Management Plan for Waimakariri Irrigation Scheme

Prepared for
Waimakariri Irrigation Limited

August 2013

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Appendices

1.0 Introduction

Waimakariri Irrigation Limited (WIL) has developed an Irrigation Scheme drawing water from the Waimakariri River and distributing this water to farmers between the Waimakariri and Ashley Rivers. Irrigation water is provided to properties within an area bounded by the Waimakariri River in the south, the Ashley River in the north and generally between a line from grid references L35:340-590 to M34:470-740 in the west and a line from grid references M35:780-530 to M35:750-690 in the east. This coincides with the 44,000 ha command area of the Waimakariri District Council stockwater race system.

This management plan has been prepared to fulfil the requirements of conditions on consents CRC952566.1, CRC952567.1, CRC952568.1, CRC952571.1, CRC952572.1, CRC952573.1, CRC952575.1, CRC952577.1 and CRC952578.1, which were all originally issued in 1996, and CRC000585.9, which has had changes to its conditions on various occasions, with the most recent change occurring in May 2010. These consents were issued by Environment Canterbury (ECan) to Waimakariri Irrigation Limited (WIL) and the Waimakariri District Council (WDC) to allow the abstraction of water from the Waimakariri River and its distribution and use across the Waimakariri-Ashley Plain. This Scheme is referred to as the Waimakariri Irrigation Scheme.

This plan details the ownership and operation of the Scheme, the management of the various water uses, methods for complying with the consent conditions, the monitoring of environmental effects and mitigation of any adverse effects.

Conditions 12 and 13 of consent CRC000585.9 promote the reasonable and efficient use of water by the Waimakariri Irrigation Scheme (the Scheme), as well as on individual properties that utilise Scheme water. The preparation of a Water Use Management Plan assists in achieving that purpose. The Water Use Management Plan has been incorporated into this overall management plan for the Scheme.

WIL also consider that this plan should reflect its corporate requirements as outlined in its Constitution, Policy and Operation Manuals, Shareholders' Water Supply Agreements and best practice guidance by Irrigation New Zealand, as well as industry standards and new technologies. The Management Plan also has to have regard to the Waimakariri District Council Water Race Bylaw 2007, and the WDC/WIL Licence Agreement.

The Plan is a living document which will be updated on an annual basis to incorporate WIL initiatives to improve management that are implemented each year.

2.0 WIL Mission and Values

WIL is a cooperative company established in 1998 to own and manage the Irrigation Scheme. WIL places high priority on the responsible and efficient use of water in its Scheme, and has been proactive in introducing measures and procedures to ensure continuous improvement in the operation of the Scheme. This proactive approach is embodied in WIL mission statement which is:

"To be Leaders in Water Management, providing Reliable, Economic and Sustainable Supply".

3.0 Description of the Waimakariri Irrigation Scheme

The Waimakariri Irrigation Scheme provides irrigation water to 212 shareholders utilising up to 10.5 m^3/s of water to efficiently irrigate land between the Waimakariri and Ashley Rivers. The Scheme operates in conjunction with a stockwater supply scheme. The water races used by the Waimakariri Irrigation Scheme and the stockwater supply scheme are owned by the Waimakariri District Council (WDC). The WDC has put in place a licence for Waimakariri Irrigation Limited (WIL) to construct, manage and operate an Irrigation Scheme over the existing stock water race system for the duration of the resource consents. The total length of the stockwater races is approximately 1,400 km over a command area of 44,000 ha.

Water for both schemes is drawn from the Waimakariri River through a newly constructed intake and an existing intake (now referred to as the twin intakes) located at Browns Rock. The water then passes through a sedimentation basin, prior to being distributed across to the plains via the water races. A map of the water distribution network is shown in Figure 1.

It takes up to 48 hours for water from the Waimakariri River to reach those shareholders furthest from the intake. As a consequence, requests for water, or to cease supplying water, must take the time lag into account.

Water is only available to shareholder properties at a flow rate that does not exceed their share allocation. All races have been designed for specific volumes and shareholders must take their ordered water entitlements from the designated location. Each share entitles the irrigator a maximum of 45.4 cubic metres of water in any week. When the full allocation of 10.5 m^3/s became available for irrigation use a standard allocation was made to each shareholder of 7 shares per hectare (i.e. 0.525 L/s/ha).

Shares can be traded between shareholders so that different application rates and annual volumes can occur on different properties, provided that they represent a reasonable and efficient use of water and provided that the physical capacity of the water races is sufficient to distribute the water to all shareholders. The amount of water that is used is typically in the range from 6 shares per hectare (i.e. 0.45 L/s/ha) to 9 shares per hectare (i.e. 0.675 L/s/ha).

4.0 Management of Water

The water intake and distribution network is used to supply water to the irrigators and the stockwater users (authorised by consent CRC133965 held by the WDC) and can also be used for trials of aquifer recharge using the Eyre River. The allocation of water between these different uses is distributed according to the following priorities.

A. Water Not Subject to Low Flow Restrictions from Waimakariri River

Priority	Water Use	Allocation Criteria
1st	Stockwater supply	Maintenance of existing stockwater supply. Water requirements determined from past experience up to the quantities specified in resource consent CRC133965.

