation and hand in hand with the Treaty settlements making water resource management more environmentally and culturally significant.

- The Māori asset base in 2010 was worth $36.9 billion and growing. Iwi are making major investment into water infrastructure.

Resource Consent Process

Tangata whenua consultation normally occurs as part of a consent process under the RMA. For large or complex consents or consents that *tangata whenua* are interested in, e.g. those activities set out in the section on the Māori World View, *tangata whenua* would generally be considered to be a potentially affected party by the District or Regional Council and their affected party approval may be required. Consultation is, however, often an integral part of completing an Assessment of Environmental Effects (AEE) as part of the resource consent process.

- When consulting with *tangata whenua* as affected parties the process requires the irrigator to;
- Provide enough information for *tangata whenua* to understand the proposal;
- Discuss the application with *tangata whenua;*
- Receive any comments they may have including suggestions to change or amend the proposal; and
- Gain as much information to ensure that the AEE that is lodged is robust and the application is as thorough and complete as possible.

Who to consult with

One of the fundamental errors is to engage in communication and then at a later stage discover you have not engaged with the mandated group. For resource consent purposes the best approach to determine the correct mandated group is to contact both the Regional and District Council and seek their advice. Large organisations may have their own internal *iwi* advisor and possibly even agreements with *tangata whenua* on consultation protocols.

Regional and District Councils have an obligation under section 35 of the RMA to maintain records of the contact details of any *iwi* authority in the area and the area over which they hold jurisdiction. Council may have an *iwi* liaison officer whose role is to facilitate this contact. There may be more than one group. On contacting the relevant person or people from the *iwi* authority or *tangata whenua* group, they may instruct you to engage with a specific person or group. Some groups have resource management advisors who facilitate the consent process. *Tangata whenua* groups have different ways of consulting. Some groups, as indicated may have resource management advisors who are mandated to speak on their behalf and others may have to go back to the *iwi* and *hapu* to seek confirmation. It is important that at all stages of the process that you maintain records of the dialogue. Some groups may expect payment for their time.

Also keep in mind that *tangata whenua* may not only be considered the *kaitiaki* (guardians) of the area or the resource but also landowners. It is wise to separate the landowner view from the view of the mandated group. Landowners and *kaitiaki* may approach the issue in a different way. Both viewpoints are valid.

In the event of the correct party not being evident the Environment Court in *Gannet Beach Adventures Ltd v Hastings DC,* the Environment Court has established these principles:

- When an *iwi* or hapu has a formal management body, such as a trust board, a marae committee, or something similar, it is entirely appropriate that an applicant and a local authority should consult that body as the *iwi/hapu* representative;
- Unless there is some extraordinary factor plainly signalling that the processes of that body are dysfunctional and cannot be relied upon, the responses given by it should be accepted as authoritatively speaking for the *iwi* or *hapu*;
- It is human nature that, in any organisation, there will be dissenting views which remain after the decision-making processes have concluded. That can be so even where, as is the custom for Māori organisations, the objective is consensus rather than a majority decision;
- The fact that individuals express dissent with an announced decision does not mean that the applicant or local authority, or the Court, cannot rely upon the decision announced by those whose positions appear to entitle them to announce it;
- The internal processes of such bodies are for the members of them to control and resolve. Outsiders have no ability to do so and no business in trying to do so;
- Unless bodies such as councils or the courts can rely upon the apparent authority of office holders to speak for an organisation, no agreement could be relied upon unless there was a referendum of every member of that organisation. That is obviously completely unworkable and unreasonable; and
- If there is a serious issue within a Māori organisation, or between Māori organisations, as to who holds *mana whenua* or who has the right to express an authoritative view, the Māori Land Court is the appropriate tribunal to resolve it.

How to consult

Tangata whenua decision-making is not the same as a European model. It is suggested that you factor in the following considerations:

- Consensus is preferred. This often has time implications, so the earlier the engagement, the better. Once a decision is made, then actions tend to follow rapidly;

- Emotion in the process is acceptable as it is generally followed by reconciliation;
- Do not expect an answer on your first meeting. A good first step is to put the proposal and agree further terms of engagement;
- Silence is important. Do not presume that silence is agreement; and
- Procedure and protocol is part of the process (*whakapapa* (genealogy), *karakia* (prayers) and *waiata* (songs). These aspects are important.

Tangata whenua like to be consulted on their own territory and this is often a *marae*. Some tips are provided in the appendix (Section 9.3) to guide you on this process. Some further tips are also provided on protocols when meeting on a *marae* in the appendix (Section 9.2).

Success Factors

Communication and the approach to communication is the fundamental key to a successful outcome. Success may be considered a general agreement within the group that genuine consultation has occurred. This means that all the affected groups have been approached and included in the process, that the consultation has been undertaken in good faith, it has been transparent and that there was a complete willingness to hear and understand the *tangata whenua* perspective. It also needs to be clearly understood that an effective consultation process does not mean that the *tangata whenua* view will be the only consideration but that, wherever practical, *iwi* requirements will be built into the outcomes.

5.4 The Resource Consent Process & Consultation

Any irrigation proposal is likely to require resource consents under the RMA (land use consents from the District Council and then major consents from the Regional Council for water takes, diversions, discharges and earthworks). In addition, the nature of the planning frameworks within which consent will be sought is becoming more stringent given the high volume of competing uses for water and the impacts of over allocation becoming more apparent. While there is no obligation under the RMA for consultation to occur, consultation can benefit any project in a number of ways.

As part of achieving the resource consent, a consenting strategy should be prepared outlining the approaches and steps to be taken to secure the necessary statutory approvals. Consultation links directly with this process and is a valuable tool to achieve any consenting strategy.

The Environment Court has been clear as to what is considered consultation and it is wise to frame your approach and AEE based on these principles. This applies whether consulting with iwi, community groups, affected parties, local authorities or anyone else.

The synthesised principles are as quoted from paragraph 104 of the case *Horahora Marae v Minister of Corrections* A085/2004, which specifically cites the earlier decision in the *Land Air Water Association and Others v Waikato Regional Council* A110/2001 (paragraph 453).

- The nature and object of consultation must be related to the circumstances.
- Adequate information of the proposals is to be given in a timely manner so that those consulted know what is proposed.
- Those consulted must be given a reasonable opportunity to state their views.
- While those consulted cannot be forced to state their views, they cannot complain, if having had both time and opportunity, they for any reason fail to avail themselves of the opportunity.
- Consultation is never to be treated perfunctorily or as a mere formality.
- The parties are to approach consultation with an open mind.
- Consultation is an intermediate situation involving meaningful discussions and does not necessarily involve resolution by agreement.
- Neither party is entitled to make demands.
- There is no universal requirement as to form or duration.

- The whole process is to be underlain by fairness.

Best Practice principles stated on the Planning Quality website (http://www.qp.org.nz/) go further to state that the following can be derived from both the case cited above and from other Environment Court cases:

- There is an overall duty on the part of both parties to act reasonably and in good faith, because consultation is not a one-sided affair.
- Consultation has overlapping requirements of reasonableness, fairness, open mind, freedom from demands, and the need to avail oneself of the consultation opportunity.
- Consultation is as much about listening as it is about imparting information, and is more about the quality of information imparted than it is about the quantity.
- Consultation is not an end or an obligation in itself; it is just one possible method of gathering views from those affected so that they can be taken account of in the decision-making process. The primary obligation is to ensure that the decision-maker has sufficient material before the necessary decisions are made on the consent.

There are a number of advantages to consulting in order to facilitate consent processes:

- It allows environmental or cultural issues or concerns that may arise to be addressed early in the consent process. An early, open and transparent approach may save considerable time and cost further down the consent process;
- An early understanding of issues can allow the AEE to be modified or amended in the early stages allowing fundamental issues to be addressed before they become problematic and costly;
- Early, open and transparent approaches facilitate relationship building. This is of value not only to the project but also to the future;
- Early consultation may avoid costly confrontation at hearings and in the Environment Court at later stages of process;
- May increase the chances of the resource consent application succeeding; and
- May produce a consent application that results in better or more acceptable outcomes.

5.5 Land Tenure

Securing property rights/interests for irrigation schemes generally involves a mix of land tenure options. The preferred and most secure forms of holding property rights for irrigation include freehold ownership, long term leases and easements (generally in perpetuity rather than for a defined period). Less secure interests can be licences to occupy, short duration leases and deeds of grant. As a general rule, the higher the importance or value of the infrastructure then the more secure form of land tenure should be sought in order to maintain the long term operational security of the scheme. The exception is where the lands are owned by the Crown (for whatever purpose) or are legal roads, and the relevant legislation associated with the administration of the land may not allow for alienation of the land (sale of the freehold), or the granting of interests or easements in perpetuity.

Reticulation

The reticulation of irrigation water, either by pipe or open channel/canal, is generally accommodated by way of an interest over land, usually by way of an easement. However, with some more significant infrastructure like major canals, freehold ownership may be preferred or sought; an example being parts of the Rangitata Diversion Race in Mid Canterbury. Where possible, a legal interest like an easement in perpetuity, or full ownership of the freehold in the land should be sought for the reticulation corridors.

Lesser forms of occupation should only be considered once all options available have been considered and risk assessed. For security of supply, the whole of the reticulation route must have a secure tenure as it only takes one property interest that is not acquired, to affect the ability to reticulate over the whole irrigation network downstream of that location. Whatever the type of property interest, the key issue is that the duration of the interest, where possible, matches or exceeds the expected lifespan of the project. In most cases, this is either through freehold ownership, or an easement in perpetuity. However, in some instances, or in the case of some Crown-owned land, a deed or concession may only be available for a defined period. For easements, the types of easements should also be taken into consideration with the two main types being:

- easements in gross, which acts in favour of an entity like an irrigation company, or
- easements in favour of the land that receives the benefit (dominant tenement).

It is more likely that an easement in gross will be used for an irrigation scheme.

Other Infrastructure

For major infrastructure associated with a scheme such as intake areas, control stations and pumping stations, the general preference should be for the irrigation company/entity to own the freehold. The benefit of this is that freehold ownership provides security of tenure where major capital expenditure is required. An additional benefit is that these sites can also be used as security for any finance required. While the ideal is for freehold ownership, other arrangements may need to be considered, especially where the water is being shared with other users, such as power companies. In these instances, a robust legal agreement needs to be in place to secure the necessary property rights and to protect the rights of all parties.

Relevant legislation that may be associated with irrigation projects (Note that these are relevant acts that may impact or assist in any project, and are not exhaustive):

