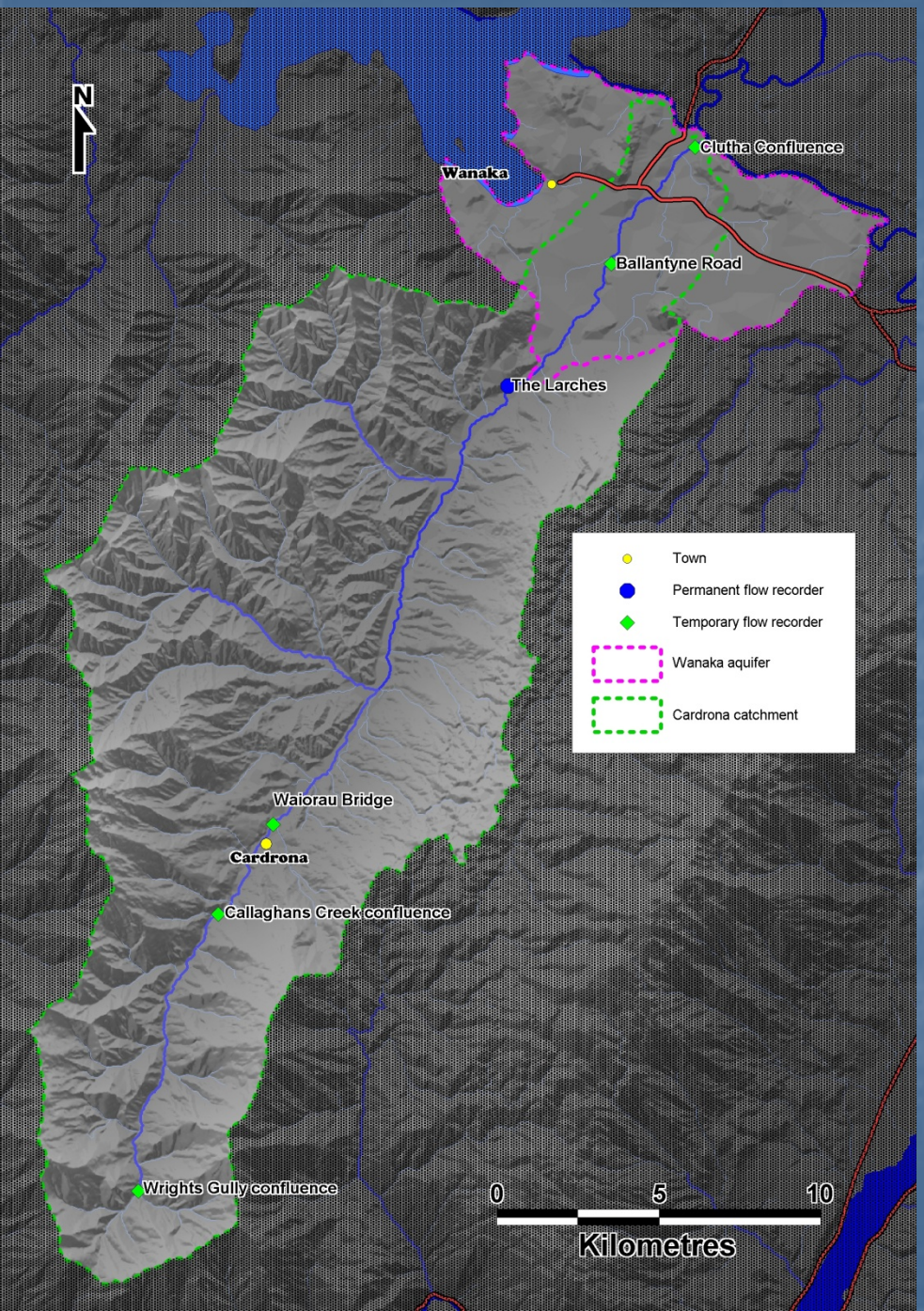
Hydrology and instream values of the Cardrona River