B. Water Subject to Low Flow Restrictions from Waimakariri River

Priority	Water Use	Allocation Criteria
2nd	Irrigation Supply	Water requirements determined by WIL – based on areas irrigated and water application rates that are within ECan's Report U05/15/1 "Schedule WQN9 Revision: Review of seasonal use approach included in Proposed NRRP".
3rd	Filling storage reservoirs	WIL water can be used to fill on-farm storage reservoirs or scheme based reservoirs, up to an annual volume of 57,100,100 cubic metres in any 12 month period.
4th	Groundwater Enhancement	Trials of aquifer recharge can be conducted when groundwater levels are low (as indicated by a network of monitoring wells), and only when the usage of this water does not jeopardise the irrigation supply to WIL shareholders.

WIL is responsible for management of the water race system covering all water uses. This includes a management contract between WDC and WIL, covering the provision of the stockwater supplies. WIL's responsibilities include:

(a) Controlling the intake;

(b) Discharge or disposal of sediment deposited in the sediment trap;

(c) Maintenance of the races;

(d) The distribution and management of stockwater;

(e) The distribution and management of irrigation water;

(f) The discharge of water to the Eyre River, for groundwater enhancement purposes;

(g) The discharge of by-wash water to the Eyre River, the Ashley River, and the Cust Main Drain.

4.1 Control of the Intake

The Scheme intake at Browns Rock is monitored by continuous flow gauging with the measurements published on the WIL web site. The intake gate is controlled by the Operations Manager having regard to the water requirements of Scheme users and in accordance with information from ECan regarding water allocation rules.

Two other factors may control the management of the water intake:

(a) Management During High Flows in Waimakariri River

There are times of very high flow in the Waimakariri River when the suspended sediment load is so high (including the mobilisation of the river bed) that it is necessary to close the Scheme intake so as to protect the intake structure and to prevent over filling of the sediment trap and races. Such times will be kept to a minimum and will be determined by the Operations Manager based on past experiences.

(b) Management of Unforeseen Problems

An assessment of the anticipated environmental effects arising from this Scheme was prepared as part of the resource consent application. Where any adverse effects are foreseen, mitigation measures have been built into the Scheme operation. This information provides the best available assessment of the effects created by Scheme operation.

4.2 Management of the Stockwater Supply

The existing stockwater race system is essential to a great number of farms in the district which have no readily available alternative source of water for stock. It is a basic requirement of this scheme that an adequate stockwater race system will be maintained at all times during the operation of the Waimakariri Irrigation Scheme. The actual supply requirements are determined from the experience of the Operations Manager, up to a maximum rate authorised by the WDC resource consent.

A management licence has been established that protects the rights of both stockwater users and irrigators, and an Operations and Maintenance Manual details the work to be carried out under the contract between WIL and WDC.

In addition to management of the stockwater race network WIL must also manage the stockwater use of the shareholders on the irrigation races. One example of how WIL does this is the WIL Policy with respect to stock in water races. Waimakariri District Council Water Race ByLaw 2007 (Clause 3.4) states: "*No one is to permit, allow or do any of the following:… …3.4.4 Any animals to linger in a water race, but a drinking station may be provided outside the race*". Stock faeces and urine in race water is undesirable and unhygienic for other stock downstream. The nutrients produced as a result, contribute to the growth of algae and other

weeds in the water races and potentially in any natural water way which receives bywash flows from the water races.

WIL's policy is that if WIL observe anyone breaching the ByLaw it will issue a first notice requiring the landowner to erect a fence to prevent stock from lingering in the water race. In the event that the landowner does not comply with the first notice they are issued with a final notice to inform the landowner that the matter will now be referred to the Waimakariri District Council (for addressing under the rules of the ByLaw).

4.3 Management of Irrigation Supply

Each share entitles the shareholder to take a quota of 0.075 L/s. This quota is allocated as follows:

(a) an initial allocation of 7 shares per hectare was made to all current shareholders at that time, giving them an allocation rate of 0.525 L/s/ha.(b) ; The average rate that irrigation water is applied to the land, including the combined rate of application from any other water source, shall not exceed 6.5 mm/day; (c) variable allocations achieved by trading of shares between shareholders , typically within a range of 6 – 9 shares per hectare, provided that the use of the water is reasonable and efficient and that the delivery of water to all shareholders can still be achieved within the physical capacity of the water race network.

In order to promote the development of water storage and make its development more economically viable, WIL propose to allow irrigators to use their share allocation across a larger area of land, provided that irrigation is undertaken in an efficient manner. In order to achieve this WIL has lodged an application to ECan to vary the use of their water permit (consent CRC000585.9) over their irrigation command area, to allow water to be used across a wider range of properties. This is particularly required when WIL's run of the river supply is used in combination with stored water and with groundwater supplies to meet the irrigation requirements on a property. WIL is proposing the following condition, which will govern the use of WIL water for irrigation, once the application is granted:

Water may only be supplied to properties where the combined effect of the irrigation water from this consent and from any other consent held for irrigation shall comply with the following criteria:

(a) The average rate that irrigation water is applied to the land, including the combined rate of application from any other water source, shall not exceed 6.5 mm/day;

(b) The irrigation water shall be used in a manner that takes all practicable steps to:

(i) Ensure that the volume of water used for irrigation does not exceed that required for the soil to reach field capacity; and

(ii) Avoid leakage from pipes and structures; and

(iii) Avoid the use of water onto non-productive land such as impermeable surfaces and river or stream riparian strips.

