

REPORT

HURUNUI COMMUNITY WATER
DEVELOPMENT PROJECT

Stage 1A
District Scoping Summary Report
Final



Tonkin & Taylor

ENVIRONMENTAL AND ENGINEERING CONSULTANTS



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Executive summary

This report has been prepared for the Hurunui Community Water Development Project Working Group (the Working Group) to summarise the District Scoping Study report completed by Tonkin & Taylor in 2004, and to consider a smaller scale development.

The Working Group comprises representatives of the following:

- Hurunui Irrigation and Power Trust
- Esk Head Owners
- Ngai Tahu Property Limited
- MainPower New Zealand Limited
- Enterprise North Canterbury (HCWDP Project Co-ordinator)

The Working Group acknowledges the funding contribution provided by the Sustainable Farming Fund.

It is intended that this report will become a discussion document to assist the Working Group to consult with interested parties on various aspects of possible development options and the appropriate way forward.

The initial District Scoping Study investigated options to potentially irrigate a net area of 61,640 hectares, comprising 40,840 hectares in the Hurunui catchment and 20,800 hectares in the Waipara/Kowai catchments. Subsequently a scaled down, staged scheme has been considered a more cost effective approach.

Short listed storage sites include storages located at Lake Sumner (by managing the natural fluctuation in lake level), on the Hurunui River South Branch, Mandamus, Pahau and the Waitohi rivers. Aside from the South Branch, each of these storages has insufficient capacity to serve demand so the individual storages are combined into various development options. In addition to an initial engineering assessment, the storage sites were considered from an environmental and cultural perspective.

Five development options have been derived to provide a secure irrigation supply to serve a reduced area of some 38,890 hectares. The required storage forms a substantial part of the development cost and the volume required is dependent upon the flow regime applied to a particular option. Storages have been assessed against the existing and proposed Mosley flow regimes (per ECAN report, Hurunui River: instream values and flow regime, Reference 3). Primary distribution would utilise existing water courses where appropriate in addition to open races.

All of the storage sites have different levels of risk associated with development on that site, including the likes of engineering and geological matters given the nature of the initial assessments, environmental and cultural issues, consentability, land purchase and access.

Primary scheme costs (ie excluding on farm costs) as at November 2005 (for 38,890 hectares) range from:

- Existing Flow Regime \$3,100/ha to \$4,550/ha
- Mosley Flow Regime \$2,700/ha to \$3,650/ha

Development costings are heavily dependent upon the Hurunui River flow regime constraints. The initial study brief prescribed a focus on the Existing flow regime. However, for completeness, and to put this matter into context, consideration of the proposed Mosley flow regime was subsequently included. Brief discussion on the consented Amuri Irrigation Company flow regime is also provided.

The reported costs are based on the prior June 2004 District Scoping Study and have been increased by 30% to reflect typical November 2005 market conditions. Storage costs range from \$0.30/m³ to \$0.67/m³ under the Mosley flow regime and \$0.35/m³ to \$0.83/m³ under the existing flow regime. It is expected that with a more favourable flow regime such as the Amuri Irrigation Flow Regime, storage costs would be expected to reduce further.

Any development is heavily dependent upon ECAN's recently notified Natural Resources Regional Plan (NRRP), particularly as it progresses towards becoming operative. This report provides a brief overview of the NRRP and summarises the Working Group's submission.

The desk top study concludes that the potential exists for a viable large scale water management project in the Hurunui District, and that further investigations are warranted.

1 Introduction

1.1 Background

The Hurunui Community Water Development Project Working Group (the Working Group) previously commissioned a Tonkin & Taylor (T&T) led team to complete a District Scoping Study (DSS, Reference 1) to identify and report on the following:

- define apparent ultimate irrigation potential in the Hurunui catchment
- examine potential irrigation sources with an assessment of how the available water is best utilised, including taking account of storage
- desk top identification and evaluation of storage options initially for the Existing flow regime and subsequently the proposed Mosley flow regime
- associated assessment of planning, environmental, cultural and socio-economic matters

The DSS report summarises the first phase of a proposed three phase pre-feasibility study. Appendix A contains a relatively brief overview of the DSS, updated slightly to take account of the proposed Natural Resources Regional Plan (NRRP Reference 2). The following sections describe subsequent developments with implications in terms of possible additional scheme options.

1.2 Developments Subsequent to the DSS

Subsequent to the completion of the DSS, Environment Canterbury (ECAN) has notified a new proposed Regional Plan, the NRRP. Additionally, the Working Group have assessed that pursuing a more modest and focused staged scheme is more cost effective and is therefore the preferred way forward. Key reasons for this approach include:

- a smaller demand area is able to apply water more reliably from the available run of river water supply on a per hectare basis
- the cost of the primary distribution works is reduced for a demand area located immediately adjacent to the point of supply
- the total size and associated cost of storage is reduced as more cost effective storage is able to be utilised in the first instance

At the time the DSS was undertaken, there was uncertainty regarding ECAN's intentions for a future Hurunui River flow regime. The potential supply available both for run of river abstraction and impoundment in storage, all with associated cost implications, is heavily dependent upon the allowable quantity of water available for abstraction, use and diversion to storage. Previous work with resulting development options, was complicated by uncertainty in future minimum flow constraints. The DSS report therefore refers to the Existing, the proposed Mosley flow regime and the regime associated with the existing Amuri Irrigation Company Consent.

At the time the DSS was completed, there were no statutory provisions in place setting out minimum flows in the Hurunui River. The prior 1980 Hurunui River Water Management and Allocation Plan had expired in 1990, and its provisions were excluded from the ECAN Transitional Plan. Nevertheless, it was understood that ECAN retained the provisions of the 1980 document as policy via a 1989 Council resolution (statutory weight unclear). This is referred to as the Existing flow regime. Furthermore, Mosley (Reference 3) proposed an alternative flow regime and, although the Mosley regime was

not a statutory provision at the time of the Stage 1 study, the Mosley regime was broadly addressed in the DSS report, given that it was assessed as being ECAN's favoured way forward in terms of the future Hurunui River flow regime and therefore likely to be incorporated into the NRRP. Additionally, at the time of the DSS, ECAN was consulting with various community groups to assist in defining a future flow regime.

Concurrent with the time of writing this report, ECAN has published a report titled, Draft Staff Report on Hurunui and Tributaries Proposed Flow and Allocation Management Regime (Reference 4). This report recommends the Mosley regime be adopted in terms of NRRP Policy WQN 3 & 4. ECAN also proposes that per NRRP Policy WQN 3, the minimum Hurunui River flow (at the Mandamus recorder site) be raised in five years time to 20 m³/s year round if the existing water quality issues that ECAN describes remain unresolved. The outcome of this process is expected to result in a further variation to the NRRP being notified.

The proposed NRRP indicates that following further work, a Hurunui River management regime will be incorporated into schedule WQN1 of the NRRP. The recent ECAN report is part of this ongoing process to determine an appropriate flow and allocation management regime.

While noting the draft nature of the recent report, and that the NRRP is still under submission, the ECAN report sets out ECAN's preferred intentions for the potential future Hurunui River minimum flows. This summary report takes account of the possible future statutory framework in terms of minimum flows by comparing the impact of both the Existing flow regime and the proposed Mosley Flow Regime on potential development.

1.3 Data limitations

This early stage of study is heavily based on the DSS work and the Stage 1 qualifications apply to this further work.

As was the case during the DSS, this Stage 1A report is a desk study exercise based on the published information available for the initial work in addition to a brief account of the recent ECAN publications previously referred to (References 2 & 4).

While this approach is acceptable to identify preliminary development options with best potential, and to put indicative costs into relative context, it must be appreciated that this approach does constrain the accuracy of this work and the DSS. Appendix B, Stage 1 and 1A - Primary Constraints, lists the key limitations in more detail.

Notwithstanding the above, the reported work does, however, give a realistic initial assessment of potential development options, including relative cost effectiveness and, an initial assessment of consentability of the preferred options.

2 Staged scaled down development

2.1 Introduction and scope

The motivation behind the scaled down development in terms of defining a more cost effective project is broadly set out in Section 1.2. The following sections summarise previous relevant work, and, illustrate how development options derived as part of the DSS, can be adapted to suit the more focused Stage 1A approach.

2.2 Demand and storage requirements

The DSS split demand into a number of geographical regions and the following areas, derived for the DSS, have been included in the Stage 1A reassessment and are set out in table 2.1. The extent of these areas is illustrated in Figure 2.1.

Table 2.1 – Scaled down development ultimate demand

Area	Peak Flow Rate ¹ (m ³ /s)	Net Irrigable Area ² (ha)	Net Storage Requirement ³ – Mosley Regime (x10 ⁶ m ³)	Net Storage Requirement ³ – Existing Regime (x 10 ⁶ m ³)
AICL Balmoral Scheme from the Hurunui River (security of supply)	5.0	5,240	9.3	9
Areas adjacent to the Balmoral Scheme	1.2	2,130		
Balmoral Forest	4.2	7,320	10.5	12
Hawarden – North of Waitohi River	2.9	5,030	9.2	11
Hawarden – South of Waitohi River	5.1	8,960	19	26
Scargill Valley	2.7	4,700	16	21
Upper Waipara Area Masons Flat and Pyramid Valley	3.2	5,510	19	26
Total	24.3	38,890	83	105

- 1 Peak flow rates include an allowance of 15% extra over the assessed reported on farm demand to account for system losses and, aside from the AICL scheme, do not reflect current uses.
 - 2 Per previous work net irrigable area is assessed as 80% of gross map area. The estimate of potentially irrigable area includes areas which are currently irrigated via existing consents. Due to the nature of the Hurunui, Waitohi and Waipara Rivers, many of the existing consents have a low level of reliability and as such it was assumed that existing consent holders will want to be part of any future storage scheme in order to improve their reliability of supply. This matter will be resolved as part of further studies.
 - 3 Based on the adopted Stage 1 criteria and associated assessment to provide storage to meet the 90 percentile demand year, hierarchy of areas to be served determined by the Working Group.
- Note: The net storage requirements for the Amuri Regime will be less than that required by the Mosley regime.