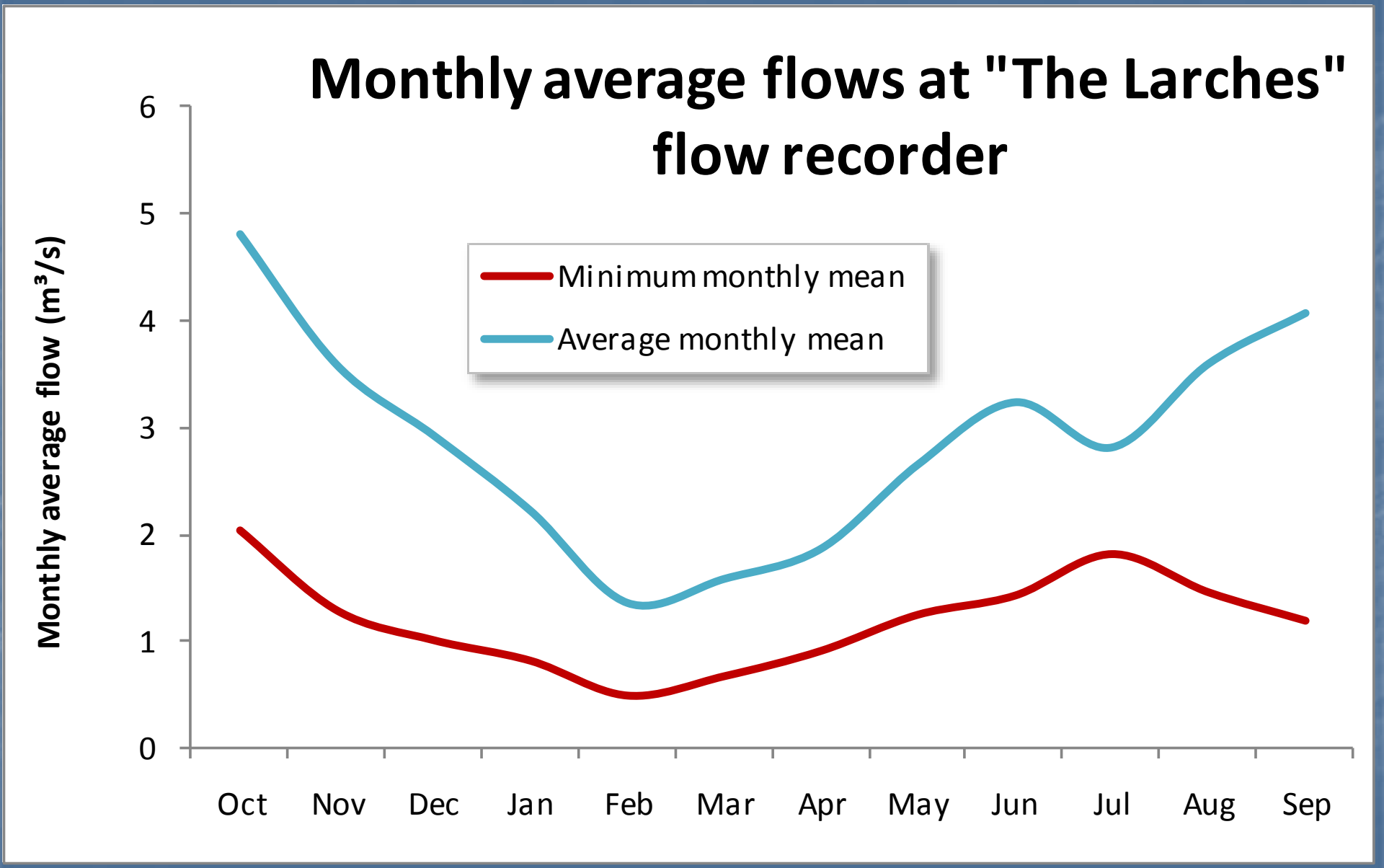
Matt Dale: Otago Regional Council



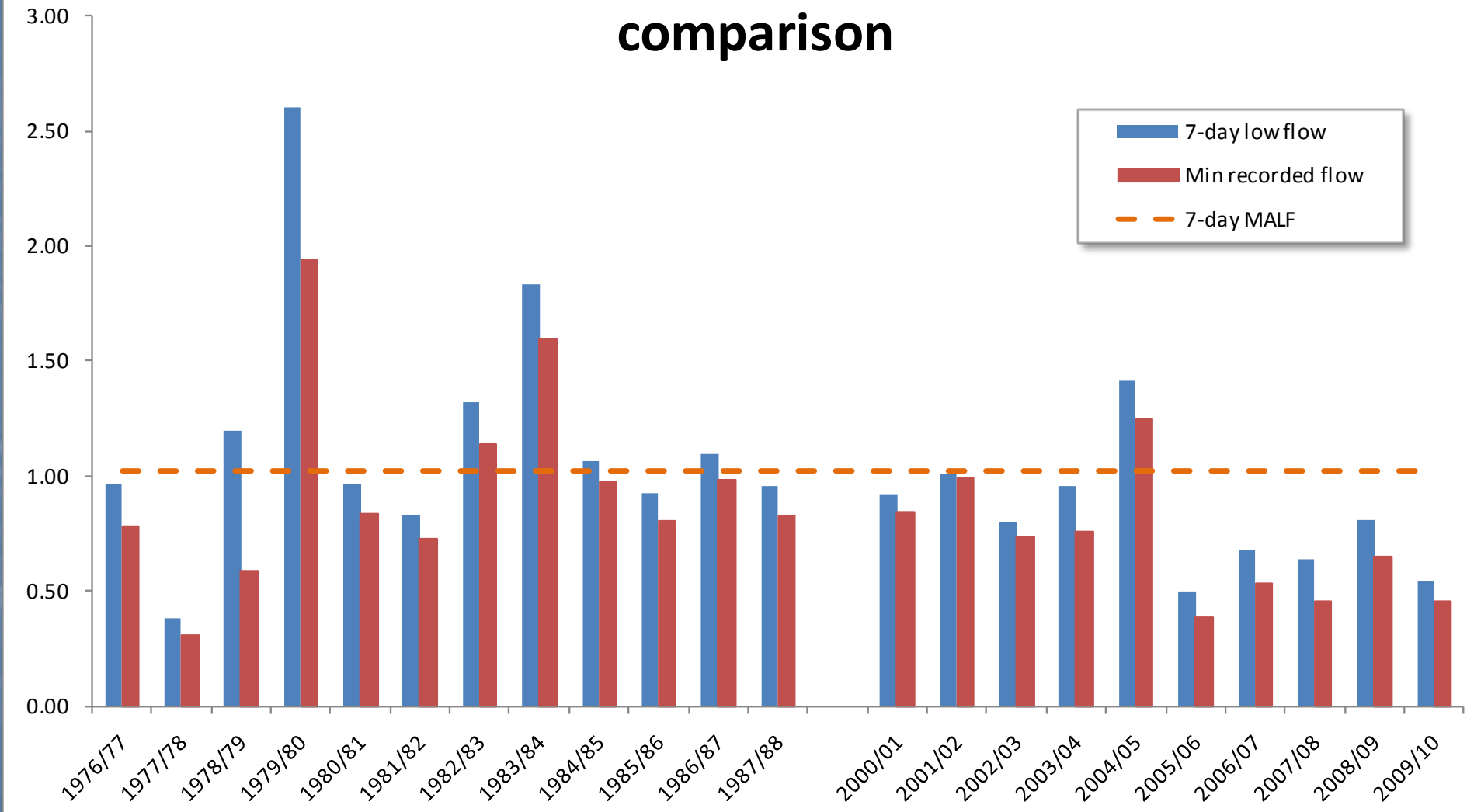
Cardrona River flow sites

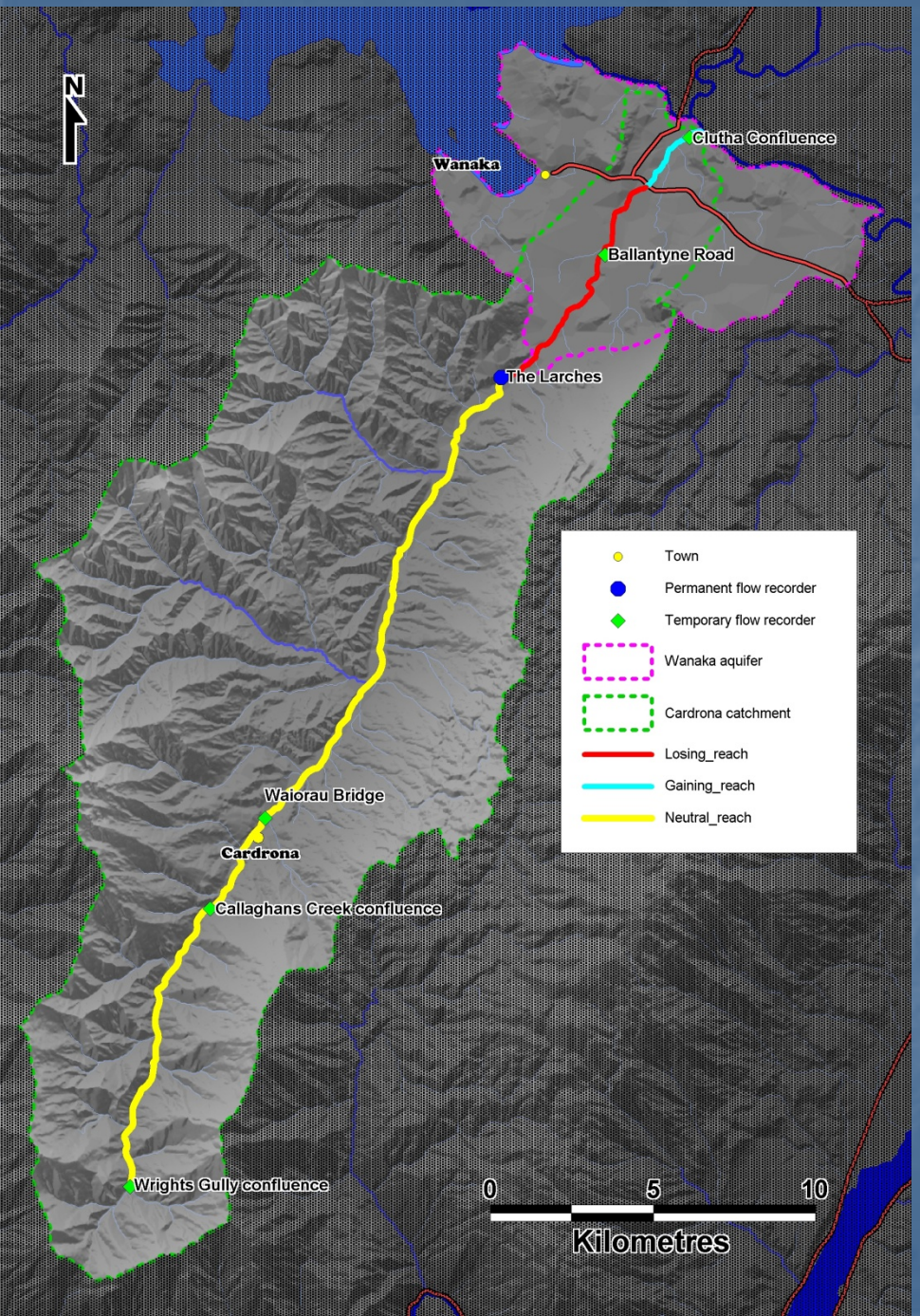
Summary statistics for the Cardrona River

Site Name	Catchment area (km^2)	Term of record (years)	Min recorded flow (m^3/s)	Max recorded flow (m^3/s)	Mean flow (m^3/s)	Median flow (m^3/s)	MALF (m^3/s)
Cardrona at The Larches	293	22	0.308	145.299	3.137	2.306	1.02
Cardrona at Ballantyne Road	307	2	0	24.366	1.868	1.177	0
Cardrona at Clutha Confluence	347	2	0.297	22.024	1.747	1.386	0.321


Monthly average flows at "The Larches" flow recorder
Monthly average flow (m³/s)
6
5
4
3
2
1
0
Minimum monthly mean
Average monthly mean
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep

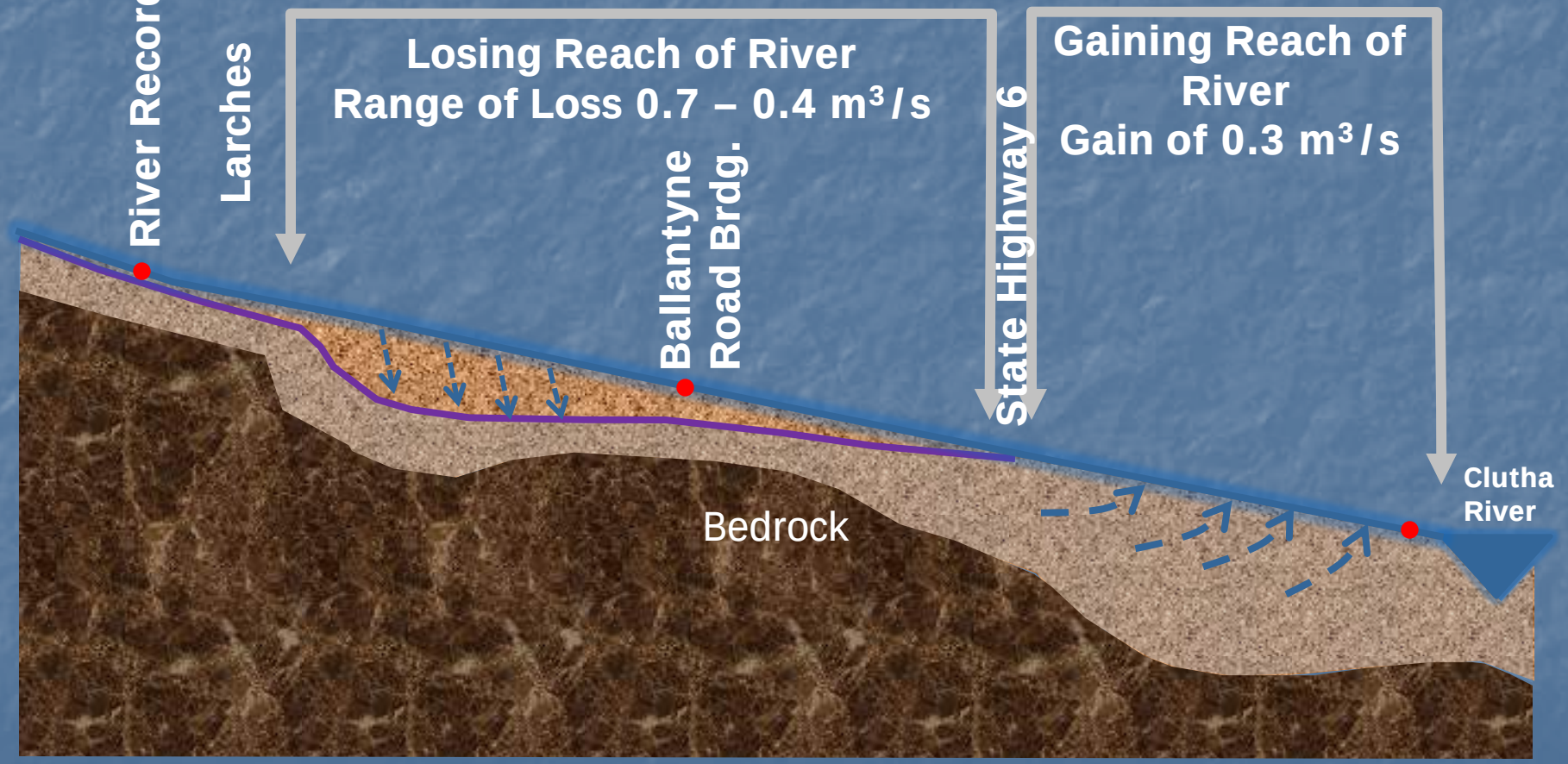
Cardrona River at The Larches low flow comparison



