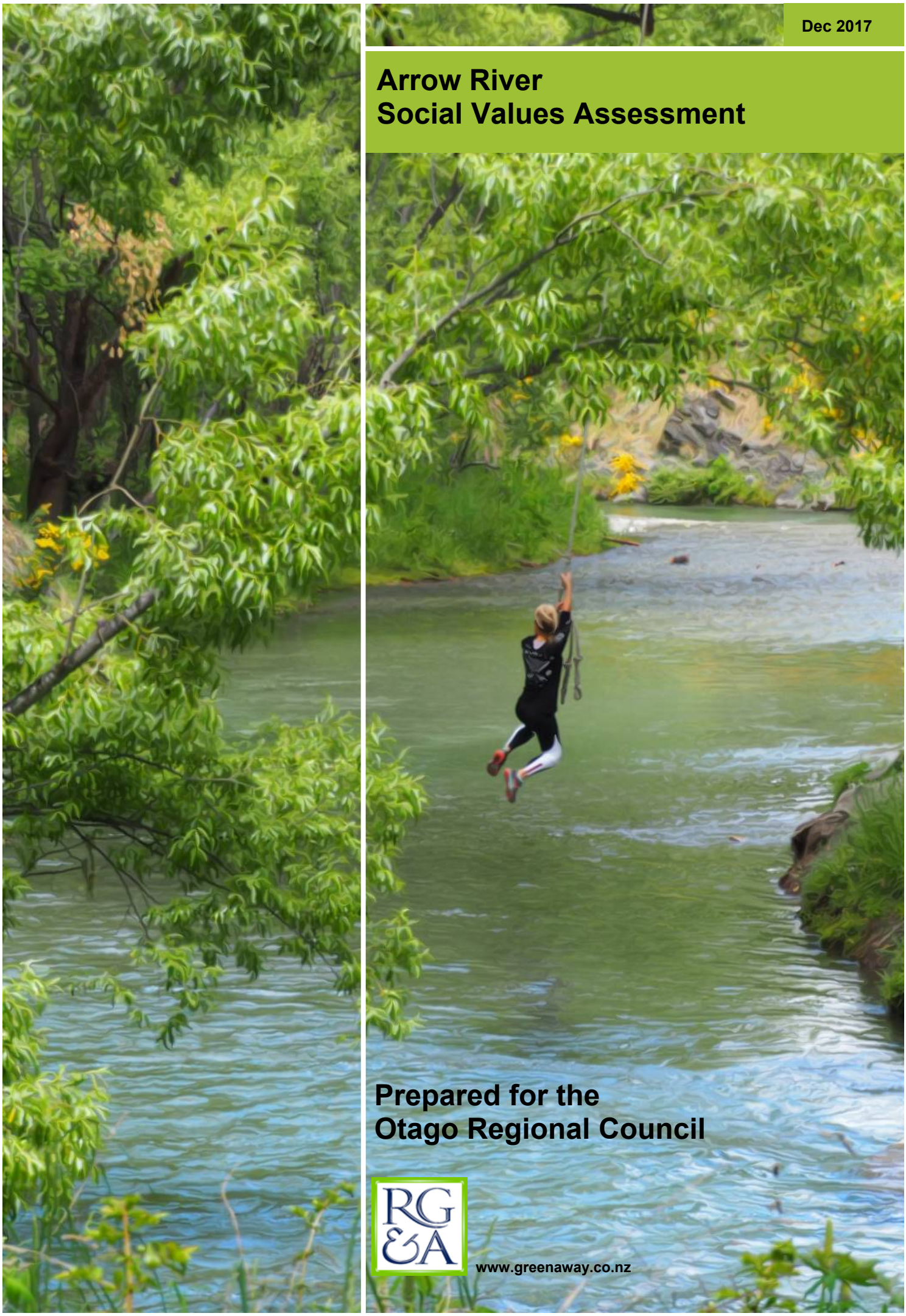
Dec 2017

# Arrow River
# Social Values Assessment



## Prepared for the
## Otago Regional Council

RG&A

www.greenaway.co.nz

# Arrow River
# Social Values Assessment

## December 2017

**Prepared for:**

Otago Regional Council

**By:**

Rob Greenaway & Associates
www.greenaway.co.nz

**Version status:**

14 December 2017. Final

# Contents



**Figures**



**Tables**

# 1 Executive summary

Otago Regional Council (ORC) is developing a change to the Regional Plan: Water for Otago (the Water Plan) to set minimum flows and water allocation limits for the Arrow catchment and to manage the amount of water in the Wakatipu Basin aquifers.

Section 30 of the Resource Management Act 1991 (RMA) requires regional councils to set levels and flows for water bodies, if appropriate. The National Policy Statement for Freshwater Management 2014 (NPSFM) requires every water management unit to have 'environmental flows and/or levels' and to phase out over-allocation and ensure efficient water use. ORC began a programme of plan changes in 2004 to set minimum flows and levels for catchments throughout Otago. This report supports the process of setting minimum flows and allocation limits for the Arrow catchment and Wakatipu basin aquifers by describing the social values of the Arrow River (particularly recreation and tourism values), and identifying relevant community preferences for flows.

There are a number of historic 'deemed permits' in Otago which provide rights to take water which have not yet been required to comply with take restrictions such as minimum flows. On the Arrow River, these permits – if they were taken up – would result in the flow being over-allocated. Under the RMA, the deemed permits expire in 2021.

This report supports the process of replacing the permits with resource consents, and will be used in further consultation to identify a preferred flow regime, including limits to water abstraction and/or minimum flows. The preferred option will then be notified as a proposed change to the Water Plan, with opportunities for submissions and input via a public hearing process.

This report is based on:

- Identifying how the River is accessed, the relevant management objectives of central and local government, and the preferences of the local community as described in local planning publications (Section 2);
- A review of literature which describes waterways at the national level, putting the Arrow River's significance in context (Section 3);
- Reviewing available data which might identify and quantify the recreation and tourism uses of the River (Section 4);
- Describing the River's existing flow regime (Section 5);
- Summarising consultation outcomes (Section 6);
- And concluding with the key findings, and recommendations for setting a future preferred flow regime for social values (Section 7).

Key findings are:

- The Arrow River has never been identified as significant at the national level and has only local in-river recreation values focused on swimming, paddling (including on boards, tubes and the like), picnicking, angling, walking and cycling, and landscape and scenic values, particularly adjacent to and downstream of Arrowtown; and regional recreation values centred on the River's use for tourism, including a small amount of angling (with its main fishing value as a hatchery), 4WD excursions, walking and cycling, gold panning, and landscape and scenic values.
- The River's flow has generally been considered to be in a good state for recreation, with a common refrain being that, 'it ain't broke and does not need fixing'. Much of the

discourse over the past decade about the Arrow River has been focused on, for example, riparian values (exotic trees and weeds), the potential for poor water quality from stormwater and irrigation, effects on water quantity from exotic tree growth, and the effects of 4WDs on water quality (via disturbing fine sediment and trout redds).

- Flows which sustain the River as a trout hatchery were agreed to be a minimum requirement for fishing. The River was described as always suitable for the activity of angling, with lower flows normally experienced through summer often better suited to the beginner style of fishing carried out at that time and below Arrowtown. More experienced anglers would be most likely to fish at the start of the season up to the weir for a short period in November when flows are normally high and variable (4 to 5 $m^3/s$).
- For landscape and scenic values, and local recreation, the current regime was considered quite acceptable (if not normal and taken-for-granted), with low flows in summer suiting kids swimming, and swimming holes having adequate depth – although such settings often come and go with gravel movement.
- Since water quantity was considered appropriate now, there was a reluctance to explore the potential for additional abstraction.

From the data available, it appears that a flow regime suitable for in-river recreation and scenic and landscape values can be delivered by:

- Identifying and maintaining flows which support the River's trout hatchery values;
- Maintaining abstractions at the level currently experienced, and delivering the existing flow regime which is considered appropriate; and
- Monitoring and maintaining water quality in the River below Arrowtown.

Support for the use of abstracted water in tourism and recreation is evident and are assessed in parallel technical reports for the Plan Change (particularly economics).

# 2 Setting access and management

This section considers regional recreation planning material in relation to recreation values on the Arrow River, and public access.

## 2.1 Access

Figure 1 to Figure 4 show the public access opportunities to and beside the Arrow River according to the Walking Access Commission's online mapping system.[1] This is rarely accurate – being based on an unverified algorithm query of LINZ data – and does not include easements in favour of the public. The Motatapu Track, for example, is not shown as having public status. Otherwise, the maps appear reasonably comprehensive, showing access to Macetown from Arrowtown via the riverbed and marginal strip (administered by the Department of Conservation (DOC)) and various forms of public land on both sides of the River – administered by DOC and the Queenstown Lakes District Council (QLDC)) – from Arrowtown to its confluence with the Kawarau River.

Marginal strip extends north from Macetown (north from Figure 1) – although not always on both sides of the River – to the Motatapu Conservation Area (which includes the Treble Cone ski area).

The Te Araroa Trail (from Cape Reinga To Bluff) relies on the Motatapu Track from Glendhu Bay to Macetown, and on the Big Hill Track from Macetown to Arrowtown. From Arrowtown it leads southwest to Lake Hayes and does not follow the Arrow River.

