

4 APPENDICES

4.1 Technical Panel Notes

The Technical Panel undertook a field examination of a number of sites in order to make flow recommendations. On the field trip days, Community Advisory Group members took the panel to various sites in the catchment to observe the rivers and streams. The river was gauged the day prior to the trip and no rain fell between the gauging and the field visit. Additional information provided to the panel included a 7DMALF, the current minimum flow and consent information. Each member provided a visual assessment methodology particular to the instream value/s they hold expertise in. The results of the assessments, as recorded on the field worksheets, are set out below.

4.1.1 Waihaorunga Stream immediately upstream of Waihaorunga water supply intake (NZMS 260 J40:315-053)

The minimum flow site was visited on 22 March 2006.

Site Flow (L/s)			Suggested Minimum Flows (L/s)				
Gauged	MALF	CMF	Burrell	Duncan	Partridge	Pflugger	Tangata Whenua
18	No MALF	16	19	15	12	16	30

Stream Character Significance					
	Burrell	Duncan	Partridge	Pflugger	Te Runanga o Waihao
Natural character				H-M	
Mauri					L
Trout	L				
Native fish	L				
Mahinga kai					M-H
Wāhi tapu & wāhi taonga					M-H
Mauri					H
Indigenous Vegetation			L		
Boat passage					
Angling amenity					
General amenity				L	

Greg Burrell (trout & native fish)

Greg did not complete a form during the Technical Panel site visits. The ecological information gained is included in the Kingett Mitchell Ltd Report.

Maurice Duncan (hydrology)

Substrate gravel and small cobbles
 Straight to meandering reach
 Rushes on banks – vegetation to water edge
 Fish – eels and upland bullies
 Clear flow
 Macrophytes and green filamentous algae.

0.5 to 1 m wide and 150 deep
Habitat for eels and bullies – these values looked after at the gauged flow. Stream appearance is good in terms of vigour of the flow. No particular natural values. Recommended minimum flow is 15 l/s
Trevor Partridge (indigenous habitat)
Aquatics – Lemna* Glyceria, Azolla*, algae, Myosotis Margins – Glyceria, Carex geminata* bent, musk, cress Banks (lower) – Carex geminata* (upper) – pasture grasses Floodplain – Carex geminata*, thistles, crack willow Terrace – pasture grasses and weeds. Good margin vegetation even though there is little native. Carex geminata is the only one. But the zonation is clear and the relationship with the water is healthy. The thick growth of musk, cress, Glyceria etc is appropriate. The present flow of 18 l/s is enough and more to maintain these communities that show no signs of stress around the upper margins. The water level could drop a bit further before that stress becomes evident. An estimate of 12 l/s would be a minimum to support the vegetation. Grazing – the margins are grazed. At the time of visit the aquatics and marginal plants show no adverse effects but it would not take too much more to tip the balance.
Yvonne Pfluger (natural character)
Small drain with slow flow and not much water. Water quality appears appropriate given farming use of adjacent land. Sparse vegetation – few exotic groups of trees. Wider landscape highly natural and unmodified (tussock on hills). A lot of vegetation in and along water – native and appropriate (healthy system). Algae give slimy impression of channel. Flow seems appropriate – can't be much lower or stream will dry up; current flow (18l/s) is slightly higher than minimum flow (16 l/s). therefore minimum flow seems to be an appropriate minimum to maintain current landscape values. Given scale of stream, wider landscape values are more dominant than values of stream itself. Values associated with the creek include: Land cover: Matagouri on hills in tussock Channel: Single thread, narrow and uniform upstream from site, varied downstream Riparian edges: gentle banks, upstream banks not grazed, downstream intensely grazed Water processes: slow and tranquil, cobble channel, slimy bed. Built modifications: Small bridge structure, appropriate for rural farm landscape. Scenic: Rolling hills in backdrop Access: Roadside, farmland
Tangata whenua (cultural values)
Not able to comment on mahinga kai Mauri remains on a high priority. This area has historical significance for tangata whenua Te Runanga o Waihao and mana whenua are unable to recommend a flow at this time but would like to investigate the area and assist in setting a required flow. The above schedule of values is incomplete but it would be recommended that investigations should take place to accurately comment on flows for the future. It seems to be that many of the flows set in the upper reaches of the Waihao will require some further work but it should not alter the flow values set at McCulloughs Bridge.

4.1.2 Waihao River (Waihaorunga) (NZMS 260 J40:380-062)

The minimum flow site was visited on 22 March 2006.

Site Flow (L/s)			Suggested Minimum Flows (L/s)				
Gauged	MALF	CMF	Burrell	Duncan	Partridge	Pflugger	Tangata Whenua
60	Est. 20	110 90	MALF	90	70	75	90

Stream Character Significance					
	Burrell	Duncan	Partridge	Pflugger	Te Runanga o Waihao
Natural character				M-L	
Trout	M				
Native fish	M				
Mahinga kai					H
Wāhi tapu & wāhi taonga					H
Mauri					H
Indigenous Vegetation			M		
Boat passage					
Angling amenity					
General amenity					

Greg Burrell (trout & native fish)

Greg did not complete a form during the Technical Panel site visits. The ecological information gained is included in the Kingett Mitchell Ltd Report.