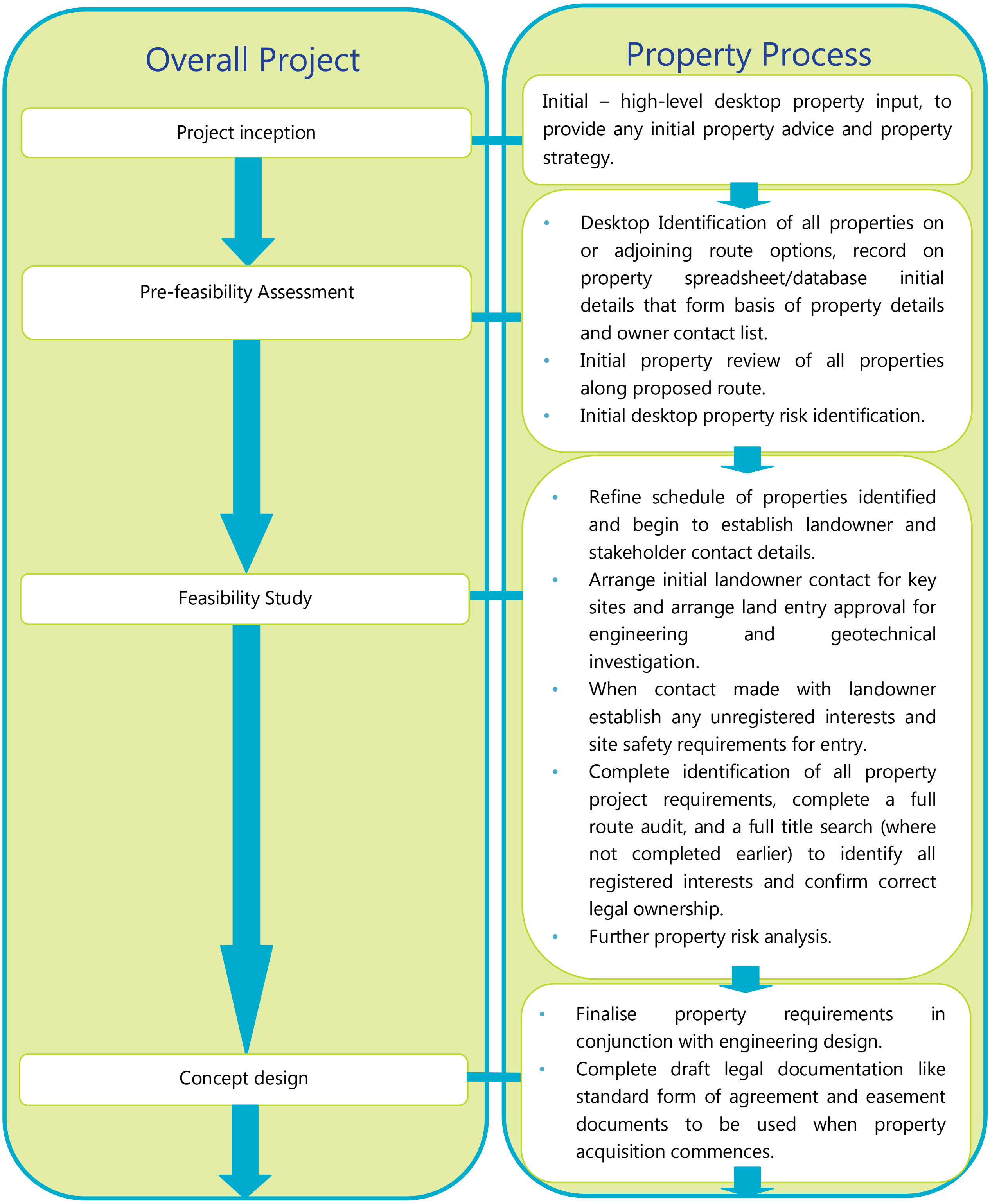
- Part 19, Public Works Act (PWA) 1981 – acquisition of property for irrigation development projects if government-initiated and to be government-owned;
- Irrigation Schemes Act 1990;
- Resource Management Act (RMA) 1991;
- Land Act 1948;
- Reserves Act 1977;
- Conservation Act 1987.

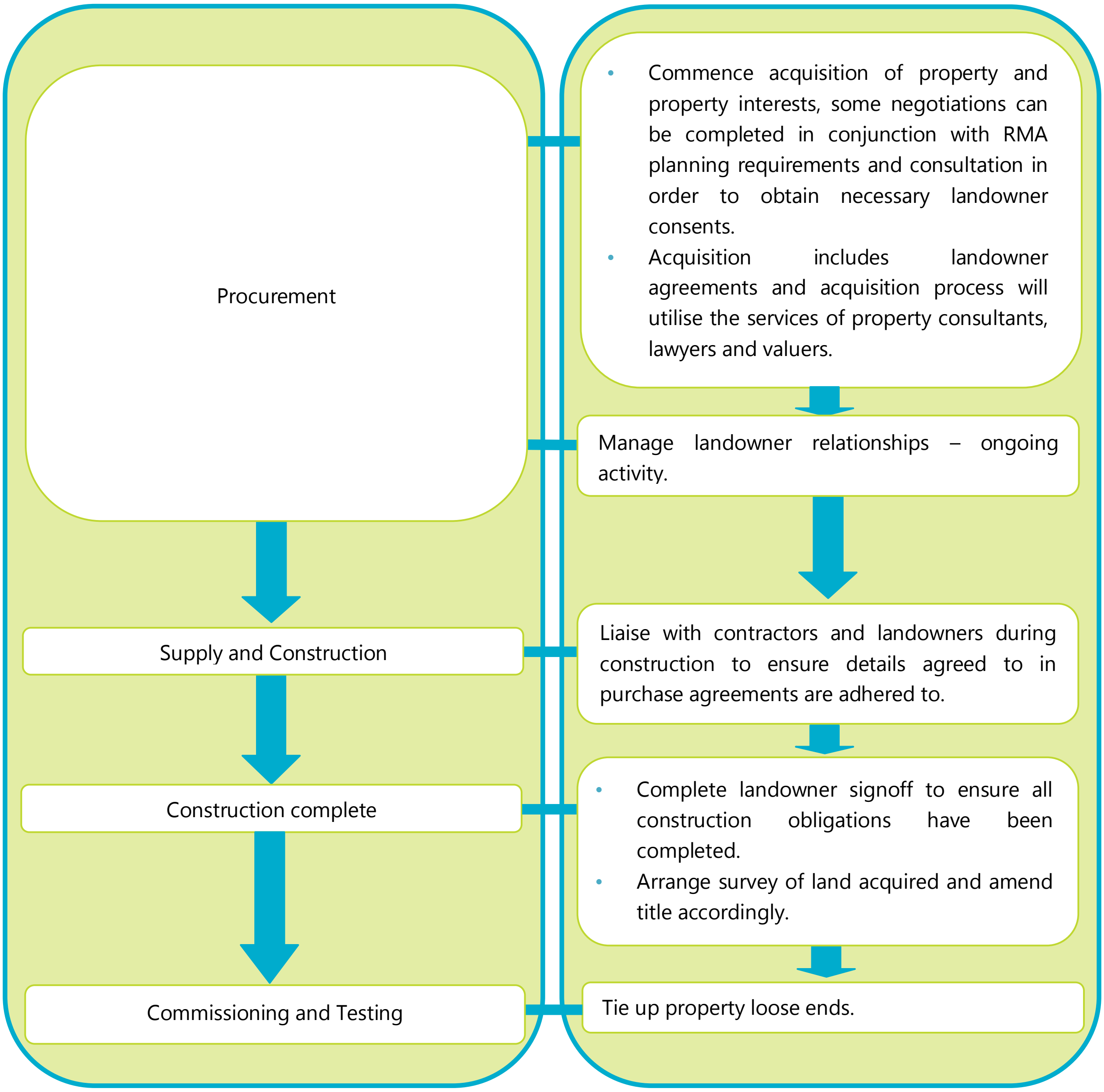
Property acquisition, Government Projects using Statutory powers, or Private Sector Model

Government-initiated projects generally utilise part 19 of the PWA and accordingly have the backing of the provisions of the PWA, including compulsory acquisition powers and the ability to acquire (by transfer of administration) Crown Land; Land Act land, Conservation Act land and Reserves Act land. This model is unlikely to be used as while there is this provision in the legislation, the current Government direction is not to use this. The preference is, therefore, for private sector projects using the IAF process.

A commercial private sector model relies on open negotiation and commercial contracts. The private sector model does have the potential to use compulsory acquisition powers of the PWA (over private land owners) if the project allows for the entity to hold ‘requiring authority’ status. A private sector organisation that holds ‘Requiring Authority’ status still needs to attempt to openly negotiate with affected parties in a commercial manner before any approach to the Minister of Lands to use the compulsory powers of the Public Works Act, and the decision to use these powers lies with the Minister. An irrigation development project where the governing body has ‘requiring authority' status allows for the use of section 186 of the RMA to provide a mandate to acquire those property interests, not able to be acquired by open negotiation, using the compulsory purchase provisions of the PWA. With a private sector model, there is some risk associated if the acquisition of 'fee simple' or easements in perpetuity is contemplated where the land required are Crown-administered (i.e. either Land Act land, Conservation Act land or Reserves Act land), as the compulsory powers of the PWA, when applied to a private requiring authority, do not extend to the acquisition of Crown-administered land.

The property processes involved through the stages of the irrigation development project:





Risks

While the above process applies to both Public and Private sector projects, Public sector projects may have additional investigation and reporting requirements in order to satisfy statutory requirements.

Key risks associated with Private sector projects may be the acquisition of the freehold or interests in perpetuity of land held either as Crown Land under the Land Act 1948, Reserves land under the Reserves Act 1977 and Conservation land under the Conservation Act 1987 as the two of the three Acts do not generally contemplate alienation or disposal to preferred parties for irrigation. The Land Act does contain provision for transfer of land for irrigation or water schemes. While there are risks for private sector projects associated with Crown-owned land, there are also risks with Māori land, generally identified as Māori Freehold or Māori General land. There are several areas of risk including the spiritual aspects of the land like locations of *urupa* (Māori burial sites), and early identification and avoidance of such sites is recommended. Land ownership and tenure of Māori land can also be a risk with multiple Māori owners that require consultation. In some cases, it may be difficult to locate some owners and the assistance of the Māori Land Court may be required.

SECTION 2

6 Investigation Methods

Key Messages

- The investigation process must cover the economic, environmental, cultural, social, and technical aspects of the project. Early investment into this process provides the ability to influence whole-of-life costs.
- Economic assessments at key hold points throughout the project are essential to assess based on available information whether an irrigation development project sufficiently increases the overall gross farm income to make irrigation affordable.
- Hydrological investigation primarily involves quantification of water requirements, identification of reliable water sources, assessment of soil hydraulic properties, and assessment of how irrigation should be applied.
- The construction and operation of irrigation infrastructure will respectively result in direct and indirect effects on the ecological environment, including land use and water quality. Together with cultural and social impacts, consideration should be given early in the process to allow for a design to be developed that minimises adverse effects and maximises benefits.
- Social and cultural impact assessments should be strongly interlinked with public engagement.
- Engineering investigations comprise a range of technical studies that must be conducted appropriately to inform the design and procurement process.

The objectives of the investigation methods covered in this section are to improve knowledge and reduce risks as the project progresses towards procurement. The investment into robust investigation as well as risk management prior to procurement is what empowers the irrigation development entity to influence whole-of-life costs. This investment would take the form of either building internal staff expertise if that is seen to be appropriate, or more likely the engagement of the external consultants' professional services. Recognition of this risk/cost trade-off is important; conducting robust investigative and design work costs money, but inevitably reduces risks which therefore reduces overall costs in the long run. This section provides guidance on what this investigation should involve. The investigation process must be holistic, i.e. consider the economic, environmental, cultural, social, and technical aspects of the project.

It is worth remembering that the investigation process is not only to uncover potential negative impacts that need to be mitigated, but also to discover potential positive impacts. Knowing the potential positive impacts is important for two key reasons:

- The opportunities for positive impacts can be further enhanced and maximised.
- They can encourage greater buy-in from all stakeholders.

The following sections describe the investigation methods in simplified terms to allow irrigators to broadly understand what should be expected from these investigations. However, the significance and complexity of this work should not be underestimated. A key part of good practice that will be assessed for the IAF is the commitment demonstrated in the work programme to conduct all these investigations with appropriate robustness and thoroughness.

6.1 Agriculture Economics and Affordability Assessments

The economic viability of an irrigation development project, while being only part of the overall consideration, is usually a prerequisite for the project to be considered further, and is what enables the other considerations to be adequately addressed. Therefore, an economic assessment, both at the on-farm and scheme-wide levels, is an important investigation step. It allows stakeholders to appreciate the economic contribution that an irrigation scheme can potentially make to individual irrigators, to the area of influence, and to the wider regional and national economy, as well as the potential cost and disruption to the region if a scheme is not implemented.

While there is currently a lack of market mechanisms to ensure that irrigators consider the costs and benefits not only to themselves but also those externalised to the wider society, there are regulatory and consenting requirements that attempt to strike that balance. Therefore, the investigation methods in this section only cover a private cost-benefit economic assessment.

There is a tendency for irrigators to focus on the initial capital outlay required to get the irrigation scheme to the start of operation. However, experience has shown that the on-going operating, maintenance, and replacement costs far outweigh the initial capital costs. Therefore, irrigators ought to take a longer-term view and place much greater emphasis on whole-of-life costs. This emphasis on whole-of-life costs influences many decisions throughout the life of the project.

A new irrigation scheme has a construction cost to the point where it is commissioned and it has a running cost during its lifetime. Whether it is funded by debt or from farmers' equity, it will ultimately be paid for by the additional income earned by farmers as a result of irrigation. Other income from sources such as the sale of any electricity generated may reduce the net cost. Farmers investing in an irrigation scheme must be confident that they can support these additional costs.

The affordability of a proposed irrigation scheme can be analysed first at the individual farm level by budgeting the potential increase in farming surplus (EBIT) resulting from the farmer's investment in irrigation. This is the surplus available to reward that capital investment.