[1] https://www.wams.org.nz/wams_desktop/index.html

**Figure 1: Public lands Upper Arrow River. Source – Walking Access Commission**

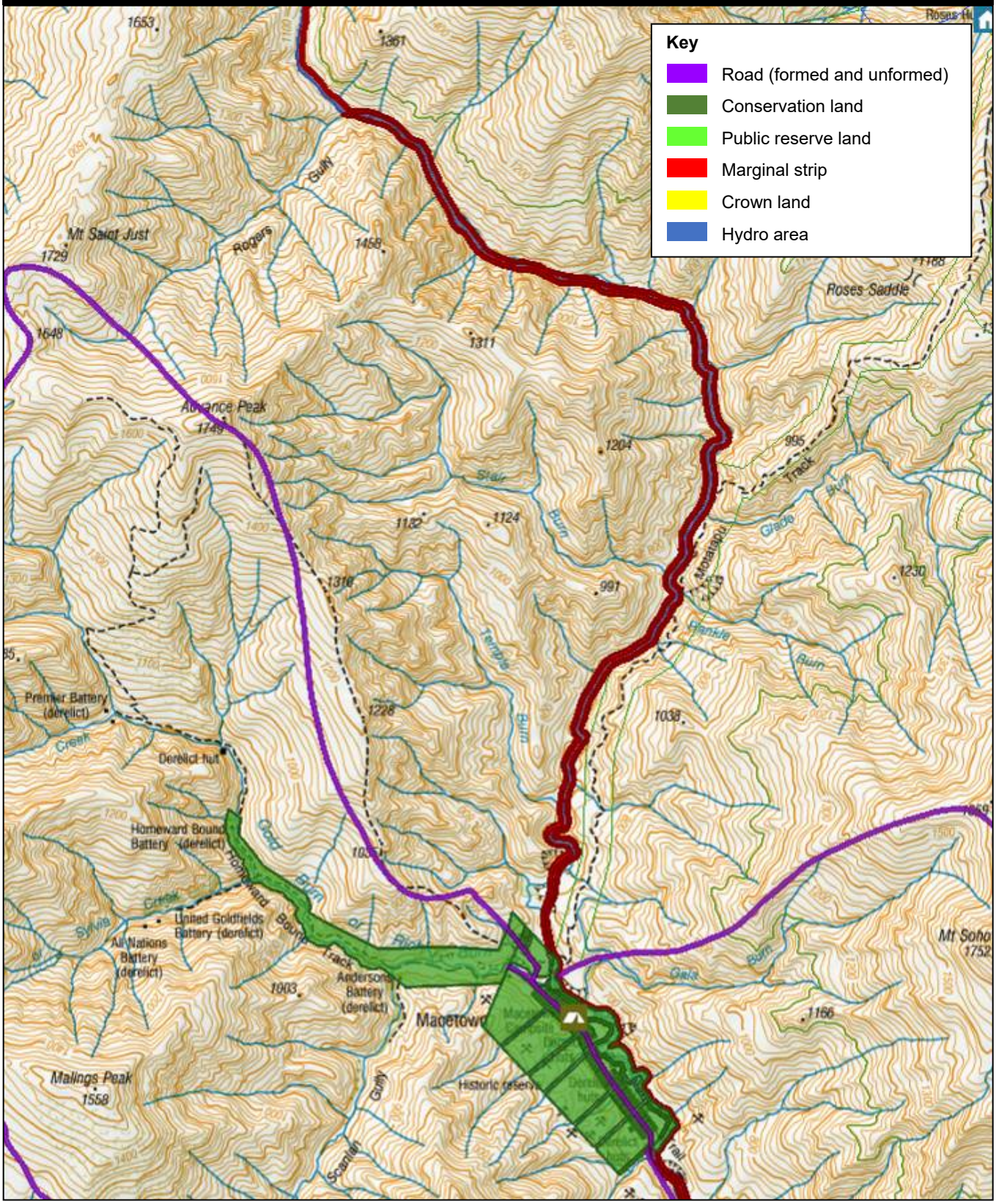


**Figure 2: Public lands Arrow River Macetown to Arrowtown. Source – Walking Access Commission**

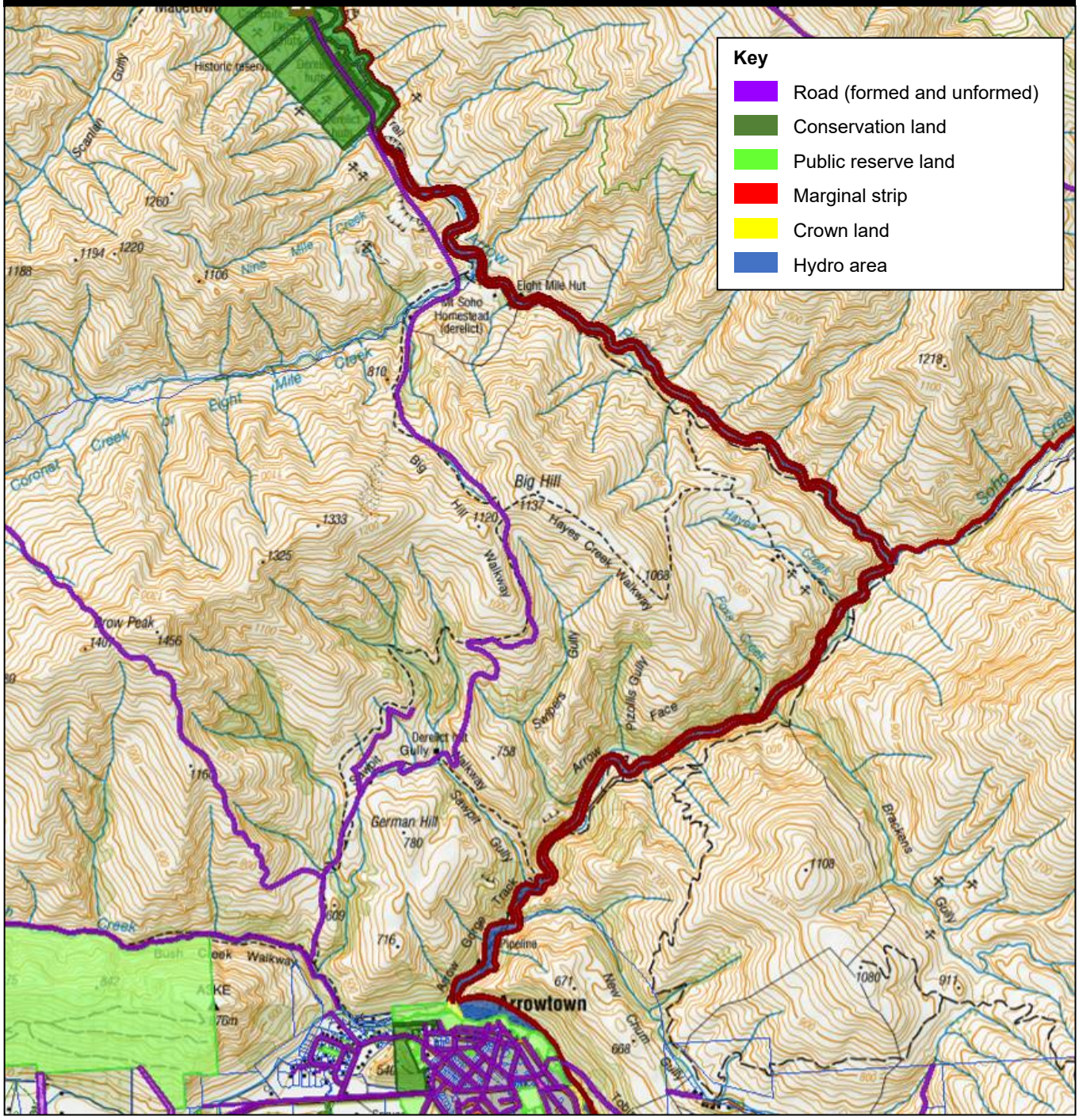


**Figure 3: Public lands Arrow River at Arrowtown. Source – Walking Access Commission**

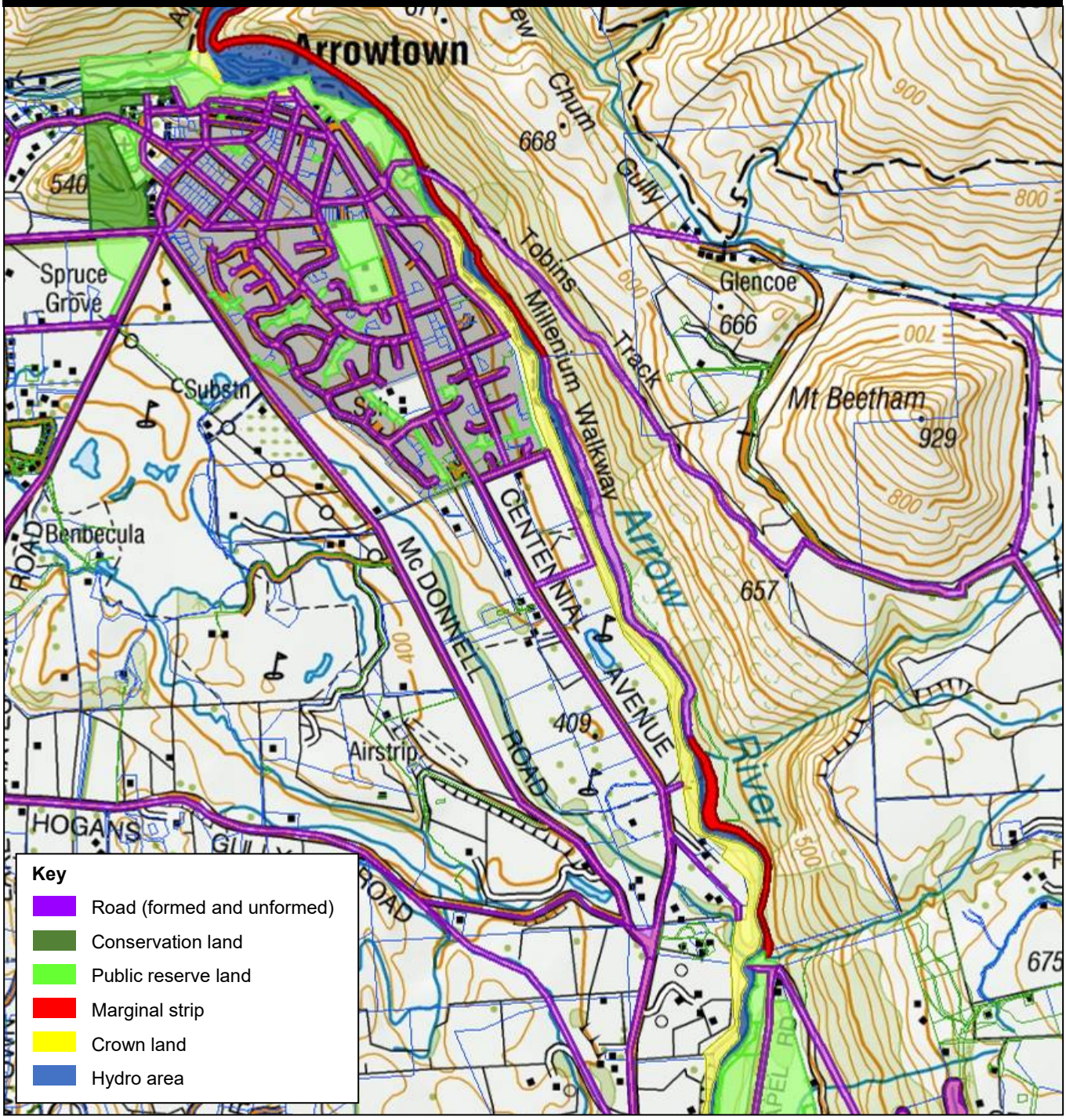
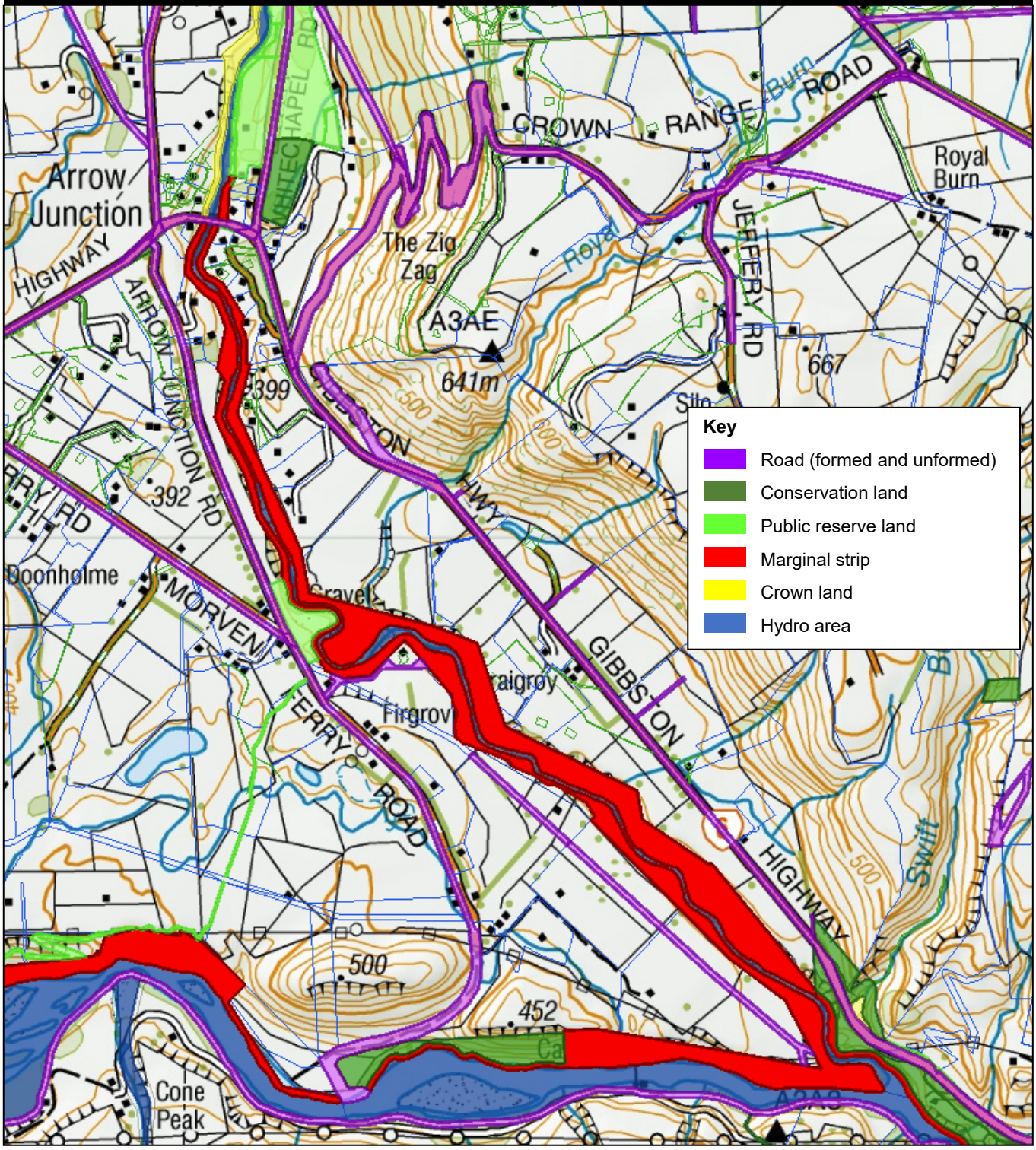


**Figure 4: Public lands lower Arrow River. Source – Walking Access Commission**



## 2.2 Department of Conservation

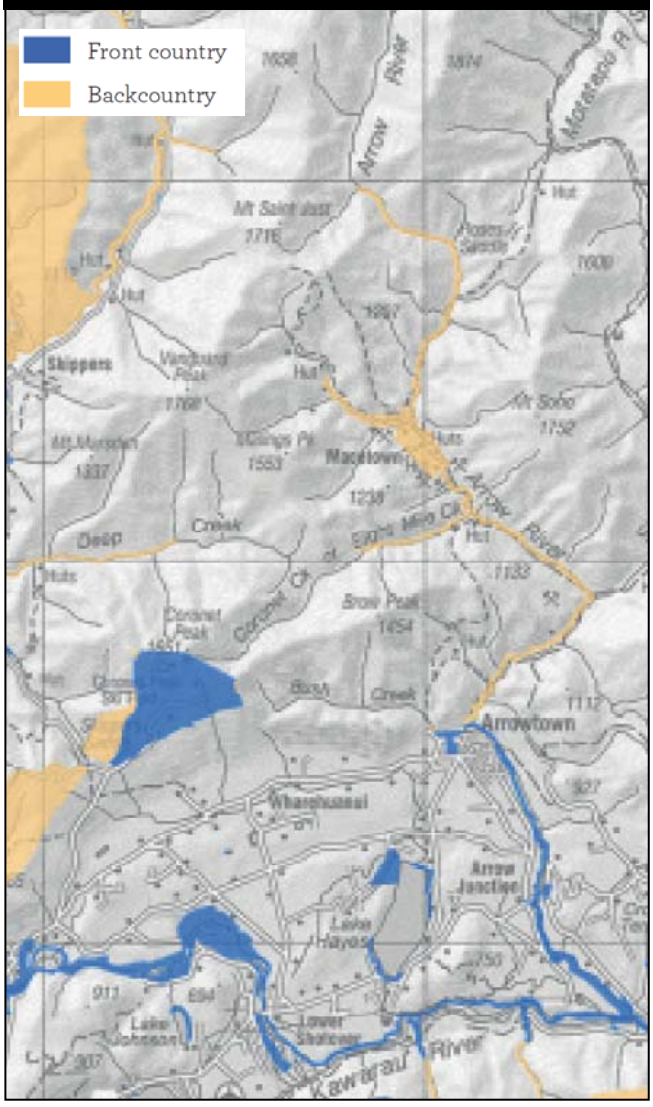
### *2.2.1 Conservation Management Strategy*

The *Otago Conservation Management Strategy 2016* (CMS) identifies two sites of direct interest to the Department near the Arrow River: the Macetown Historic Reserve and the Arrowtown Chinese Settlement Historic Reserve. The latter is defined as an 'Icon Destination' (high profile, popular destinations that underpin national and international tourism, and provide memorable visitor experiences in New Zealand) and Macetown is a 'Local Treasure' (vehicle-accessible, locally valued locations that provide recreation opportunities for, and grow connections with, nearby communities). The Arrow River Marginal Strip is also identified as a Department asset, but there are no relevant site-specific management objectives in the CMS.

The CMS notes (p62):