Maurice Duncan (hydrology)

Brown trout juvenile and bullies and galaxias.
Riffles with gravel, cobbles and boulders, 10 m wide, 100 m long deep.
Pools 20 m wide, slow flowing 0.3 – 2 m deep.
The pools are deep beside the willows that line one bank at the assessment site. Macrophytes in pools.
Good periphyton cover in riffles with caddis fly and large mayfly larvae abundant.
Mainly slow flowing pools with willow on one bank. Flow is clear.
Fairly non-descript stream with willows, and scattered gorse and pasture on banks.
Main value is habitat for native fish and juvenile trout.
Recommended minimum flow 90 l/s

Trevor Partridge (indigenous vegetation)

Aquatics – water buttercup (lots of it and very healthy) algae, Azolla, Myriophyllum propinquum*
Lilaeopsis* Lemna * Carex gaudichaudiana*.
Margins – musk, cress, jointed rush, Epilobium, Myosotis, Eleocharis acuta*, Carex virgata
Floodplain – crack willow, Carex buchananii* pasture grasses, soft rush, gorse, Juncus sp*, Carex geminata*.
Good aquatic vegetation and marginal plants that are fairly healthy despite presence of willows. The relationship between the vegetation and water seems good as the willows are not too dominant.
Willows have the potential to impact on stream and marginal vegetation – not too bad so far but it could become worse if they increase in density.
Some cattle pugging of the soil containing the margin aquatics was noticed.

Yvonne Pfluger (natural character)

Forestry upstream – stream could dry out, due to forestry in head waters (used to be tussock – now no runoff).
 Downstream of site gorge – difficult to decide on representativeness.
 Willows along stream very dense and overhanging – very close to water – clogged up with branches and leaves.
 Looks like stable system, not highly natural (exotics – overgrown) and riverbed overgrown.
 Single thread – riverbed over grown with exotics – converted to pasture and farmland.
 Naturally slow flowing stream – wide and flat bed with low gradient.
 Amount of water seems quite appropriate, although significantly lower than minimum flow.
 No necessity for minimum flow to be at 90l/s with this gradient and bed. Proposed minimum flow 75 l/s.
 Would need big flood to change it due to low gradient and wide shallow bed. Flow seems appropriate for these parameters.

Values associated with the creek include:

Land cover: exotics and willows dense along stream, some gorse on riverbed, extensive paddocks and forestry upstream

Channel: Single thread, wide river bed, but confined stream channel

Riparian edges: gentle shelf, steep banks but also varied not grazed, downstream intensely grazed

Water processes: slow and tranquil, cobble channel, slimy bed.

Built modifications: none

Scenic: Rolling foothills in backdrop

Access: Roadside, farmland

Tangata whenua (cultural values)

Mahinga Kai is an important value but is unknown. With water level set at 1300 ltrs/sec at McCulloughs Bridge the value will become high
 High value remains
 There are taonga in the vicinity of this site which in fact there are in the whole of the upper catchment these reside in the landscape and relate to particular whanau from Hateatea Hapu
 The minimum flow to remain until the Manawhenua and runanga and have the opportunity to access the current flow.

4.1.3 South Branch Waihao River Coal Pit Bridge (NZMS 260 J40:4486-0224)

The minimum flow site was visited on 22 March 2006.

Site Flow (L/s)			Suggested Minimum Flows (L/s)				
Gauged	MALF	CMF	Burrell	Duncan	Partridge	Pfluger	Tangata Whenua
67	31	100	31	50	70	70-80	No suggestion

Stream Character Significance					
	Burrell	Duncan	Partridge	Pfluger	Te Runanga o Waihao
Natural character				H	
Trout	M				
Native fish	L-M				
Mahinga kai					H
Wāhi tapu & wāhi taonga					H
Mauri					H
Indigenous Vegetation			L		
Boat passage					
Angling amenity					

General amenity				L	
Greg Burrell (trout & native fish)					
Greg did not complete a form during the Technical Panel site visits. The ecological information gained is included in the Kingett Mitchell Ltd Report.					
Maurice Duncan (hydrology)					
<p>Habitat for eels. Water naturally cloudy even at low flows. Single thread slow flowing pool like stream lined with willows. Grass to waters edge. Gravel/cobble substrate. Meandering Pools too deep, water too cloudy and too much shade for macrophytes Banks covered in willows and broom. Macroinvertebrates typical of slow flowing streams Heavy periphyton cover Habitat for eels, passage for juvenile trout to lower river. Given the wide deep character of the flow probably no advantage in having more than the gauged flow. Recommended minimum flow 50 l/s.</p>					
Trevor Partridge (indigenous vegetation)					
<p>The margins differ considerably between open areas and beneath willows. Where willows dominate there is little if any bank vegetation, but in the open there are aquatics and well developed margin plants. Where margins occur there is frequently a flat 'terrace' of typical marginal species just above the present water flow. The soil here is moist and suitable for these species. Therefore a flow of about 70 l/s is sufficient to sustain that habitat. Willows are threatening the remaining marginal vegetation.</p>					
Yvonne Pfluger (natural character)					
<p>Banks, bed and channel look stable with vegetation. This contrast with eroding cliffs provides visual diversity. Escarpment main landscape feature. Willows dense along banks – no good views of creek itself. Influence on natural character, but high visual amenity still high with varied surrounding landscape. Water naturally discoloured. Flow below minimum flow, but increase would not increase natural character value. Incised channel – increase in flow will not change wetted area much. Water cloudy, so flow increase would not change appearance of water itself (bottom of creek not visible). Possible to reduce minimum flow to 70-80 l/s. Escarpment and terraces dominate the landscape. Escarpment is a feature with high natural and legibility values. Values associated with the creek include: Land cover: Extensive willows and trees, quite dense Channel: Single thread, narrow and confined Riparian edges: terrace around site, escarpment downstream, extensive willows and trees Water processes: slow and tranquil, cobble channel, slimy bed. Built modifications: bridge and road, appropriate Scenic: cliffs, impressive landforms the dominant feature Access: Roadside and bridge</p>					
Tangata whenua (cultural values)					
<p>Mahinga kai High priority with future flow management taking affect Mauri remains high There are taonga in the vicinity of this site which in fact there are in the whole of the upper catchment these reside in the landscape and relate to particular whanau from Hateatea Hapu Flow at 100 L/s, stop abstraction</p>					

4.1.4 Waihao River McCullough's Bridge (NZMS 260 J40:497-989)

The minimum flow site was visited on 22 March 2006.