Additional information is provided in the DSS report setting out the assessed DSS demand in terms of the assumed extent of irrigable land together with details regarding initial water balance modelling, essentially based on the Lincoln Environmental Irrigation demand scheduling model utilising the following data:

- published evapotranspiration data
- soil moisture holding capacity
- rainfall
- likely crop/pasture demand
- Hurunui River daily time series flow data (recorded at Mandamus) with limitations regarding river flow available for diversion, either to storage or direct to irrigation

Figure 2.1 following, puts into perspective the progressive increase in cumulative storage demand as irrigable area is progressively developed. Figures 2.3 and 2.4 illustrate storage demand specific to the ultimate development of the scaled down scheme for the Existing and Mosley flow regimes respectively.

These 3 figures clearly show the progressive increase in the relative reliance on storage and provide an indication of the sensitivity of the required storage to the adopted flow regime. However, for any benefit to irrigation from the Mosley regime to be realised, extensive storage development would be necessary to ensure reliable access to water given the higher minimum flows. It is important to note the data presented in Figures 2.2 and 2.3 is based on the Mosley flow regime applied to data measured at the Mandamus flow recorder site. Development of some sites, for instance the favoured South Branch site, is potentially constrained by NRRP policy WQN2 which implies a likely requirement for flow sharing extra over the Mosley flow regime and this policy could impact upon achievable storage characteristics (potentially demand and supply).

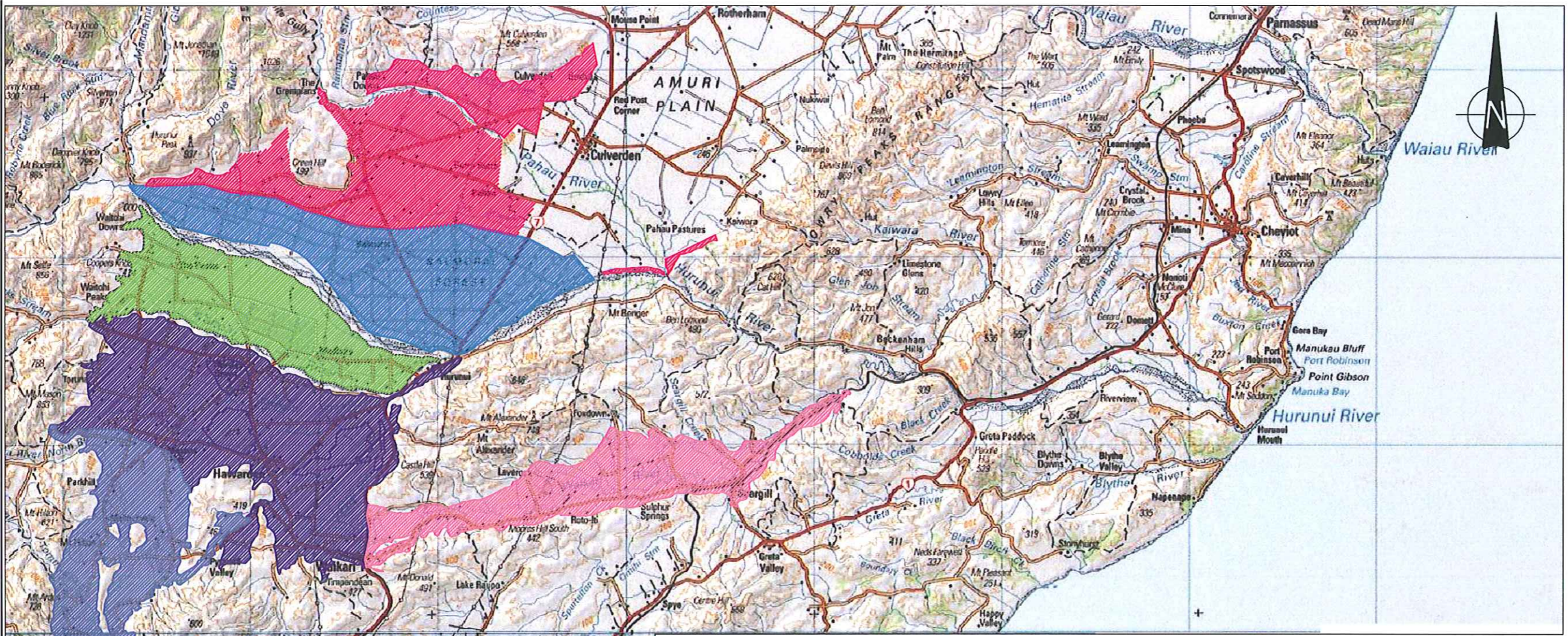
At the time of writing this report, and based on limited scheme promotion, it is understood that landowners with some 15,600 ha (approximately) in the Hawarden, Upper Waipara/Masons Flat/Pyramid Valley and Scargill Valley have expressed interest in the proposed scheme (this represents approximately half the identified irrigable land in this area).

Based on the foregoing, it is apparent that for ultimate development of the focused area (security of supply for the existing AICL Balmoral Scheme, Balmoral Forest, Hawarden, Upper Waipara/Masons flat/Pyramid Valley and the Scargill Valley) to meet the assessed 90 percentile demand, some $83 \times 10^6 \text{ m}^3$ of net storage is required based solely on the Mosley flow regime.

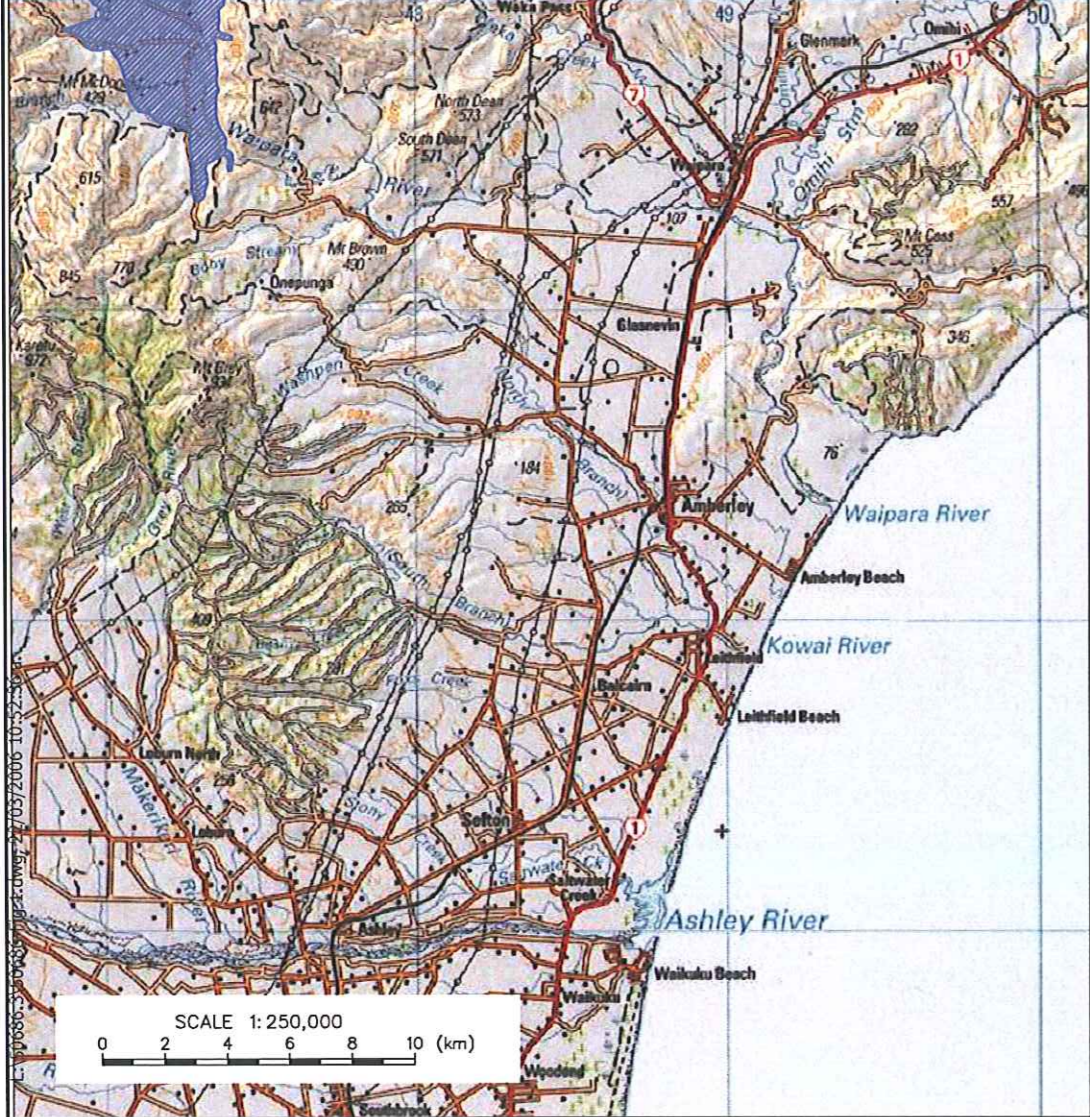
The required net volume would increase to, in the order of, $105 \times 10^6 \text{ m}^3$ if the existing flow regime (per current ECAN policy) is maintained, given it contains flow sharing provisions above the minimum flows.

The required volume of storage would decrease if a flow regime per the existing Amuri Irrigation company consent (often referred to as the Amuri (Jowett) regime) is able to be utilised, and conversely, it would increase if the year round $20 \text{ m}^3/\text{s}$ minimum flow, recently raised by ECAN, is imposed. This is illustrated in Figure 2.5

For completeness, the various flow regimes are summarised in Table 2.2.