> *Commercial tourism activities include rafting and jet boating on the Shotover River and scenic tours in the Skippers area and Macetown. …. Fire is a particular concern in the drier and high-use areas of the Shotover River catchment and at Macetown. Historic sites and tracks at Skippers and Macetown have been damaged by indiscriminate trail bike and four-wheel drive use. Many vehicle users respect these sites and work with the Department to reduce adverse effects and repair damaged areas, but limits to motorised vehicle access may become necessary should adverse effects from motorised vehicles increase. There are some introduced trees in the Mt Aurum Recreation Reserve and Macetown Historic Reserve that are valued for their historic and amenity values.*

**Figure 5: DOC ROS classification CMS Map 8.7**




There are no stated outcomes or milestones for the Arrow River, with mention only of Macetown and the Arrowtown Chinese Settlement (p66):

> *The diverse historic heritage of Macetown Historic Reserve and Mt Aurum Recreation Reserve is protected, well-interpreted and enjoyed by a wide range of people. Visitor experiences at Skippers and Macetown are enhanced by concessionaires who raise awareness of the history of the area, and their associated conservation values. … The restored Arrowtown Chinese Settlement Historic Reserve Icon site and Icon destination takes visitors on a journey through a part of New Zealand's Chinese gold mining history. It is an integral part of an Arrowtown visit.*

Policy 2.3.1 (p67 and p70) specifies that 'motorised vehicle, mountain bike and electric

power-assisted pedal cycle' are permitted to access the Arrow River Marginal Strip and Macetown Historic Reserve via "Macetown Road (part on public conservation lands and waters)".