WIL has put in place a management structure and procedures which ensure that it supplies water to the irrigators in an efficient manner while complying with the conditions of its resource consent. The management structure includes:

- Policy and procedures
- An ordering system
- Rostering of water use during restrictions
- Disciplinary measures

4.3.1 WIL Policy and Procedures

WIL has a series of policies and procedures to ensure best practice is adopted for the Scheme. The company's approach is to anticipate or lead developments in the irrigation industry and considers that the resource consent conditions are a standard to be exceeded, not a target to be met. With this proactive approach, WIL wishes to progress, with the support of key stakeholders, to a self-audited management system to promote efficient use of water, stream and riparian management with a focus on nutrient and load limit management.

WIL already monitors its water use carefully, along with the water use of its larger shareholders. This information is used to ensure that the Scheme minimises the water lost from the by-washes from the Scheme, and farmers only use the amount of water allocated to them. The Water Supply Agreement for shareholders includes the ability for WIL to refuse to supply farmers who breach the rules relating to water supply. These procedures enable WIL to manage its Scheme activities in a manner that is consistent with its mission statement.

4.3.2 Ordering System

A standard 48 hours notice is required from Shareholders who wish to take, or cease to take, water. This is required because it takes that amount of time for the water to travel through the system and reach all shareholders' properties. Shorter notice periods are possible in some cases with due regard being given to the lag times involved.

Requests for water are either faxed, e-mailed or sent via text messaging, to the Operations Manager and must include the following information

- Which property the water is for
- The start up time and date
- The stop time and date
- Flow rate

Water is only available to properties that have been formally identified by the shareholders and at a flow rate that matches their share allocations. All races have been designed for specific volumes and shareholders must take their ordered water entitlements from the designated location.

4.3.3 Rostering During Restrictions

The area of the Scheme has been broken up into four zones of approximately the same area. This enables restrictions to be applied in stages. For example:

- A 25% reduction means that each area in turn would have no water for two days and then have six days of water.
- A 50% reduction means that each area would have water four days and no water for four days.
- With a 75% reduction each area would only get two days of water then wait six days before water is available again.

4.3.4 Disciplinary Measures

In the event that WIL determines that a shareholder is taking water in excess of that permitted under the Water Supply Agreement WIL has instituted the following disciplinary measures:

1. In the first instance a Verbal Warning will be given.
2. In the second instance a Written Warning notating the consequences of failure to comply (refer 3, 4 and 5 below) and a requirement that an “off-race” sump be built (the Company will then install a lockable gate at the intake of the sump).
3. In the third instance a Written Notice will be issued permitting the Shareholder to elect to accept a suspension of supply for a period of 7 days (and action will then be taken to ensure that supply is immediately suspended for a period of 7 days) in lieu of the Company not exercising its right to reduce or cease the supply of water under clause 15 of the Water Supply Agreement.

4. In the fourth instance a Written Notice will be issued permitting the shareholder to elect a suspension of supply for a period of 21 days (and actions will then be taken to ensure that supply is immediately suspended for a period of 21 days) in lieu of the Company not exercising its right to cease the supply of water under clause 15 of the Water Supply Agreement.
5. In the case of further breaches or continuing breaches notices will be given, that under Clause 15 of the Water Supply Agreement, that the water supply is to be ceased permanently and the Water Supply Agreement is to be terminated.

4.4 Management of Filling Storage Reservoirs

If there is surplus water available after the stockwater and irrigation requirements have been met, water can be used to fill appropriately consented storage facilities. The construction and maintenance of storage structures is controlled by separate rules and consenting requirements than the consents currently held by WIL and it is the responsibility of the owner of the storage reservoir to demonstrate to WIL that they have the appropriate approval from both ECan and WDC to authorise their reservoir structure.

4.5 Management of Eyre River Groundwater Trials

There is no intention to carry out Eyre River Groundwater Trials in the foreseeable future. However consent CRC000585.9 allows for such augmentation of groundwater surrounding the Eyre River to occur. The following section refers to the management of such an undertaking, if it were to occur at some time in the future.

Groundwater recharge can be achieved by the discharge of water into the Eyre River bed. Trials of this water use will only occur if there is a surplus from the fundamental requirements of water supplied directly to farm properties for stockwater and irrigation purposes.

Water used specifically for recharge purposes must comply with the following requirements:

- The rate at which water is discharged shall not exceed 3 m^3/s;
- Field trials will be carried out in the August – May period;
- A discharge rate in excess of 0.5 m^3/s shall only take place in the stretch of river bed specified below when the water levels in the listed bores are lower than the specified levels.

Bore	Water Level (m below ECan measuring point)	Stretch of River Bed to be Recharged
M35/0028	8	Main Race to Steffens Road
M35/0008	3	Steffens Road to Downs Road
M35/0058	4	
M35/0193	4	Downs Road to Browns Road

- The suspended sediment concentration of the water discharged to the Eyre River shall not exceed 50 g/m^3.

Monitoring must be undertaken during any recharge trial period, including documenting the hours and flow rate of the source water and its quality (suspended solids, nitrate-nitrogen and E. coli). Monitoring of groundwater levels and groundwater quality in the receiving environment are detailed in Section 8.0.

The results of any field trials will be presented to land owners who may be affected by the Eyre River recharge.

5.0 WIL Initiatives

As stated in Section 2.0, WIL's mission is to be "Leaders in Water Management, providing Reliable, Economic and Sustainable Supply". WIL will be aiming to put into place initiatives to improve the water management to farmers and to ensure that they use the water as efficiently as is practicable.