- NOTES :
1. Map sourced from Land Information New Zealand 262 Series Topographical Map Sheets 11 & 13.
 2. Preliminary irrigable areas, irrigation and storage demand derived from Stage 1 reporting.
 3. Storage requirements based on listed priority and assumes previous development has priority in terms of access to run of river supply.
 4. Peak flow rates include an allowance of 15% extra over the assessed on farm demand to account for system losses and aside from the AICL scheme do not reflect current uses.



Summary of Maximum Potential Areas with Associated Demand & Storage Requirements

Area	Nett Irrigable Area (ha)	Cumulative Total	Peak Demand (m ³ /s, gross)	Net Storage Demand (note 3) (m ³ x 10 ⁶)	
				Existing Regime	Mosley Regime
Existing Balmoral Scheme & Adjacent Areas	5,240	5,240	5.0	9	9.3
Balmoral Forest & Adjacent Areas	2,130	7,370	1.2	12	10.5
Balmoral Forest & Adjacent Areas	7,320	14,690	4.2	11	9.2
Hawarden Area North of Waitahi River	5,030	19,720	2.9	26	19.0
Hawarden Area South of Waitahi River	8,960	28,680	5.1	21	16.0
Scargill Valley	4,700	33,380	2.7	26	19.0
Upper Waipara/Masons Flat	5,510	38,890	3.2	Approx. 105	83.0
Total	38,890		21.1		

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Hurunui Community Water Development Project
Stage 1A-District Scoping Summary Report
Potential Demand