Figure 5 shows DOC's recreation opportunity classifications for the Arrow River, which is 'frontcountry' from Arrowtown downstream and 'backcountry' upstream. Definitions for these settings include (CMS, p261):

***Frontcountry:***

- *Where the majority of visits occur; typically small areas, scattered within or on the periphery of large, relatively natural areas*
- *Readily accessible areas, usually via sealed roads, or scheduled ferry or air services*
- *Enabled for people of most ages and abilities*
- *Predominantly shortstop travellers, day visitors and overnighters*
- *Other visitors in transition to backcountry and remote settings*
- *Good-quality facilities and services, and easy access*
- *Sometimes the origin for tramping tracks and routes, with signs and information to make this transition clear*
- *High degree of control via information and direction signs, and barriers*
- *Varying visitor experiences, from activities with large groups, time with small groups/families, some time away from other groups and, in some cases, solitude*

***Backcountry***

- *Large-scale natural settings generally accessed first through frontcountry*
- *Includes popular walks and tramps set within largescale natural settings and/or that access other settings*
- *People will have travelled some distance to reach these settings*
- *Backcountry accessible focuses on unsealed roads, four-wheel drive roads, navigable waters and aircraft landing sites*
- *Motorised ground access generally restricted to roads and designated routes*
- *A range of facility standards, including any designated vehicle routes, and popular walks and tramping tracks*
- *Evidence of control limited to essential directional signs and barriers on Great Walks, and where there are significant hazards*
- *Generally some time away from other groups and, in some cases, solitude*

The Department of Conservation has issued (at December 2017) 34 concessions for commercial use of the Arrow River Marginal Strip and the Macetown Historic Reserve (Table 1). Only fishing (one concession) depends on in-river water conditions.[2]

[2] Data provided by Susie Geh, DOC Senior Ranger/Supervisor Community, Queenstown

| Table 1: Concessions issued by DOC for Arrow River Marginal Strip and Macetown Historic Reserve | |
|---|---|
| **Activity** | **Count** |
| 4WD or Quadbike | 6 |
| 4WD or Quadbike, Campgrounds (public), Camping, Walking - up to eight hours | 1 |
| 4WD or Quadbike, Camping, Cross Country Skiing/ Skitouring, Walking - up to eight hours | 1 |
| 4WD or Quadbike, Car, Cycles/Mountain Biking, Walking - multi-day, Walking - up to eight hours | 1 |
| 4WD or Quadbike, Cycles/Mountain Biking, Walking - up to eight hours | 2 |
| 4WD or Quadbike, Walking - up to eight hours | 5 |
| Bus | 1 |
| Camping, Walking - multi-day, Walking - up to eight hours | 1 |
| Cycles/Mountain Biking | 1 |
| Cycles/Mountain Biking, Heli-biking | 1 |
| Cycles/Mountain Biking, Huts (public), Walking - multi-day, Walking - up to eight hours | 1 |
| Cycles/Mountain Biking, Minibus, Walking - multi-day, Walking - up to eight hours | 1 |
| Cycles/Mountain Biking, Walking - multi-day, Walking - up to eight hours | 2 |
| Fishing | 1 |
| Mountain Running | 1 |
| Walking - multi-day, Walking - up to eight hours | 2 |
| Walking - up to eight hours | 6 |

## 2.3 Queenstown Lakes District Council

The QLDC administers several reserves adjacent to the Arrow River near and downstream of the town centre. These are administered via the *Arrowtown – Lake Hayes Reserve Management Plan 2013*. There is little information in the Plan of relevance to flow in the River. For the Arrow River Reserve and Butler's Green, the following is noted (p13):

> *The Arrow River reserve and Butler's Green are the main reserve areas adjoining the township. They include the lower section of Bush Creek adjacent to the Chinese Village, the car park areas at the confluence of Bush Creek and the Arrow River, the skate park and the land between the Arrow River and Flint Street.*
>
> *The reserve is under pressure to accommodate increasing demands for parking balanced with a desire to maintain the character of the river area. The Queenstown Trail passes through the reserves as does the 4WD road to Macetown and the area is frequently used for events. Most visitors to Arrowtown will take the time to walk around the river or try their hand at fossicking for gold in the adjoining arrow river.*

And for Morven Ferry Reserve (p51):

> *This reserve is located at the intersection of Morven Ferry Road and Arrow Junction Road. The land was a government quarry reserve administered by the Department of Conservation and used as a local quarry until transfer to the Council as a recreation reserve in 2012.*
>
> *The reserve has been extensively worked for gold mining as evidenced by the historic gold workings on the site. The reserve adjoins the Arrow River and the reserve provides convenient access to the river for swimming and fossicking.*

Policy is set to limit the effects of 4WDs and trailbikes on Arrow River Reserve and Butler's Green (p82):

> *18.1 Prohibit the use of motorbikes and vehicles within the reserve, other than on the formed track that provides access across the reserve from Buckingham Street to Macetown and in accordance with policy 18.3.…*
>
> *18.3 Permit parking on the grass flat between Bush Creek and the skate park when required for special events and at peak times of the year….*
>
> *The riding of trail bikes and 4WD has been a popular pastime in Bush Creek and the Arrow River. The high level of public use of the reserves, the noise from trail bikes and the damage caused by 4WD vehicles means that these uses are no longer compatible with the nature of the reserve. There are many opportunities for operators of trail bikes and vehicles to carry out their activity outside of the reserve on the Arrow River and towards Macetown.*

*The Arrowtown Plan* was developed for the QLDC by the 'Arrowtown Workshop Project Team' in 2003. This 'outlines the community's proposals for their place'. There are no references to flows in the Arrow River, but it is referred to as an important feature of the village (p3):

> *Whilst the Wakatipu is a grand landscape, Arrowtown is a town of a niche. Now straddling the ice-shorn lip, the McDonnell Road scarp, the town is less of a surprise. However, its character remains principally that of being tucked away, landform confined and Arrow River oriented. A town both discrete and discreet. These characteristics are valued and their retention is sought.*

The ORC is recognised as being involved in River management (p19):

> *The river and associated lands are managed by the Otago Regional Council. River encroachment below Ramshaw Lane is of concern. Management is needed to keep the fairway open, clearing fallen trees and tree islands, but carefully so that a character of wildness and naturalness is retained.*

The 'Action' "Encourage ORC to undertake appropriate river and river reserves management" is stated in the final section of the Plan with no further explanation.

The QLDC *Parks And Open Space Strategy 2017* makes no reference to the Arrow River.

The *Arrowtown Community Visioning 2017 Draft Report* identifies river management as part of achieving its Environment Vision (p13): "Arrowtown is known on the world-stage for being a cutting-edge sustainable town – zero waste, walking and cycling take priority, homes are energy efficient, low water usage and healthy - with a proud and caring community engaged in the environment." An indicator of success is "River management – the community is actively engaged in increasing river water quality and the surrounding native environment." And a relevant KPI is: "Improved quality and quantity of river water. Surrounding land is rich in native flora and fauna."

The Visioning document notes that there is (p14), "minimal community engagement in river management; lack of native vegetation along the river," and that the "ORC is responsible for river quality. They have displayed a lack of community knowledge and engagement." And (p25):

> *Water: A community consultation process began in June 2017 with ORC investigating water allocation from the Arrow River. Domestic water is supplied from shallow bores in the Bush Creek river bed as well as from the Arrow River. Water is drawn from the river for irrigation purposes, and is used for recreational activity.*

*Episodes of water contamination do occur. QLDC has allowed in its Annual Plan for possible chlorination of all domestic water, mostly as a result of the Havelock North 2016 water contamination experience.*

*Sewage/wastewater is pumped to the Shotover treatment plant.*

*Storm water is discharged through drains to the Arrow River and soak pits. River discharge picks up pollutants such as products of combustion, decayed vegetation and car wash residue.*

A summary of findings and recommendations for 'river water' is provided in table format (p28). There is no specificity about which waterway any statement refers to (**Table 2**).

**Table 2: Arrowtown Community Visioning 2017 Draft Report: River water findings**

| What does success look like? | KPI's – how do we measure success? | What is the gap with today? | Impediments to delivering the vision | Recommendations |
|---|---|---|---|---|
| RIVER WATER<br>The community is engaged in river management.<br>Water quality and quantity of rivers and streams is better than today.<br>River environment has been protected and enhanced with native planting.<br>Native species flourish in and alongside river. | Research base-line measures of:<br>River water quality.<br>River water quantity.<br>Presence of native flora & fauna.<br>Robust river management regime. | Awareness of river values – mauri.<br>Lack of native vegetation.<br>Minimal community engagement in river management. | Lack of easily accessible base-line information.<br>No one agency looking after the river environment – community not engaged in river management.<br>Agency capture.<br>Community understanding of what a healthy river is. | Set up a Group that includes stakeholder agencies to manage the river and environment.<br>Engage the community in enhancing the river environment. |

Two "Arrowtown Community Visioning Forums" were staged in August 2015 to support the development of the Visioning document. The summary of workshop findings report included several mentions of river health and water quality, but no references to water quantity.[3]

## 2.4 Otago Regional Council

The ORC is currently completing a full assessment of the values of Arrow River (see the following chapter of this report) and has no existing fine-scale review of the River's attributes. The Regional Plan Water (1 March 2016 version) identifies in its schedules the following features:

**Schedule 1A: Natural Values**

- Large water body supporting high numbers of particular species, or habitat variety, which can provide for diverse life cycle requirements of a particular species, or a range of species.
- Sand and gravel bed composition of importance for resident biota.
- Access within the main stem of a catchment through to the sea or a lake unimpeded by artificial means, such as weirs, and culverts.
- Presence of significant fish spawning areas: trout
- Presence of significant areas for development of juvenile fish: trout

[3] See: https://www.shapingourfuture.org.nz/assets/Arrowtown-Forum-Notes.pdf

- No aquatic pest plants (eg *Lagarosiphon*) identified in the Pest Management Strategy for Otago 2009
- A high degree of naturalness above 900 metres above sea level.
- No outstanding natural feature or landscape
- No significant indigenous vegetation and significant habitat of indigenous fauna