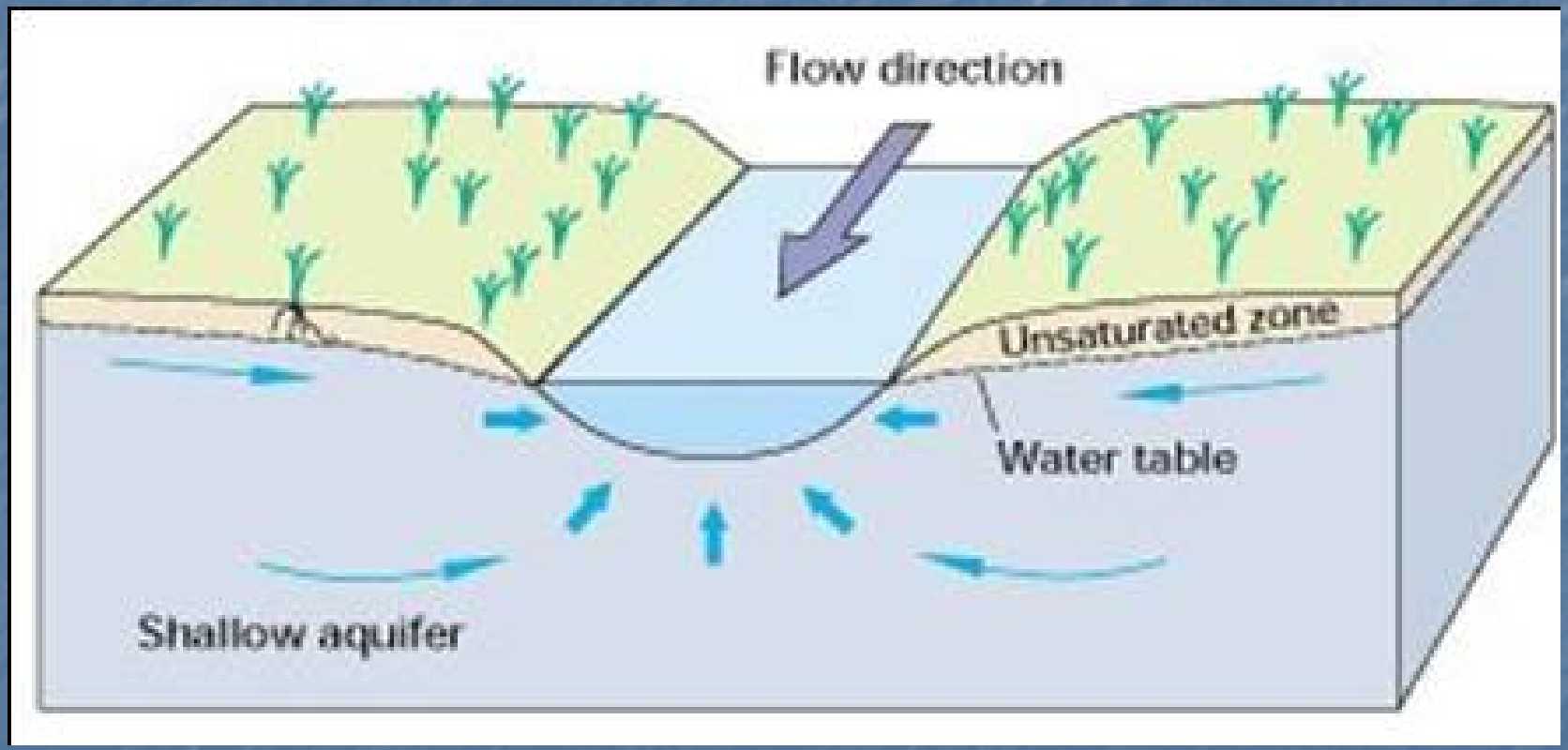


Surface water/ groundwater interactions in the Cardrona River

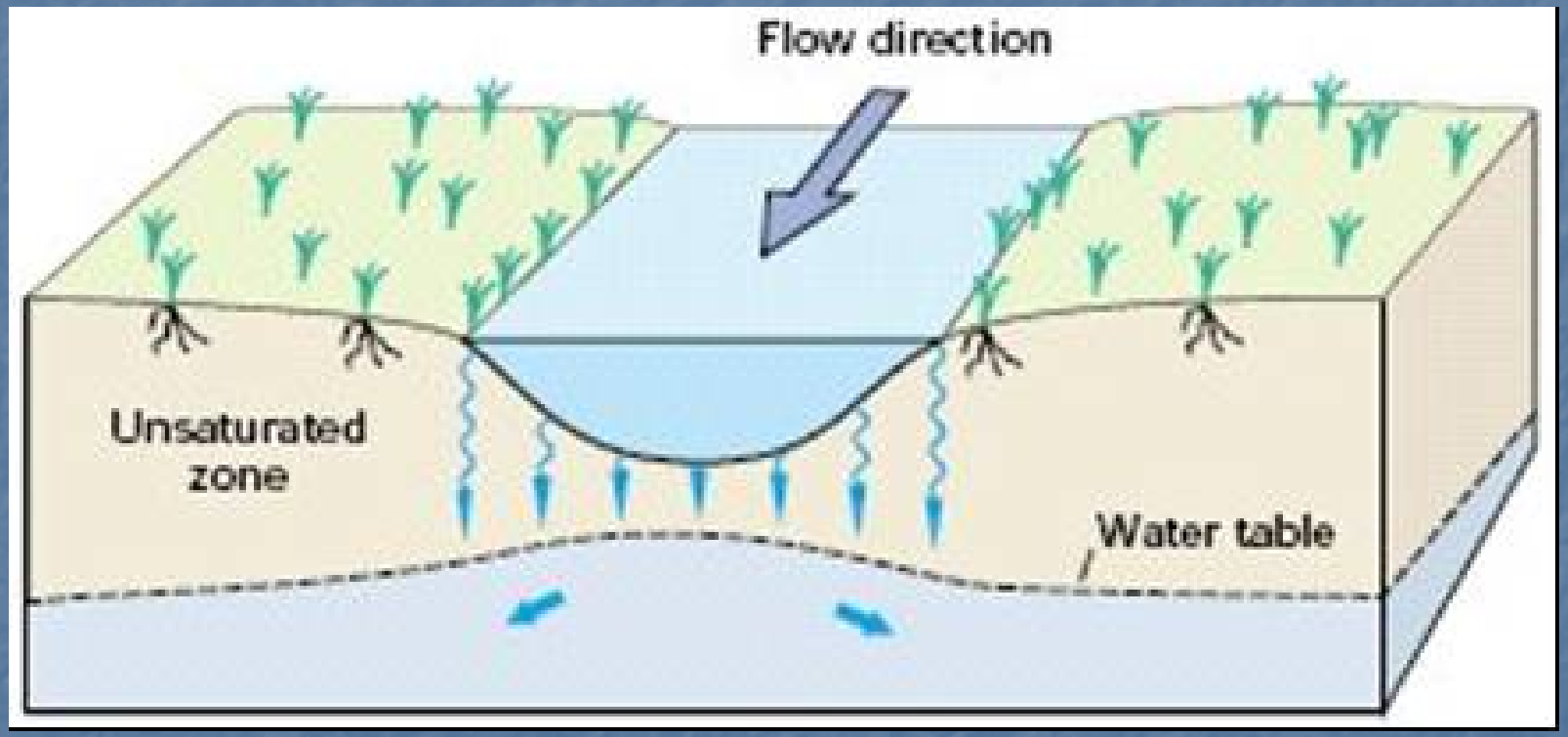
Cross-section of the lower Cardrona River



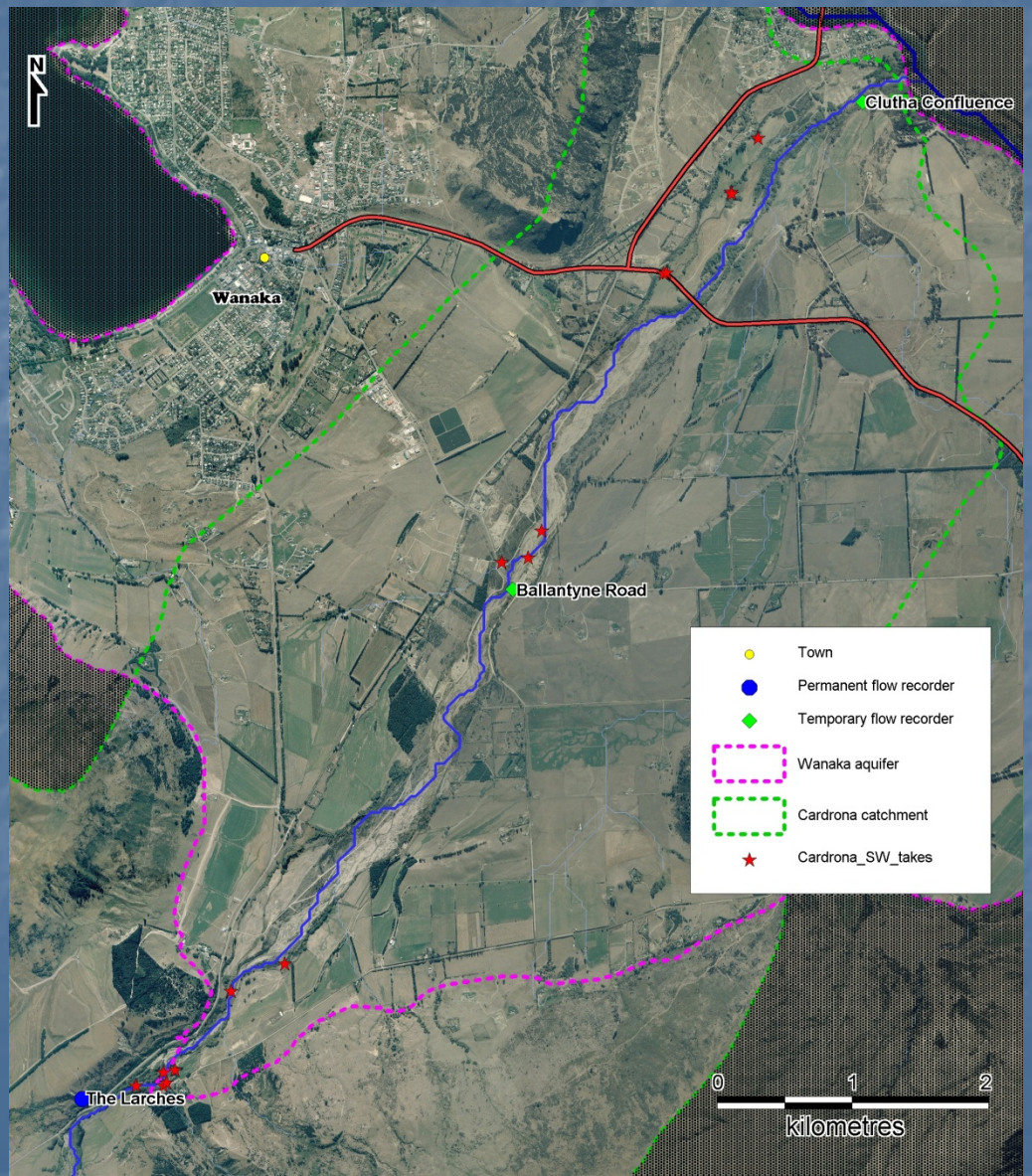
Gaining reach (Downstream of SH6)