Figure 2.2 Net Storage Demand vs. Irrigated area

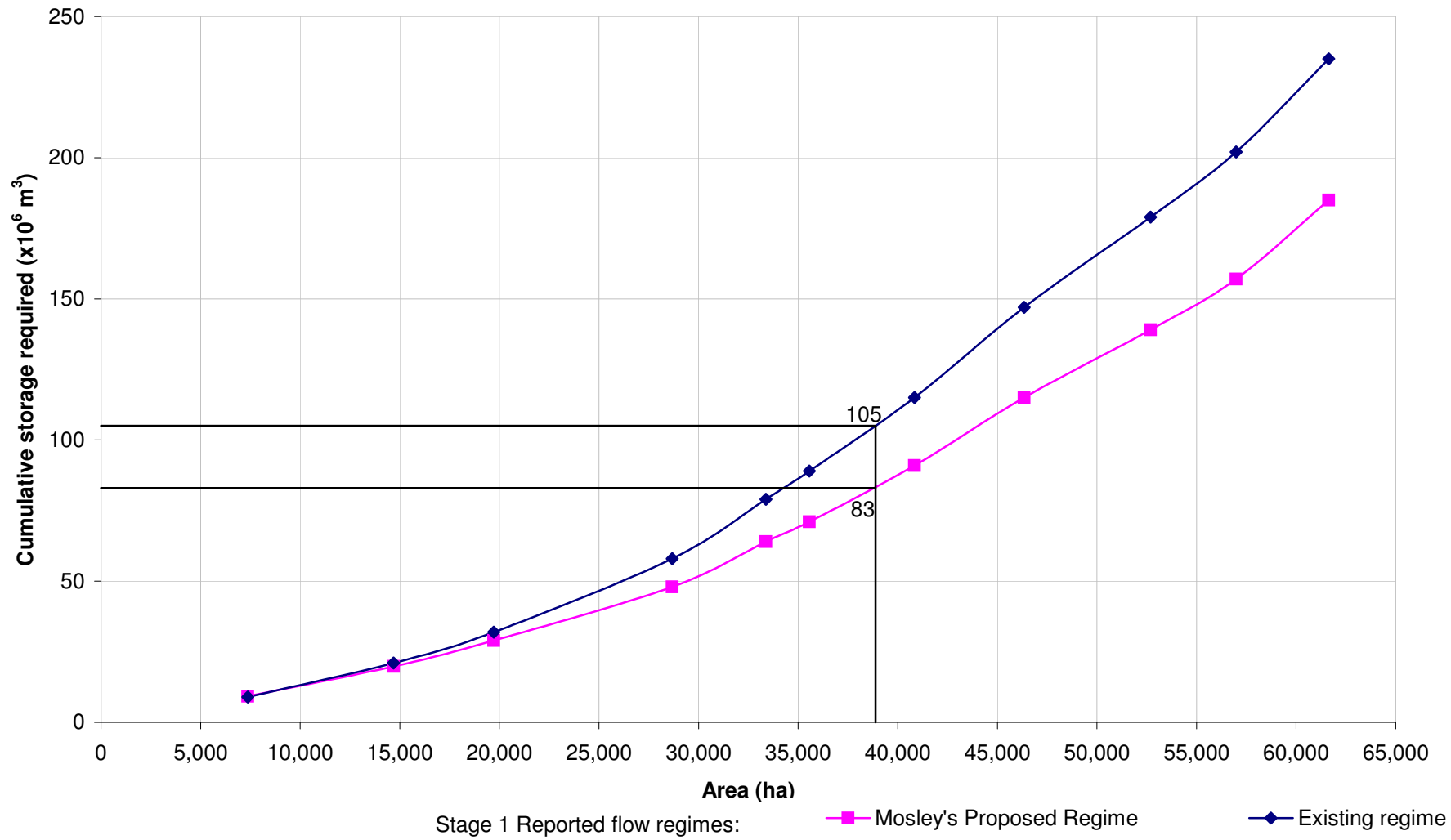


Figure 2.3 Net Storage vs. Demand - Existing Flow Regime

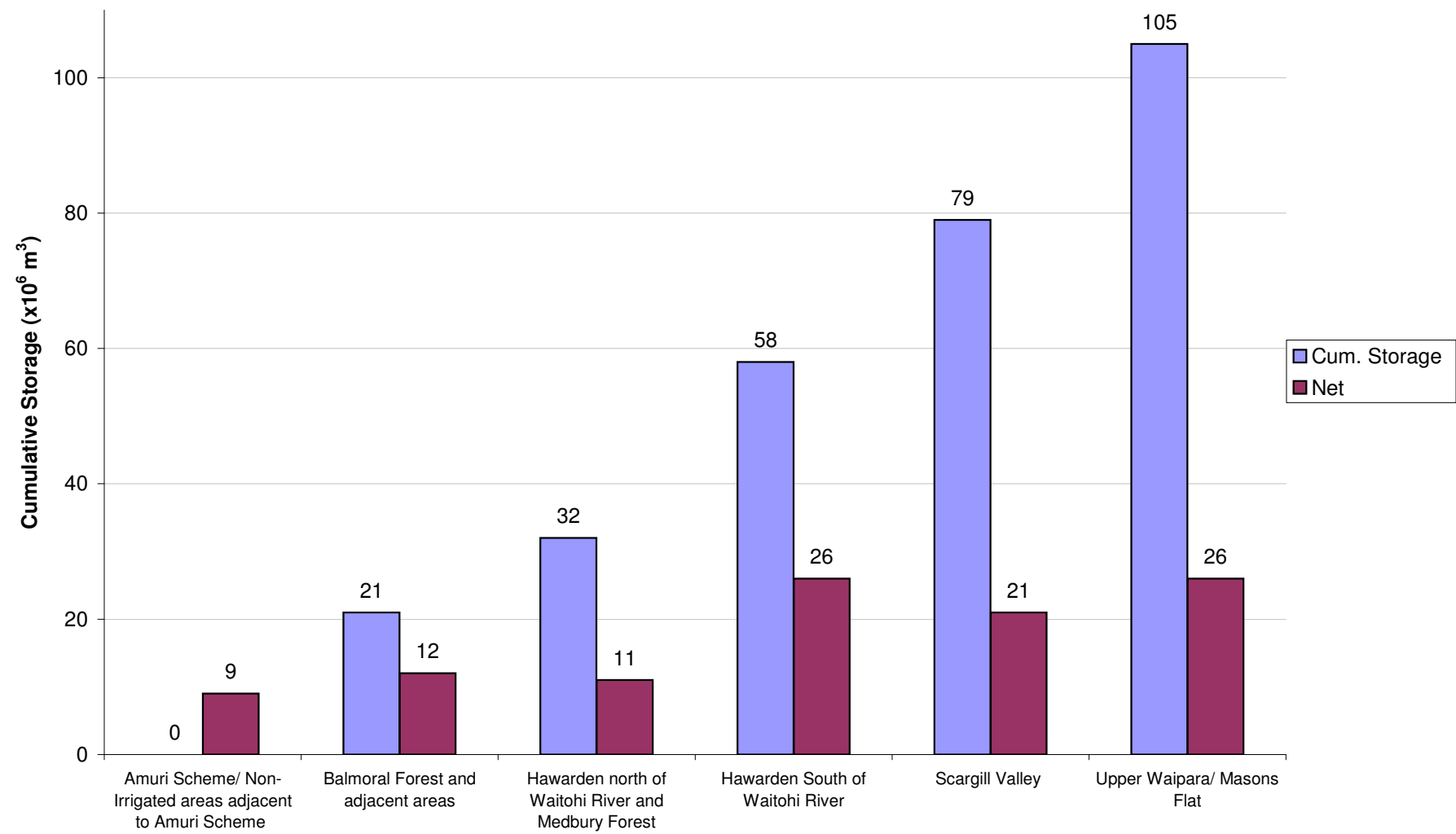


Figure 2.4 Net Storage vs. Demand - Proposed Mosley's Flow Regime

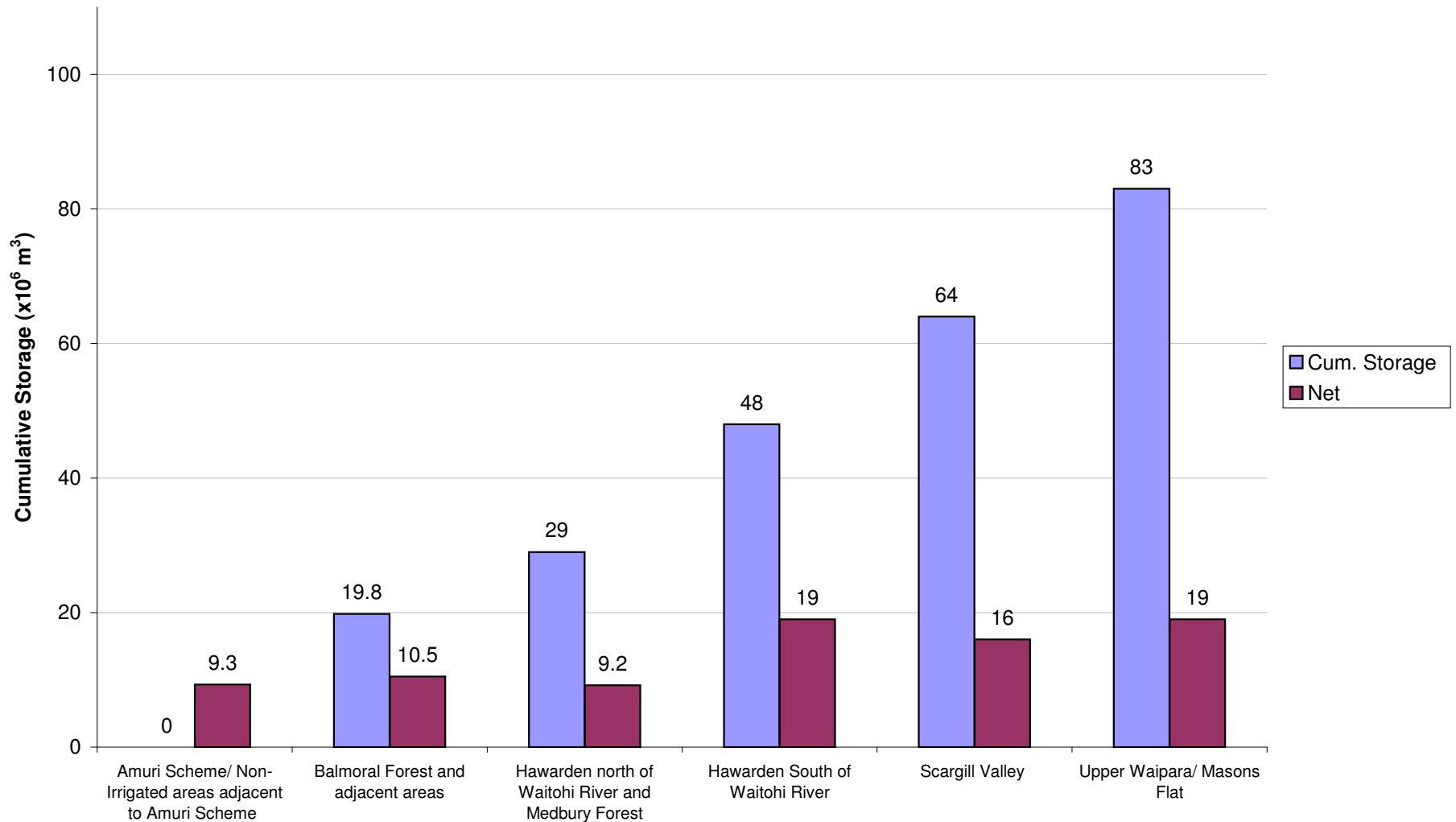


Figure 2.5 Flow Regime Curves

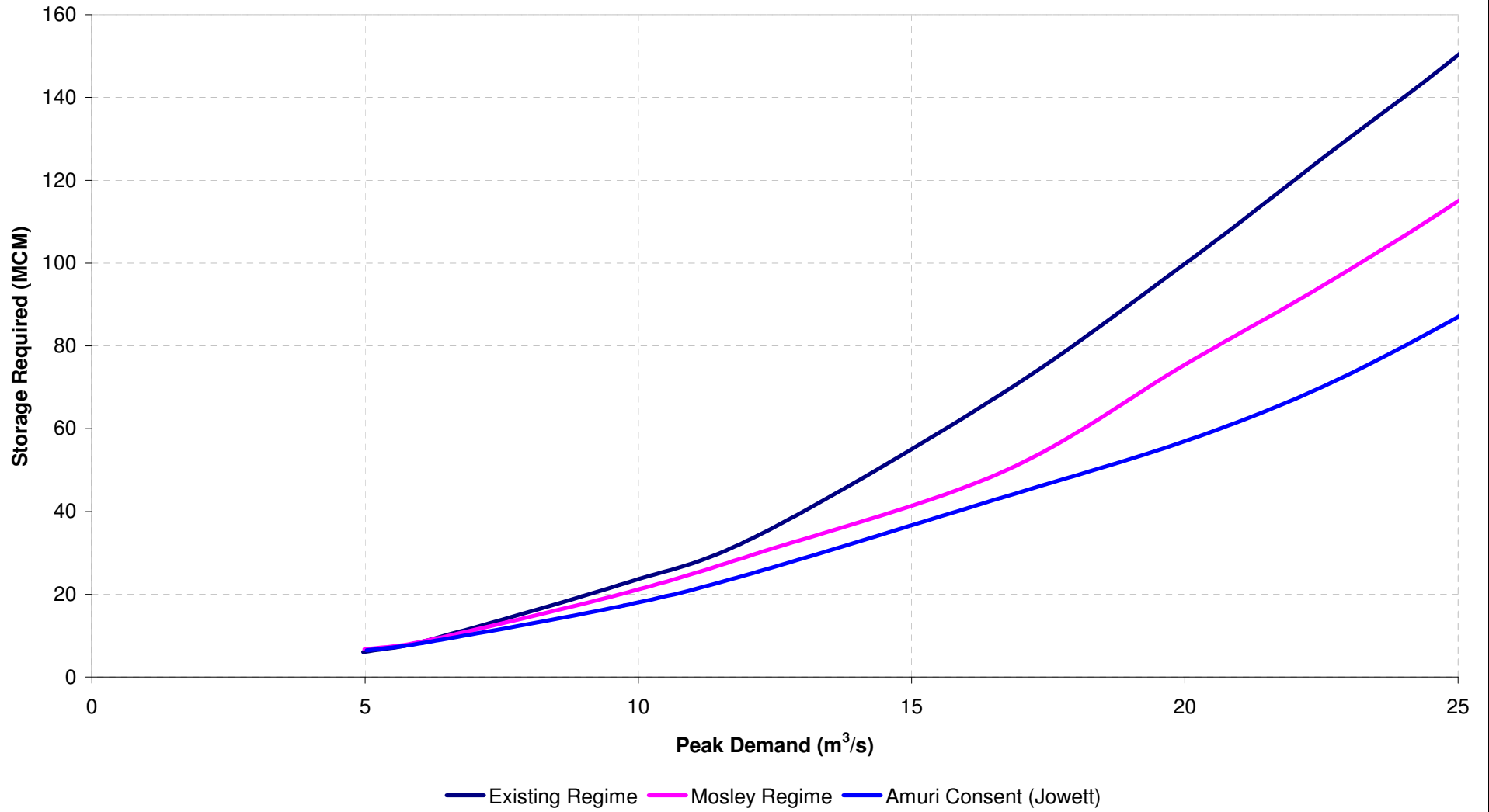


Table 2.2 Various Hurunui River flow regimes¹

Regime	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Sharing regime for flows above the minimum flow
Existing regime ²	10	11	13	17	16	11.5	10	10	10	10	10	10	Yes 1:1
Existing Amuri regime(Jowett)	12	13	15	19	18	13.5	12	12	12	12	12	12	No
Proposed Mosley regime ³	15	15	20	20	20	20	15	12	15	15	15	15	No
Possible future regime ⁴	20	20	20	20	20	20	20	20	20	20	20	20	Unclear - assume no

1 Minimum flows are based on Hurunui River measured flows, at the Mandamus recorder site, which is located just upstream of the Mandamus River confluence.

2 Per 1980 and 1989 ECAN policy

3 Recently proposed by ECAN (Reference 4)

4 Potential to be adopted in 5 years to suit water quality and jet boating (Reference 4)

2.3 Development options

The DSS took account of apparent risk and engineering factors, as well as the statutory framework in place at mid 2004 and associated environmental factors, identified 7 storage sites as having best potential.

The short list included two sites in the Waipara Catchments. These two sites are discounted for the Stage 1A assessment given they do not readily suit the revised demand area. The remaining previously identified five sites are overviewed in Table 2.3 following.

Table 2.3 Storage Sites

Storage	Indicative maximum reliable capacity (x10 ⁶ m ³)	Basis for capacity
Lake Sumner	20	Environmentally driven to mitigate adverse effect by managing the existing operating range and neglecting storage from a lake raising.
Hurunui River South Branch	90-175	Capacity influenced by flow regime and inflow availability
Waitohi	130	Likely practical maximum recognising pumping requirements
Pahau	20	Suits North side of Hurunui requirements
Mandamus	120	Predominantly topographically constrained but also dependent on flow regime and possible Hurunui River transfer– potentially constrained by active faulting

For consistency, and given that the DSS did not allow for optimisation of particular dam type to suit each site, generic earth dam construction has been assumed in each case. Features allowed for, albeit at a coarse level, include:

- structural dam shoulder with a low permeability internal core with associated filter and drainage zones
- upstream rock armour protection
- primary spillway comprising an ungated ogee weir with concrete chute and consideration of energy dissipation
- allowance to incorporate an auxiliary spillway
- construction diversion retained and incorporated into dam outlet works
- multi level dry outlet tower for irrigation draw off for smaller flows with a wet tower allowed for large outlet flows
- miscellaneous appurtenant works including for instance an elver pass, temporary works, access, power supply, miscellaneous electrical and mechanical equipment

Unique descriptions of each site including the likes of embankment height, discussion on sedimentation issues, assessed live storage and flood flows, are included in the DSS report.