5.1 Strategic Initiatives

WIL continues to investigate strategic initiatives to maximise the efficiency of the irrigation system and the water abstracted from the Waimakariri River. Current initiatives under investigation include:

- Storage
- Power generation
- Working with Ngai Tahu Property Ltd to achieve joint efficiencies in irrigation

5.1.1 Storage

Both WIL and some of its individual shareholders are actively investigating the use of reservoirs for the storage of water abstracted from the Waimakariri River at times of high flow to be used for irrigation when the flow in the Waimakariri River limits the water available directly from the river for irrigation. The aim is to maximise the efficient use of water and the farm production of the shareholders.

Some individual shareholders have already constructed on farm storage reservoirs that have been consented by ECan or fall within the scope of a Permitted activity. These reservoirs are filled from the WIL scheme water at times when the irrigation demand is not at its peak. Filling also occurs throughout the winter period so that reservoirs are full prior to the commencement of irrigation.

In July 2011 WIL shareholders voted to undertake detailed investigations for a scheme wide storage reservoir. This has resulted in the lodging of consent applications to construct and operate an 8.6 million cubic metre storage reservoir at Wrights Road. On 10 June 2013, Building Consent BCA122892 was approved.

5.1.2 Power Generation

The slope of the main race is flatter than that of the Waimakariri River. As a result where the main race reaches the top of the terrace there is a significant drop back to the Waimakariri River. WIL in conjunction with MainPower are investigating the possibility of generating power with a series of generators located within the main race system. Subject to resource consents, water could be diverted from the Waimakariri River and used to generate power. If this strategic initiative goes ahead it will provide generation of power local to the area where it is used.

5.1.3 Working with Ngai Tahu Property Ltd

WIL and Ngai Tahu Property Ltd are involved in discussions regarding combined intake and race enlargements to efficiently utilise the consents held by each party. WIL is able to play a management role in the delivery of water to the Ngai Tahu Property irrigation areas. The construction of a new intake at Browns Rock, adjacent to the WIL intake to enable the abstraction of water authorised by consent CRC052033.2 is completed. An application to vary that consent and the WIL consent has been lodged with ECan to allow a more consistent management approach to apply to water abstracted at Browns Rock.

5.2 2013 Operational Initiatives

WIL has undertaken the following initiatives to improve the overall efficiency of the Scheme:

- The installation of flow meters and telemetry on five remaining takes > 20 L/s
- The installation of flow meters on select on farm storage ponds at the abstraction point from the irrigation race to better manage on farm stored water.
- In conjunction with Irrigation NZ WIL has developed an Environmental Management System (EMS) to enable shareholders to undertake and demonstrate active, positive management to protect and enhance the environment. The EMS is currently being developed as a web based application. In addition and in conjunction with PDP, MWH and NIWA each shareholder property is being spatially represented onto a digital mapping system which is a key component of the EMS. In conjunction with the Waimakariri Zone Committee (WZC) the EMS is being piloted of six farms.
- WIL is working with the WZC to assist informing shareholders of the proposed ASM programme and promoting best practise nutrient management and water use efficiency.
- The installation of two additional stilling wells to measure flow within the race system.

- The development of a web based programme whereby shareholders can more efficiently trade shares and transfer water to improve water use efficiency.

6.0 Monitoring of Water Quality and Quantity

WIL carry out water quality and quantity monitoring to:

- determine the water usage of individual irrigators to assist in determining the efficiency of on farm usage as required by the resource consent and compliance by shareholders with their Water Supply Agreement (including ongoing surveys of farmers water use and efficiency of operation),
- determine the impacts that irrigation is having on the environment, particularly groundwater.

This monitoring is discussed in the following sections.

6.1 Monitoring of the Scheme Intake and Distribution System

The monitoring of the intake and water race system by WIL consists of the following measuring and flow control points:

- Automatic Flow Monitoring

There are 13 points on the race network where flows are monitored continuously. This includes the flow monitoring point immediately downstream of the sediment ponds which controls the flow taken from the Waimakariri River. The information from these monitoring points is telemetered back to WIL offices. The positions of these flow monitoring devices are shown on Figure 1.

- Automatic Flow Control

At the same 13 points where flow monitoring is carried out are flow control devices. These are adjusted remotely from the WIL office or vehicles to control the flow to respective parts of the race network where water is required for irrigation.

- Manual Flow Control

There are approximately 50 points on the irrigation races where there are manually adjusted gates. These gates are adjusted to match the flow required by irrigators downstream of the gate.

- Manual Flow Gauging

The gauging at each of the 13 flow monitoring sites is checked manually three times per year. The contract to gauge these sites is currently held by NIWA. If required the control mechanism of the automatic devices is altered based on these manual measurements.

The monitoring and flow control systems enable WIL to effectively and efficiently manage the distribution of water required by shareholders throughout the Scheme.

6.2 Monitoring of Groundwater Effects

Groundwater effects may occur due to changes in groundwater levels and groundwater quality.

6.2.1 Monitoring of Groundwater Level Effects

Groundwater level changes resulting from Scheme activities will be caused by changes in groundwater recharge due to irrigation usage and groundwater recharge trials.

WIL will monitor the following water inputs:

- The flow taken into the Scheme at Browns Rock;
- The flow used for artificial recharge trials.