Site Flow (L/s)			Suggested Minimum Flows (L/s)				
Gauged	MALF	CMF	Burrell	Duncan	Partridge	Pflugger	Tangata Whenua
369	377	600/250	377	300	250	250	1300

Stream Character Significance					
	Burrell	Duncan	Partridge	Pflugger	Te Runanga o Waihao
Natural character				H	
Trout	M-H				
Native fish	M				
Mahinga kai					H
Wāhi tapu & wāhi taonga					H
Mauri					H
Indigenous Vegetation			M		
Boat passage					
Angling amenity					
General amenity				H	

Greg Burrell (trout & native fish)

Greg did not complete a form during the Technical Panel site visits. The ecological information gained is included in the Kingett Mitchell Ltd Report.

Maurice Duncan (hydrology)

Bullies and adult brown trout
 Single thread river 30-50 m wide. Low gradient – a big long pool at assessment site.
 Bed of shingle and limestone blocks. Deep pools, (2m+), vegetation to pool edges. Willows, pasture and gorse on banks. Macrophytes in pools.
 Riffle 20 m wide and 0.2m deep with gravel and small cobbles. Thick periphyton. cover, plenty of invertebrates.
 Riffles looks healthy and looks well. Some gravel bars in pool section.
 Visual interest in limestone cliffs on banks and large blocks of in places.
 Visual interests of limestone terraces and the blocks of limestone in the river.
 Habitat for adult juvenile brown trout and native bullies.
 OK for angling.
 OK for swimming
 Good place for picnics
 Recommended minimum flow 300 l/s.

Trevor Partridge (indigenous vegetation)

Aquatics, Elodea (big beds), Myriophyllum*

Margin – bent, jointed rush, Limosella*, Carex secta* (rare), Myosotis, soft rush, Hydrocotyle sulcata* (wet) Floodplain – pasture grasses, Carex buchananii*, tall fescue, bent, soft rush, Schoenus pauciflorus*, Carex geminata*, Epilobium*.

Banks to terraces – crack willow, gorse, broom, brier, pasture grasses and weeds.

Crack willow occurs on gravels but may not be permanent there.

The zonation patterns are very poorly defined and the plant species have a wide range of zones. They are essentially all mixed up. There are species normally associated with tarns and other oddities such as Schoenus, pauciflorus and lots of Carex buchananii. Which all suggests a fluctuating water level.

Those variations are likely to be frequent and of considerable size. All this makes estimating a minimum flow difficult. The only clear boundary is that between the submerged macrophytes and the land plants.

There is however quite an unvegetated gap between, again indicating variability as neither is able to exploit the zone between. At the time of visit the macrophytes were all well below the surface so there is still sufficient leeway for these plants before they become exposed. Difficult that it is, an estimate of minimum flows as indicated by the macrophytes would be about the current minimum of 250 l/s, but this is a broad estimate.

Grazing impacts on margin plants.

Yvonne Pfluger (natural character)

Landscape values of surrounding landscape high – limestone outcrops and cliffs.

Bedrock limestone features in river.

Willows along bank are far enough from water surface to allow for access and views along riverbed – extensive growth.

Water level seems to fluctuate a lot (recently wetted surface still visible).

Landscape values of river would be affected when bedrock starts to be exposed. Wider landscape values are limestone outcrops, which provide high visual diversity. Amenity values, such as recreation (swimming, fishing), present at site.

Minimum flow is 25% less than current flow. Bedrock would not be visible, but gravel banks larger.

Key features (amenity value – swimming) of this part of river are pools between bedrock – they would not be changed significantly with current minimum flow. It is recommended to keep current minimum flow regime (see above) and provide for fluctuation.

Significant stream with interesting bed (bedrock)

Values associated with the creek include:

Land cover: Paddocks, trees and scrub, matagouri on terrace and willows along the bank

Channel: Single thread, wide and natural

Riparian edges: banks around 1.5m high, boulders with willow plantings for flood protection

Water processes: slow and steady flow, flow slows as river comes out of hills into plains, clear water

Built modifications: bridge and road appropriate

Scenic: limestone outcrops and cliffs interesting features, walkway and good swimming

Access: Roadside and bridge

Tangata whenua (cultural values)

significant

There are many taonga in the upper reaches of the river and at McCulloughs bridge there are Rock Art sites Rock shelters

The recommended environmental flow is 1300 L/s with ramping flow commencing 1500 L/s 50% at 1400 L/s cease take on return 50% at 1400 L/s full return once recharge has been continuous @ 1500 L/s for 5 days

4.1.5 Waihao River Bradshaws Bridge (NZMS 260 J40:6420-0150)

The minimum flow site was visited on 22 March 2006.

Site Flow (L/s)			Suggested Minimum Flows (L/s)				
Gauged	MALF	CMF	Burrell	Duncan	Partridge	Pfluger	Tangata Whenua
902	No MALF	100	MALF	No suggestion	No suggestion	100-250	No suggestion
Stream Character Significance							
			Burrell	Duncan	Partridge	Pfluger	Te Runanga o Waihao
Natural character						L	
Trout			M-H				
Native fish			H				
Mahinga kai							H
Wāhi tapu & wāhi taonga							H
Mauri							H
Indigenous Vegetation					L		
Boat passage							
Angling amenity							
General amenity						M	

Greg Burrell (trout & native fish)

Greg did not complete a form during the Technical Panel site visits. The ecological information gained is included in the Kingett Mitchell Ltd Report.