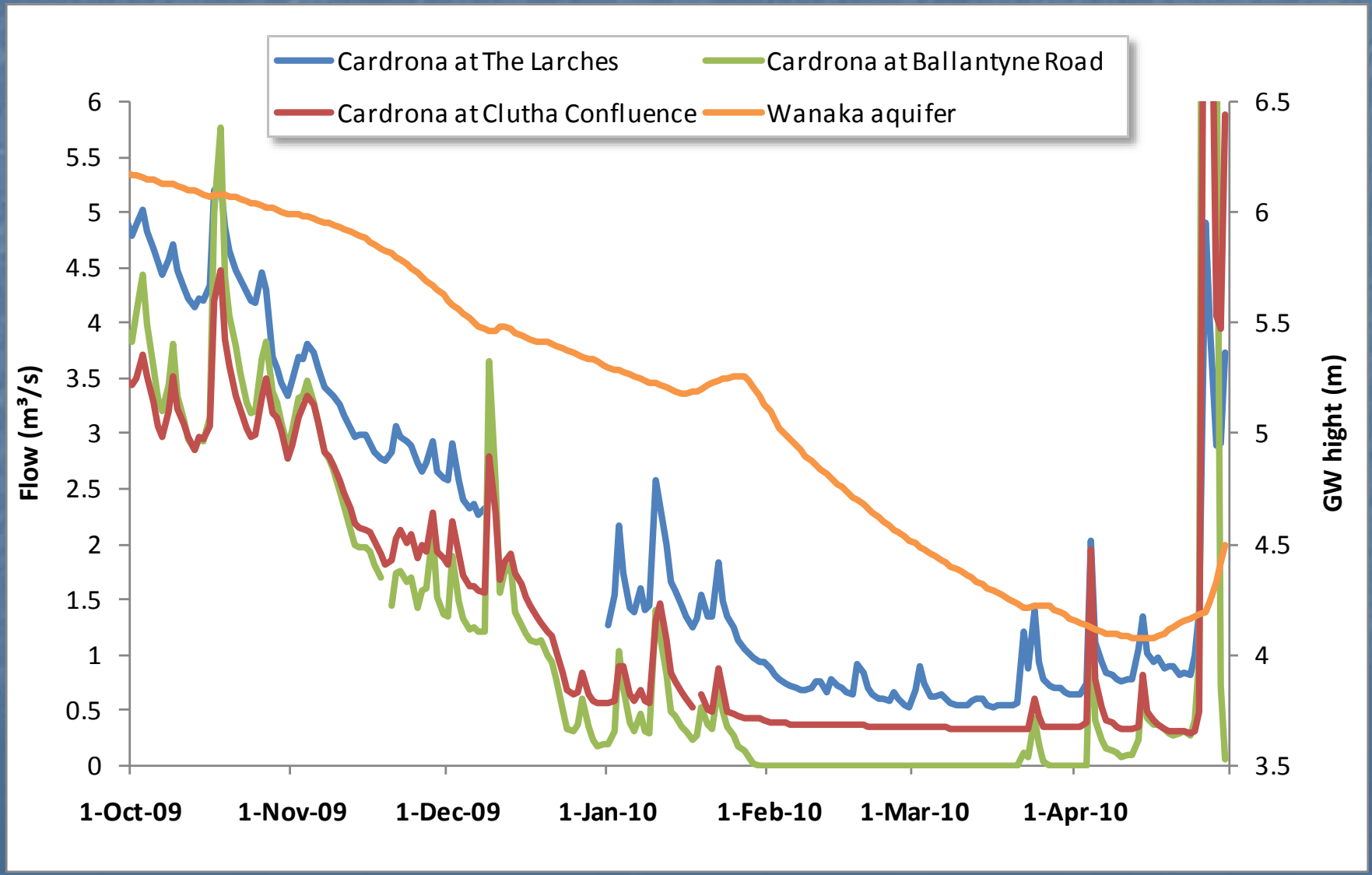
Disconnected losing reach (From The Larches to above SH6)