This data will provide an indication of the input to the groundwater resource created by the Scheme.

The response of the groundwater system to these new inputs can be observed from measurements of groundwater levels in monitoring bores. Bores that have a historical record of monitoring by ECan will be used to assess Scheme impacts. At the present time, the monitoring network is for the boreholes listed in the following table. Changes may need to be made to this list depending on the availability and suitability of boreholes. If changes to the bore monitoring network are required they will be made with an aim to maintaining the same distribution of monitoring points as listed below.

Borehole Number	Depth (m)
L35/0004	12.0
L35/0051	75.9
M34/0306	10.3
M35/0008	14.6
M35/0017	12.9
M35/0026	16.8
M35/0058	11.0
M35/0143	29.0
M35/0174	45.7
M35/0222	13.7
M35/0312	9.1
M35/0637	10.7
M35/4757	21.7

The frequency of water level measurements in these boreholes will be the same as that used by Environment Canterbury to identify seasonal trends in groundwater level fluctuations.

The location of these boreholes is shown on Figure 2.

6.2.2 Monitoring of Groundwater Quality Effects

The main groundwater quality parameters of concern related to irrigation development arise from increased concentrations of nitrate-nitrogen and E. coli concentrations. In addition, there is a contrast in chloride concentrations between existing groundwater quality and Waimakariri River water. Chloride is particularly mobile in the subsurface environment and therefore may prove to be a useful indicator of any effect arising from the application of irrigation water from the Scheme.

Where feasible, the bores that are monitored are those which tie in with ECan's existing monitoring programme for this area. At present, one of the regularly sampled bores (M35/0132) is sampled by ECan.

In order to determine water quality impacts six monthly sampling is carried out prior to, or at the start of, the irrigation season (August-September) and towards the end of the irrigation season (April-May). This monitoring is timed to match the maximum variation with any impacts that may be caused by the Irrigation Scheme.

The groundwater quality sampling is undertaken for nitrate-nitrogen, E. coli, chloride, ammoniacal-N, pH and electrical conductivity.

Bore Number	Sampling Frequency	Depth (m)
L35/0349	Monthly	20.0
M35/0132	Monthly	20.4
M35/4682	Monthly	15.8
M35/0731	Twice a year	21.5
M35/0008	Twice a year	14.6
M35/2711	Twice a year	21.7
M35/4757	Twice a year	21.7
M35/4795	Twice a year	13.8
M35/5440	Twice a year	20.9
M35/5869	Twice a year	20.5
M35/6385	Twice a year	40.2
M35/6639	Twice a year	15.5

The location of these bores is shown in Figure 3.

6.3 Demonstrating the Efficiency of Individual Irrigation Shareholders

Condition 12 of resource consent CRC000585.9 requires that the efficiency of the irrigation on shareholder properties is evaluated at least once every five years. Therefore, in any one year it is planned to evaluate approximately 20% of the properties. The exact number will depend upon access to the properties, and responses to the survey requests.

To demonstrate the efficiency of the individual shareholders, a combination of on-farm inspections and email/phone surveys will be carried out. It is generally intended to carry out on-farm inspections for all properties using 700 shares or more and email/phone survey for properties using less than 700 shares. The number of actual properties subject to email/phone or site surveys will depend on a number of factors, including an individual's response to previous surveys; any checks that WIL wish to carry out on a particular property; and any general compliance objectives that WIL may determine.

Details of the number of farms surveyed, their size, and whether they are subject to site inspections or email/postal surveys will be provided in the annual report discussed in Section 8.0 below.

It is intended that the surveys of the farmers shall be carried out during the irrigation season each year. The analysis of the data also includes a consideration of the theoretical requirements of the scheme compared to the water that was actually taken, which is subject to river intake restrictions.

To facilitate full and frank disclosure, information will be obtained on the basis that it will not be released by WIL and WIL's consultants except in a form that does not identify the specific farmer or the property.

The two types of survey – site inspection and postal/phone survey are detailed below.

6.3.1 Site Inspection

The process for the site inspection will be:

- Contact farmer to arrange date for site inspection and confirm contact details (this contact may be by phone or email).
- Email survey form out to farmer prior to site visit. The site survey form is included in Appendix B.
- Carry out site visit to collect information from farmer and view the irrigation system in operation.
- Collate information.
- If necessary, report back to farmers with any suggestions for improvements that could be made to their irrigation management.

6.3.2 Postal Survey

The process for the phone/email inspection will be:

- Email details of the information required from the farmer. The survey form is included in Appendix C.
- Farmer fills out form and return by email.
- Where necessary, phone farmers to collect details, request replies or verify information.
- Collate information.
- If necessary, report back to farmers with any suggestions for improvements that could be made to their irrigation management.

7.0 Distribution of Educational Material

WIL works closely with Irrigation New Zealand, NIWA, professional consultants and other agencies to obtain information on the operation of efficient irrigation systems. This material is made available to shareholders in the WIL newsletters (which are issued quarterly), workshops, shareholder meetings and briefings by NIWA, consultants and other agencies.

WIL through the new website will facilitate the distribution, to its shareholders, of the bi-monthly Irrigation New Zealand newsletter. The annual report collating the environmental monitoring and water usage of the Scheme required in Resource Consent CRC000585.9 is made available to shareholders.