Maurice Duncan (hydrology)

Trevor Partridge (indigenous habitat)

Aquatics (not much here)– musk, Glyceria algae,

Gravels – Polygonum, cress, musk, Myosotis, bent, rape, jointed rush.

Floodplain – tall fescue, pasture grasses and weeds, thistles, crack willow, lupin, Carex geminata*, broom.

The gravels have species normally associated with margins. The water table is just below the upper stones meaning that these plants actually have their roots in water and this zone is equivalent to the margin. They will be under water during floods but this gravel zone doesn't appear to dry out.

Data flows seems suspect. However, for the plants of the gravels to survive, the water table, which is probably an extension of the river water level, cannot drop too much below its present level. If the water table was to drop a further 3-4cm these species would find things very difficult.

Yvonne Pfluger (cultural values)

Stream looks quite healthy.

Banks willow lined – relatively low natural character for surrounding landscape.

Gravel banks partly overgrown (grass)

Flat low terraces on true left bank; constructed steeper banks on true right.

Water seems clear, brown in colour – bottom of stream can be seen, quite deep in places, few slow runs between pool areas.

Assumption: current flow is less than 300 l/s and minimum flow is 100 l/s. At 100 l/s the stream could be classified as insignificant in scale, as the difference to the current flow represents a significant drop.

River quite deep – wetted surface would not change much, but 100 l/s seems very low – around 100-200 l/s would be appropriate (difficult to estimate without reference to current flow).

Surrounding landscape quite plain – farmed flats with shelterbelts.

Values associated with the creek include:

Land cover: Paddocks, and shelterbelts

Channel: Single thread, confined

Riparian edges: High constructed banks on right close to the river, low terraces in close

Water processes:	proximity slow and steady flow, riffles, gravel, some periphyton flow slows as river comes out of hills into plains, clear water
Built modifications:	bridge and road appropriate
Scenic:	plain , willows on left and high constructed banks on right
Access:	Roadside and bridge

Tangata whenua (cultural values)

Mahinga is a significant and a nursery for some twenty six species of native fish, with an eel fishery that is non commercial and is rapidly expanding since the commercial closure this area that extends down stream to the Waihao Box and upstream to where the river appears from it's underground journey.

Mauri High

Adequacy of flow is unreliable at Bradshaws bridge because the level is unstable and inaccurate. This mainly bought about by the influence of the tide and irrigation inputs but the halting of abstraction at 100 L/s is reasonable enough in the mean time. The need to consider the relationship between the flow set at McCulloghs bridge and reliability of the flow associated with irrigation discharge from Morven Glenavy scheme.

No recommendation has been made for Bradshaws but dialogue will be had to discuss the reliability of a cultural flow being measured.

4.1.6 Buchanans Creek at Fletcher's Bridge (NZMS 260 J40:630-019)

The minimum flow site was visited on 22 March 2006.

Site Flow (L/s)			Suggested Minimum Flows (L/s)				
Gauged	MALF	CMF	Burrell	Duncan	Partridge	Pflugger	Tangata Whenua
276	233	112	100	No suggestion	100	150	No suggestion

Stream Character Significance					
	Burrell	Duncan	Partridge	Pflugger	Te Runanga o Waihao
Natural character				L	
Trout	M				
Native fish	M-H				
Mahinga kai					H
Wāhi tapu & wāhi taonga					H
Mauri					H
Indigenous Vegetation			L		
Boat passage					
Angling amenity					
General amenity				L	

Greg Burrell (trout & native fish)

Greg did not complete a form during the Technical Panel site visits. The ecological information gained is included in the Kingett Mitchell Ltd Report.

Maurice Duncan (hydrology)

Trevor Partridge (indigenous habitat)

Aquatics – Limosella* Glyceria, Lemna*, musk, Myosotis.
 Margin - Isolepis prolifer*, crack willow, Gunnera, soft rush, Yorkshire fog, cress.
 Bank – Crack willow, pasture grasses and weeds.

The weir under the bridge has resulted in extensive growth of aquatics upstream. There are also fairly extensive patches downstream. Many of the plants in the water are typical bank species that have extended out. If water flow was reduced these would be on the banks. Therefore a minimum flow of 100 l/s seems to be plenty enough to still support the aquatic and bank species in their appropriate situations.

It is however difficult to picture what the stream looks like with about a third of its present flow. The aquatic growth has the potential to choke the stream in its present state.

Yvonne Pfluger (natural character)

Healthy low land stream

Currently flow appears to be quite high.

Minimum flow set at half of current flow, which seems to be enough from landscape point of view. While stream is now 70cm deep it would only be around 30 cm deep at current minimum flow. Difference in wetted surface would not be significant, but possibly minimum flow should be 150 l/s.

Incised channel with dense vegetation on banks, so landscape values would not be significantly affected at minimum flow.

Looking at stream is quite separate to surrounding landscape – dense vegetation along river and sparse vegetation on surrounding farmland.

Values associated with the creek include:

Land cover: Willows and poplars very dense vegetation on the banks paddocks intensely used as farmland

Channel: Single thread, narrow and incised

Riparian edges: trees, willows, poplars, dense planted and overhanging, residential garden next to site

Water processes: slow and steady movement visible, quite deep, clean lowland stream

Built modifications: bridge and road and gauge all appropriate, culvert

Scenic: mostly a farming landscape- exotic, sparse and pastoral

Access: Roadside and bridge

Tangata whenua (cultural values)

This telemetry site has a value albeit the reliability is erratic because of the influence of the tide and the congestion of pest weed material that back up the water.