**Schedule 1D: Spiritual and cultural beliefs, values and uses of significance to Kai Tahu**

- Kaitiakitanga – the exercise of guardianship by Kai Tahu in accordance with tikanga Maori in relation to Otago's natural and physical resources; and includes the ethic of stewardship.
- Mauri – life force; for example the mauri of a river is most recognisable when there is abundance of water flow and the associated ecosystems are healthy and plentiful; a most important element in the relationship that Kai Tahu have with the water bodies of Otago.
- Waahi taoka – treasured resource; values, sites and resources that are valued and reinforce the special relationship Kai Tahu have with Otago's water resources.
- Mahika kai – places where food is procured or produced. Examples in the case of waterborne mahika kai include eels, whitebait, kanakana (lamprey), kokopu (galaxiid species), koura (fresh water crayfish), fresh water mussels, indigenous waterfowl, watercress and raupo.
- Kohanga – important nursery/spawning areas for native fisheries and/or breeding grounds for birds.
- Trails – sites and water bodies which formed part of traditional routes, including tauraka waka (landing place for canoes).
- Cultural materials – water bodies that are sources of traditional weaving materials (such as raupo and paru) and rongoa (medicines).
- No known Waahi tapu and/or Waiwhakaheke – sacred places; sites, areas and values associated with water bodies that hold spiritual values of importance to Kai Tahu.
- No known Waipuna – sources of water highly regarded for their purity, healing and health-giving powers.

# 3 Recreation significance

This section reviews academic and popular literature to provide a description of the recreational activities carried out on the Arrow River, and the values ascribed to them. Activity-specific literature is reviewed in section 4. The Arrow River has never been identified as significant at the national level.

## 3.1 New Zealand Recreational River Use Study: specialisation, motivation and site preference

Galloway (2008) reported on the findings of a survey of individuals who recreate on and around rivers in New Zealand (*New Zealand Recreational River Use Study*). Individuals were invited to participate in an internet survey via direct contact at river recreation-related events and electronically via a range of related web sites, group membership, internet bulletin boards, magazines and newspapers. Just over 1300 respondents completed the survey which ran from October 2007 to March 2008. Although the survey results cannot be considered representative of the recreation population, as the sample was self-selected and not randomly generated, they give a useful impression of the opinions and preferences of what is probably the more active and aware end of the recreation participation spectrum.

Twenty-three activities were represented in the data. The dominant respondents were white water kayakers, anglers and multisport participants. Respondents were grouped into four broad activity groups: boating (non-motorised) (55.4%), fishing (21%), boating (motorised) (2.4%), and shore-based (21.2%).

The survey was designed to evaluate respondents' motivations and site preferences about their level of specialisation in their activity. It was not designed to ascribe values to defined reaches of rivers throughout New Zealand so, in that sense, its results must be treated conservatively.

A list of 1043 rivers was compiled and respondents were asked to indicate up to ten rivers that they had last visited, and the next ten that they wished to visit. This provides a snapshot, rather than a complete picture of the respondents' experiences and views. A total of 4921 rankings were provided for 513 rivers. Rivers ranked more than 100 times included the Waimakariri (227), Tongariro (191), Buller (154), Hurunui (128), Kaituna (118), Mohaka (116), and Clutha (113) Rivers. The Arrow River was rated by seven respondents out of 1300 (Galloway 2008: Table B1), and with such a low data set, no further analysis was provided for the River.

## 3.2 Water Bodies of National Importance

As part of the Government's assessment of Water Bodies of National Importance just after the turn of the century, work was undertaken to identify water bodies of value for recreation and tourism. The recreation report, titled *Potential Water Bodies of National Importance for Recreation Value* (MfE, 2004), lists 105 freshwater bodies including lakes, river and wetlands that are potentially important for recreation. Eight water bodies are identified in Otago, and did not include the Arrow River. The list was derived from an internet survey of recreationists (Fink-Jensen, 2004b), a telephone survey of the public (Fink-Jensen, 2004a), a literature review and discussion with selected representatives of recreational groups. The report has many inconsistencies and the base research has significant weaknesses.

The internet survey with 772 respondents – which was based on a self-selected sample with an apparent bias to kayakers and canoeists – had only one respondent who identified using the Arrow River. The telephone survey with 1041 respondents had two who identified using the Arrow.

The equivalent report for tourism (TMT, 2004) used activity data from the International Visitor Survey and Domestic Travel Study to identify trips associated with freshwater bodies and included the following 'activities': scenic cruises, beaches, jet boating, glow worm caves, swimming, caving, white water rafting, black water rafting, lake fishing, river fishing, sailing, river kayaking, water skiing and punting. The dataset identified the top eight freshwater destinations (eight near Queenstown, and not including the Arrow River[4]) and the top ten freshwater activities (in local waters: jet boating, scenic cruises and whitewater rafting). A separate listing of freshwater bodies important for their scenic appeal rather than use value was also identified (13 in the South Island). The Arrow River was not included.

### 3.3 New Zealand Recreational River Survey

The only comprehensive national assessment of recreation potential of inland waterways was undertaken over three decades ago (Egarr & Egarr 1981). While this is a dated analysis, it provides a baseline against to which to measure change, and, where flows have not altered greatly in the meantime (as in this case), it provides a good analysis of recreation potential – while noting the changes in skill levels and equipment in some activities since the 1980s (particularly kayaking). The Arrow River was described as a tributary of the Kawarau:

> ***ARROW RIVER***
>
> ***Location:*** *The Arrow River is a small river flowing in a deep gorge from the hills to the north of Arrowtown. It joins the Kawarau downstream of Lake Hayes. The former gold town of Macetown is situated on the upper rover.*
>
> *Length: 42km*
>
> *Average gradient: 1:230 4.4m/km.*
>
> ***RECREATIONAL USE:***
>
> ***Recreational use and scenic description:*** *Above Arrowtown, water is extracted from the river and the pipeline runs down the river bed to Arrowtown. The river from the pipeline intake, is seldom of sufficient size for recreational boating. Above the pipeline, is the ghost town of Macetown which is well worth a visit. The river lies in a deep valley, tussock covered and barren, similar to but far smaller than the Shotover (it does not have the grandeur of the Shotover). The river is seldom of boatable size and is not used. Willows clog the lower river as it flows into the Kawarau.*
>
> ***Scenic value:*** *Picturesque.*
>
> ***Recreational value****: Insignificant.*

The Egarrs' report provides rankings of rivers/reaches for recreational and scenic value and goes on to select the most important that deserve protection for their recreational value. The Arrow was not identified.

### 3.4 National Inventory of Wild and Scenic Rivers

In 1982 the National Water and Soil Conservation Authority released a draft inventory of wild and scenic rivers and sought submissions. A resulting document was published in 1984 (Grindel 1984), which provides a list of what were considered to be “nationally important wild and scenic

[4] Lake Wanaka - predominately for scenic cruises and sitting on the foreshore, Lake Wakatipu - predominately for scenic cruises and sitting on the foreshore, Lake Hayes – important for its photographic value, fishing, sailing and swimming, Lake Hawea –predominantly used for jet boating, swimming and fishing, Shotover River - predominately used for jet boating and white water rafting, Kawarau River - predominately used for jet boating and white water rafting, Clutha River – predominantly used for jet boating and fishing

rivers." The final list excluded lakes because the Committee responsible for compiling the list decided that its terms of reference did not include them. Thirteen rivers were identified in the North Island and 40 in the South. The Arrow River was not amongst them. Again, this is a dated assessment (as are the following references), but provides a baseline and serves to show whether the status of the Arrow River was ever sufficient to have been a focus for special protection.

The Ministry of Agriculture and Fisheries made a substantial submission to the draft inventory in relation to freshwater angling values (Tierney *et al* 1982). The authors did not identify the Arrow River.

### 3.5 A list of rivers and lakes deserving inclusion in a Schedule of Protected Waters

In 1986 the Protected Waters Assessment Committee released its recommendations for a, "*list of those lakes and rivers which the committee commends as suitable for inclusion in a Schedule of Protected Waters*" (Grindel and Guest 1986). The intention of the study was to advise the then Ministers of Works and Development and Conservation of, "*those waters deserving inclusion in a schedule of Protected Waters that can be attached to the Water and Soil Conservation Bill.*"

The committee's analysis built on the *National Inventory of Wild and Scenic Rivers* (Grindel 1984), but expanded the scope of assessment from that study's limit of wild, scenic, recreational and scientific values to include, in addition: fisheries, wildlife habitat, flora, tourism and cultural values.

In terms of recreational values, the relevant assessment procedure for identifying an outstanding waterbody was well outlined (p7). This process was drawn, in the main, from the approach used in the *National Inventory of Wild and Scenic Rivers*:

> *"This category includes those rivers where the existing water regime plays an essential and dominant role in providing an outstanding recreational experience or range of experiences. An area which has an unrealised potential for providing an outstanding amenity may be considered. While the surrounding landscape may contribute significantly to those experiences the water, the river or lake bed and possibly a narrow riparian strip are the crucial elements for the recreational value. The recreations are mainly instream use (angling, jetboating, canoeing, packfloating, etc) but this committee recognised that picnickers, etc, also went there because of the water, not in spite of the water. An area may be considered outstanding because of one or more of a number of characteristics. It may provide a wide variety of recreational experiences and be used often by people within and, to an extent, outside its region. Or its present level of use may be low but provide an exceptional type of recreational experience, possibly requiring advanced skills so that people from other regions or overseas travel to the area to use it.*
>
> *"Summary of characteristics*
>
> *a The characteristics vary and largely reflect the recreational uses for which the river is outstanding.*
>
> *b The river satisfies the recreational needs of a large number of people, or constitutes an amenity for a wide variety of recreational activities, or provides an outstanding recreational experience.*
>
> *c A river in this category may be under-utilised at present but have potential for varied, intensive or specialised use.*

d *The area may be readily accessible, frequently by road. The surrounding land may show signs of human activity and settlement.*

e *The water may be subject to some minor diversions and there may be some development such as bank protection works, but not to the extent that the river regime is controlled.*

f *While there may be some waste discharges, the water will usually be of a quality compatible with the recreation activities.*

*"Rivers are the focus of a great variety of recreational activities. A range of recreational facilities for present and future recreationists must be protected throughout the country.*

a *Wilderness and expedition type facilities : generally wild and scenic rivers of sufficient size to permit a range of recreational values.*

b *White water : essential for whitewater rafting, canoeing, jetboating.*

c *Placid water : essential for boating activities where coastal waters unsuited to boating.*

d *Small urban streams : close to populated areas for general recreation and picnicking.*

e *Routes as access and as a form of recreation."*

The committee developed a three tier classification (groups one, two and three) to define an order of importance for the waters identified as outstanding. In terms of including the waters in a schedule of protection (p12), "*anything less than the first group would provide an inadequate representation. If the Schedule should be bigger, then the second group should be used for making a selection. If the two together are insufficient then the third group should be used for making a selection*."