A similar affordability analysis can be carried out on the "area of influence" by budgeting farming surpluses for the district without-project and again with-project. This area will not necessarily be limited to the land to which water is applied but can be extended to nearby farm systems affected by the scheme and include the benefits of any transfer of existing consents released by the scheme.

The resulting capital investment, plus change in incomes and expenses over the area of influence can be used to assess the economics of the proposed scheme at a regional and national level. This might include the effects on secondary industries such as transport, rural supplies, contractors and processing.

Explanation of Terms

- Area of influence = the entire geographical area economically affected by irrigation, not just the area to which water is applied.
- Earnings before interest and tax (EBIT) = Gross Farm Income (adjusted for changes in value of stock and produce on hand) less farm working expenses and depreciation.
- Total farm capital (TFC)= All farm assets involved in earning the gross farm income including land, buildings, stock, plant, machinery, processing company shares (e.g. Fonterra, fertiliser co-ops) working capital and any investment in off-farm irrigation development (e.g. via shares in an irrigation company).
- Without-project = steady state farming systems without the additional investment into the proposed irrigation project development.
- With-project = steady state farming systems with the additional investment into the proposed irrigation project development, incorporating all capital expenditure, structural development, farm system changes and management changes.
- Marginal = additional
- Status quo = the steady state (ignoring short-term transitional effects) achieved by a farm, allowing for full maintenance, reasonable medium-term costs and prices and with constant livestock and produce on hand.

Methods of financial analysis

- A simple 'rate of return' calculation gives the total profit of the business (EBIT) as a percentage of the total capital invested in the business. The *marginal* rate of return to irrigation calculates the *additional* profit from irrigation as a percentage of the *additional* capital invested to achieve that return.

- The Internal Rate of Return (IRR) adjusts for the time delays between the capital investment and the resulting returns. IRR for irrigation may be calculated over 35 years which is a typical life span of the investment in irrigation and of water consents. It does not assume any inflation of returns but could assume productivity growth e.g. 2% p.a.

- The Net Present Value (NPV) may also be calculated to give the present value of future investment and returns. The selection of discount rate is critical. Given low returns in farming, and low interest rates reflecting low time value of money, a discount rate of 5% may be appropriate.

Calculations for 'Status quo marginal return on marginal capital'

The marginal rate of return, or the 'status quo marginal return on marginal capital', is estimated by comparing the farm profits and the farm assets before and after the scheme development at steady state.

Status quo area-of-influence with-project EBIT

Less Status quo area-of-influence without-project EBIT

= Status quo marginal EBIT

Status quo area-of-influence with-project TFC

Less Status quo area-of-influence without-project TFC

= Status quo marginal TFC

Status quo marginal return on marginal capital

$$= \frac{\text{(Status quo marginal EBIT)}}{\text{(Status quo marginal TFC)}} \%$$

Use of the three methods

- Farmers (those typically making the investment decision) tend to think in terms of return on capital once development is completed. Rate of Return is a clear, transparent method to assess future cash flows. It is useful to calculate the increase in profitability resulting from investment in the proposed scheme at both an individual farm level and for the area of influence.
- Regional and national output models need to analyse timing of capital input and cash flow returns to farms. Farm capital investment, spending and income can be extrapolated to quantify regional costs and benefits. IRR can account for timing at a regional level.
- NPV can derive a lump sum benefit when applying various time values of capital. Typically, farmers do not examine investments in NPV form, but regional and national Governments do.

Budgeting for Affordability

A. Individual Farms

The irrigator in a new scheme needs to create a new farm system combining the most appropriate irrigated farming policies given the nature of the farm, the water available and the irrigator's personal circumstances. The irrigator will then do a capital budget to estimate the capital cost of buying into the new scheme and converting the farm to irrigation. Finally, the farmer can budget the new farm system at steady state, including full maintenance, scheme running costs and allowing for reasonable medium term prices and costs to estimate a cash farm surplus (profit). A combination of profit and capital investment, with-project and without-project, will allow a calculation of a rate of return for both farm systems and for the marginal investment. This process will help the farmer decide whether or not to take up the offer of water and how to best profit from it.

B. Area of Influence

At a wider level, the affordability of the scheme can be analysed in the same way by estimating the total increase in EBIT to the area of influence resulting from the investment in irrigation. To estimate the without-project farming EBIT for a district requires broad assumptions. There is unlikely to be accurate information on existing farming policies, areas, stock numbers, crop areas and levels of productivity, hence local experience will be required. Similarly, broad assumptions will need to be made about the shape of farming systems that will evolve under irrigation. Individual farm systems and the district will continue to evolve over time. The affordability analysis can only be a "stake in the ground" with stated assumptions about farm systems, productivity, management ability, costs and prices.

A. On-farm Considerations

1. Farm environment: soils, precipitation, climate and markets.
2. Farmer: age, debt level, skills, ambition and plans for succession
3. Proposed Irrigation Water: volume and reliability.
    - Possible farming enterprises
    - Feasible irrigated farm system
    - Farm budget
4. Farm development required to achieve the system

B. Capital Budget

Total Farm Capital requirement calculated from:

1. Initial land and buildings investment
2. Additional buildings, e.g. grain storage, implement sheds, housing, dairy shed, calf shed, effluent.
3. Irrigation development and power supply
4. Any on-farm water storage
5. Associated development including earthworks, tree & fence removal, levelling, cultivation, capital fertiliser, pasture renewal, stock water, fencing
6. Plant and machinery: e.g. cropping machinery or milking plant.
7. Livestock e.g. sale of existing stock e.g. breeding cows and purchase of other stock.
8. Shares e.g. off-farm irrigation investment (e.g. scheme shares) or dairy company shares
9. Increase in produce on hand.
10. Working capital
11. Fees e.g. survey, engineering, consents, legal, farm management consulting and accounting

C. Cash Forecast Budget

1. Describe the chosen farm system at steady state using dollar values.
2. Assume reasonable medium term production levels, product prices and input costs.
3. The budget must be feasible and credible.
4. Gross Farm Revenue (net of changes in stock and produce on hand).
   Less Farm Working Expenses (to maintain the farm at steady state, including labour, wages of management and a share of scheme running costs.)
   = EBIT (Earnings before interest and tax)
5. Available as a reward to the capital investment for:
   - Interest on debt
   - Principal repayment
   - Tax
   - Profit

D. Affordability – Farm & Area of Influence

$$\frac{\text{(With-project EBIT)}}{\text{With-project Total Farm Capital}} = \text{With-project Return on Capital \%}$$

$$\frac{\text{(Without-project EBIT)}}{\text{Without-project Total Farm Capital}} = \text{Without-project Return on Capital \%}$$

(With-project Return on Capital %) – (Without-project Return on Capital %)
= Status Quo Marginal Return on Marginal Capital %
(Calculated in a different way previously)

Variables impacting on base information making up the calculations:

A. Time Frame

- 35 years is a recommended time frame for analysing farm irrigation benefits. It is consistent with typical resource consent periods. Most on-farm or off-farm capital investment is made with a minimum 35 year time frame (less than one working generation).
- Long time frames mean analysis may need to "look through" short-term price and production trends.
- In past years, use of historical trends has tended to underestimate returns.
- When analysing over 35 years, assume land uses that tend to be more efficient at:
  - Converting water to dollars
  - Converting other resource units to dollars

B. Standard of management

- Farm management standards invariably rise with the irrigation development project. Key factors of influence include intergenerational change, ownership change to farmers new to the district, necessity borne of debt, greater awareness of technology and the impact of scale on profitability.
- Using top 20% performance in with-project performance data is justified, as history shows post scheme performance is high. Use average without-project performance levels.
- In excess of 150 university graduates are entering farm management each year, improving the intellectual capability in farming business.

C. The "Area of Influence" concept

- Irrigation and economic influence extends beyond the soil irrigated.
- Farm systems are built on a "whole farm" (e.g. dairy) or "partial farm" irrigation (e.g. hill or high country) input.
- The farm area directly influenced by water includes non-irrigated areas on irrigated farms.
- A further impact is on non-irrigated farms in close proximity. Dryland farming systems adapt to requirements from nearly irrigated farms, thereby improving EBIT.
- Water "released" by a new irrigation scheme can be available in other nearby areas, e.g. this effect occurs where consented underground water is replaced with surface/stored water, freeing up underground reserves for use elsewhere in the catchment.

When analysing the on-farm economics, it is therefore recommended to analyse (with-project and without-project) the total catchment or "area of influence" likely to be subject to land use change.

It has been found in the past that:

- Close to dairy development, dryland dairy support increases. (Typical South Island dairy platforms use 0.7ha off farm for every hectare of dairy platform).
- Close to arable areas, dryland cropping increases with more availability of cultivation, harvest and storage infrastructure, specialist advice, and contracts.
- Close to livestock finishing, greater finishing on dryland to fit in with finishing systems nearby.

D. The "golf course effect"

This describes the impact on farms with partial irrigation. That is, irrigating the green has environmental and productivity benefits on the fairway that need to be accounted for. Those effects typically result from good management timing on stock and pest pressure on dryland areas. Ability to destock more accurately not only retains beneficial vegetation, it protects soil, and reduces pasture replacement for pest control costs. Hence both economic and environmental benefits are derived. Further, higher EBIT levels on partially irrigated farms allow more disposable income for investment into land enhancement and/or pest control, further improving EBIT gains.

E. Impact of water reliability

- Improved water reliability, knowing that it will be available, not only enhances output, but tends to reduce water use per hectare.

- The intensity of the farm system is determined by the base reliability of irrigation water. Examples of system intensity include the crop type, rotation intensity, and animal stocking rate and flexibility.

- Evidence suggests system intensity drops off considerably once reliability reduces below 90%. That policy decision relates to how often management plans are disrupted before greater flexibility is created.

- High reliability during the irrigation season creates "just in time" behaviour, instead of "just in case" behaviour. As a result, output from reliable systems is improved in both wet and dry years.

- Lower reliability schemes will tend to have less intensive land uses, and lower productivity, but also high farm working expenses as a proportion of gross income.

F. Impact of water control

- As technology improves the ability of farmers to control and place water is enhanced. New technology includes low pressure systems, variable water application, and fixed application all in tandem with good soil moisture and plant monitoring.

- With improved technology, water is used where the impact is highest, and cost per unit output lowest.

- Technology improvements are increasing at a fast rate.

G. Rate of uptake and confidence

- Compulsory uptake of water shares has long gone as a planning option.

- Inefficiencies in design occur from staggered uptake.

- "Seeing is believing": some farmers can envisage the farm with water, others need to see their neighbour with water before they act.

- Incremental development is easier to comprehend than "start from scratch", even at higher cost.

- There is a high correlation between the rate of uptake and the state of the economy. Variables include land use options, cost and availability of debt (confidence to borrow), and commodity pricing (confidence in income generation).

- Farmers often need a motivating factor, or a "trigger" to invest. Sometimes the trigger can be a perceived shortfall in the availability of water.

- Good advice should be provided initially in a group situation, but followed up with specific one-on-one advice tailored to the individual circumstance of the farmer.

H. Capital costs – Past lessons:

- On-farm expenditure often exceeds budget.
- Usually, farmers end up with more for their money – their innovative thinking enhances the end result.
- Associated development (e.g. machinery, silos, re-fencing, fertilizer etc.) tends to be under-estimated.
- Working capital is almost always under-estimated.
- Capital spend does not stop with the initial development.
- Much of the high increase in capital cost of recent irrigation is associated with new technology such as storage and pressurisation, both of which contribute greatly to EBIT and water use efficiency.

Note: MAF Cost Benefit Handbook: Cost Benefit Procedures in New Zealand Agriculture (Volume Two) 1984 is being considered for review.

6.2 Hydrological Investigation

There are four areas where correctly answering a number of key questions relating to the hydrology and water resources can directly impact on the efficiency, effectiveness and even viability of an irrigation scheme. These areas relate to:

1. Quantifying how much water is required;
2. Identifying a reliable source of water;
3. Assessing the hydraulic properties of the soil; and
4. Determining how any irrigation should be applied.

The better the information available at the conceptual stage of a project, the more efficient, effective, and successful the irrigation scheme will eventually be.

1. Quantifying how much water is required

Irrigation is required when the evapotranspiration needs of a crop are greater than the amount of water available to the plants from precipitation (rainfall) and soil moisture.