The Punatarakao stream has significant mahinga kai values with the ability to repatriate some of the species that were once resident in the system. Species currently in the stream are eels, patiki, inanga, aua(mullet), kokopara(giant cockabully) common bully, trout and Salmon. Salmon reds were sighted in the lower reaches of the stream last year.

The Mauri of Punatarakao has been protected by taha wairua o nga tipuna (the spirit of our ancestors).

The Punatarakao Wetland Trust has taken to restoring the once major kai resource in the hope that the mauri will be enhanced, the repatriation of the species once abundant in the stream by the aquaculture technology available today.

The ancient Pa site of Punatarakao is of major significance to the people of who descend from Ngati

Hateatea there are wahi taonga tapu site recorded in the district from a silent file in Whakatau Kaupapa 1990.

4.1.7 Sir Charles Creek at Hayman's Road Bridge (NZMS 260 J40:643-049)

The minimum flow site was visited on 22 March 2006.

Site Flow (L/s)			Suggested Minimum Flows (L/s)				
Gauged	MALF	CMF	Burrell	Duncan	Partridge	Pfluger	Tangata Whenua
No velocity	No MALF	100 0.75m 0.85m	No suggestion	No suggestion	0.5m	0.5m	No suggestion

Stream Character Significance					
	Burrell	Duncan	Partridge	Pfluger	Te Runanga o Waihao
Natural character				L	
Trout	M				
Native fish	L				
Mahinga kai					H
Wāhi tapu & wāhi taonga					H
Mauri					H
Indigenous Vegetation			L		
Boat passage					
Angling amenity					
General amenity				L	

Greg Burrell (trout & native fish)

Greg did not complete a form during the Technical Panel site visits. The ecological information gained is included in the Kingett Mitchell Ltd Report.

Maurice Duncan (hydrology)

Trevor Partridge (indigenous habitat)

Aquatics – Lemna*, Azolla* Elodea, Myosotis, musk, cress – lots of these.

Glyceria, Myriophyllum*, Potamogeton crispus, Callitriche*.

Margins – cress, musk, Glyceria, Carex geminata*, bent.

Banks – bent, dock, pasture weeds and grasses. Large areas of couch.

Very difficult in these kinds of streams that are large with little flow. If this triggers at 0.75 height there is still a vast quantity of water and more than sufficient to support aquatic species. A minimum trigger of 0.5 still seems to be plenty enough for both aquatics and margin species.

Yvonne Pfluger (natural character)

Highly modified farm landscape – flat and shelterbelts.

Vegetation in water very dense – waterway in parts overgrown with underwater and surface weeds.

Water quality looks quite good, but environment surrounding creek very altered.

Tidal influence, not sure what current water level is. Therefore difficult to judge. Appears to be high at moment, and could be half without significant landscape change.

No tall vegetation along stream, pasture up to edge

Values associated with the creek include:

Land cover: very few trees but flax, paddocks surrounding

Channel: channelised and uniform, bed not visible

Riparian edges: flat and gentle, paddocks up to edges

Water processes: millpond, looks deep and no riffles, very calm, weeds on bottom

Built modifications: bridge and road and buildings (small scale)

Scenic: plain, farmed and pastoral

Access: Roadside and bridge

Tangata whenua (cultural values)

The Sir Charles Creek is one of the most significant sites historically and currently there are a number native fish species resident in the creek but the Hao eel is prominent ranging from elver to migrant. The next significant feature is the habitat for spawning inanga. Flows in Opiro are governed by spring that are fed from the Waihao water and levels are also subject to the tide.

The mauri has been affected over time with drainage and intensive farming for many generations but because this water way has so many cultural values that have not been destroyed the mauri remains high.

Not sure this creek is fed by a number of springs and is affected by the tide.

No cultural flow is recommended

This stream has a range of special mahinga kai resources species such as braided Kokopu, Kokupara ,(giant bully) Hao eel, horohorowai, (longfin eel) , manu, (many varieties of native birds) aruhe, (fern root), kakahi, (freshwater muscle), Trout, Patiki (flounder at bottom end of the stream, aua (Yellow eyed mullet)

4.1.8 Hook River immediately above intake (NZMS 260 J40:492-160)

The minimum flow site was visited on 23 March 2006.

Site Flow (L/s)			Suggested Minimum Flows (L/s)				
Gauged	MALF	CMF	Burrell	Duncan	Partridge	Pflugger	Tangata Whenua
71	36	50 30	36	No suggestion	No suggestion	50-70	No suggestion

Stream Character Significance					
	Burrell	Duncan	Partridge	Pflugger	Te Runanga o Waihao
Natural character				H	
Trout	M				
Native fish	L				
Mahinga kai					H
Wāhi tapu & wāhi taonga					H
Mauri					H
Indigenous Vegetation			H		
Boat passage					
Angling amenity					
General amenity				H	

Greg Burrell (trout & native fish)

Greg did not complete a form during the Technical Panel site visits. The ecological information gained is included in the Kingett Mitchell Ltd Report.

Maurice Duncan (hydrology)

Trevor Partridge (indigenous habitat)

Aquatics – none as too shaded.

Margins (gravels) – occasional weeds – chickweed, Epilobium*, Pseudognaphalium*, Cardamine*, Scleranthus*, Senecio* tutu*, Acaena* Hydrocotyle nz*, Acaena nz* Acaena sp* hawkweed,

Banks (well developed and open) – gorse, grasses, herbs, native trees shaded areas have tree fuchsia* wineberry*, Himalaya honeysuckle.

Superb stream flowing through native forest.