The Arrow River was not identified (the Shotover and Kawarau were identified as group one rivers).

# 4 Activity data

This section reviews activity-specific data, although the only quantification of recreational use on the Arrow River is available for angling and cycling.

## 4.1 Trout fishing

The Otago Fish & Game Council manages the Otago salmonid angling resource according to its *Sports Fish and Game Management Plan for Otago Fish and Game Region 2015-2025*. This identifies the Arrow River as:

- A locally significant rain-fed river
- Rural in character (according to the Fish & Game recreation opportunity spectrum analysis)
- Fished using fly, spinner and bait
- Fished by locals, regional visitors and juniors

Unwin (2013) reported on a survey of river values with 2231 national anglers responding (from a sample of 11,923). Eighteen respondents had used the Arrow River and gave it a mean enjoyment score of 2.11, with a range for 57 Otago rivers of 3.43 to 1.44 (putting it in 39th position in Otago out of 57 rivers). Respondents were asked to identify up to three reasons why they fished each river from a list of nine options. Table 3 shows that proximity to home, scenic beauty and wilderness feel were the most often chosen reasons for fishing the Arrow.

**Table 3: Reasons for fishing the Arrow River (Unwin 2013) n=18**

| Close to home | Close to holiday home | Ease of access | Area of fishable water | Scenic beauty | Wilderness feeling | Angling challenge | Anticipate good catch rate | Anticipate large fish | Other |
|---|---|---|---|---|---|---|---|---|---|
| 56% | 11% | 22% | 11% | 39% | 33% | 11% | 6% | 0% | 0% |

A pilot study for Unwin (2013) asked the a similar set of questions for only Otago and Nelson/Marlborough rivers, with 616 respondents (Unwin 2009). The results for the Arrow River were based on 10 respondents. The River gained a mean importance score of 2.00 with a range for 57 Otago rivers of 5.00 to 1.00 (putting it in 64th position in Otago out of 69 rivers). Responses for angler values for the Arrow are shown in Table 4.

**Table 4: Reasons for fishing the Arrow River (Unwin 2009) n=10**

| Close to home | Close to holiday home | Ease of access | Area fishable | Scenic beauty | Wilderness character | Anticipated catch rate | Anticipate large fish |
|---|---|---|---|---|---|---|---|
| 100% | 0% | 60% | 0% | 60% | 20% | 20% | 0% |

National angler surveys (NAS) completed – wholly or largely – by Martin Unwin since 1998 (see references) show the Arrow River to have relatively little angling pressure, with no angling recorded in the 2001/02 season (Table 5). Large margins of errors suggest results are from a

small number of respondents who fish the River regularly, and are therefore most likely local. Error margins were not given in the 1994/95 NAS but were recalculated for trend analysis for the annual total in the 2001/02 study.

**Table 5: Angling activity by month for three national angler surveys**

| Year | Oct-Nov | Dec-Jan | Feb-Mar | Apr-May | Jun-Jul | Aug-Sep | Total |
|---|---|---|---|---|---|---|---|
| 2007/08 | 120 ± 100 | 130 ± 100 | 90 ± 90 | 0 | 0 | 0 | 350 ± 160 |
| 2001/02 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1994/95 | 20 | 165 | 21 | 0 | 0 | 0 | 210 ± 120 |

There are few references to angling on the Arrow in popular fishing guides. Turner (2003) notes (p35):

> *This small river rises in the mountains beyond Macetown, and is gorgy for much it its length down to its confluence with the Kawarau.*
>
> *The Arrow holds a moderate population of small brown and rainbow trout in the mid and lower reaches, but is not generally thought of as a first class sports fishery.*
>
> *When the Arrow is clear it is worth exploring sections if the river with small dry flies and light spin-fishing lures. But it should be noted that from mid-December through to February the valley is chocker with walkers, runners, cyclists and 4-wheel drive excursionists, tripping back and forth to Macetown.*

Kent (2006) merely notes (p297):

> *The Arrow holds small trout only.*

The NZ Fishing website recommends using artificial flies or spinners and states:[5]

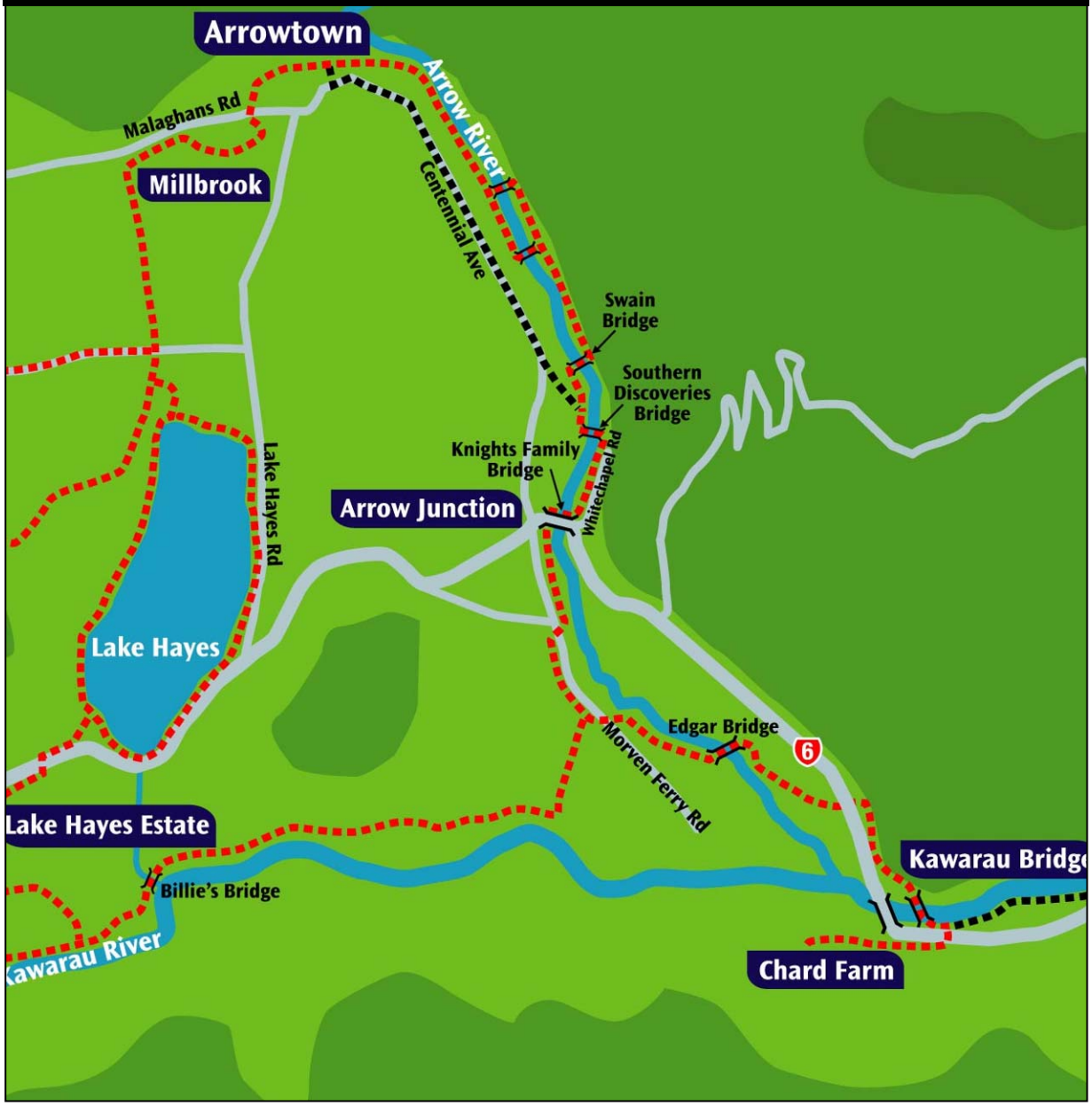
> *The Arrow river holds Brown and Rainbow trout in its middle reaches, but is not normally thought of as first class fishing due to the small size of the trout.*

[5] http://www.nzfishing.com/FishingWaters/Otago/OTFishingWaters/OTArrowRiver.htm

## 4.2 Walking and cycling

The Queenstown Trails Trust reports counts for walking and cycle activity on its complete network (Kennedy 2017). In 2016, a counter at the Swain Bridge on the Arrow River Bridges Ride (Figure 6) recorded 16,206 trail users (termed 'journeys' to account for individuals passing multiple counters), with a daily average of 53. Between 1 January and 31 March 2017, almost 20% of all traffic on the Queenstown Trails Trust network was on the Arrow River Bridges Ride, which includes the Millennium Track.