WIL have worked closely with Biosecurity New Zealand with respect to Didymo in the Scheme. Shareholders and Waimakariri District Council have been briefed regarding risks associated with Didymo in the Scheme. To date, whilst Didymo spores have been found in the river there has been no significant build up of Didymo biomass in the river.

Information regarding consenting requirements for on-farm storage has been presented to shareholders to ensure they are aware of their responsibilities.

8.0 Compliance with Resource Consent Conditions

The following management measures have been implemented to achieve compliance with resource consent conditions. The relevant consent conditions are listed below each management point.

(a) All works in the river bed shall be undertaken by machinery which, as far as is practicable, will not enter river channels containing flowing water. The contractor undertaking this work will be informed of this requirement. Compliance with consent conditions will form a part of the contract conditions.

- CRC952566.1 - Condition 1

(b) ECan must be notified at least two days in advance of any works to disturb the river bed.

- CRC952566.1 - Condition 2

(c) Inspections of the fish screen shall be carried out by the Operations Manager at weekly intervals for first 12 months and after any significant flood flows in the Waimakariri River (>1000 m^3/s). If the screens become ineffective, WIL will notify ECan and North Canterbury Fish and Game Council within 24 hours and will commence remedial measures on the fish screen. The frequency of fish screen inspections will be reviewed after the first 12 months of operations.

- CRC952568.1 - Condition 8

- CRC000585.9 - Condition 8

(e) The intake gates will be controlled by the Operations Manager based on information provided by ECan regarding water sharing rules.

- CRC000585.9 - Conditions 4-7

(f) Groundwater recharge will be undertaken following checks on groundwater levels in bores M35/0028, M35/0008, M35/0058, and M35/0193. The results of this monitoring will determine times when groundwater enhancement can be carried out.

- CRC952571.1 - Condition 2

(g) Sampling of discharge water entering the Eyre River for the purposes of groundwater recharge shall be analysed at monthly intervals for sediment concentrations, nitrate-nitrogen and faecal coliforms. Samples will be collected from the water race channel prior to entry in to the river bed.

- CRC952571.1 - Conditions 4 and 5

(h) Monitoring of groundwater levels, groundwater quality, and liaison with landowners will be undertaken as part of the Eyre River recharge trials.

Monitoring in the receiving environment is described in Section 8.0 of this plan. Liaison with land owners will be undertaken through the preparation of a report on the recharge trials which will be distributed to all property owners who are affected by the recharge. These property owners will be asked to provide comments on the report. Depending on the level of interest, a public meeting may be held to facilitate this liaison.

- CRC952571. Conditions 6 and 7

(i) An annual monitoring report will be provided to ECan by July 31st each year providing the following details:

- Results from monitoring groundwater levels and groundwater quality;
- The hours and rate at which water is taken from the Waimakariri River;
- Results from sampling in Waimakariri River at times of sediment pond discharge;
- The hours and rate at which water is discharged to the Eyre River for aquifer recharge purposes;
- Recommendations for future monitoring.

- CRC000585.9 - Condition 9

- CRC952571.1 - Conditions 3, 5, 6

- The annual review conditions on all consents

(l) An annual report shall be prepared which collates the shareholder survey information, along with an estimate of total water usage consistent with the requirements of resource consent CRC000585.9. Rainfall and evapotranspiration records for the irrigation season will be compared to longer term records to determine the significance of the surveyed season compared to peak demand requirements. River flow records will also be compared with longer term records to evaluate the significance of the water flow restrictions for the year. An estimation of annual water usage will be prepared based on information from surveyed farms. Where possible this estimate shall be calibrated with actual usage (as determined from properties with flow meters). This shall be prorated across the entire Scheme to provide an estimate of the annual volume of water used. Based on the comparison of the rainfall and ET data for each year, with regional averages, the relationship of the season to dry years shall be determined. From this the typical maximum volume will be calculated.

The annual report shall be prepared at the end of the irrigation season for presentation to Environment Canterbury by 30 June each year. In addition to information about the water usage the management plan will also be updated to include any initiatives WIL has incorporated into the management of the Scheme in the past year.

- CRC000585.9 - Conditions 12 and 13

9.0 Measures to be Implemented Following Non-Compliance with Conditions Dealing with Discharges and Fish Screen

It is not envisaged that any non-compliance with consent conditions will occur.

WIL will implement the following measures should any non-compliance with conditions occur:

(1) Take immediate preventative or remedial measures to avoid adverse effects, in accordance with Section 330 of the RMA;

(2) Take action to restore a situation where compliance continues to occur.

10.0 Mitigation of Effects on the Groundwater Environment

Any effects on groundwater arising from the scheme activities are expected to relate to groundwater levels, groundwater quality and surface water quality. Should any adverse effects arise in these areas the first step would involve an investigation as to the cause of the adverse effect and whether or not it is related to Irrigation Scheme activities.

If it is related to Scheme activities then the following mitigation measures can be considered:

- Raised groundwater levels causing drainage problems
  - identify and rectify any water usage practices which are causing excessive groundwater seepage
  - modify aquifer recharge practices
  - discuss drainage network operations with WDC to see if works can be effectively implemented to intercept high water tables
- Deteriorating groundwater quality
  - consider modifications to water usage practices
  - modify aquifer recharge practices
  - promote and encourage efficient fertiliser applications and other farming practices which avoid adverse groundwater quality effects
  - discuss with WDC the options for alternative water supply sources
- Deteriorating surface water quality
  - identify causes and eliminated sources of poor water quality
  - implement further treatment measures prior to discharge

Appendix A

Figures

Appendix B

Site Inspection Form

Irrigation Survey - Site Inspection Form

Waimakariri Irrigation Limited (WIL) is required to survey all irrigation operations as part of the management of the resource consent for water abstraction from the Waimakariri River. Each year approximately 20% of the shareholders need to be surveyed.