The stream bed is somewhat separated from the forest ecosystem by the gravel banks. Thus under normal flows the river depends on the forest rather than the forest being dependent on the river. There are no distinct margin and aquatic habitats as it is too shaded for these plants. Instead the gravels constitute the margins. These gravels, have a surprising number of native herbs but as with other gravel streams the habitat is dependent on and controlled by flood flows.

So, as interesting as the river is, and as good as the forest is, no vegetation is dependent upon minimum flows. Therefore no recommendation is made despite the high biodiversity values.

Yvonne Pfluger (natural character)

DOC land along stream surrounded by private properties, so stream serves as access.

Very high natural character values for both the stream and surrounding bush.

Clear water (slightly discoloured from tannins) – pristine condition.

Currently banks and riparian edge in natural condition – reduction in flow to half (which is current minimum flow set at 30l/s) would adversely affect natural character values.

Minimum flow should be 50 – 70 l/s.

Any built structures would be in contrast to natural environment and would compromise values.

Bush in good condition, seems to be very rare in this region-area and values, such as clean fast flowing streams should be protected in association with the bush –

Birdlife present.

Values associated with the creek include:

Land cover: Great bush in highly natural condition,. Native broadleaf forest surrounding stream

Channel: single thread and narrow, long and winding, channel bed materials coarse, clear and pure

Riparian edges: gravel banks on one side, limestone rock the other side, indigenous, mature and dense bush, birdlife present

Water processes: rapid flow, gurgling sound

Built modifications: water intake structure

Scenic: incised foothill valley, enclosed, limestone, highly natural bush

Access: from private track

Tangata whenua (cultural values)

The Hook River has a high value for mahinga kai resources and habitat for native fish species .

4.1.9 Hook River South Branch (NZMS 260 J40:4987-1433)

The minimum flow site was visited on 23 March 2006.

Site Flow (L/s)			Suggested Minimum Flows (L/s)				
Gauged	MALF	CMF	Burrell	Duncan	Partridge	Pfluger	Tangata Whenua
31	15	13	15	No suggestion	20	25	No suggestion

Stream Character Significance					
	Burrell	Duncan	Partridge	Pfluger	Te Runanga o Waihao
Natural character				H	
Trout	M				
Native fish	M				
Mahinga kai					H
Wāhi tapu & wāhi taonga					H
Mauri					H
Indigenous Vegetation			H		
Boat passage					
Angling amenity					
General amenity				H	

Greg Burrell (trout & native fish)

Greg did not complete a form during the Technical Panel site visits. The ecological information gained is included in the Kingett Mitchell Ltd Report.

Maurice Duncan (hydrology)

Trevor Partridge (indigenous habitat)

Aquatics – none as too shaded.
 Margins (gravel) – minimal as too shaded.
 Banks – Asplenium*, Polystichum*, Blechnum*, Microlaena avenacea* Hebe*
 Terraces/floodplain - Mahoe*, Coprosma* Muehlenbeckia australis*, Pittosporum tenuifolium*, tree fuchsia*, Parsonsia*, 5-finger*, big kowhai*
 Description from forest area – not by bridge.
 As in these forest systems there is no aquatic or margin (gravel) species because of shade. Therefore stream flow does not directly effect species dependent on them.
 However, such streams do supply humidity that keeps the forest healthy. If such streams dry up the forest species, especially the native ferns along the bank will suffer. To keep this aspect of the ecosystem healthy requires a decent flow. An estimate of the amount is very difficult but considering the present flow, a sensible estimate would be 20 l/s minimum.
 The stream flows close to the forest margin making its functioning vulnerable to encroachment of adjacent farming.

Yvonne Pfluger (natural character)

Highly natural creek
 Flow very appropriate – smaller in scale than Hook River site. Difference between current flow and minimum flow is significant - minimum flow should be raised to – 25 l/s.
 Landscape values significant – natural character very high, sound of creek part of experience – flow reduction would lead to adverse effects on these values.
 Highly natural bush surrounding the creek.
 Value of bush for birds. High numbers of birds.
 Values associated with the creek include:
 Land cover: Natural dense bush
 Channel: single thread, contained and varied, natural
 Riparian edges: gentle banks, mature natural dense bush
 Water processes: gentle and tranquil, riffles, fine shingle. Clear water, pristine
 Built modifications: bridge small scale
 Scenic: gullies and valleys, some highly natural bush remnants
 Access: from bridge, road

Tangata whenua (cultural values)

No additional comments were provided with the minimum flow recommendation

4.1.10 Waimate Creek at John Kirk's intake (NZMS 260 J40:526-077)

The minimum flow site was visited on 23 March 2006.

Site Flow (L/s)			Suggested Minimum Flows (L/s)				
Gauged	MALF	CMF	Burrell	Duncan	Partridge	Pflugger	Tangata Whenua
21	No MALF	15	16	No suggestion	15	25-30	No suggestion

Stream Character Significance					
	Burrell	Duncan	Partridge	Pflugger	Te Runanga o Waihao
Natural character				M-L	
Trout	M				
Native fish	L				
Mahinga kai					No ranking
Wāhi tapu & wāhi taonga					No ranking
Mauri					No ranking
Indigenous Vegetation			L		
Boat passage					
Angling amenity					
General amenity				L	

Greg Burrell (trout & native fish)

Greg did not complete a form during the Technical Panel site visits. The ecological information gained is included in the Kingett Mitchell Ltd Report.

Maurice Duncan (hydrology)

Trevor Partridge (indigenous habitat)

Aquatics – none as very shaded here.

Margin – willow mat, and gravel – scattered weeds etc, musk, violet, Muehlenbeckia australis *, cress.