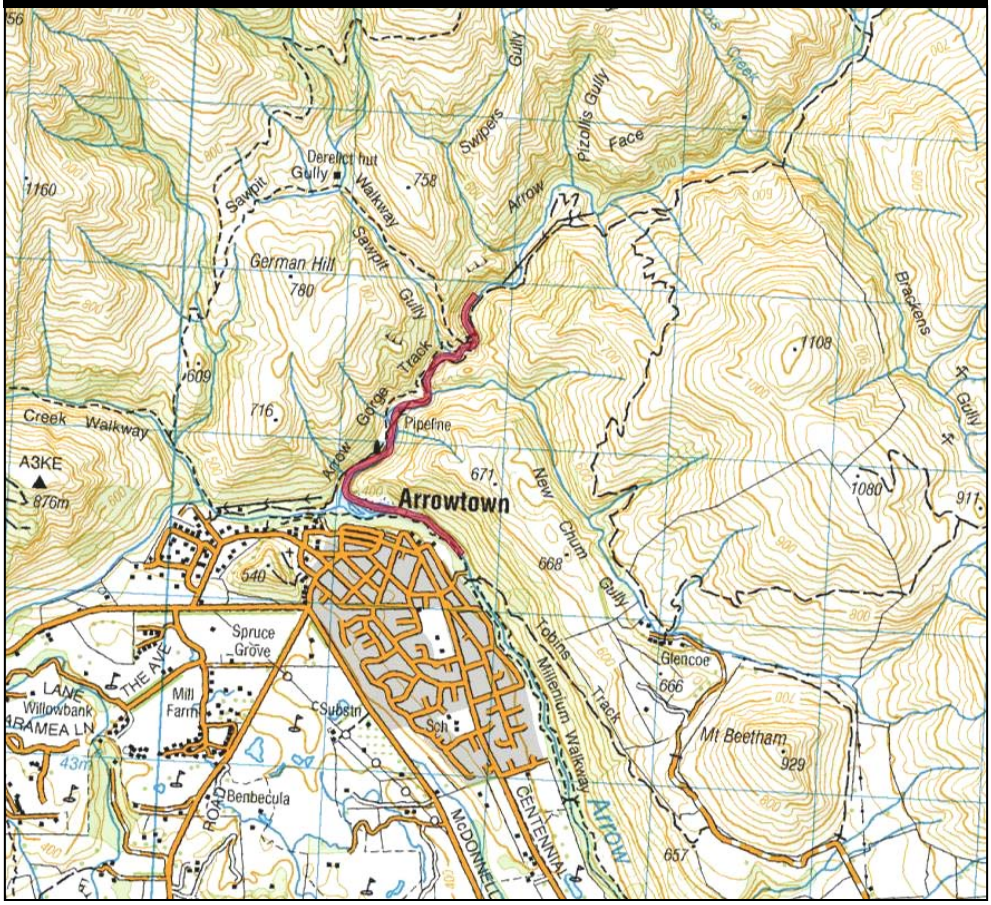
**Figure 6: Arrow River Bridges Ride**



## 4.3 Gold fossicking

The Ministry of Business, Innovation and Employment, via NZ Petroleum and Minerals, has set aside 17 areas in historic South Island gold mining regions – in Nelson-Marlborough, the West Coast and South and Central Otago – where the public can freely carry out gold mining without the need for a permit – and also without powered tools.[6] Four sites are in Central Otago: Twelve Mile Creek, Five Mile Creek, part of the lower Shotover River and part of the Arrow River near the township (Figure 7).[7]

**Figure 7: Arrow River gold fossicking area**




[6] See https://www.nzpam.govt.nz/our-industry/nz-minerals/gold-fossicking-pounamu/ and http://www.doc.govt.nz/parks-and-recreation/know-before-you-go/care-codes/activity-minimal-impact-codes/gold-fossicking-care-code/

[7] See http://www.paydirt.co.nz/locations/public-gold-fossicking-areas

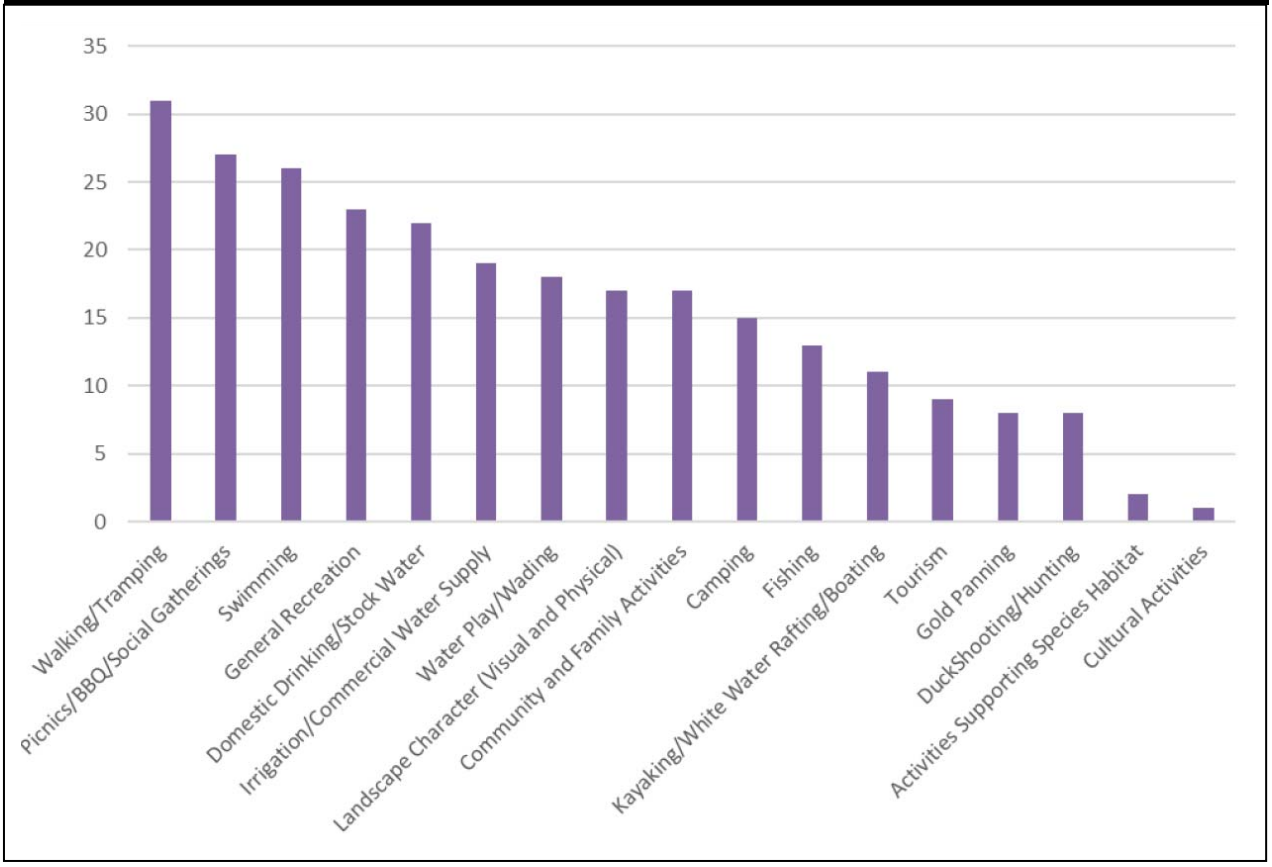
## 4.4 Other activities

Approximately 90 people from the Arrowtown community attended consultation sessions staged in June 2017 by the ORC to inform the development of a Plan Change for the Arrow catchment and Wakatipu Basin aquifers. Participants identified their uses of the Arrow River as shown in Figure 8. This is merely indicative of use and does not quantify actual or relative activity levels. It does, however, provide a list of activities to consider.

There are no published data to indicate the levels of use of the River for any of these activities, apart from for fishing, walking and cycling, as discussed above.

Swimming holes and swing ropes are evident at many locations along the River downstream of the township to near the Kawarau confluence, often located near flat areas suitable for picnics. There is no published water quality monitoring for contact recreation. The data for kayaking/rafting/boating may include small play boats, tubes and paddling boards, and there are no recommendations in popular guides (such as Charles (2013 and Egarr (1995)) to indicate the River is regularly used for whitewater kayaking or rafting.

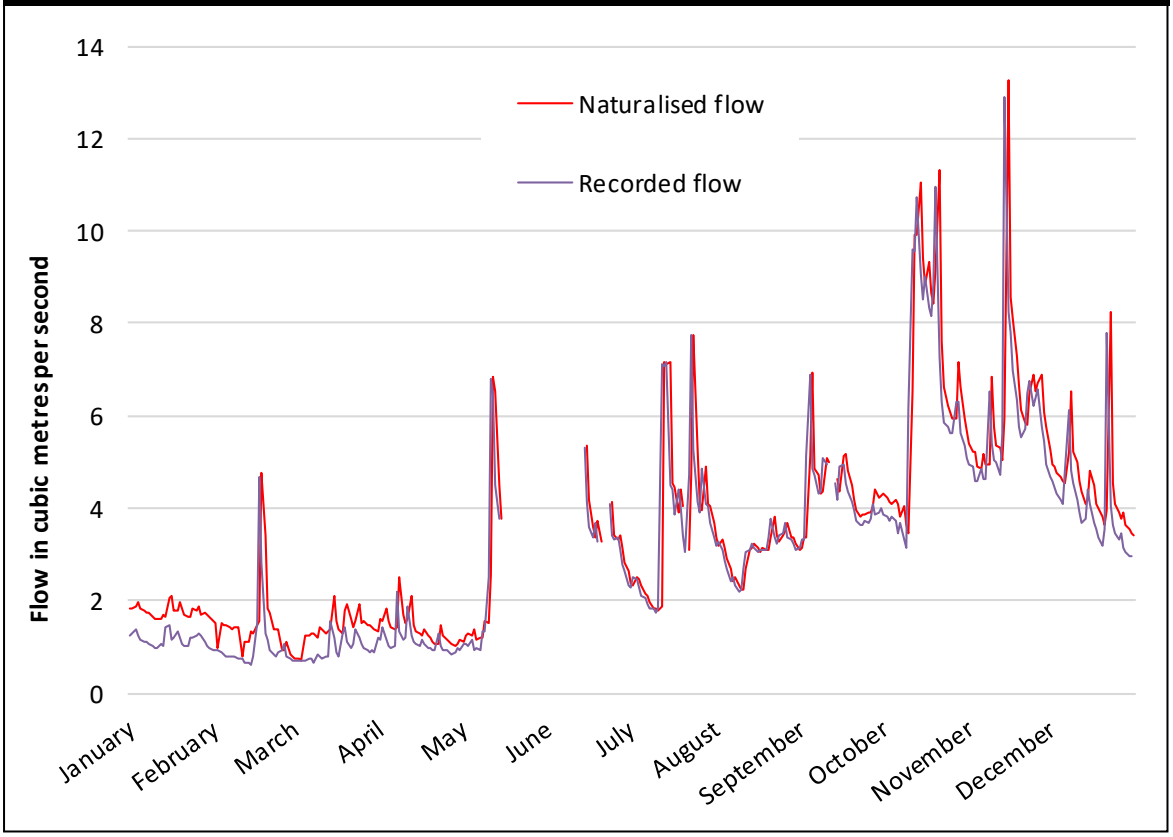
**Figure 8: Community uses of the Arrow River**