The first question therefore relates to the average daily evapotranspiration (in mm/day). How does evapotranspiration vary on an annual, seasonal, and daily basis? What are the maximum rates of evapotranspiration and how long might these persist? While evapotranspiration tends to be relatively uniform, is there any significant variability across the project area?

Ensuring that the evapotranspiration needs of a crop are met, so as to avoid stress and reduced production, requires moisture. Some moisture will be available from precipitation and the soil, but the rest will need to come from irrigation. While soil itself is not a source of moisture, it is able to store some moisture between precipitation events. Precipitation replenishes soil moisture naturally without the need to irrigate. Irrigation, however, may be necessary to supplement or replace precipitation which is irregular, unreliable, or insufficient to meet crop needs. Therefore, what is the variability of precipitation; daily, monthly, seasonally and annually? What level of risk is acceptable, and therefore what precipitation is assumed? How does precipitation vary across the project area?

The effective precipitation (precipitation *less* evapotranspiration) will determine how much water will be required either from storage within the soil or irrigation. Given the level of risk associated with precipitation, how much water may be required? When will this water be required? How often will this amount of water be required? How does the amount of water required vary through the irrigation season? How does the amount of water required vary across the project area? Climate change effects need to also be considered in this analysis.

In addition to water, all crops require optimum soil temperatures to grow. What is the seasonal variation in soil temperature? Since crops cannot utilise water when it is too cold, how does the temperature regime affect irrigation demand?

2. Identifying a reliable source of water

Having identified how much water is required, it is necessary to identify possible potential water sources. These sources may include: rivers and streams, storage, groundwater, or a town supply.

With regard to the preferred source, what is the variability and availability of water from this supply? How does this relate to the irrigation demand for water? In cases where there is a mismatch between water supply and irrigation demand, can this be balanced with the use of storage? Is storage a practical option to minimise instantaneous and variable pumping rates? How much water would need to be stored? Where could this water be stored? When and how would storage be replenished? How does the amount of storage relate to the level of risk adopted for the scheme? Is this risk acceptable to all prospective parties to the scheme?

Are there any water quality issues which may impact on the suitability of supply? Are there quality issues which need to be considered with regard to its abstraction and application, e.g. algae, bacteria, sand, silt, iron, and calcium carbonate?

Are there any other constraints on the potential use of the preferred supply? These could include: existing users, environmental effects, cultural considerations, regional planning constraints, minimum or ecological flows which must be maintained, abstraction and allocation limits, and other protection or conservation orders. Does the water have other perceived values besides irrigation? Can these constraints on supply be avoided through the use of storage? Are there likely to be consenting issues?

3. Assessing the hydraulic properties of the soil

While the climate of a region controls the effective precipitation, the soil is critical in determining the nature and amount of plant-available water. Soil moisture provides a buffer against short-term climatic variability; and the size of this buffer is determined by the volume and distribution of the pores within the soil. In essence, the soil acts as a 'sponge' that can absorb and release water; the rate and amount being determined by a range of soil properties.

Each soil profile is likely to have more than one layer. The soil texture, density, porosity and permeability will all likely change down the profile. This affects how quickly water can move into and through the soil, and how much 'plant available water' a soil can store. Of critical importance are the soil properties within the root zone, the depth of which may vary depending on the crop. To schedule irrigation efficiently and effectively requires an understanding of how much water the soil can hold that is available to the crop.

The soil surrounding a plant's roots stores the water the plant needs to live, grow, and produce a crop. This water is held within the pores with increasing strength as the soil dries out. How the strength with which the moisture is held increases with decreasing moisture content is a function of the nature of the soil, particularly the size of the pores; smaller pores hold water more strongly than larger pores. For example, clay soils hold water much more strongly than a silt loam. This is why clay soils become harder and often crack when they dry out. Likewise, large pores (macropores) can act as 'pipes' allowing rapid drainage of any water past the root zone.

The hydraulic conductivity is the rate at which water can pass through the soil, and is controlled by the volume, size, and tortuosity of all potential flow paths. The near-saturated hydraulic conductivity can be measured by the K_{-40} test, which applies 40mm of tension to 'shut off' pores greater than 1mm, eliminating the contribution of cracks or large pores. Applying irrigation at a rate equal to or less than the near-saturated hydraulic conductivity ensures that the soil matrix saturates and water is not 'lost' via macropore flow.

The pore size distribution throughout the root zone therefore determines not only how much moisture the soil can store, but whether this moisture will be available to a crop. Field capacity is the maximum amount of water a soil can hold after drainage. Any additional water will simply drain rapidly past the root zone. To irrigate when the soil is at field capacity is therefore a waste of both the water and the energy required to apply the water. The 'Refill point' is the point at which the plants have used all the water that is readily available. Beyond the 'Refill point', as the soil continues to dry out, the crop will need to work harder to extract any water. This places the crop under stress and will lead to a drop in production. The moisture held between field capacity and 'Refill point' is called the Readily Available Water (RAW) – water stored in the soil that is easily extracted by plants (Figure 1).

The amount of RAW varies with the soil type, crop type, crop rooting depth, and the irrigation system.

Fundamental questions relating to the soil which must be addressed include: How rapidly can water pass through the soil surface, and then through the profile? What is the nature and character of the soil profile? Are there any barriers to the movement of water and roots? Are there any macropores down which water may be lost? What is the field capacity of the soil? How much water can the soil hold within the crop root zone? What is the RAW for the project area? How does the RAW vary as a function of soil properties and preferred land use? What is an acceptable level of risk with regard to the RAW i.e., how low can the moisture content go before irrigation is essential? What is the near-saturated hydraulic conductivity (K_{-40}); this should determine the maximum rate at which irrigation is applied?

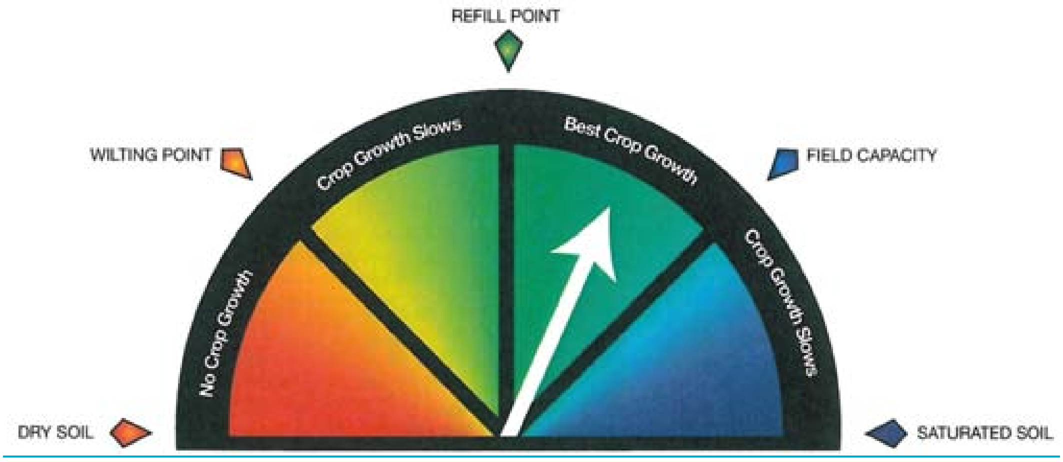


Figure 1: Relationship between soil properties, moisture availability, and crop production (DAF, 2007).

4. Determining how this water should be applied

While the climate determines largely when and how much water is required, the soil properties determine how this water should be applied. Irrigation should be applied so as to maintain the RAW within the root zone for optimum production. Where the RAW is low, a little water will need to be applied often. Where the RAW is high, more water can be applied less often. Irrigation needs to be applied at a rate where it can soak into the soil, and at a depth that does not raise the moisture content above field capacity. For irrigation to be efficient and effective the water must also be applied at a rate and depth where it remains within the root zone. Any drainage past the root zone is a loss, both in terms of the water resource, and the cost of irrigation.

Fundamental questions relating to the soil which must be addressed include: When is irrigation required? How much irrigation is required? At what rate should the water be applied to ensure rapid drainage through the soil surface to avoid evaporation losses? At what rate should the water be applied to prevent rapid drainage through any macropores, thereby saturating the soil matrix and preventing any water bypassing the root zone (i.e. less than the near-saturated hydraulic conductivity (K_{-40}))? How much water is required to replenish the RAW? How rapidly will the RAW need to be replenished?

Summary

Attempting to answer these various questions will help to ensure that the proposed irrigation scheme will be efficient, effective, and sustainable, while ensuring the best use of water resources to achieve the expected gains in productivity.

6.3 Ecological Environment Impact Investigation

The use of the term "environment" in this section refers to the ecological environment, not to be confused with the wider definition in the RMA. The social and cultural aspects of the environment are covered in Section 6.4.

Construction and operation of large-scale irrigation schemes have a range of effects on the environment. The degree of environmental impact will depend to a large extent on applying the best design for the environment (e.g. choice of an online dam or off-line dam that harvests floods, how much water is taken, and when water is captured). Environmental impacts from an irrigation scheme can be separated into direct impacts and indirect impacts. Direct impacts include environmental impacts that result directly from the construction of the infrastructure associated with an irrigation scheme such as vegetation removal, construction of dams/storage reservoirs etc. Indirect impacts typically occurs off-farm as a result of the development of an irrigation scheme. This includes the effects of land use intensification on the local ecology. Both direct and indirect environmental impacts must be investigated and addressed during the conceptual design phase of the project, with any negative impacts identified should be managed where possible, or mitigated through the design of the scheme.

It is important that any "non-negotiables" such as habitats that support rare and endangered species are identified early in the investigation phase. This ensures that the design can evolve to avoid causing any negative effects to the habitat and where possible, used to enhance such habitats.

The effects of irrigation infrastructure are not all negative and consideration should be given to what opportunities there are to enhance the environment. Environmental enhancement opportunities might include riparian planting and fencing of waterways, creation of marginal wetlands, creation of habitat for waterfowl, creation of fish spawning areas, and replacement of exotic tree species with natives. Irrigation also can have benefits to the land through increasing the quality and quantity of topsoil.

In many cases, environmental enhancement on-site or off-site can be considered as mitigation (or partial mitigation) for adverse effects caused by the activity. Mitigation for loss of ecological values generally needs to be of at least a similar quality and of a larger extent than the area lost. Inevitably, there is a time lag before the benefits of restoration activities are fully realised and it is generally accepted that this delay should be compensated. The Stream Ecological Valuation method (Rowe et al. 2006), although generally applied to urban streams, provides a useful approach for quantifying appropriate compensation based on changes to ecosystem functions.

The magnitude and significance of effects will depend to a large extent on the values associated with the river and land affected by the proposal. Instream values may relate to: ecology, landscape, amenity values for fishing or boating, Maori values or commercial values for fishing. Ecological assessments undertaken early in the process can feed into an assessment of constraints and opportunities presented by the project. The flow guidelines for instream values (MfE 1998a) discusses instream values associated with rivers.

There are a range of potential environmental effects of developing irrigation infrastructure. These are described in Table 1. It is convenient to separate the direct effects related to constructing the irrigation infrastructure from the indirect effects associated with the ongoing operation. A more detailed discussion of the ecological effects associated with changes in the hydrological regime of a river can be found in flow guidelines for instream values (MfE 1998b).

Investigations into the potential effects of an activity such as establishing irrigation infrastructure and changing a river's flow regime will have a degree of uncertainty associated with the conclusions. Uncertainty about both the effects and absence of effects can be reduced by undertaking robust investigations and using appropriate tools and models. Nevertheless, it is likely that any consent will require ongoing monitoring of the effects of the activity on some aspects of the environment.