To allow for system losses, the net storage requirements of 83 x 10⁶ m³ and 105 x 10⁶ m³ for the Mosley and Existing flow regimes are increased to an assessed gross storage requirement of around 95 x 10⁶ m³ and 120 x 10⁶ respectively. With a flow regime similar to the existing Amuri consent the net storage requirement will be less than the Mosley storage requirements.

As per the DSS report, given the large demand relative to average individual storage size, the five preferred sites can be combined in various ways to produce overall development options.

The following development options are therefore proposed to suit the demand area of some 38,890 ha:

Table 2.4 – Stage 1A development options

Development Option¹ <i>(based on Mosley Flow Regime)</i>	Contributing Volume (x10⁶ m³)	Component Storage
M.I	20	Sumner
	75	South Branch
M.II	95	South Branch
M.III	75	Mandamus
	20	Sumner
M.IV	20	Sumner
	20	Pahau
	55	Waitohi
M.V	70	Mandamus
	25	Waitohi

Development Option¹ <i>(based on Existing Flow Regime)</i>	Contributing Volume (x10⁶ m³)	Component Storage
E.I	20	Sumner
	90	South Branch
	10	Pahau
E.II	90	South Branch
	30	Mandamus
E.III	20	Sumner
	100	Waitohi
E.IV	65	Waitohi
	55	Mandamus
E.V	120	Waitohi

1 M denotes Mosley flow regime applied to storage sizing and similarly, E refers to the Existing Regime.

2.4 Estimated development costings

The Stage 1A desk study includes preliminary costing of primary irrigation infrastructure to put the whole development into perspective and indicate via the storage options considered, how costs may vary. Because of physical limitations on the size of storages able to be developed, and uncertainties about consenting, a straight forward shortlist is not achievable. Thus the scope of preliminary costing is reasonably extensive with 10 different development options costed.

Notwithstanding these difficulties, the approach described in the DSS report which recognises key factors such as flood flows and release capacities and consistency for all options has been retained. While the absolute costs resulting from the study may not have particularly high reliability, and any one storage may have a high-cost or geological issue which is not presently recognisable, the approach achieves relativity between options insofar as is practicable.

Distribution costing has been undertaken as a single case because except for areas of minor detail (e.g. variations in Waitohi River intake connection into race system), the distribution system is independent of the storages. Essentially the primary distribution system utilises cost effective open races to supplement existing river channels to supply by gravity water to the demand areas. In addition to races, components include control gates, an upgraded Hurunui north side intake, a new South bank intake (both with appropriate fish screens) as well as fencing and road, farm and water course crossings. Indicative operating costs have also been assessed in the DSS report.

Complete or ultimate development potential is not examined in the Stage 1A report. Setting aside the value of resource planning to identify a comprehensive solution, it is relevant to note that the cost of providing irrigation increases incrementally in a non linear fashion as the area served increases. So while general inferences can be drawn, specific consideration of an incremental or staged development with associated costing is outside the scope of Stage 1A of the pre-feasibility study.

Indicative total development costs to supply water to the farm gate (but not under pressure) resulting from the foregoing, are tabled below. These costs are "raw" capital costs and do not include other costs such as accumulated interest during construction (IDC), legal costs and developer administration costs. No specific allowances have been made for environmental mitigation other than the likes of fish passes. Preliminary investigation and consenting costs prior to moving to detailed design are excluded on the basis of their being sunk costs. Allowance for engineering (detailed design) and a project contingency are included.

Table 2.5 Stage 1A Development options costings (November 2005)

Development Option ¹ (based on Mosley Flow Regime)	Component storage volume and description (x10 ⁶ m ³)	Indicative storage raw capital cost (\$ x10 ⁶)	Indicative storage raw capital cost including primary distribution works (\$/ha)
M.I	20 Sumner 75 South Branch	27	\$2,700/ha
M.II	95 South Branch	29	\$2,750/ha
M.III	75 Mandamus 20 Sumner	36	\$2,950/ha
M.IV	20 Sumner 20 Pahau 55 Waitohi	64	\$3,650/ha
M.V	70 Mandamus 25 Waitohi	48	\$3,250/ha

Development Option (based on Existing Flow Regime)	Component storage volume and description (x10 ⁶ m ³)	Indicative storage raw capital cost (\$ x10 ⁶)	Indicative storage raw capital cost including primary distribution works (\$/ha)
E.I	20 Sumner 90 South Branch 10 Pahau	46	\$3,200/ha
E.II	90 South Branch 30 Mandamus	42	\$3,100/ha
E.III	20 Sumner 100 Waitohi	87	\$4,250/ha
E.IV	65 Waitohi 55 Mandamus	81	\$4,100/ha
E.V	120 Waitohi	100	\$4,550/ha

1 M denotes Mosley flow regime applied to storage sizing and similarly E refers to Existing regime. It is likely that the Amuri Flow regime will have a lesser storage requirement.

Summaries, including a breakdown of key components contributing to storage costings are appended to the DSS report. The November 2005 Stage 1A costs have been increased by a factor of 30% from the DSS costings to reflect significant recent cost increases and this figure takes account of material price increases (for instance steel), diesel price rises (effectively earthwork rates) and the present nature of the market including numerous major infrastructure projects nationally consuming much of the available resource with resulting general price increases.

The raw capital cost as at November 2005, on a per hectare basis, assuming the Mosley regime is adopted is therefore likely within the range of \$2,700/ha to \$3,650/ha. This cost range is expected to increase to in the order of \$3,100/ha to \$4,550/ha if the Existing regime remains. It is expected that should the Amuri Flow regime be adopted the likely cost range will be less than the Mosley Regime.

3 The proposed NRRP

3.1 Introduction

The planning provisions adopted by ECAN via the NRRP are fundamental for any development. Unfavourable NRRP Rules could preclude various options and the NRRP appears difficult to interpret in some important instances. For example, and while subject to interpretation, the identified South Branch storage is assessed as having non-complying activity status under Variation 1 of the NRRP, and similarly, the status of the Lake Sumner storage is also subject to interpretation. Additionally, the finalised Rules could increase the required storage volume (cost) via the adopted flow regime. The following sections provide a brief overview of key aspects of the NRRP, and a brief summary of the Working Group's NRRP submission is also included.

3.2 Overview of Proposed NRRP

3.2.1 Status

- the RMA requires proposed plans be considered when undertaking activities and when regulatory authorities are processing resource consents
- an activity could require a consent that previously did not require consent, and may not if the plan is withdrawn or amended
- any consent application would require an assessment in accordance with RMA s88 and the 4th Schedule that takes into account the proposed NRRP
- as the proposed NRRP goes through the submission process, some parts will become certain if no submissions and/or appeals are lodged against them

3.2.2 Process

- ECAN notified Variation 1 and invited submissions
- ECAN has prepared a summary of submissions document that has been publicly notified
- ECAN has invited further submissions on matters raised in original submissions
- once all further submissions have been received, Council will set down hearings
- submitters are required to be given 10 working days notice of a hearing, and are required to receive the officer report 5 working days before the hearing
- at the hearing, expert evidence can be provided in support of an original submission or further submission
- ECAN issues a decision which can be appealed to the Environment Court

3.2.3 Timing

- initial submissions closed 17 December 2004
- 667 submissions were received
- the summary of submissions document was notified on 15 October 2005
- the further submission period closed 19 December 2005
- hearings can be held with different approaches – by issue, or by chapter, or by submitter groups, hearings are expected to start in mid 2006

- decisions can also be released in batches, decisions may be available from late 2006 – early 2007.
- any submitter has 15 working days to appeal a decision and the appeal period is expected to commence in 2007 - timeframes for Environment Court hearings are unknown.
- the Plan is not likely to be fully operative until late 2007/8.

3.2.4 Key Provisions

It is considered that the following provisions of the Proposed NRRP are of particular relevance to the Hurunui Community Water Development Project:

Chapter 4 – Water Quality

- riverbed sedimentation – Table WQL5 – percentage of embeddedness
- contact recreation – water quality standards – Schedule WQL7
- unconfined/semi-confined aquifers – Rule WQL19
- discharges – Rules WQL56/57
- vegetation clearance in riparian zone – Rule WQL32
- soil disturbance in the riparian zone – Rule WQL34
- earthworks over unconfined or semi-confined aquifers – Rule WQL41

Chapter 5 – Water Quantity

- taking, using, damming, diverting of surface water – Rules WQN6-10; WQN25 & 26
- activities in High Naturalness Water Bodies – mainstem of Hurunui River to Lake Sumner; tributaries of the Hurunui River upstream of the confluence with, but not including, the Mandamus River – Policy WQN2
- water flow and level regimes – minimum flows for Hurunui River – Table WQN11; Policy WQN3
- water allocation – Policy WQN14
- instream values – Policy WQN4
- groundwater takes/stream depletion effects – Rule WQN17-24
- hydro-electricity generation – discretionary activity – Rule WQN30

Chapter 6 – Beds and Margins of Lakes and Rivers

- structures, bed disturbance, works – Rules BLR1-2; BLR5&6
- land use activities – Policy BLR1

Chapter 7 – Wetlands

- effects of take, use, discharge of surface water on wetlands – Policy WTL1; Rules WTL2, 4 and 10
- earthworks and land use activities – Policy WTL1

Chapter 8 – Soil Conservation

- earthworks and vegetation clearance – Policy SCN5
- effects on water quality – Policy SCN4

3.2.5 Variation 2 and 3

Schedule WQN9 of Chapter 5 of the NRRP, contains criteria relating to peak and seasonal irrigation demand throughout Canterbury. Following notification of Variation 1, a number of issues were raised that indicated that the figures presented in Table WQN9 of the NRRP did not accurately represent seasonal and peak demand given the various soil types and land uses considered, all based on the assumption that the reported seasonal demand will be exceeded 20% of the time. Variation 2 recognises the inaccuracies contained in the Variation 1 Schedule WQN9 and seeks to address this. Further water balance modelling will take account of appropriate criteria set out in Table WQN24 in conjunction with the assumptions described in the Stage 1 Report.