Banks and narrow floodplain – blackberry, violet, crack willow, grasses, Muehlenbeckia*, Dryopteris fern, broom, Polystichum*

The musk, cress, etc are in moist hollows probably fed by the water table. The bank and floodplain are a 10-20cm step above that, then a steep bank. The current flow keeps the water table in the right position for the margin species but if the flow dropped to below the current minimum of 15 l/s they might become stressed. At this site the ecosystem functioning values are low and the indigenous component minimal, but there may be other areas that might be of greater value and the recommended minimum is to protect those more than this site.

Dairy farming on adjacent probably has impacts.

Yvonne Pflugger (natural character)

Riverbed in bad condition – weed infested (hardly any natives). Willows are dense and shading creek.

Banks steep with steps due to straightening of creek.

Water brown, but relatively clear.

Difference above and below pump: mainly velocity and surface water movement. Wetted area is similar, but stream is shallower below pump – less lively including sound.

Creek wide (wetted area wide) but shallow, very slow flowing – low gradient.

Current flow is very low – close to minimum flow (15 l/s).

15 l/s seems to be very low as a minimum flow. Flow of 25-30 l/s seems to be more appropriate.

However, natural character of the stream is currently low (exotic vegetation, banks, etc.). Condition of these attributes has more adverse effect on natural character than flow and would not be improve significantly with increase in flow.

Noise of pump affects river experience significantly.

Values associated with the creek include:

Land cover:	dense willows along banks and lots of weeds along riverbed
Channel:	confined channel, uniform, coarse cobble, exposed gravel
Riparian edges:	steep banks, farm around creek
Water processes:	water slow, low gradient
Built modifications:	bridge small scale, water pump for groundwater, noisy
Scenic:	start of plain, foothills backdrop, paddocks, weeds, housing
Access:	from farm track
Tangata whenua (cultural values)	
Waimate creek has a significant cultural and mahinga kai value	
Eels, kokupara, manu	

4.1.11 Wainono Dead Arm at Poindestres Road (NZMS 260 J40:639-072)

The minimum flow site was visited on 23 March 2006.

Site Flow (L/s)			Suggested Minimum Flows (L/s)				
Gauged	MALF	CMF	Burrell	Duncan	Partridge	Pfluger	Tangata Whenua
No velocity	No MALF	Water level exceeds 1.50m	No suggestion	No suggestion	200mm	No suggestion	Water level exceeds 1.50m

Stream Character Significance					
	Burrell	Duncan	Partridge	Pfluger	Te Runanga o Waihao
Natural character				No ranking	
Trout	H				
Native fish	H				
Mahinga kai					H
Wāhi tapu & wāhi taonga					H
Mauri					H
Indigenous Vegetation			L		
Boat passage					
Angling amenity					
General amenity				No ranking	

Greg Burrell (trout & native fish)
Greg did not complete a form during the Technical Panel site visits. The ecological information gained is included in the Kingett Mitchell Ltd Report.
Maurice Duncan (hydrology)
Trevor Partridge (indigenous habitat)
Aquatics – floating mats of reed canary grass from edge. Elodea in centre Margins – dense swords of reed canary grass – little else can compete with this. Tidal stream with few ecosystem function values because of invasion of reed canary grass. As this grass mat goes up and down with the water level, it is impossible to know what constitutes a 'normal' situation. Therefore it is difficult to estimate a minimum for the site. The level is used as for gauging. A third of the present amount of water would be sufficient. It is estimated that the present level is about twice that, so a minimum of 200mm seems sufficient.
Yvonne Pfluger (natural values)
No additional comments made

Tangata whenua (cultural values)

The whole of the dead arm is historically significant and remains so today history has never been important when the utilization of resources such as land water became a necessity for prosperity. High exploitation of both land by drainage, and water for the same reason saw the Mahinga kai cultural value diminished, but the value of resources still available is still important Eels, patiki, aua, inanga, kutai, tuaki. Kanakana, manu, Wahi tapu sites significant to whanau and te Hapu o Ngati Hateatea, Te Pou a Rakihouia.

4.1.12 Merrys Stream (SH1) (NZMS 260 J40:621-130)

The minimum flow site was visited on 23 March 2006.

Site Flow (L/s)			Suggested Minimum Flows (L/s)				
Gauged	MALF	CMF	Burrell	Duncan	Partridge	Pflugger	Tangata Whenua
No velocity	No MALF	Less than 250mm	30	No suggestion	Could reduce a little	250mm	No suggestion

Stream Character Significance					
	Burrell	Duncan	Partridge	Pflugger	Te Runanga o Waihao
Natural character				L	
Trout	M				
Native fish	M-H				
Mahinga kai					M-H
Wahi tapu & wahi taonga					No ranking
Mauri					H
Indigenous Vegetation			L		
Boat passage					
Angling amenity					
General amenity				M	

Greg Burrell (trout & native fish)

Greg did not complete a form during the Technical Panel site visits. The ecological information gained is included in the Kingett Mitchell Ltd Report.

Maurice Duncan (hydrology)**Trevor Partridge (indigenous habitat)**

Aquatics – water buttercup, musk (floating)

Banks (steep and high at site). - Carex geminata*, periwinkle, cocksfoot, gorse, broom, Dryopteris fern, convolvulus.

Top/terrace - blackberry

Floodplain (small areas) - crack willow, elder, grasses, foxglove, Muehlenbeckia australis*

A variable stream with many habitats ranging from willows to steep banks and open margin areas. The musk and cress are well into the water at present so a reduction in flow would be of little problem to them.

Yvonne Pfluger (natural character)

Water looks clear – easy to see streambed.

Assessment of landscape values only applicable to SH1 bridge site – not possible to see up or down stream due to vegetation. Constructed banks overgrown with weeds – low natural character of banks, but might be locally.

Upstream from bridge exotic weeds block water flow

Incised bed and slow flow – less water will not make a very big difference in terms of landscape values.