Table 1 Potential environmental effects of irrigation infrastructure

Potential Effect	Considerations
Construction Phase	
Terrestrial and aquatic flora and fauna	Direct removal of habitat for terrestrial and aquatic flora and fauna i.e. through vegetation removal, stream diversion etc. The presence of rare or endangered species needs to be addressed and managed. The quality and significance of any vegetation removed. Methods are available to quantify mitigation for the loss of aquatic habitat (e.g. Stream Ecological Valuation (Rowe et al 2006)).
Fish passage and spawning	Instream works and diversion of streams impact on fish passage. The timing and nature of construction activities (many regional councils have calendars showing key times of fish migration and spawning).
Erosion and sediment	Erosion and sediment control plans are key to minimising and avoiding effects of erosion and sediment runoff, particularly where large scale earthworks are required (e.g. dam construction).
Transferring pest	Construction activities need to be managed to prevent the spread of terrestrial and aquatic plant and animal pests, including: *Didymosphenia* sp., water net, Hornwort (*Ceratophyllum* sp.) etc

Potential Effect	Considerations
Operation Phase	
River hydrology	Aquatic biota are directly and indirectly affected by a number of aspects of river hydrology including: • Low flows (the minimum flow of a river affecting aquatic habitat and fish passage); • Flood regime (the frequency and magnitude of high flows that can move substrate and flush away periphyton); • Seasonality of flows (the times when flows are high and low should reflect natural seasonality); • Ramping rate (short term changes in water level that can result in fish being stranded and the availability of river margins for aquatic habitat). Off-line reservoirs that harvest flood flows can avoid effects on minimum flows or from ramping, but still impact on the flood regime.
Water quality	Reservoirs can affect downstream water quality in a number of ways including: • Reducing flows and water depths that impact on downstream water temperature, pH and oxygen (there are a number of models available to estimate this effect). • Reducing flows that dilute poorer water quality from downstream discharges or tributaries. • Releasing warmer (or sometimes cooler bottom water) from the reservoir. • Releasing low oxygen water; particularly if the lake becomes eutrophic or if carbon rich sediment have not been removed prior to commissioning. • Increasing the residence time of water and thus allowing time for phytoplankton to grow which can change the clarity and colour of the water. This effect can be mitigated by limiting nutrient loads to the reservoir e.g. by restricting the intensity of land use. • The ANZECC guidelines (ANZECC 2000) identifies acceptable trigger levels for water quality variables and information on how these can be investigated. Indirectly, land use intensification and increased water application to land through irrigation can result in poorer quality of runoff entering waterways. Effective farm management and taking steps such as riparian planting and fencing to keep stock out of waterways can help reduce these effects.

Potential Effect	Considerations
Erosion	Changes to the hydrological regime can impact on downstream erosion. Reservoirs can trap and interrupt the movement of bed sediments which can impact on erosion downstream in the river or coastal area. Irrigation during dry spells can reduce the effects of wind erosion of soils.
Aquatic biota	Consideration should be given to the effects of a project on: • Periphyton and cyanobacteria (particularly sensitive to the magnitude and frequency of flushing flows, but also changes in water depth/velocity, water temperature and nutrient concentrations). • Aquatic macroinvertebrates (impacted by water depth/velocity, substrate composition, hydrology changes and water quality). • Fish habitat in river (ecological flows need to consider native and game species). • Fish passage upstream and downstream past instream structures is required for both native and introduced diadromous fish. It is generally preferable to use fish passes/fishways but ongoing 'catch and transfer' should also be considered, particularly for high structures or to ensure downstream migration. Useful guidelines for ensuring fish passage past culverts and dams include Boubee *et al.* (1999) and Boubee *et al.* (2000). • Fish screens on water takes / outlets to avoid fish being killed in pumps. Jamieson et al. (2007) provides good practice guidelines on fish screening with a focus on Canterbury.
Ecological flows and water levels	Minimum ecological flows may already be set for the river by the regional council, if not they will need to be determined as part of the project. A range of tools are available for setting ecological flow requirements and there are a number of guidelines available discussing these tools (i.e. MfE 1998b, Beca 2008).
Reservoir ecology	Design and management of a reservoir impacts on the degree to which it enhances ecological values and minimises adverse effects. Consideration should be given to: • Magnitude and frequency of water level fluctuations (this affects the habitat for wetland plants that can grow on the reservoir margins, the type of plants, and the suitability of the reservoir margins for nesting birds. Riis and Hawes (2002) found that "diversity and species richness in these littoral plant and turf communities were maximal in lakes where water level fluctuations had an amplitude of 1 m and occurred in cycles shorter than 2 months. • Marginal planting and wetlands (planting can considerably increase

Potential Effect	Considerations
	the biodiversity, aesthetic and recreation values provided by a reservoir). • Birds (constructed reservoirs are commonly used by game birds and native birds). • Pest plants (many reservoirs have problems managing nuisance aquatic macrophytes (e.g. hornwort, water net) which can block water intakes and reduce ecological values. Preventing initial establishment of aquatic pests is much easier and cheaper than ongoing control and management). • Pest fish (introduction of coarse fish into a reservoir will significantly influence its ecology, reduce the cover of macrophytes and reduce water clarity).

6.4 Cultural and Social Impact Investigations

Social impact assessment (SIA) is required for a number of reasons in irrigation development projects. The main one is to meet the regulatory drivers of the RMA. As such, it will sit alongside the various technical assessments of the project and form part of the overall assessment of environmental effects.

The International Association for Impact Assessment (IAIA) defines SIA as:

> *"Social Impact Assessment includes the process of analysing, monitoring and managing the intended and unintended social consequences, both positive and negative, of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions."*

The RMA also requires some specific understanding about the impacts on communities and neighbourhoods which need to be addressed in an assessment of environmental effects.

Social Assessment Themes

The IAIA outlines a way of conceptualising social impacts as being changes to:

- People's way of life – how they live, work, play and interact;
- Culture – shared beliefs, customs, values, language/dialect;
- Community – cohesion, stability, character, services & facilities;
- Political systems – ability to participate in decisions that affect their lives, level of democratisation and resources;
- Quality of their physical environment;
- Health and well being – physical, mental, social and spiritual;
- Personal and property rights – economic effects, personal disadvantages, violation of civil liberties; and
- Fears and aspirations – perceptions of safety, future for themselves, their children and community.

In essence, it is important to realise that social effects arise from alterations to the environment that have indirect or direct impacts on individuals and the communities.

Social Impact Assessment Process

Social assessment can be included in various stages of an irrigation development project. Critically it should be used to inform the decision making right at the outset of the Pre-feasibility Phase. This is to inform the evaluation and consideration of alternative sites and options.

In addition, it can also assist in the development of the community engagement programme throughout the project process. In fact, it is essential that the social assessment and public engagement (see Section 5) be strongly interlinked.

Finally, the assessment of environmental effects will include a social impact assessment of the proposal and its component parts.

The process usually involves the following steps:

- Develop a Public Involvement Program – this should be done in liaison with the people responsible for the community engagement.
- Describe the proposed action (and possible alternatives) - develop a clear statement of the proposed action, and likely area of impact.
- Develop a profile of the social environment-this should document the community within the affected area.
- Scoping – identify the range of possible impacts of the proposal against the baseline community.
- Investigate and understand the social effects of the proposal action.
- Project the response to the effects (assess their significance).
- Changes or modifications to the proposal – may be required as a result of the above assessment
- Develop appropriate mitigation and appropriate conditions which can be incorporated in any planning approvals.
- Develop a monitoring programme which involves the proponent and community.

Community engagement will occur throughout the impact assessment process.

Lifecycle of Social Effects in Irrigation Development Projects

The reporting of social effects should be broken down into the various phases of the project. These include the planning, construction & operational phases of the scheme itself as well as the wider impacts generated by the final scheme. Social effects differ to other physical effects as they occur right at the onset of a project during the planning process as soon as the community becomes aware of any proposals. A useful reference is Frank Vanclay's contribution on Social Impact Assessment for Large Dams. Hence, the importance of having the social assessor on board right at the planning phase.

Cultural Impact Investigation

A cultural impact investigation needs to be done separately taking into account *iwi* interests and values, as covered in Section 5.3. The scope of this investigation would vary depending on the project, but the following is an example:

- A survey *of taonga* (treasured things) in the area;
- Biodiversity restoration and management opportunities;
- A harvest plan for removal/transfer of *taonga*;
- Potential public access;
- Potential restoration sites; and
- Iwi indicator sites for monitoring of cultural and environmental health.

6.5 Engineering Investigations

To achieve an efficient, effective and successful irrigation scheme, it is crucial that the design is based on good information, gathered at the conceptual stage of a project. The degree of information that should be gathered during the engineering investigation phase is dependent on the scale of the proposed irrigation scheme; a large scheme including a large water storage structure such as a dam will require much more information to be gathered, particularly around site and geotechnical conditions, compared to a smaller scheme where the most significant infrastructure is a pipe or open channel network.

The purpose of an engineering investigation is to obtain information relating to the site conditions, as these will have a significant influence on how the infrastructure design progresses and evolves. The investigation phase will often be conducted both in the office as a desktop study, and in the field. It may also be necessary to carry out tests in a laboratory as part of an engineering investigation, particularly if large water storage structures or dams are part of the scheme, where ground conditions become critical. The outcome could be that the site or project is not economically or technically sound.

Typically, the engineering investigations increase in detail as the irrigation development project progresses. This section provides a guide to the issues to be considered as part of the engineering investigations. The timing of the various investigation steps (e.g. whether it should be done at the feasibility study or conceptual design stage) should be taken as a guide only, because it depends on the particular complexity and circumstances of each project.

Feasibility Study

This is the reconnaissance stage designed primarily to support a decision on whether to proceed with more detailed investigation on the basis of rough data and shortcut studies.

- Desktop study looking at:
  - Site topography – topographical maps, aerial photographs, other useful information held by local authorities, Google Maps, etc.
  - Site geology – geological maps, GNS Science website for active faults and earthquakes
  - Local hydrology of catchments of interest – precipitation records.
  - General information gathering.
- Drive by or walk over the sites – this gives an appreciation of the physical features and materials.
- Local knowledge and existing structures in the vicinity.

Conceptual Design

This determines the scope, magnitude, essential plan and features, and the approximate benefits of the project with sufficient dependability to support approval for detailed design sufficient for procurement.

A. Confirm hydrology and determine flood characteristics

- Determine design flood(s)
- Impoundment or intake sedimentation
- Climate data, temperature range, wind direction and velocities

B. Site geology

- Site walkover and feature mapping by an engineering geologist, includes any impoundment areas.
- Identify local faults and proximity of fault lines that will influence the design of structures
- Groundwater data
- Materials/foundation information:
  - Test pits and trenches
  - Laboratory testing material properties
  - Adits and shafts (large dams only)
  - Drilling, auger holes, cored drill holes
  - Geophysical surveys
  - Source of borrow for construction materials, engineering properties and volumes available, e.g. gravel, low permeability fill, rock

Conceptual Design (Continued)

C. Site survey

- LIDAR (light detection and ranging)
- Topographical survey using GPS

D. Preliminary design of structures.

- Under the Building (Dam Safety) Regulations 2008 and subsequent proposed amendments ("the Regulations") will give practical effect to the Dam Safety Scheme. The Scheme applies to all dams, including detention dams. The purpose of the Scheme is to ensure the safety of large dams through a formal system of monitoring, inspection and maintenance. At this stage, it is not known when the Regulations will become law or exactly what criteria they may apply. The Scheme only applies to 'large' dams (current definition is structures with maximum holding capacity greater than 20,000 m3 and depth greater than 3 m)
- A dam may be classified as either a low, medium or high Potential Impact Category (PIC) dam, depending on the potential impact of a failure on persons, property and the environment. Minimum design requirements are set by the PIC rating, e.g. the size of the design flood or earthquake. Classifications are to be reviewed every five years, recognising that the PIC can change, primarily as a result of development in the flood path downstream of the dam.
- A dam break hazard map will be required to identify people at risk downstream of the dams.
- Consideration of seismic risk and other safety issues.

E. Design of the distribution network

Consideration of:

- Appropriate pipe/race mix, and choice of pipe and/or race lining materials
- Construction staging
- Pressure boosting required, e.g. turbine/pump stations
- Level of service: reliability/flexibility required
- Mini hydropower generation potential
- Surge and fatigue issues
- Safety issues and failure risk management (including seismic risk)
- Water source issues
- Electricity supply
- Site establishment areas, access roads to the site(s) and around the site(s)
- Pollution controls

F. Risk Analysis (see Section 4.2) and Cost Estimation (see below)

Detailed Design

This stage is dependent on the procurement model used but generally supplements the conceptual design to the degree needed to prepare final plans/specifications after approval has been gained to proceed.