Variation 3 to the NRRP on groundwater is due to be notified shortly. This will be monitored and the Working Group advised regarding submission requirements.

3.3 The Working Group NRRP Variation 1 submission

The Working Group has submitted specific comments on 79 provisions of the Proposed Plan. A general overview of the specific matters of concern was provided at the beginning of the submission. The following comments were made:

- there is a lack of recognition of the enabling provisions of the Resource Management Act 1991 (the Act) and the social and economic benefits to the community that arise from the use of water resources. The objectives and explanations may reflect the enabling intent of the Act, but the methods proposed are unduly restrictive. For example, promotion of water storage/ irrigation/ hydro generation have been shown to have broader benefits to the local community
- there is a lack of clear definition and/or investigations of regionally significant resource management issues – examples: no specific areas are identified where groundwater contamination is an issue; no specific reference to rivers with water quantity/quality issues apart from the four rivers included in Schedule 1; regionally significant wetlands are not identified and managed accordingly; soils at risk to nitrate-nitrogen levels or sensitive to land use intensification are not specifically identified, and the classification of rivers is not clearly linked to the ‘river types’ developed in the Proposed Plan
- The Working Group is supportive of steps to establish a framework that allows the community to make strategic decisions with regard to the use and management of the natural resources of the region
- there is a lack of a clear target for how to address resource management issues; issues identified are broad and not resource/ location specific – examples: classification of rivers as high naturalness; zoning of large areas of groundwater/nitrate-nitrogen sensitive (the aerial extent of the Zone NN and Zone IB); wetlands
- The Working Group opposed the use of a blanket approach through zones or schedules to regional resource management issues; zoning techniques is a blanket approach and non-resource/location specific, nor effects-based – examples: Zone IB; Zone NN; natural state and high naturalness river classifications
- the Proposed Plan provisions are unduly restrictive; objectives and policies are very prescriptive and complex; rules default to full Discretionary or Prohibited Activity

status quickly – examples: objectives and policies far too long (Policy WQN 14 is 5 ¼ pages) and complex (policies include formulae); policies that include standards; policies that define activity status for activities; rules that have Permitted Activity standards that are too onerous defaulting to full Discretionary; liberal use of Prohibited Activity status

- the Proposed Plan provisions are potentially restrictive for any new development and continued use of existing investments – examples: Prohibited Activity status of rules associated with high naturalness rivers and Zone IB will restrict efficient and effective use of existing resources and limit any new developments
- the Proposed Plan states outcomes that are not apparent in methods – positive promotion of activities with social and economic benefits in explanations not carried through to methods – examples: water storage, augmentation, and irrigation.
- the Proposed Plan includes many detailed issues and rules, which potentially compromise the objectives of a proposed Plan of this nature included in a strategic or policy setting. Detailed rules or procedural matters complicate the Proposed Plan document and process and will make the document less able to remain valid over time, and inhibit constructive input and debate, especially from the community

The Working Group opposed Variation 1 in its entirety, and sought for Council to withdraw the Variation and review and rewrite it.

In particular the Working Group sought for Council in any review or rewrite to:

- undertake a detailed investigation of the regional resources to be managed by Variation 1
- identify specific resource management issues of regional significance to be addressed, and the nature and location of these issues
- target specific resource management issues with objectives, policies and methods that adopt an 'adaptive management' approach
- ensure the Proposed Plan provisions balance the managing of the specific resource management issues targeted and the social and economic and cultural well being of the regional and local community
- ensure enabling provisions in the Proposed Plan by using Controlled Activity and Restricted Discretionary Activity status for activities that are unable to meet Permitted Activity performance standards and only using Prohibited Activity status for activities with catastrophic environmental consequences of a national/regional proportion
- promote water storage options including identifying specific sites where water storage facilities will be encouraged by Council and consider specific planning mechanisms to provide for these facilities (such as a special zone)
- investigate each river by itself in order to ensure water storage/ augmentation/ irrigation and hydro electricity opportunities are recognised and provided for
- promote the concept that where an area is identified as having regionally significant resource management issues and the activities are controlled accordingly, other areas are able to be utilised
- develop a review process for minimum flow regimes once water storage has been included in a catchment

4 Development option ranking

The preceding sections provide a broad overview of potential development options to provide a secure irrigation supply to serve an area of some 38,890 ha included in the Stage 1A assessment together with consideration of the recently proposed NRRP. Rules incorporated into the NRRP as it progresses through the submission process towards becoming operative, will significantly guide the Hurunui Community Water Development Project as it proceeds. For instance, the promising South Branch site will be challenging to consent as Variation 1 of the NRRP appears to consider storage at this site a non-complying activity. Other storage options exist that could be easier to consent. However, it is apparent these options are significantly less cost effective, and on this basis, and assuming no significant geological issue not presently identified, a more expensive consenting process could be justified to obtain resource consents for a South Branch storage, given its apparent non-complying status. In addition, irrigation supply reliability will be a vital factor to any development and will need to be assessed in detail at a further stage of study. The Hurunui River flow regime that will be incorporated into Chapter 5 of the NRRP is of similar significance.

It is therefore important that consentability is considered together with the initial Stage 1A costings to put options into perspective when the various development options are ranked. Table 4.1 includes a very coarse and somewhat crude 1-5 ranking for each option for the 2 flow regimes considered (1 = less favourable, 5 = more favourable).

Table 4.1 – Development option ranking

Development Option	Consentability Ranking (1 = lowest; 5 = higher)	Relative Stage 1A cost ranking (1 = lowest; 5 = higher)
M.I	1	5
M.II	2	4
M.III	4	3
M.IV	5	1
M.V	3	2

Development Option	Consentability Ranking (1 = lowest; 5 = higher)	Relative Stage 1A cost ranking (1 = lowest; 5 = higher)
E.I	1	4
E.II	2	5
E.III	4	2
E.IV	3	3
E.V	5	1

The above consentability ranking included in Table 4.1 has been determined using the following methodology:

- i. Review of the consentability of the various individual storage site options included in the DSS prior to notification of the NRRP.
- ii. The consentability categories were awarded the following values:
 - Low – 1 (easiest to consent)
 - Low/medium – 2
 - Medium – 3
 - Medium/high – 4
 - High – 5 (harder to consent)
- iii. Each of storage site options was awarded a value based on the Table 9.2.2 DSS report ranking – for example, Lake Sumner scored a medium/high ranking and was therefore assigned a 4 value
- iv. The development options in Table 2.4 of this report were then reviewed and the corresponding value of each storage site option was awarded to the corresponding component of the development option – for example, Development Option M.I comprises Lake Sumner (consentability score medium/high with a corresponding value 4) and South Branch (consentability score low with a corresponding value of 1) giving a total of 5
- v. All of the development options were assessed to provide a total score for that combination of development options, and the scores were ranked from 1 – 10, with 1 having a low consentability and 10 high.

Project costings are ranked on the basis of the information presented in Table 2.5.

5 Recommendations and conclusions

The Stage 1A study has assessed that there are some 38,890 ha of potentially irrigable land in the study area, made up as follows

- the existing AICL Balmoral Scheme supplied via the Hurunui River (included for security of supply)
- non irrigated areas adjacent to the Balmoral Scheme
- Balmoral Forest
- the Hawarden area
- Scargill Valley
- North Waipara, Masons Flat and Pyramid Valley area

For full development of the ± 39,000 ha, some 83 and 105 x10⁶ m³ of net storage is required to provide a secure supply to meet the 90 percentile demand for the proposed Mosley and the Existing flow regimes respectively.

Five development options are proposed for each of these 2 flow regimes. Based on the preliminary June 2004 DSS report costing updated in November 2005, the “raw” capital development costs to provide water to the farm gate are in the range of \$2,700/ha to \$3,650/ha for the Mosley regime and approximately \$3,100/ha to \$4,550/ha if the existing flow regime is retained. While dependent upon the ongoing NRRP submission process, the adoption of a favourable Hurunui River flow regime (for instance as per the existing Amuri Irrigation company consent (Jowett) regime) has the potential to provide a significant saving by way of reduced storage costs as irrigation could utilise a higher run of river abstraction.

The 3 key points stemming from the Stage 1 study that still hold are as follows

- i. Storage requirements/possibilities together with cultural, consentability and land issues are such that more than one development strategy may need to be pursued.
- ii. Required storage forms a substantial part of development cost and the volume required is strongly dependent upon the sustainable flow regime that applies to a particular development.
- iii. Flow regime and development constraints, are defined in Variation 1 of the proposed NRRP. Input into the submission process is critical to ensure as far as is practicable, Rules favourable to the Hurunui Community Water Development Project are include in the operative version of the NRRP.

Overall this study concludes that potential continues to exist for an economically viable large scale water management project in the Hurunui District. Further investigations and consultation with a range of stake holders is warranted.

6 Applicability

This report has been prepared for the benefit of the Hurunui Community Water Development Working Group with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

TONKIN & TAYLOR LTD

Environmental and Engineering Consultants

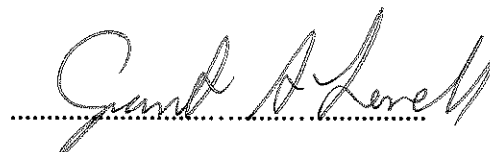
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**Appendix A: Hurunui Community Water
Development Project –
Stage 1 District Scoping Study –
Summary**

Stage 1 District Scoping Study - Summary

A.1 Introduction

The following Appendix summarises the prior Stage 1 District Scoping Study Report and provides a broad overview of the study background, identified irrigation supply and demand with associated constraints, as well as consideration of planning, environmental, and cultural issues together with discussion on indicative development options with costing and study recommendations and conclusions.