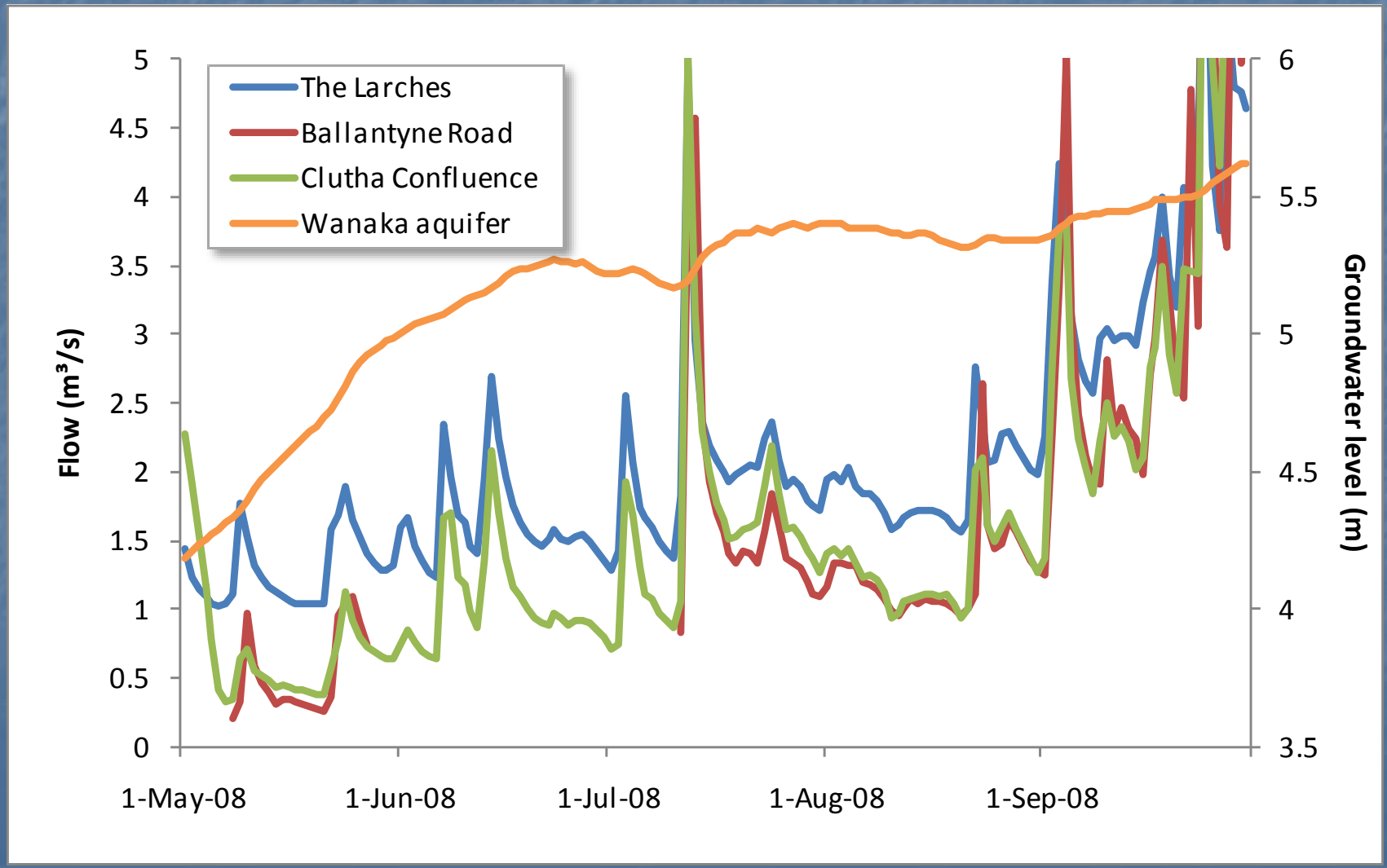
Hydrology of the lower Cardrona River



Flows in the lower Cardrona: 2009-10 season

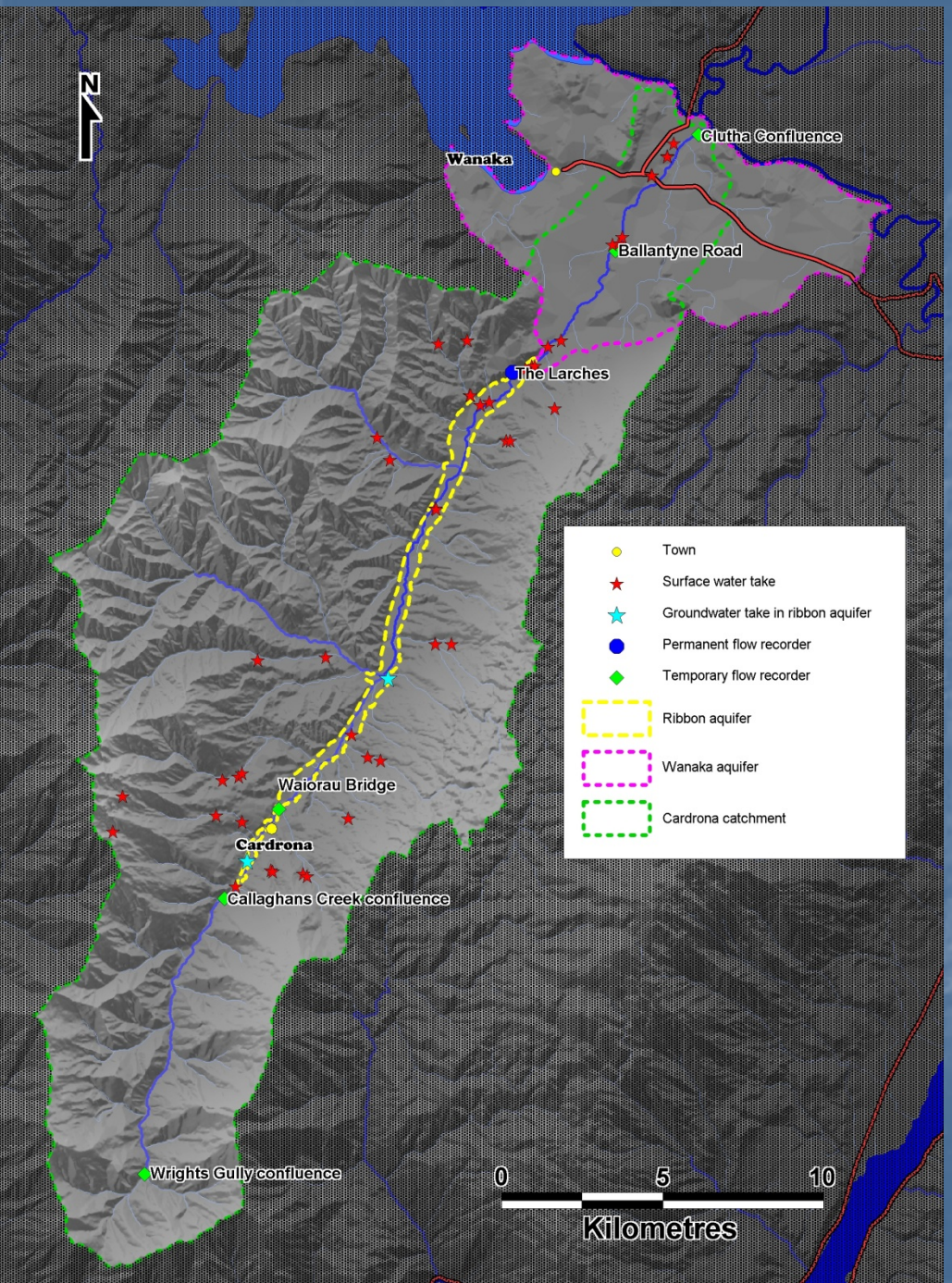


Flows in the lower Cardrona: Winter 2008



Hydrology of the lower Cardrona River – a summary

- Approximately 0.7 m^3/s (700 l/s) of surface water is lost to groundwater between The Larches and SH6.
- Once surface flows cease in the losing reach, groundwater levels in the Wanaka aquifer drop sharply
- Approximately 0.3 m^3/s (300 l/s) returns to the river between SH6 and the Clutha confluence



- There is a total of 2.411 m^3/s of primary allocation in the Cardrona catchment.
- The non-consumptive takes for snow making have not been included in this total.

Breakdown of surface water takes

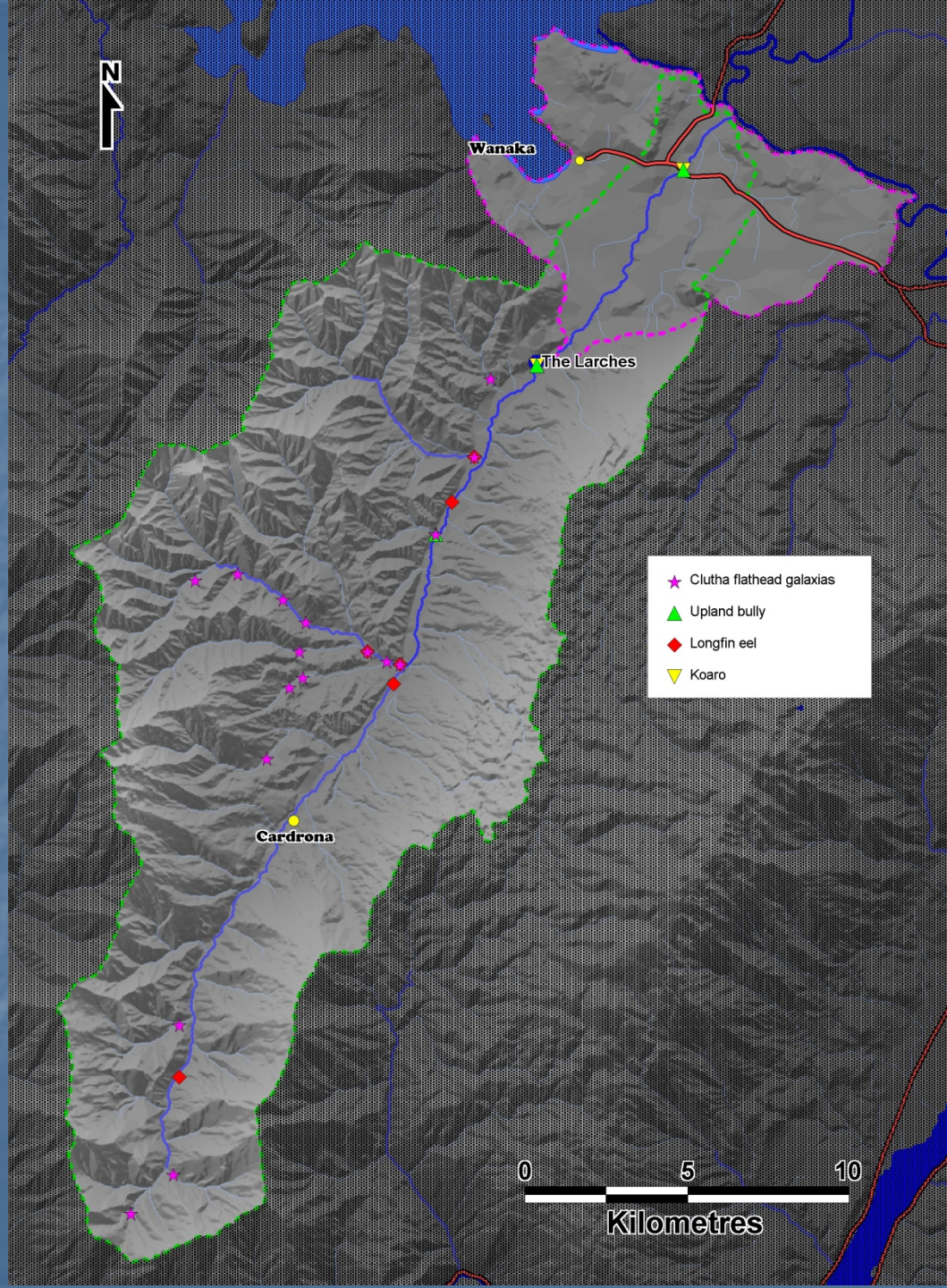
- There is 1.133 m^3/s (1,133 l/s) of primary allocation upstream of The Larches.
- Many of these takes are from small creeks that flow much less than consented rates of take during the irrigation season
- There is 1.278 m^3/s (1,278 l/s) of primary allocation downstream of The Larches. These represent the largest takes in the catchment but are still not able to take their full allocation for the latter half of the season.

Natural values of the Cardrona River

Native fish

- Koaro
- Upland bully
- Longfin eel
- Clutha flathead galaxias

- Clutha flathead galaxias and longfin eel are listed as being in gradual decline