- Additional geotechnical information required to complete the design
- Testing of proposed construction techniques
- Finalise the design to the level required to match the procurement method
- Update cost estimates
- Prepare specifications and schedules, the format and content to match the procurement method
- Quality assurance, including appropriate testing and commissioning programme

The degree to which each area of investigation is taken depends on the potential impacts, and the scale of the project. When large water storage structures and/or dams are being considered, it is critical that suitably qualified specialists and dam designers are used to perform the required investigations, particularly when considering the ground and geological conditions. Many dam safety issues and failures have been attributed to inadequate investigation and/or use of sufficiently qualified personnel.

Thorough engineering investigations when performed at the initial stages of a project help to minimise uncertainties and risk as the design progresses, through demonstrating the technical feasibility of a scheme. It is also critical for estimating the capital costs and the level of risk and uncertainty associated with these estimated costs.

Project Cost Estimation

Throughout the engineering investigation process, the capital costs for the infrastructure supply and construction will need to be estimated. Project cost estimation is by definition an inexact process. The cost estimator seeks to approximate the actual costs that will be incurred as closely as possible, but the actual costs will remain a prediction until the project is completed. These are a few key considerations in estimating costs:

Escalation

Where a project extends over a number of years, allowance needs to be made for escalation in the project out-turn cost. It is important to make it clear what cost index the estimate has been based on and whether provision has been made for escalation.

Whole-of-life Costing

Investment decisions require consideration of not only the capital cost of a project but also the operating and maintenance costs over the life of the project. The assessment of capital and operating and maintenance costs is often referred to as 'whole-of-life' costing. For the purpose of comparing options and decision making it is usual to discount future costs back to present value costs so that options can be considered on a common basis.

Whole-of-life costing is essential to good decision making. Often a solution with low capital cost but higher operating and maintenance costs will not be the best investment when the costs over the lifetime of the project are considered. There are many examples where higher maintenance and operating costs will offset capital cost savings, e.g. when comparing different waste water treatment options, pavement surfacing treatments.

With increasing attention on providing sustainable solutions it is essential that whole-of-life costs are considered to ensure decisions are soundly based.

When preparing a whole-of-life cost estimate it may be best to prepare two separate estimates, one addressing the capital cost and one addressing the operating and maintenance costs and their anticipated timing of future costs. This approach provides clarity for any present value calculations required, also the skills required to prepare each aspect may be different. The present value calculation must take into account:

- the rate at which future costs are discounted;
- how to deal with inflation (costs and discount rate);
- whether or not differential inflation is warranted;
- allowance for residual value;
- economic vs. financial perspective;
- effect of capital deferral (initial CAPEX contract calendarisation and future CAPEX requirements);
- variable or increasing demand;
- the cost of consumables (power, labour, parts, chemicals) and regular other fixed and variable costs; and
- how maintenance and renewals are allowed for.

Cost of Financing Construction

The cost of financing construction over the construction period should be considered. For a construction project where there is a long period between the start of construction and completion ready for operation, this cost can be significant for the owner, or the contractor. This is often ignored where the contractor gets regular payments throughout the project and the cost is incurred by the owner/client. However, if the contractor has to hold these costs for a significant duration, then he/she will include an allowance for them in the contract price (e.g. for a design build project, the contractor may not get reimbursed until after the completion of the project). For a project of 12 months' duration, the charge could be in the order of 5% of the total construction cost. This could rise to around 10% for a 24-month duration project.

Contingencies

Contingencies are provided to account for uncertainty when estimating a part of a project. They are often used for estimating work relating to site conditions because it is usually very difficult to determine exactly the work involved in such items.

The contingency must not be adopted as a standard percentage, but estimated specifically for the particular project, depending on the nature of the work, the extent to which it has been defined and the risks involved.

6.6 Design Standards and Peer Review

Professional peer review focuses on the performance of professionals, with a view to improving quality, upholding standards, or providing certification. Professional peer review activity is widespread in engineering. While this section focuses on engineering design standards and peer review, similar robustness is required for other aspects including planning and environmental impact assessments.

It is difficult for designers, whether individually or in a team, to spot every mistake or flaw in a complicated piece of work. This is not necessarily a reflection on those concerned, because with a new and perhaps complex subject, an opportunity for improvement may be more obvious to someone with special expertise or who simply looks at it with a fresh eye. Therefore, showing work to others increases the probability that weaknesses will be identified and improved.

Design standards for large impoundments in New Zealand are set out in the New Zealand Dam Safety Guidelines November 2000 issued by the New Zealand Society of Large Dams. This standard only applies to large dams for which the current definition is those structures that have a maximum holding capacity greater than 20,000 m^3 and a depth greater than 3 m. Irrigation schemes with impoundments smaller than the above and the larger dams are all subject to conventional building consents for appurtenant structures such as valve towers, access bridges and earthworks. Normal standards apply to those aspects and a Producer Statement PS1: Design provided.

It is normal practice for dam design to be subjected to an external peer review process as an owner (or funder) requirement. In most cases, the peer reviewer would report to the owner but have direct access to the designer.

The peer review should include comment on but not necessarily be limited to:

- Technical design
- Constructability
- Construction costs – sometimes included.

The technical review should consist of reviewing the adequacy of principles of design, designer quality assurance systems, conservatism, reasonableness of analysis for innovative methods or systems. Detailed checking of calculations or re-analysis would not normally be required. The peer reviewer should produce a report and a Producer Statement PS2: Design Review to satisfy requirements of the Building Act and to accompany the building consent application. The report should endorse the final design and the reviewer should be available to assist in answering queries that might arise from the building consent.

Where the designers and peer reviewer cannot agree on an approach or solution, be it technical, constructability or cost, then the owner may need to appoint an independent and qualified mediator to facilitate agreement.

Peer review normally continues throughout the construction period as well.

The Institute of Professional Engineers New Zealand (IPENZ) has many resources that may be of use for the irrigation development project, including:

- A Guidance Note to Conditions of Contract for Consultancy Services (2005)
- IPENZ Practice Note 02, Peer Review, Reviewing the work of another engineer (2003)
- Fee Guidelines for Consulting Engineering Services (2004)
- Guideline on the Briefing and Engagement for Consulting Engineering Services (2004)

These documents are available on the IPENZ website (http://www.ipenz.org.nz).

7 Pathway to Procurement

Key Messages

- The procurement strategy covers decisions surrounding procurement model, contract type, 'conditions of contract' document used, and the tender process.
- The appropriate procurement strategy depends on the unique priorities of the irrigators – e.g. final cost certainty upfront, timing, quality, flexibility, and timing of funding availability.
- Because capital is required not only for supply/construction, but also for the stages before and after, the appropriate source of funding should consider the stage of the project's life, as well as the different benefits and challenges of each source.

7.1 Procurement

Procurement Strategy

Every irrigation development project and the irrigators involved are unique in their aspirations, circumstances and preferences. For some irrigators, the certainty of price is the dominant aspiration whilst for others this may be secondary to the need for an early finish, quality of the final product or the ability to work around operational restrictions.

Factors which should be taken into account when deciding which procurement strategy to adopt include:

- How well-known are the requirements for the project and what likelihood is there of change?
- Who has the necessary design experience?
- Is there any pressure to complete the project quickly?
- How important is the performance of the completed project?
- Is certainty of the final cost more important than the lowest initial cost?
- What risks are there with the project and are these tolerable?
- Who is best placed to manage the risks?

- Is it important to have a single point of responsibility?
- Is there a likelihood of cross-contract co-ordination to complete the project?
- Is there any reason to select specialist companies to be involved?
- Is avoiding formal disputes a priority?

Engagement of Specialists

The delivery of an irrigation development project from conception to completion will almost certainly require professional skills/expertise not available among the irrigators themselves, e.g.:

- Planning/consenting and engagement services
- Geotechnical investigations and site surveys
- Engineering investigation, concept designs and detailed design
- Social, cultural and ecological environment impact assessments
- Drafting of contract documents, and running the tender process
- Insurance, external communication and legal services
- Management of construction, quality control and payments to contractors

These services might be able to be provided by a single organisation or it might be necessary to engage several over a period of time. For the latter, it is not unusual for the irrigators to appoint a Principal or Trusted Advisor to provide impartial advice and help them through the process. In many ways, the engagement of specialists is no different from the process described later on to appoint a contractor to build the scheme, with the exception that in the early stages of the project it is often quite difficult to define the scope and moreover the services required are unknown. As such, the process can take two forms:

1. The irrigators require a solution or service, the nature of which is not fully understood at the time they need to engage a specialist. In this situation, the irrigators and the specialist would work together to define the scope and agree on what is to be provided as deliverables before fees are finalised. In this arrangement, it is unlikely that a selection based on fees alone will result in the optimum solution and selection is largely based on the quality of the service offered. That said, a number of appropriate specialists can still be approached for their submissions to provide surety of competitive pricing.

2. The irrigators require a service that they, or their Trusted Advisor, fully understand and they are able to precisely define the scope and what is to be provided as deliverables. In this arrangement, if a number of specialists are available who can meet the requirements, then it would be appropriate to approach several and select on the basis of price. Short-listing the number who are approached, however, avoids cost and time for the irrigators in evaluating specialists who have no real prospect of selection.

The costs of specialists for larger projects can be expected to be less than 10% of the capital costs, whereas for smaller projects the percentage is higher. These costs cannot be avoided – they are either borne by the irrigators themselves as risks, hidden in the costs of other services, or explicitly paid to specialists who manage the risks. It is worth remembering that the investment to procure advice and expert investigation from competent specialists during the early stages of a project, coupled with innovative design and project management, can make significant savings in the whole-of-life cost of the project, hence getting the right people is crucial.

The Procurement Process After Concept Design

The following flow diagram outlines the steps on the pathway to procurement:

Select the Procurement Model

There are a number of procurement models likely to be encountered with irrigation infrastructure, some of which are best known by their acronyms:

- **Design and Construct (D&C)** is the traditional model where an engineer is engaged to design and detail a scheme and a contractor subsequently builds what has been detailed. The engineer will most likely have tendered to provide their service and the contractor will almost certainly have tendered to undertake the construction. The model gives the irrigators the most control over the design solution and it is associated with certainty of price.
- **Design and Build (D&B)** is a relatively new model whereby consortia (each typically incorporating at least one contractor and one design partner) tender to provide their unique solution to the irrigators' problem and thereafter they design and then build their solution. The attraction of this model is that the irrigators obtain design and construction innovation from several sources but with that comes a reduced level of control over the solution. Due to the very high cost to each consortium of tendering, the number invited to tender is limited to, say, three and it is not uncommon for the irrigators to pay the unsuccessful tenderers an amount in recognition of their costs. The irrigators still engage an engineer for this model but rather than complete the design, the engineer will produce documentation setting the targets for the design and subsequently assist the irrigators in ensuring that the consortia meet their obligations.
- **Design Build and Operate (DBO) or Build Operate Transfer (BOT)** is the same as Design and Build except that the successful consortium goes on to operate and maintain (O&M) the scheme for a number of years before transferring these responsibilities back to the irrigators. The O&M period can typically be between 3 and 25 years.
- **Build Own Operate Transfer (BOOT)** is the same as DBO/BOT except that successful consortium funds and hence owns the scheme. As an analogy, the irrigators effectively rent it from the consortium until the mortgage is paid.

Select the Type of Contract

The most common types of contract for physical works are:

- **Lump Sum or Priced Contracts** where the contractor provides a fixed price for undertaking a known scope and the price typically only alters if there has been a change to the scope. This is suited to situations where the scope can be well defined or where the irrigators are willing to pay for the contractor to accept the risks for unknowns.
- **Target Cost Contracts** where the contractor provides a price for undertaking the project. If they manage to complete it for less, then there is the facility for the contractor and irrigators to share the savings thereby providing the motivation for ongoing innovation. Conversely, if they complete it for more than the target, then there is the facility for both parties to share the losses thereby providing the motivation for an overall *best for project* approach. This is suited to situations where the work might not be fully defined and there is an interest in sharing the risks.
- **Measure and Value Contracts** where the physical work is measured and paid against a schedule of tendered rates, such as the cost per metre to lay pipe of a certain type and diameter. This is suited to situations when the type of work can be well defined but the extent of it cannot and the irrigators are prepared to accept the risks for the extent of work required.
- **Cost Reimbursable** where the contractor/consortium is typically reimbursed for all of their costs with the addition of a fee. This is suited to situations where maximum flexibility is required and cost is secondary to all other aspirations. With planning, it should always be possible to avoid this type of contract for irrigation development projects.