The complete Stage 1 Report is held by Working Group members.

A.2 Background

The scoping report has been prepared for the Working Group of the Hurunui Community Water Development Project (HCWDP). The Stage 1 Report represents the first stage of a proposed 3 stage prefeasibility study.

The Working Group comprises representatives of the following:

- Hurunui Irrigation and Power Trust
- Hurunui Water Management Trust (referred to as the “Esk Head Owners”)
- Ngai Tahu Property Limited
- MainPower New Zealand Limited
- Enterprise North Canterbury (HCWDP Project Co-ordinator)

The Working Group acknowledges the funding contribution provided by the Sustainable Farming Fund.

The Working Group aims to define and promote a comprehensive water management regime for the Hurunui District. The principal objective of the Group is to:

“Identify and promote that combination of water management regimes and water storage options that collectively enhance the sustainable management of in-river flows within the Hurunui District within an environmentally sensitive, consentable and viable scheme, while providing for the irrigation, hydrogenation and economic needs of the community.”

Tonkin & Taylor’s brief was to identify options that were primarily focussed on irrigation with any identified hydro opportunities included as secondary enhancements.

The Working Group has three primary objectives:

- i. To identify the preferred combination of water storage options that will permit the implementation of a sustainable water management regime in the Hurunui including:
 - selection of options that are acceptable environmentally, socially, technically and economically; and
 - identifying that combination of options that will ensure the sustainable management of in-river flows within the Hurunui District.
- ii. To protect and promote the realisation of those options and water management regime through consultation and ensuring the options and water management regime are provided for in district and regional plans.

- iii. To attract the resources necessary to realise the preferred water management scheme for the benefit of the community.

A.3 Issue

The farmland and community of the Hurunui District has significant potential for enhanced productivity provided the irrigation potential of the district can be realised.

While the Hurunui River is a plentiful water resource, it experiences periods of low flow in summer months. Unless excess flows are harvested into storage that can be drawn upon in dry periods, the river has limited potential for increased irrigation which has adequate reliability. The adjacent Waipara catchment is even more restricted.

The current statutory planning framework and resource consent process does not ensure water resources will be managed and allocated in a way that is both sustainable and optimises community and national benefits.

The Working Group has commissioned this Scoping Study to assist in resolving this issue.

A.4 Study Objectives

The Hurunui District Scoping Study has been prepared for the Working Group Report by lead Consultant Tonkin & Taylor. Sub Consultants who assisted with Stage 1 of the study include Aqualinc Research, Boffa Miskell, Crighton Anderson & Associates, Riley Consultants and Rob Greenaway & Associates.

The principal objectives set for this Scoping Study include:

- i. definition of the ultimate potential (and practical) irrigation zones and associated irrigation demand within the study area;
- ii. examination of sources for irrigation supply and determination of how sources may best be utilised, including related storage requirements;
- iii. evaluation of potential storage sites and associated systems for delivery of water to irrigators, together with indicative costings for development;
- iv. assessment of key environmental issues and statutory planning requirements anticipated for relevant components, plus the likely consentability of components, and then development options;
- v. preliminary evaluation of socio-economic and cultural issues, particularly those of importance to Te Runanga O Ngai Tahu;
- vi. assessment of how in-river flow regimes may be enhanced through water harvesting and storage of excess flows for subsequent release during periods of low flow.

The primary conclusions are summarised in the following sections.

A.5 Irrigation potential and demand

The total potential net irrigable area within the Hurunui District is estimated to be approximately 61,640 hectares comprising 40,840 hectares in the Hurunui catchment and 20,800 hectares in the Waipara / Kowai catchments. A modest proportion of this total is presently irrigated, but very little has an adequate level of supply security.

Water demand for irrigation has been assessed based on local climatic and soil type characteristics together with the assumption that the irrigated land will be developed for pastoral use, except for a small portion in the Waipara catchment, which is assumed to be developed for viticulture. These assumptions are expected to waterproof ultimate development against future landuse changes, pastoral irrigation having the greatest demand.

The water demand estimates may be summarised as follows:

Table A.1 Assessed Demand

	Hurunui Catchment	Waipara / Kowai Catchment	Grand Total
Potential Irrigation Area (Hectares)	40,840 ha	20,800 ha	61,640 ha
Peak Water Demand	22.69 m ³ /s	9.44 m ³ /s	32.13* m ³ /s
Average Irrigation Season Demand	13.80 m ³ /s	5.77 m ³ /s	19.57 m ³ /s
Worst Drought Irrigation Season Demand	18.71 m ³ /s	7.79 m ³ /s	26.50 m ³ /s
90 % Security – Irrigation Season Demand	16.40 m ³ /s	6.75 m ³ /s	23.15 m ³ /s
90% Security – MCM** of Water Demand	306 MCM	128 MCM	434 MCM

Note:

* About 10.5 m³/sec of peak demand is currently drawn from the river and groundwater sources in the Hurunui catchment.

** MCM = Million Cubic Meters

A.6 Water sources

Principal water sources considered in consultation with the Working Group were:

- i. The Hurunui River including its principal tributaries
With appropriate storage, the Hurunui River has more than the capacity needed to supply the estimated demand.
- ii. The Waiau River to the north
Given that supply resources are adequate without the Waiau; that the Waiau catchment has severely restricted storage opportunities; and there is significant future irrigation potential in the Waiau's own catchment, the Waiau has been excluded as a source.

- iii. The Waipara River to the south
While a small amount of water may be harvestable from the Waipara, the reality is that the Waipara catchment will require supplementing from the Hurunui water sources.
- iv. Groundwater sources
Potential for groundwater as a source to sustain large scale irrigation is quite limited and to be conservative, has been discounted.

For the above reasons, the water supply and storage potential has been assessed in terms of Hurunui catchment only, with a basin transfer required from the Hurunui catchment to the Waipara. Associated cultural issues are recognised.

A.7 Water storage requirements

The volume of water storage required to supply irrigation water to the potential demand area of 61,640 hectares is dependent upon the flow regime ultimately adopted by Environment Canterbury (ECAN). The current flow regime was an initial basis for the study and includes flow sharing policies for the Hurunui and a minimum flow regime at Mandamus. In broad terms, the policy allows 50% of available flow to be taken for use (e.g. via storage) after first satisfying minimum flow criteria. ECAN's investigations have included consideration of a different policy, the so-called Mosley flow regime, which would allow greater capture and usage of river flows. The Amuri Irrigation Company currently utilises the major proportion of the current total river abstraction under their current consent based on the Jowett flow regime.

Under the “**Existing Flow Regime**”, a net storage volume of some $235 \times 10^6 \text{ m}^3$ is required to supplement the available run of river supply. This volume would increase to about $270 \times 10^6 \text{ m}^3$ when an allowance for system loss is made. The required storage per hectare irrigated increases progressively from around $1,430 \text{ m}^3/\text{ha}$ net at 14,690 hectares to $3,810 \text{ m}^3/\text{ha}$ net at 61,640 hectares.

Under the proposed “**Mosley Flow Regime**”, adopted for the Hurunui river, the net storage volume requirement would reduce to about $185 \times 10^6 \text{ m}^3$, increasing to $215 \times 10^6 \text{ m}^3$ after allowing for losses. However, for irrigators to realise any benefits from the proposed Mosley regime, significant storage must be provided. Implementing the Mosley regime without water storage would be detrimental to the existing water extractors.

A.8 Storage sites and volumes

Evaluation of potential storage sites commenced with a comprehensive map-based listing of potential storage sites of appreciable size (order of $20 \times 10^6 \text{ m}^3$ minimum capacity). Storages considered unlikely to be consentable, such as on the main stem of the Hurunui, were discarded. Thirty seven sites were identified and ranked according to environmental and economic criteria, using a systematic and robust approach. From this initial list, seven sites able to be combined to achieve the higher total storage figure of $270 \times 10^6 \text{ m}^3$ were short-listed. None of the seven can achieve the required storage on their own and various storages have to be combined.

The seven short-listed storage sites and their indicative maximum storage capacities based on ECAN's Existing Flow sharing regime are as follows:

Table A.2 Short listed storage sites

Water Source	Storage Site	Storage Volume
Hurunui Headwaters	Lake Sumner via lake level management without lake raising and operating within natural lake level fluctuations.	20 x 10 ⁶ m ³
	South Branch storage dam about 1.5 km upstream of the Esk confluence – capacity subject to adopted flow regime.	90 x 10 ⁶ m ³ to 175 x 10 ⁶ m ³
Hurunui Tributaries	Waitohi at Seven Hills primarily filled by pumping from the Hurunui – in the order of 40 x 10 ⁶ m ³ from the Waitohi catchment.	130 x 10 ⁶ m ³
	Mandamus near Glens of Tekoa, supplemented by pumping from the Hurunui above about 50 x 10 ⁶ m ³ .	120 x 10 ⁶ m ³
	Pahau , about 2 km above the plains, set primarily to meet AICL area requirements.	20 x 10 ⁶ m ³
Waipara River	Waipara at Greys Road vicinity filled mainly by gravity transfer from Hurunui but requiring pumping to higher levels.	25-30 x 10 ⁶ m ³
	Waipara at Clarke Hall Road vicinity filled by gravity transfer and sized to serve local demand in conjunction with Greys Road.	35 x 10 ⁶ m ³

All of the storages can release their outflows into substantial tributaries and for the Waipara, directly into the main river, essentially in all cases above where water would be abstracted into irrigation supply networks. The Waitohi and Pahau storage site releases would feed directly into main races.