This year you have been selected for a site inspection survey. Please fill out as much of the form as possible prior to the site inspection. You will be contacted to arrange a time to inspect the irrigation system. This site inspection is expected to take about an hour.

Property Details

Shareholder Name/WIL Shareholder Number:

Address:

Phone/Fax:

Email:

Number of Shares Owned:

Number of Shares Leased to Other Parties: ..... Name/Shareholder ID:.

Number of Shares Leased from Other Parties:. Name Shareholder ID: .

Total Number of Shares Applying to This Farm: .....

Total Land Area of Farm (ha): .....

Source of Irrigation (Water Allocation (l/s) / Area Irrigated (ha) / Application rate)

Bore .....

WIL Scheme .....

Effluent .....

Total Area of Land Being Irrigated (ha): .....

Race Location e.g. M1, R1B:

Land Use Percentage e.g. dairy, sheep/beef, crops:

Dairy		Orchard/vineyard	
Sheep/beef		Nursery	
Cattle		Lifestyle	
Mixed Cropping		Other	
Total	100%		

The information supplied by you will only be released by WIL or WIL's consultants in a form that does not identify you or the specific property.

Stock Units or Area:

DAIRY		CATTLE		OTHER STOCK (type /no)	
Peak. cows milked		Cows			
Cows milked in winter Y/N		R1 & R2 cattle			
No cows wintered off farm		Cattle trading Y/N		CROPS	
No: R1 &/or R2 heifers grazed on farm		Winter grazers		Ha in annual crop	
		Young stock dairy support		Standard Crop rotation (example rotation)	
SHEEP		DEER		Other - vineyards, orchards etc (describe)	
Ewes		Hinds			
Hoggets		R1 & R2 deer			
W.lambs Lamb trading Y/N		Velveting stags			

Farm Manager (where different to shareholder):.....

Address:.....

.....

Phone/Fax:.....

Email: .....

No: of staff.....

Person Responsible for Implementing Farm Environment Plan.....

Person Responsible for Managing Water Use.....

List any Resource Consents held for this property.....

Environmental Details

1. Map of Property

2. Can you please provide us with a map of the property identifying the areas being irrigated?

3. Alternatively, at the site visit, the PDP staff member will bring a map of your farm so that the irrigable areas can be identified during the site visit.

Are you aware of differing soil types on your farm: .....

If so, can you name or describe them (e.g. light or heavy)

1) .....

2) .....

3) .....

Do you take into account different soils during your irrigation practices (e.g. reduced rates for lighter soils), if yes please explain.....

.....

Do you take into account different soils during your farming practices (e.g. wintering off certain areas, avoid pugging susceptible areas)), if yes please explain

.....

.....

Do you take into account the location of waterways and streams during your farming practices. If yes, how so? (e.g. Fencing off areas, avoid irrigation fert runoff entering water etc).....

.....

Nutrient Management

Nutrient budget prepared by:(Person, company):.....

Current farm nutrient losses: N kg/ha.....

Current farm nutrient losses: P kg/ha.....

N loss target (if known): kg/ha .....

N loss target (if known): kg/property.....

Irrigator Design and Operation Details

4. Irrigator Type

Please can you fill in the table below with the details of your irrigators? Part A allows for details on the larger irrigators such as the centre pivots and guns, while Part B is for details on the smaller irrigators you may have such as K-line.

a) Centre Pivots, Linear, Briggs, Guns etc			
	Irrigator 1	Irrigator 2	Irrigator 3
Make			
Model			
Run Length (m)			
Wetted Width (m)			
Application Rates (mm/hr)			
Travel Speed (m/hr)			
Return Period (days)			
Days Irrigated per Return Period			
Hours of operation (Hours per day)			

b) K-Line, Sprinklers, Long Line Laterals, Set line etc			
	Irrigator 1	Irrigator 2	Irrigator 3
Make			
Model			
Length (m)			
No of pods			
Return Period (Days)			
Days Irrigated per Return Period			
Hours of operation (Hours per day)			

The information supplied by you will only be released by WIL or WIL's consultants in a form that does not identify you or the specific property.

5. Is effluent spread? details.....

6. Irrigation Designer:.....

7. Irrigation Efficiency Practises (e.g. end guns/ avoid application to non-target areas (tracks, impermeable surfaces, rivers streams) etc.) .....

.....

8. Pump Rate (L/s):

   a) Pump 1 .....

   b) Pump 2 .....

   c) Pump 3.....

9. Do you undertake Soil Moisture Monitoring?

   a) Manual e.g. digging holes Yes / No

   b) Instrument (specify type) e.g. neutron probes

   Yes / No Type:.....

10. How do you determine the soil moisture trigger point to start and stop irrigation?

   a) Manual measurement Yes / No

   b) Instrument measured Yes / No Type:.....

   % PAW ..... Or soil moisture: .....

   c) Follow neighbours lead Yes / No

   d) Use past experience Yes / No

11. Inspect Irrigation System in Operation

   Leakages Yes / No

   If yes, discuss.....