These provide, in descending order, a distribution of risk with the Lump Sum Contract providing the maximum certainty of price for the irrigators and Cost Reimbursable providing the least.

Select the Conditions of Contract

The conditions of contract is the legal document under which the contractor is engaged. There are various contract conditions available and those currently in use within the New Zealand contracting environment and their relative merits are:

- **NZ3910** Extensively used and understood in its standard format and best used with Design and Construct projects.
- **FIDIC** A suite of contracts that include versions purposefully developed for the procurement models and types of contract detailed above.
- **NEC3** Again, a suite of contracts that lend themselves to any of the procurement models and types of contract detailed above. Recently introduced to New Zealand and a different approach based on best practice and sound project management.
- **AS4910** Suited to smaller or individual contracts for the supply and installation of purpose-built equipment or machinery rather than, perhaps, the entire irrigation system.

Select the Tender Process

There are essentially two forms of procuring work and this is through either negotiations with a single contractor or competitive tendering by a number of contractors. The negotiation route is extremely rare as it is difficult to demonstrate competitive pricing or, should the contractor be undertaking design, any innovation this way.

Select the Tenderers

It is often preferable to limit the number of contractors/consortia who eventually tender for a project to either only those who are actually capable of undertaking the work or just a limited number of those most suited to the project. This is completed through a process known as the Registration of Interest (RoI) or Expression of Interest (EoI) and it follows a similar procedure to the tender itself in that the contractors have to provide a formal response to a number of requirements and these are then assessed against the other respondents. Typical criteria they would be assessed against are:

- Their project team's (their personnel) experience in delivering projects with a similar scope
- How they as a company/consortium have performed on a number of similar projects when measured on time, cost and quality.
- Who they have available to work on this project and what resources such as plant, equipment and specialist software they can call on.
- Their financial and health & safety record.

This process, importantly, also serves to alert companies to the forthcoming resource requirements of the tender itself and also, potentially thereafter, the actual contract itself.

Remember, the cost of tendering is often very high and one way of maintaining the interest of suitable tenderers, which will be for the benefit of your project, is for them to have a reasonable chance of success. It is recommended for complex projects that the number of tenderers is limited to three or four.

Select the Successful Contractor/Consortium

When the enquiry is sent out to the tenderers, it is preferable to let them know how their submissions are going to be assessed, and the hence the basis for selecting the successful contractor/consortium. There a number of ways of doing this:

- **Lowest Price Conforming** is best suited for simple work where no innovation is required or where the tenderers' abilities have already been assessed through the Expression of Interest process. The tenderer with the lowest price for a compliant solution wins the work.
- **Weighted Attributes** is appropriate for more difficult projects where experience and innovation is needed. A combination of the tendered price and non-price attributes such as their previous experience, their previous performance or their methodology for completing this particular project are used to select the successful tenderer.
- **Brookes Law** is for very complex work where the experience and availability of the contractor is paramount. The tenderer with the best non-price attributes is selected without reference to their price and then the price, or method of reimbursement, for completing the work is negotiated.

7.2 Funding

There are two types of capital, being equity and debt. Both will play an important part in any irrigation development project, not only in the supply and construction of infrastructure, but also the investigations, stakeholder collaboration, design, and consenting prior to supply/construction, and the operation, maintenance and asset management after supply/construction.

Debt

Debt finance is typically used to fund any shortfall between capital required and capital raised from irrigators and investors, and then for working capital once the project has been completed.

The loans can take the form of:

- a development loan which is drawn down for the construction of the project;
- an underwriting loan which is advanced to secure the shortfall between capital raised under a prospectus and monies required to commence the project, pending further uptake by shareholders;
- operating overdraft for working capital.

There is increasing interest by the main trading banks to lend to irrigation scheme entities. Prerequisites that banks would be looking for before lending to irrigation schemes are included in the appendix (Section 9.4), however their main requirements are as follows:

- ability of the irrigation scheme entity to fund the repayments to the bank through the recovery of costs from the irrigators pursuant to a water access agreement;
- robust legal structure securing the irrigation scheme's key assets, e.g. dam, water races, resource consents, and property rights;
- good governance.

Other sources of debt, such as a supporting local council, are likely to have similar requirements.

Equity

Most irrigation schemes are funded through farmer/irrigator equity through the issuing of shares to irrigators whose land forms part of the scheme and who require water. Some schemes, especially regional-scale schemes, may also seek external/non-irrigator equity funding through the issuing of "dry shares" that provide profit rather than water access.

The main issue with irrigator equity is "uptake risk", i.e. how many farmers will ultimately subscribe for shares to fund the development of the necessary infrastructure. Uptake risk, however, can be mitigated through a survey of farmers prior to issue to ensure that the terms of the share issue are acceptable and putting in place of underwriting or bridging facilities to cover the shortfall in the event that the minimum to develop the project is not met.

The structure of the project should allow for a certain percentage of farmers to come on board over time. There is inevitably the initial uptake followed by a number of "stragglers" who come on board once they can see that the project is going to be successful.

Debt funding arrangements with a bank or a supporting local council can bridge the difference between a conservative initial uptake and funds required for the project. In this way, there is a "safety net" and a guarantee of initial funds to commence the project.

Local Government

Increasingly, local government in the form of local councils or regional councils are becoming involved in large irrigation schemes for the general benefit of the region. Funding support can be provided to the schemes through the rating layer under the local government legislation. Local/regional councils will also have the ability to borrow money at a cheaper rate than perhaps the irrigation entity can borrow from the banks. However, it needs to be appreciated that the local authority will need to comply with the provisions of the local government legislation, with the result that local government input can only proceed at the pace dictated by the local government legislation and the need to consult, disclose and obtain peer review.

In the event that it is likely that the Council will hold 51% or more of the entity, then the Council Controlled Organisation (CCO) provisions of the Local Government Act will apply, which adds an additional layer of compliance.

Effect of Procurement Model Used

The type of procurement model will impact on the timing of funding and amount of funding required. For example, under a BOOT model, the successful consortium/operator funds the construction, so the need to pay for the scheme does not start until after the scheme is put into operation. A consortium/contractor assumes a significant amount of financial risk, therefore will seek a premium on the on-sale and transfer of the BOOT scheme to the irrigators. Initial need to raise capital is deferred, but more capital may ultimately be required. On the other hand, DBO model, however, may require the scheme to raise capital in the early stages.

8 External References to Consenting and Legal Requirements

Land and water resources are managed across three levels of government: national, regional, and district. The irrigation development projects must comply with all relevant legislation. The following is a non-exhaustive list of the relevant legislation that will have to be complied with:

- Resource Management Act 1991 and its amendments, which provide broad, overarching guidance on all planning matters in New Zealand, including the use of land and water resources.
- National Policy Statement for Freshwater Management 2011, which provides overarching guidance specifically on freshwater resources.
- Regional Policy Statements, which provide regional guidance on matters related to the environment, including objectives and policies directly related to a region's resources.
- Regional Plans which provide further specific guidance on the use and management of resources, including rules guiding the taking and use of the region's freshwater resources and the use of the beds of lakes and rivers.
- District Plans which provide specific standards/rules for a range of activities across the area, particularly the localised rules that relate primarily to physical works rather than directly to freshwater management
- Historic Places Act 1993, which does not relate directly to land or water resources, but provides guidance and regulation where there is the potential for heritage features such as historic water races in an area.
- Building Act 2004 and Building (Dam Safety) Regulations 2008, which provide the regulatory framework for the establishment and ongoing monitoring for dams. The Act also provides specific requirements that must be undertaken in establishing a new dam.
- Local Government Act 2002.
- Reserves Act 1977.
- Conservation Act 1987.

9 Appendices

9.1 Possible Business Structures

9.2 Tips for when you are attending a meeting on a *marae*

9.3 Tips on consulting with *tangata whenua*

9.4 Prerequisites to Bank Lending

9.5 Glossary/Acronyms

9.6 References/Bibliography

9.1 Possible Business Structures

	Structure of Entity	Duties and Liability	Administrative Requirements	Profits and Taxation	Reasons for Choosing this Structure
Limited Liability Company	A limited liability company incorporated under the Companies Act 1993 is a legal entity in its own right and generally has the rights, powers and obligations of a natural person. A company must have at least one director and one shareholder and governance of a company is vested in a Board of Directors, who must, in most circumstances, act in the best interests of the company.	Generally, the debts and obligations of a company are liabilities of the company itself, as opposed to liabilities of the directors and shareholders personally. The "limited liability" of a company, however, can be eroded where creditors require directors or shareholders of the company to give personal guarantees in respect of the company's obligations. It should also be noted that directors of companies have significant duties imposed on them by the Companies Act 1993. Where a director breaches these duties, personal liability may also arise.	Once a company is incorporated, there are ongoing administrative requirements, the extent of which will depend on the size of the company and the nature of the business it is undertaking. These requirements include: • The requirement to retain certain accounting records; • The requirement to keep a share register; • The requirement to complete annual financial statements; • The requirement to file an annual return.	A company is a tax payer and must file tax returns and pay income tax on its taxable income. Generally, tax losses cannot be passed through to company shareholders, but may be utilised within the company. Profits of the company may be paid out to shareholders by the way of dividend.	Limited liability is a convenient vehicle to structure, capital raising and governance.

	Structure of Entity	Duties and Liability	Administrative Requirements	Profits and Taxation	Reasons for Choosing this Structure
Cooperative Company	A co-operative company incorporated under the Companies Act 1993 and registered under the Co-operative Companies Act 1996 is a separate legal entity and generally has the powers and obligations of a natural person. A co-operative company must principally carry out a "co-operative activity" as defined in the Co-operative Companies Act 1996 and not less than 60% of the voting rights must be held by "transacting shareholders" (shareholders who supply the company, buy its goods or use its services). Co-operative companies are otherwise subject to the requirements of a company as set out in the Companies Act 1993 and discussed	See above for Limited Liability Company.	See above for Limited Liability Company.	The profits of a co-operative company are generally returned to its shareholders as rebates or as shares in lieu of rebates.	Co-operative company is appropriate where a scheme has a co-operative philosophy, i.e. an emphasis on providing service to members and recovering costs with no need to produce profit for investors. A co-operative company also has advantages under the Securities Act 1978 – i.e. evergreen prospectus.

	Structure of Entity	Duties and Liability	Administrative Requirements	Profits and Taxation	Reasons for Choosing this Structure
	above.				
Incorporated Society	A society incorporated under the Incorporated Societies Act 1908 is a legal entity in its own right and, like a company, generally has the rights, powers and obligations of a natural person. An incorporated society must have at least 15 members and must operate in accordance with a set of rules it adopts. Generally (but depending on the society's rules) governance is vested in a committee, the members of which are elected annually at a general meeting of the members.	Generally, the debts and obligations of an incorporated society are liabilities of the society itself, as opposed to liabilities of the members of the society personally. If, however, a society incurs debts or obligations for unlawful purposes, or for pecuniary gain, the members may be liable for those debts or obligations. An incorporated society, and its members, must act in accordance with the objectives of the society, which will be set out in the society's rules. The rules will govern the investment of society funds, the powers of the society to borrow money, the disposition of property, etc.	Once incorporated, a society must file annual financial statements with the Registrar of Incorporated Societies. Other administrative requirements, such as the summoning and holding of annual meetings etc., will be governed by the rules of the society.	An incorporated society may raise money to help achieve its objectives, as set out in the rules, but it may not make a profit to distribute to its members. Members of a society do not have any personal interest in the property or assets of the society. Incorporated societies may, in certain circumstances, be eligible for tax exemptions, but this will need to be determined on a case by case basis by an accountant.	Appropriate where a democratic model and structure is required, and no requirement for profit. Often useful in early stages of a scheme as Securities Act requirements and a prospectus is not required.