Very low gradient and slow flow.

Current flow during assessment 300 – 400 mm (depth). Minimum flow currently set at 250mm, which seems appropriate.

SH1 and weeds

Values associated with the creek include:

Land cover: exotic trees along stream and weeds, paddocks, trees and shelterbelts

Channel: confined channel, uniform, long and curving, fine pebbles, clear water, a few weeds in creek

Riparian edges: constructed banks quite steep and overgrown with weeds

Water processes: water slow, millpond, calm and flat

Built modifications: state highway bridge and constructed banks, fencing and houses nearby, very close to bridge so may not be a representative of stream

Scenic: farmland around, paddocks and shelterbelts

Access: from farm track

Tangata whenua (cultural values)

Mahinga kai values are important eels are resident in the stream. In the past prior to modification there were other mahinga kai species taken from the stream. Pipwai, Wai koura, Kakahi. Currently the resources available are eels, watercress, ducks.

The research results provided in the report presented carried out collaboratively with the Runanga does not reflect any cultural values in relation to flows, or at least there is no identification that cultural values were a priority.

4.2 Summary of Kingett Mitchell Ltd. Report

Twelve sites were selected to assess the instream requirements for the rivers and streams within the Waihao-Wainono catchments. These sites are the current minimum flow sites in the area. The sites were surveyed twice between March and May. The initial stream survey was undertaken in March 2006, following a substantial period of stable low flows. A follow-up survey was undertaken in May 2006, when river flows were considerably higher at most sites. Each site comprised a representative 50 to 100 m reach of the river where data on instream habitat, biology and water quality was collected from.

The streams were electric-fished to find out what fish were present and their relative abundance. Quick assessment methods were used to identify what stream invertebrates were present as well as an assessment of periphyton and macrophyte coverage on the streambed.

The WAIORA method was used to measure stream habitat at each site, and the software package RHYHABSIM modelled the predicted effect differing flows. Habitat data for each cross section were entered into the software package and then modelled over a range of flows. The approach used followed that recently used for North Canterbury streams (Wilding et al 2005), as follows:

- Stream flows were calculated from offset, depth and velocity measurements for the gauged cross-sections.

- A flow rating curve was developed for each cross-section using the best least-squares regression equation for the relationship between the flow at the gauged cross-section and stage height for each cross-section.
- Water depths and velocities were then modelled for each measurement point and habitat suitability was assessed for each reach using habitat suitability curves.
- Weighted useable area (WUA) for each species at each simulated flow was the sum of the point habitat suitability scores for each cross-section, weighted by the proportion of the habitat type (run, riffle, or pool) present in the reach.
- WUA (m²/m) was plotted against river flow for each species present to assess the flow at which maximum habitat occurred.

The habitat flow response curves provide a measure of how habitat changes with flow for each species. These curves provide a good basis for flow management decisions. This process included input from ECan technical staff, and was also based on discussions with local landowners and South Canterbury Fish and Game staff. The first stage of setting an instream management objective was to identify what key or “sentinel” species were being protected for at each site. Typically sentinel species will be one that has the highest flow requirements. Secondly, significance criteria were used to determine what percentage of maximum habitat for the sentinel species should be retained. Significance criteria (shown below) were recently developed for a number of North Canterbury streams by ECan (Wilding et al 2005), and for consistency and in recognition of the considerable thought that went into creating the criteria, the same criteria were applied to the Wainono tributary sites. Applying the appropriate habitat retention level to the chosen sentinel species produces a minimum flow for each site.

	Significance Criteria	Habitat retention level (percentage of optimum habitat)
1	Short-jawed kokopu; giant kokopu (DoC priority A & B species)	100%
2	DoC priority C species & regionally threatened species. Banded kokopu; koaro; Canterbury mudfish; alpine Galaxias spp.	95%
3	Locally or Regionally significant Brown Trout fisheries plus habitat on which these fisheries depend for spawning and rearing.	90%
4	Diverse and abundant native fish communities. Fish community featuring a significantly high number of native species, or with importance to recreational (whitebaiting) or cultural (Mahinga kai) values. Species are individually given this protection level, unless afforded higher protection by Crit. 1-3.	85%
5	Non-diadromous species of native fish.	80%
6	Sparse and unfished trout populations. Fish that are often stunted.	60%
7	Streams with few fish or aquatic fauna present.	50%
8	Other fish communities.	70%

A total of 58 invertebrate taxa were identified from the sites sampled. TWINSPAN analysis was used to split the sites into three groups based on species dominance. Sites with similar habitat and flow characteristics shared similar Macroinvertebrate communities. Each of the different group characteristics are identified below:

Group 1 Dominated by crustaceans and molluscs. These taxa are commonly associated with sluggish, macrophyte dominated streams, with finer bed sediments. Pollution tolerant taxa.

Group 2 Dominated by molluscs and caddisflies. All of these sites had stony beds and moderate velocities.

Group 3 Dominated by mayfly, stonefly and caddisfly taxa; indicative of clean, swift waters with stony bed sediments and reasonable stream shade. Clean water taxa.

From the raw invertebrate data, the Quantitative Macroinvertebrate Community Index (QMCI) was calculated. QMCI is an index of organic pollution in stony streams. Taxa are assigned an MCI score from 1 to 10 depending on their tolerance to organic pollution (1 being the most tolerant). The percentage of EPT taxa was also calculated and provides a measure of the relative abundance of water and habitat sensitive mayfly, stonefly and caddisfly (EPT) taxa in a sample. In general higher % EPT abundance is indicative of good water and habitat quality.

4.3 PowerPoint presentation used in the Council Workshop and Regional Planning Committee, July 2007