   .....

   .....

12. Irrigation of Non-Productive Land Yes / No

   If yes, discuss.....

   .....

13. What methods are used to determine if the irrigator is being supplied with water at the correct flow rate and pressure?

   .....

   .....

Appendix C

Postal Survey Form

Irrigation Survey – Postal Survey Form

Waimakariri Irrigation Limited (WIL) is required to survey all irrigation operations as part of the management of the resource consent for water abstraction from the Waimakariri River. Each year approximately 20% of the shareholders need to be surveyed.

This year you have been selected for a postal survey. Please fill out the form and return to us. We may contact you to verify the information you returned to us.

Property Details

Shareholder Name/WIL Shareholder Number:

Address:

Phone/Fax:

Email:

Number of Shares Owned:

Number of Shares Leased to Other Parties: ..... Name/Shareholder ID:.

Number of Shares Leased from Other Parties:. Name Shareholder ID: .

Total Number of Shares Applying to This Farm:.....

Total Land Area of Farm (ha): .....

Source of Irrigation (Water Allocation (l/s) / Area Irrigated (ha) / Application rate)

Bore .....

WIL Scheme .....

Effluent .....

Total Area of Land Being Irrigated (ha):.....

Race Location e.g. M1, R1B:

Land Use Percentage e.g. dairy, sheep/beef, crops:

Dairy		Orchard/vineyard	
Sheep/beef		Nursery	
Cattle		Lifestyle	
Mixed Cropping		Other	
Total	100%		

The information supplied by you will only be released by WIL or WIL's consultants in a form that does not identify you or the specific property.

Stock Units or Area:

DAIRY		CATTLE		OTHER STOCK (type /no)	
Peak. cows milked		Cows			
Cows milked in winter Y/N		R1 & R2 cattle			
No cows wintered off farm		Cattle trading Y/N		CROPS	
No: R1 &/or R2 heifers grazed on farm		Winter grazers		Ha in annual crop	
		Young stock dairy support		Standard Crop rotation (example rotation)	
SHEEP		DEER		Other - vineyards, orchards etc (describe)	
Ewes		Hinds			
Hoggets		R1 & R2 deer			
W.lambs Lamb trading Y/N		Velveting stags			

Farm Manager (where different to shareholder):.....

Address:.....

.....

Phone/Fax: .....

Email: .....

No: of staff.....

Person Responsible for Implementing Farm Environment Plan.....

Person Responsible for Managing Water Use.....

List any Resource Consents held for this property.....

Environmental Details

Are you aware of differing soil types on your farm: .....

If so, can you name or describe them (e.g. light or heavy)

1) .....

2) .....

3) .....

The information supplied by you will only be released by WIL or WIL's consultants in a form that does not identify you or the specific property.

Do you take into account different soils during your irrigation practices (e.g. reduced rates for lighter soils), if yes please explain.....

.....

Do you take into account different soils during your farming practices (e.g. wintering off certain areas, avoid pugging susceptible areas)), if yes please explain.....

.....

Do you take into account the location of waterways and streams during your farming practices. If yes, how so? (e.g. Fencing off areas, avoid irrigation fert runoff entering water etc).....

.....

Nutrient Management

Nutrient budget prepared by:(Person, company):.....

Current farm nutrient losses: N kg/ha.....

Current farm nutrient losses: P kg/ha.....

N loss target (if known): kg/ha .....

N loss target (if known): kg/property.....

Irrigator Design and Operation Details

1. Irrigator Type

Please can you fill in the table below with the details of your irrigators? Part A allows for details on the larger irrigators such as the centre pivots and guns, while Part B is for details on the smaller irrigators you may have such as K-line.

a) Centre Pivots, Linear, Briggs, Guns etc			
	Irrigator 1	Irrigator 2	Irrigator 3
Make			
Model			
Run Length (m)			
Wetted Width (m)			
Application Rates (mm/hr)			
Travel Speed			

The information supplied by you will only be released by WIL or WIL's consultants in a form that does not identify you or the specific property.

(m/hr)			
Return Period (days)			
Days Irrigated per Return Period			
Hours of operation (Hours per day)			

b) K-Line, Sprinklers, Long Line Laterals, Set line etc			
	Irrigator 1	Irrigator 2	Irrigator 3
Make			
Model			
Length (m)			
No of pods			
Return Period (Days)			
Days Irrigated per Return Period			
Hours of operation (Hours per day)			

2. Is effluent spread? details.....

3. Irrigation Designer:.....

4. Irrigation Efficiency Practises (e.g. end guns/ avoid application to non-target areas (tracks, impermeable surfaces, rivers streams) etc.).....

   .....

5. Pump Rate (L/s):

   a) Pump 1 .....

   b) Pump 2 .....

   c) Pump 3.....

6. Do you undertake Soil Moisture Monitoring?

   a) Manual e.g. digging holes Yes / No

   b) Instrument (specify type) e.g. neutron probes

   Yes / No Type:.....

7. How do you determine the soil moisture trigger point to start and stop irrigation?

   a) Manual measurement Yes / No

   b) Instrument measured Yes / No Type:.....

   % PAW ..... Or soil moisture: .....

   c) Follow neighbours lead Yes / No

   d) Use past experience Yes / No

8. What methods are used to determine if the irrigator is being supplied with water at the correct flow rate and pressure?

   .....

   .....

Appendix D

Resource Consents