	Structure of Entity	Duties and Liability	Administrative Requirements	Profits and Taxation	Reasons for Choosing this Structure
Informal Committee/ Society	An informal committee or society is not a separate legal entity and cannot own property or enter contracts.	As an informal committee or society is not a separate legal entity, members will have to enter into contracts and incur obligations in their personal liability for the liabilities of the informal committee/ society.	There is no requirement for an informal committee/ society to have rules governing its operation, and there are therefore no specific administrative requirements.	N/A (not a formal legal entity that needs to pay tax or makes a profit).	Initial structure when project is in its infancy. Low cost and simple.
Trust	A trust is not a separate legal entity in itself, unless it is a charitable trust. A trust is comprised of trustees (who own and control the assets of the trust) and beneficiaries (who may benefit from the assets of the trust). Trustees of a trust have an equitable obligation to deal with trust property for the benefit of the beneficiaries. It should be noted that the Perpetuities Act 1964 limits the term of a trust to a maximum of 80 years.	Because a trust holds property and incurs obligations in the individual names of the trustees, the trustees are personally responsible for the liabilities of the trust. Where a trustee has no potential financial interest as a beneficiary of the trust (an independent trustee), that trustee may seek to have their liability limited when incurring obligations in their capacity as a trustee of the trust (e.g. entering into a bank loan).	Administrative requirements vary depending on whether trust is incorporated or not and whether the trust is charitable. A trust is to be administered in accordance with the terms of the Trust Deed. If charitable, then returns must be filed with the Charities Commission.	In order for the profits of a trust to be passed through to the beneficiaries, trustees must make a distribution to the beneficiaries. In doing so, the trustees will be bound by the provisions of the trust deed and the provisions of the Trustee Act 1956. As a trust is generally not a separate legal entity, income is taxed either at the hands of the trustees or the beneficiaries. Beneficiaries are taxed when income is vested in, or distributed to, the beneficiary.	Initial structure that avoids Securities Act issues. May be appropriate in certain circumstances to protect environmental and community values.

	Structure of Entity	Duties and Liability	Administrative Requirements	Profits and Taxation	Reasons for Choosing this Structure
		The trustees of a trust are subject to extensive duties, arising under both the trust deed and the Trustee Act 1956, the primary duty being to act in the best interests of the beneficiaries of the trust.		Any other income of the trust is trustee income and is taxable to the trustee in their capacity as a trustee of the trust. Tax losses cannot be passed through to beneficiaries and can only be offset against the income of the trust.	
Limited Partnership	A limited partnership registered under the Limited Partnerships Act 2008 is a separate legal entity and therefore generally has the rights, powers and obligations of a natural person. A limited partnership must have at least one general partner and one limited partner (who cannot be the same person). The general partner(s) are responsible for the day to day management of the limited partnership. Limited partner(s) are passive	A limited partner's liability is limited to the value of their financial contribution to the limited partnership, in much the same way as a shareholder of a company's liability is limited. A general partner, however, is personally liable (jointly and severally with any other general partners and the limited partnership itself) for the debts, liabilities and obligations of the limited partnership. A limited partnership must have a limited partnership	Annual financial accounts must be prepared and held at the registered office, but do not need to be filed. Other records, including resolutions, minutes and any amendments to the limited partnership agreement must also be kept at the registered office.	Limited partnerships return profits by way of distributions. As with a company, such distributions may only be made where the limited partnership is solvent. The profits of a limited partnership are taxed as if the business was carried on by partners in partnership so any loss or profit may flow through to, and is attributed directly to, the partners.	Appropriate where the scheme is relatively small or there is not a large number of participants. Tax losses during development can be streamed back to investors.

	Structure of Entity	Duties and Liability	Administrative Requirements	Profits and Taxation	Reasons for Choosing this Structure
	investors who contribute capital.	agreement, which will set out the rights and obligations of the partners. A general partner also has fiduciary obligations under the Limited Partnerships Act 2008 unless these are contracted out in the limited partnership agreement.			

9.2 Tips for when you are attending a meeting on a *marae*

If participating in consultation on a *marae,* there is likely to be a *powhiri* (formal welcome).

When attending a meeting on a *marae*, there are some basic hints:

- Arrive on time or before the due time
- Do not go onto the *marae* complex but remain in the car park until called onto the *marae*.
- On arriving in the car park, introduce yourself to everybody who is there. For *tangata whenua*, this is a process of finding out who is who and what the protocol will be.
- In setting up your *marae* meeting with the relevant person or group, if you do not have someone experienced in protocol, it is advisable to tell your hosts that you are unsure of protocol and do not wish to offend. In most circumstances, the host will enable one of the tribe to assist you on entering the *marae* and advise you of the appropriate protocol.
- Before stepping onto the *marae*, the guests should be organised as men and women have specific roles. Men are located at the back and women and children in front and middle. You should have arranged who will speak at the welcome and in what order. The last speaker should have the *koha*. The elder who is guiding you will assist in this process.
- You may, if you are considered to be an honoured guest, be greeted with a *wero* (challenge). The challenge is a non-verbal test of intentions and motives.
- You will be called onto the *marae* with the *karanga* (host call). This is the first voice to be heard. The *karanga* is done by a highly respected woman elder. The intention of the call is to bring together the dead and the living, and the dead are farewelled.
- The host call is followed by the guest call. This is the reply to the hosts acknowledging the welcome. During the call, the guests will walk onto the *marae* looking down to the ground in respect.
- A *haka powhiri* (action chant) is then performed by the hosts as they advance towards the meeting house and pause before taking up their positions.
- The front seats are occupied by the male members starting with the last speaker, second to last speaker with the first speaker being at the end. Only men are allowed

to fill the remaining front seats. The rest of the men occupy the next row with women and children at the rear.

- The *whaikorero* (speeches) are then made. Oratory is only undertaken by men. The speeches are greetings to the land, the meeting house, the departed, the people present and the reason for the gathering.

- Each speaker is normally followed by a *waiata* (song). The song supports the speaker's speech.

- The last speaker closes the speeches by summarising the speeches. He is then joined by the host people to do the final *waiata* or song. He then invites the guests to be formally greeted.

- The last speaker for the guest presents the *koha*. *Koha* is normally money placed in an envelope. The purpose of the *koha* is to make a contribution to the overall cost of the operation. In traditional times, *koha* was normally food and precious gifts. The last speaker lays the *koha* on the ground at an appropriate distance from the hosts and moves backwards without turning his back on the hosts. This is very important.

- Depending on your location in the country, the speech sequence may vary. *Tainui*, *Te Arawa* and *Tuwharetoa* practise *Tau utuutu – the* host opens and then the guest responds (one speaker from the host followed by a speaker from the guest); the host speaker closes the speeches. All other tribes practise *Paeke* – the host speaker starts then invites all the guest speakers to speak, then all the host speakers speak.

- The placing of the *koha* is followed by a call from a woman to acknowledge the gift. This is followed by a junior male going forward to take the gift. While he is doing so, he thanks the guests and acknowledges their offering of peace.

- The *hongi* is traditional to Māori and is often combined with a European handshake. The last ritual is an invitation to the guests to share a meal. The meal is had after a *karakia* (prayer) is said. This then closes the sacred ritual of *powhiri* (welcome).

9.3 Tips on consulting with *tangata whenua*

The following are tips on consulting with *tangata whenua*:

- "The most effective way to engage with Māori is by investing in a relationship rather than making the task of the engagement the focus of the investment." Sir Tipene O'Regan, 2006
- Engaging with Māori is an art. It takes time, effort, and commitment. It includes:
- Gaining an understanding of the profile of Māori society and developing an appreciation of core values, language, and culture.
- Getting to know the key people from the organisations that are mandated to represent Māori society, and building lasting and meaningful relationships with them.
- Working collaboratively with those people to ensure the aspirations and expectations of the organisations, as well as your own, are clearly understood.
- Strengthen your relationship with these organisations by continually making contact with them.
- Enter into the process in good faith and be prepared to modify your position
- Consult as early as possible in the process
- Listen to what you are told and repeat it to make sure you fully understand what has been said.
- Treat people with courtesy and remember that European timeframes and protocol are different to Māori.
- If you are uncomfortable or uncertain about protocol advise your hosts before hand and indicate that you are concerned about making a protocol error and ask for assistance.
- It is fine to speak in English on the *marae*. It is better to speak English than to badly pronounce the words in Te Reo.
- When asked to introduce yourself on the *marae* the process is name, ethnic origin e.g. Scottish, Irish, French, where you are located now, what you do, your family, number of children and grandchildren. Talk about how long you have farmed on your property.

- Prepare some appropriate songs. Songs sung in English are acceptable.
- Tell a story about your property, your ancestry or experience you know that occurred on the farm property. These are excellent ice breakers that Māori like to hear or begin to discuss the views with you.
- When presenting information, a verbal presentation accompanied by plans, maps and diagrams is recommended. Follow this up with written material and include a summary.
- When on the *marae,* try to position yourself near someone who understands the language and who able to talk you through the process.
- Turn off your cell-phones and do not take photographs unless you have been given permission.
- Ask if you are allowed to undertake some activities e.g. recording, videoing or photographing the event.
- Do not sit on tables. This is culturally offensive, as tables should be limited to food.
- The female body is sacred and respected so women are advised to dress conservatively.
- It is not appropriate for men to wear shorts if they are speaking or sitting in the front row.
- After the *powhiri*, it is acceptable for women to speak.
- On departure, thank the hosts and especially the respected elders of the *marae*.

9.4 Prerequisites to Bank Lending

Adapted from material provided by ANZ Bank (Stuart McKinnon, Karl Nicholson and Glen Thompson)

Banking a scheme on a stand-alone basis requires certainty of cash flow. This requires all cash inflows and outflows to be contracted prior to provision of finance. The main two elements of this are construction costs and uptake from farmers and other users. The extent that this cannot be fully provided on day one, for example because of a delay in farmer take-up, will affect the ultimate capital structure that a scheme will be able to support and therefore its viability and affordability.

Banks would expect consequential changes in governance, capital structure, and commercial practice as local community scale schemes shift to larger regional-scale developments. Banks would undertake a high level of due diligence when lending to irrigation schemes. Much of the information required aligns with what the Government expects when considering funding infrastructure development.

Banks would normally require and investigate the following:

- The experience and track record of the governance team, management and sponsors of the scheme, and their ability to deliver the project on time and at cost.
- An analysis of the catchment area and ability of users to pay for the scheme. This analysis will include current land use and any changes in land use
- An analysis of the reliability, complexity and cost of the scheme. This will include any ongoing energy requirements.
- A review of the environmental impact assessment and any restrictions imposed by Resource Management Act consents.
- An appointment of an independent engineer to review the construction of the project, contractual arrangements and approve payments on a cost to completion and test stages.
- A detailed financial model outlining the construction timetable, the operations of the project and cashflow over the life of the project. This would be used to analyse debt servicing capability.
- A fixed price turnkey contract with a contractor of acceptable credit standing and experience to deliver the scheme within a set timeframe. This would include liquidated damages and bonding security as appropriate.
- A detailed plan outlining the management of a scheme including billing and collection arrangements.
- A legal review of all major contracts especially those with contractors, end users and equity subscribers. A review of land use consents and easement would also be required.

9.5 Glossary/Acronyms

ASM	Auditable Self Management
BCR	Benefit Cost Ratio
BOOT	Build Own Operate Transfer
BOT	Build Operate Transfer
CAPEX	Capital expenditure
Community irrigation scheme	Water supply system initiated, developed and used by multiple members of a rural community, primarily for irrigation.
D&B	Design and Build
D&C	Design and Construct
DBO	Design Build Operate
EBIT	Earnings Before Interest and Tax
IAF	Irrigation Acceleration Fund
IAIA	International Association for Impact Assessment
IAP2	International Association of Public Participation
Investment-ready	Having robust technical, economic, and financial information that is sufficient to provide for due diligence and commercial decisions on the part of potential water users and capital investors.
IPENZ	Institute of Professional Engineers New Zealand
IRR	Internal Rate of Return
Irrigation development project	Work carried out to develop regional rural water infrastructure and community irrigation scheme, including upgrades/expansions.
Irrigators	Group of people who want to develop an irrigation scheme
MAF	Ministry of Agriculture and Forestry
NPV	Net Present Value
OPEX	Operating expenditure
PIC	Potential Impact Category
PWA	Public Works Act

RAW	Readily Available Water
RMA	Resource Management Act 1991
Regional rural water infrastructure	Large-scale regionally significant water harvesting, storage and distribution for multiple rural community uses, including irrigation.
SIA	Social Impact Statement
Strategic water management study	Study assisting with the development of regional approaches to integrated water management, particularly the potential of rural irrigation-related infrastructure and improved water management in the rural sector.
TFC	Total Farm Capital

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