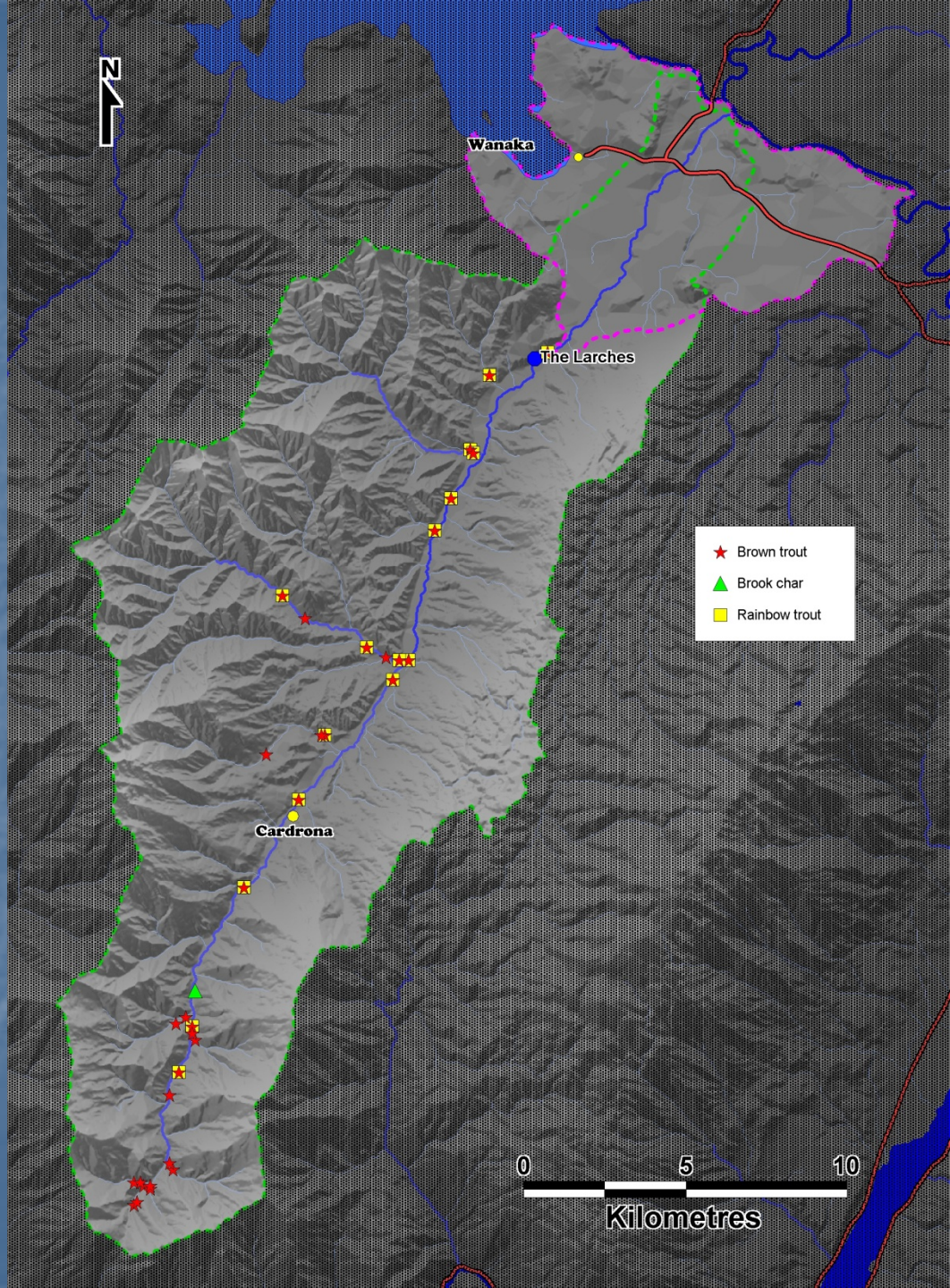
- Native fish in main stem of the Cardrona generally inhabit the edges of the river and are relatively unaffected by flow reductions until flows become low.
- When native fish are forced into refuge pools during low flows, high mortality can occur due to trout and bird predation.
- Some native fish can burrow into the gravel and survive for short periods if the gravel remains wet.
- The Clutha flathead galaxias is of high conservation importance but is only found in small tributaries where trout are absent or in low abundance.
- Will be largely unaffected by minimum flows, but setting correct *residual* flows are of high importance in maintaining habitat for this species.

Introduced fish

- Brown trout
- Rainbow trout
- Brook char

- The Cardrona River is considered a locally important brown and rainbow trout fishery

- Is one of the main spawning and juvenile rearing rivers for both brown and rainbow trout in the upper Clutha



- Due to the shallow water depths and unconfined nature of the lower Cardrona, there is relatively little habitat available for adult trout at low flows.

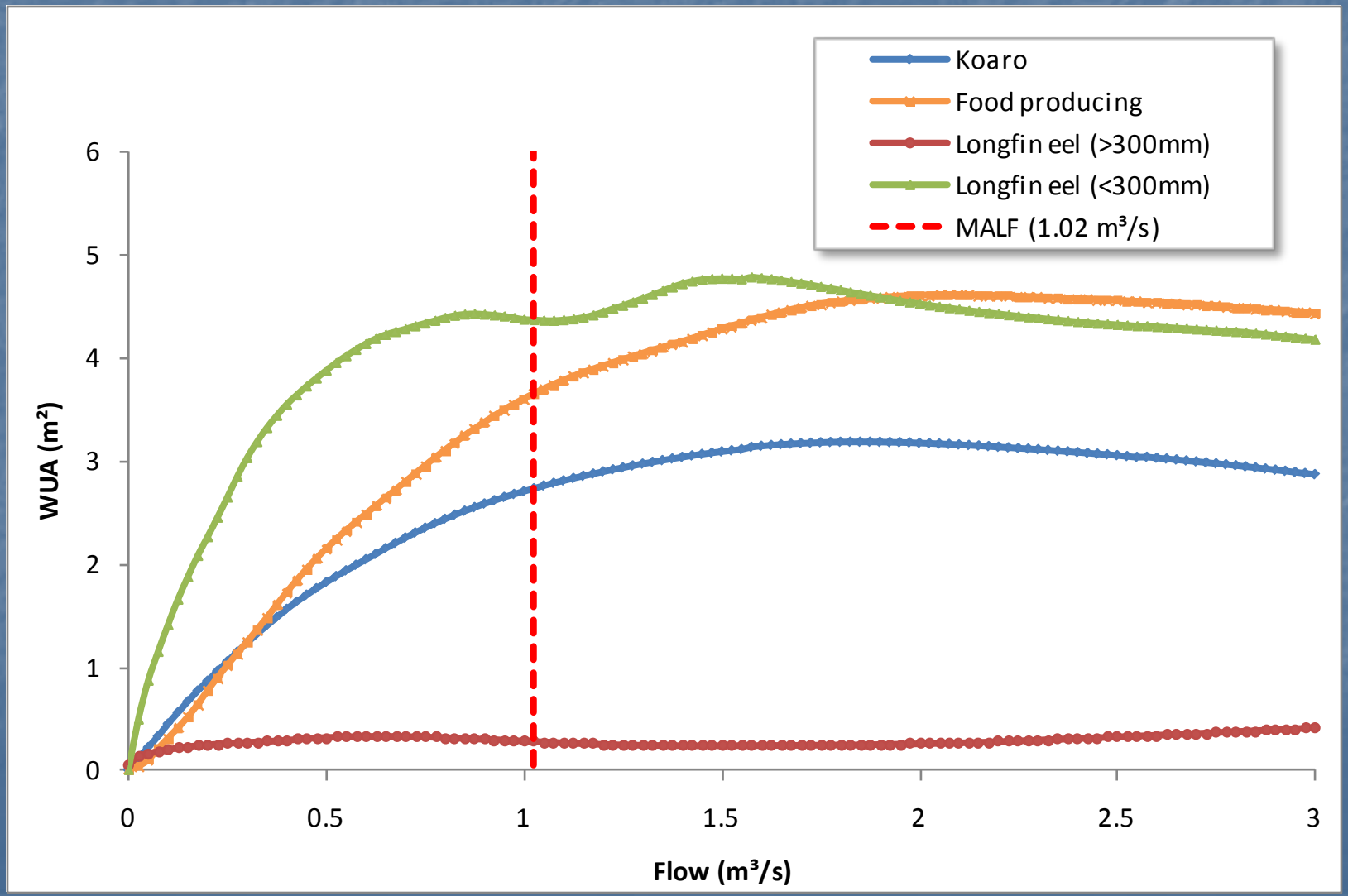
- However, the Cardrona is one of the major trout spawning and juvenile rearing areas for both browns and rainbows from Lake Dunstan and the Clutha River.

- While flows are still high early in the fishing season (Nov-Dec) many adult trout (brown & rainbow) remain in the Cardrona River and support a valued recreational fishery.

Instream habitat assessment (IFIM) for the Cardrona River

- IFIM (Instream Flow Incremental Methodology) measures the relationship between flow and available habitat for fish and invertebrates (“food”).
- Instream habitat was surveyed over 2 km of the Cardrona River upstream of The Larches flow recorder.
- The reach is characterised by fast shallow riffles and is typical of much of the lower Cardrona River.