A.9 Distribution system

A preliminary spine distribution system was developed to service all of the identified irrigable areas, substantially by gravity flow in races and possibly in some stream beds, but with the Greta Valley area requiring a modest pump lift because of topographical constraints. This system would essentially be common to all storage combinations, with some limited variants.

A.10 Development options

Six combinations (A to F) of the seven storage site developments have been assessed and compared in terms of environmental sensitivity, consentability and indicative costings. Four of the options (A, B, C & D) are based on achieving $270 \times 10^6 \text{ m}^3$ of storage under the Existing Flow Regime. Two of the options (E & F) are based on achieving $215 \times 10^6 \text{ m}^3$ of storage under the Mosley Flow Regime.

Table A.3 following details the indicative June 2004 costings as follows:

- i. The capital cost of each storage site;
- ii. The capital cost of each development option (A to F);
- iii. The capital cost of the water distribution system; and
- iv. The resulting cost per irrigable hectare (at the farm gate).

A.11 Power generation

Stage 1 studies have included preliminary assessment of the hydro potential associated with storages and irrigation distribution. In accordance with the brief, development options have been derived on the basis that irrigation flows are of primary importance and any hydro potential is of secondary importance. There may be scope to generate hydro electric power as water is managed for irrigation and to suit the river flow regime. However, the economics of any hydro add on would require a considerable amount of further analysis to confirm the reliability and magnitude of any available generation.

Table A.3 Stage 1 Development Options

Storage Site	Storage Capacity (million m ³)	Capital Cost (\$m)	Capital Cost per m ³ (cents/m ³)	Development Options & Estimated Capital Costs to irrigate 61, 640 Hectares (\$m ± 30%)					
				A	B	C	D	E	F
Flow Regime (Existing, E & Mosley, M)				E	E	E	E	M	M
Storage Volume (Million m³)				270	270	270	270	215	215
Waitohi at Seven Hills	130	\$83.2	64		\$83.2		\$83.2		
Waitohi at Seven Hills	95	\$70.0	74			\$70.0			
Waitohi as Seven Hills	75	\$63.1	84	\$63.1					
Waitohi as Seven Hills	40	\$27.3	68						\$27.3
Mandamus Trib	70	\$23.1	33						\$23.1
Mandamus Trib	55	\$24.7	45				\$24.7		
Mandamus Trib	35	\$16.3	47		\$16.3				
South Branch	90	\$32.5	36	\$32.5		\$32.5			
South Branch	175	\$41.7	24					\$41.7	
Pahau	20	\$16.1	81	\$16.1	\$16.1	\$16.1	\$16.1	\$16.1	\$16.1
Waipara @ Greys Road Main	30	\$20.1	67	\$20.1	\$20.1	\$20.1	\$20.1		\$20.1
Waipara @ Clarke Hill Road	35	\$12.7	36	\$12.7	\$12.7	\$12.7	\$12.7		\$12.7
Managed Lake Sumner	20	\$3.0	15	\$3.0	\$3.0	\$3.0	\$3.0	\$3.0	
Total estimated storage cost (\$m ± 30%)				\$147.5	\$151.4	\$151.4	\$156.8	\$60.8	\$102.3
Storage Cost per Hectare (61,640 ha)				\$2,390	\$2,460	\$2,460	\$2,540	\$990	\$1,660
Distribution System, Primary & Secondary (\$m ± 30%)				\$118.9	\$118.90	\$118.9	\$118.9	\$118.9	\$118.9
Distribution cost per Hectare (61,640 ha)				\$1,930	\$1,930	\$1,930	\$1,930	\$1,930	\$1,930
Total Estimated Equivalent Capital Cost				\$266.4	\$270.3	\$270.3	\$275.7	\$179.7	\$221.2
Total Estimated Equivalent Capital Cost per ha ± 30% (61, 640 ha)				\$4,320	\$4,390	\$4,390	\$4,470	\$2,920	\$3,590

A.12 Planning, environmental and consenting issues

There is a range of planning provisions included in the relevant District and Regional Plans that apply and a suite of resource consent applications will be required. A key planning instrument relevant to the Water Development Project is the Natural Resources Regional Plan (the NRRP) which ECAN notified in mid 2004. The planning provisions contained in this document have a significant bearing on the form of a project in terms of whether the irrigation potential can be realised and its costs. Of particular significance is the status of the South Branch site. If storage sites are precluded in areas where they are most cost effective or flow rules are adopted that are environmentally conservative, the extent of affordable irrigation may be severely constrained.

Other matters which are of high significance from the planning perspective are structures in the main stem of the Hurunui River, fish passage, sediment impediment, recreational use, landscape, and cultural values. Issues associated with securing land and river valleys for storage sites (or concessions in the case of DOC administered land), will also have a bearing on the ultimate development.

The desk level environmental assessment of potential storage sites has been drawn substantially on published information and is backed by study team members' personal knowledge. Focus has been on terrestrial ecology, aquatic ecology, landscape and recreation, with the substantial storage reservoirs and impacts on changed river flow regimes through expanded irrigation, obviously creating the biggest impacts and receiving greatest attention. The preliminary spine distribution system has also been assessed, but the environmental issues here are relatively minor.

Findings from environmental assessments are summarised as follows:

- i. Terrestrial ecology – with the exception of Lake Sumner fringes, evaluated in detail in the 1970's and protected by the lake management regime proposed, few significant aquatic ecological issues are anticipated – in broad terms;
- ii. Aquatic ecology is perceived as being protected by the flow regimes adopted in this study. Certain storages however may have adverse impacts on the sports fishery which will require mitigation, for example in the form of fish passes or confirmation or enhancement of new sports fishery habitats – the potential effect of a South Branch storage on salmon is of particular note;
- iii. Landscape – some landscapes in storage areas are classed as “Outstanding” and some are “Significant” – however, it is perceived that with attention to detail, the storages and a Lake Sumner outlet control structure can fit acceptably within local landscape forms
- iv. Recreation – with no barriers on the Hurunui main stem and no appreciable change in Lake Sumner levels from natural ranges, recreational effects are seen as modest, other than effects on the sports fishery in the South Branch. Summer flow releases from upland storage could be beneficial for kayakers and jet boaters and new water storage reservoirs could provide new recreational opportunities and amenity values.

A.13 Ranking of consentability

An appreciation of the environmental acceptability and therefore consentability of the ten development options considered has, at this stage, been limited to a comparison of the seven individual storage sites. This appreciation ranks the South Branch storage site (one of the most cost effective storages) as being the hardest to consent, the Waitohi and Mandamus storage sites to be the next hardest, Lake Sumner as easier, and the Pahau as probably the easiest.

It should be noted that all of the evaluations have been undertaken without the benefit of cultural considerations and when Te Runanga O Ngai Tahu contributions are included, the scope and nature of potential development could change. Other stakeholder inputs may also alter the study team's present appreciations.

A.14 Stage 1 Report conclusions

This Hurunui District Scoping Study provides valuable information to support the objectives of the Working Group.

A sustainable water management regime that provides for community needs and the enhancement of in-river flows is possible. Not only is this possible, it will enable the efficient use of natural resources and may guide the acceptability and direction of future resource consent approvals.

Environment Canterbury has notified their proposed Natural Resources Regional Plan (NRRP) and further submissions on the Plan close 19 December 2005. The proposed NRRP as it is currently written limits the opportunity to consider and implement the preferred water management regime and undertake the development of the short-listed water storage sites.

This scoping study has, however, principally been a desktop study. Significant additional investigation is required to prove irrefutably the most appropriate technical and environmental acceptable of the short-listed water storage sites and to identify that combination of sites which best provides a sustainable water management regime for the district to suit the demand for irrigation water.

Appendix B: Stage 1 and 1A primary constraints

Stage 1 and 1A Primary Constraints

The primary constraints include the following:

- i. Topographical data is limited and comprises 1:50,000 mapping with 20 m contour intervals.
- ii. Geotechnical information for the area of study is extremely limited and as a result, the team has relied heavily on prior experience and procedures for the initial stages of study.
- iii. Published geological information is a little better represented and essentially comprises:
 - published general geological mapping (Sheet 18, Hurunui, DSIR, Jan 1964)
 - Probabilistic Seismic Hazard Assessment of the Canterbury Region, New Zealand, Stirling et al, December 2001 with focus on active fault traces, some of which update those shown on the general geological map
 - several University of Canterbury theses of potential relevance
- iv. Notwithstanding the above, and given the major geotechnical limitations, the individual sites have not been inspected to gain a clearer idea of:
 - suitability of foundation
 - availability of construction materials
 - ease of construction including diversion
 - ease of access
 - the presence of active faulting
- v. No fieldwork has been completed and the assessed extent of the irrigable area for the initial stages has been derived from published data, primarily the Land Resource Inventory database. It is acknowledged some potential irrigable areas in the study area may have been omitted and vice versa.
- vi. Hydrological data for the Hurunui River Mandamus site is relatively thorough. However, hydrological information from the Hurunui tributaries is limited, and constrains to some extent the accuracy of the initial work. Where records do not exist, further work will include the compilation of synthetic flow records
- vii. Most of the uncertainty expressed in the “environmental” sections of the initial reports arises because of the lack of site visits and discussions with people who do know the sites. Most aspects of these environmental matters will have to be dealt with when site-specific investigations are carried out to move from selected options to one preferred option and resource consents stage. During those investigations, in depth studies will be required to develop the level of understanding about the following:-
 - the ecology and landscape values of the area,
 - the recreational uses,
 - the ways these might be affected by the proposal and
 - the way that adverse effects could be mitigated

Appendix C: References

Reference 1

Tonkin & Taylor, Hurunui Community Water Development Project, District Scoping Report, June 2004.

Reference 2

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