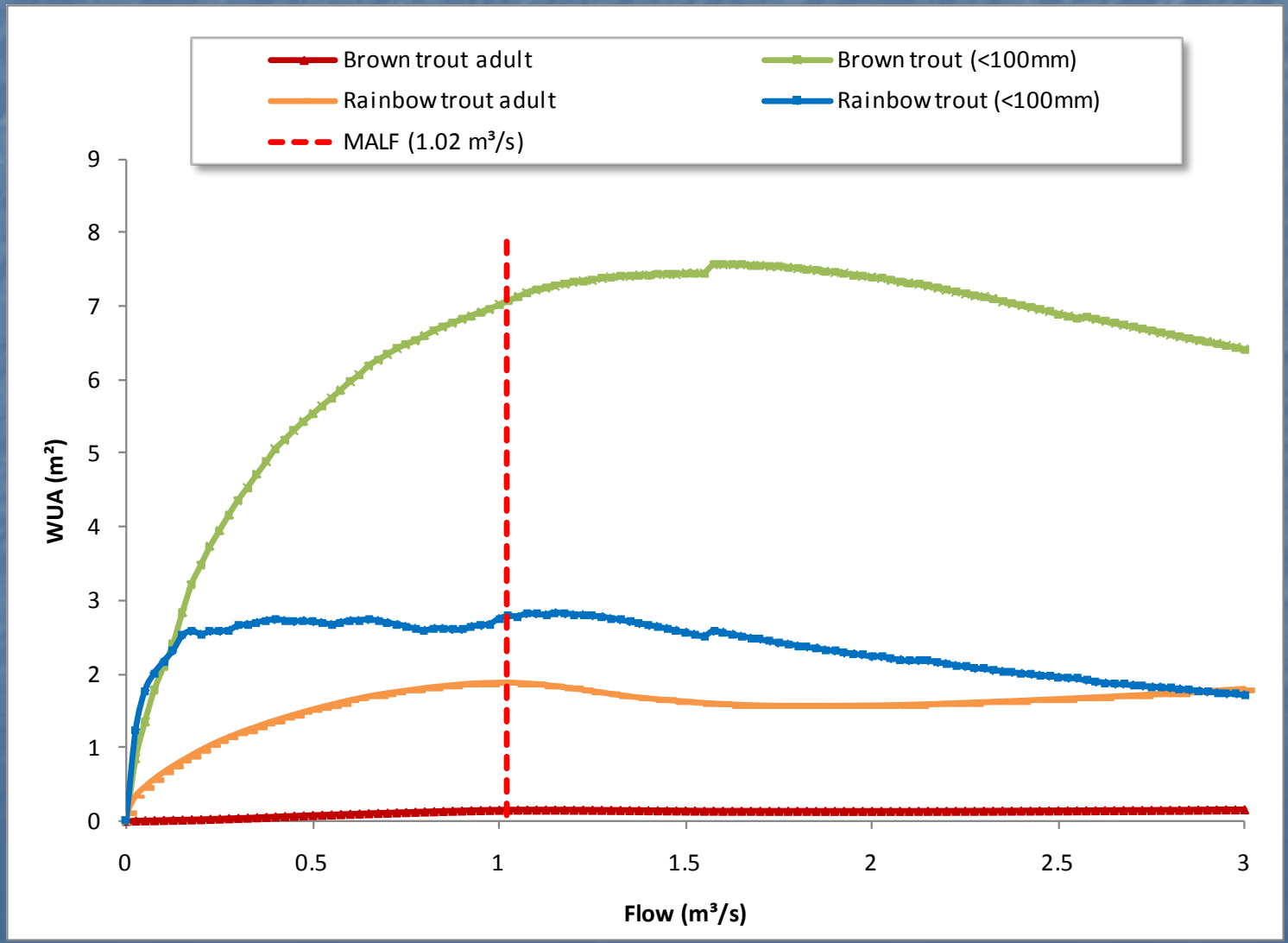
Available habitat for native fish in the lower Cardrona River



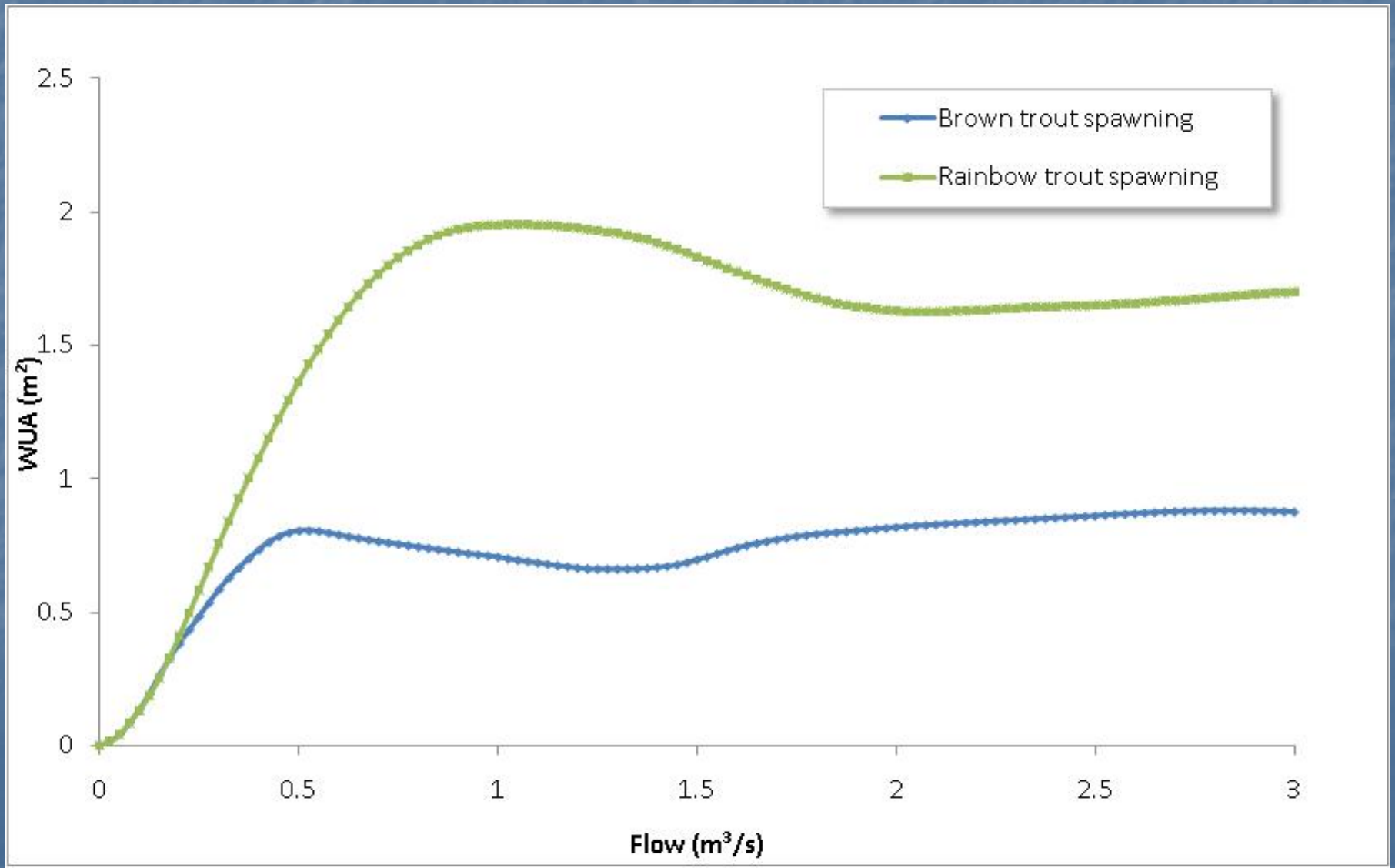
Summary of habitat requirements of native fish in the Cardrona catchment

	Koaro	Longfin eel (>300mm)	Longfin eel (<300mm)	Food producing
Optimum flow (m^3/s)	1.75	NA	1.5	1.95
Point of inflection (m^3/s)	NA	NA	0.625	NA
Flow at which 70% of available habitat at MALF occurs (m^3/s)	0.55	0.1	NA	0.625

Available habitat for trout in the lower Cardrona River



Available habitat for trout spawning in the lower Cardrona River



Summary of habitat requirements of trout in the Cardrona catchment

	Brown trout adult	Brown trout (<100mm)	Rainbow trout (<100mm)	Rainbow trout adult	Brown trout spawning	Rainbow trout spawning
Optimum flow (m^3/s)	NA	1.575	0.15 - 1.15	1.025	0.525	NA
Point of inflection (m^3/s)	NA	NA	0.125	NA	0.35	NA
Flow at which 70% of available habitat at MALF occurs (m^3/s)	0.675	0.4	NA	0.375	NA	0.5

Key points for instream values

- The lower reaches of the Cardrona River provide poor habitat for adult trout and large longfin eels, even at relatively high flows.
- However, this reach provides one of the largest trout spawning and juvenile rearing habitats in the upper Clutha. It also provides good habitat for juvenile longfin eels.
- The drying of the lower Cardrona River forces many juvenile fish to leave the main stem or become stranded and die.

BUT!!!!!!

That’s only part of the story….