# 5 Flow regime

Flows have been recorded by the ORC on the Arrow River since 2010 at the Cornwall Street measurement site. Figure 9 shows recorded flows for 2016 (with abstractions) and modelled natural flows (without abstractions), illustrating typical volatile flows in spring and early summer with snowmelt and normal rain events, with drier periods from mid-summer through to late autumn, coinciding with the irrigation season.

**Figure 9: Arrow River naturalised and recorded flows 2016, Cornwall St**




Abstractions peak around 700 l/s (0.7 $m^3/s$), but normally reach 600 l/s, through January and February (Figure 11, which excludes several aberrant spikes in recorded data). The irrigation period is described as running from October to April. The annual mean seven day low flows and main daily flows for this period area shown in Table 6.

**Table 6: Arrow River low flow data (Olsen *et al* 2017)**

| Irrigation season | Actual flow at Cornwall St | | Naturalised flow at Cornwall St | |
|---|---|---|---|---|
| | 7dLF ($m^3/s$) | Mean daily ($m^3/s$) | 7dLF ($m^3/s$) | Mean daily ($m^3/s$) |
| Oct 2010 – Apr 2011 | 1.65 | 2.50 | Not available | Not available |
| Oct 2011 – Apr 2012 | 0.87 | 3.25 | Not available | Not available |
| Oct 2012 – Apr 2013 | 1.07 | 3.42 | Not available | Not available |
| Oct 2013 – Apr 2014 | 1.09 | 3.20 | 1.64 ~ 1.66 | 3.58 ~ 3.60 |
| Oct 2014 – Apr 2015 | 1.06 | 2.75 | 1.60 ~ 1.62 | 3.19 ~ 3.21 |
| Oct 2015 – Apr 2016 | 0.70 | 1.99 | 0.83 | 2.42 |
| Oct 2016 – Apr 2017 | 1.37 | 3.84 | 1.65 | 4.23 |

**Figure 11: Arrow River modelled abstractions 2013 – 2017 measured at Cornwall St**

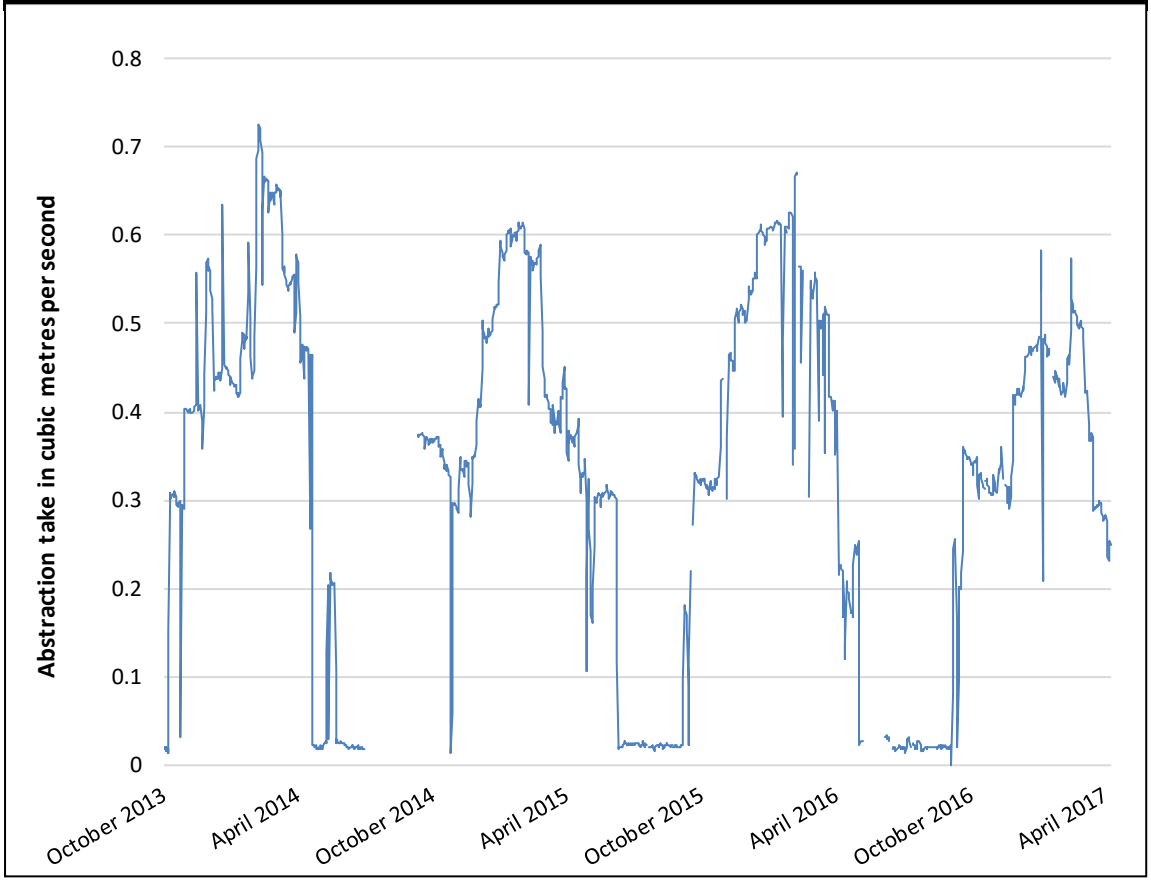
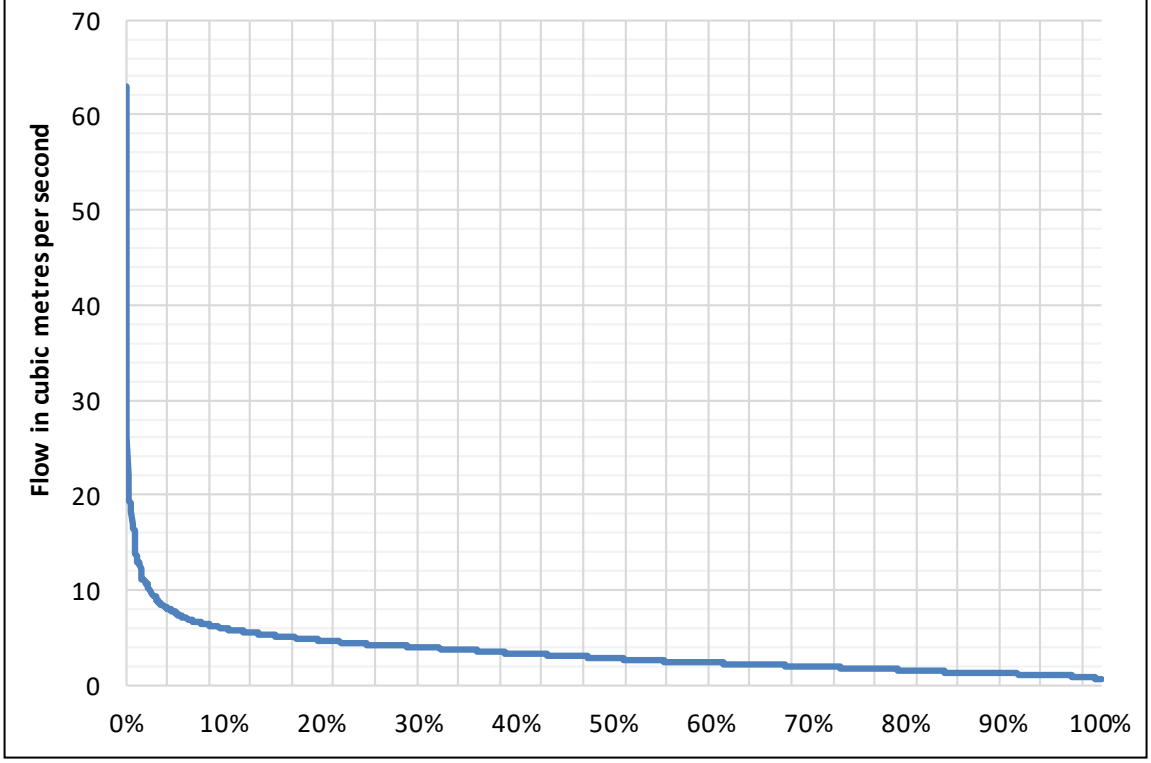



Figure 10 shows the percent of time the Arrow River flowed above defined levels between October 2011 and October 2017. The River was above 20 $m^3/s$ less than 1% of the time, with the peak recorded flow of 63 $m^3/s$ on the 2nd of June 2013. Seventy-five percent of the time the River flowed below 4.3 $m^3/s$ (and 25% of the time above that flow), and below 2 $m^3/s$ for 30% of

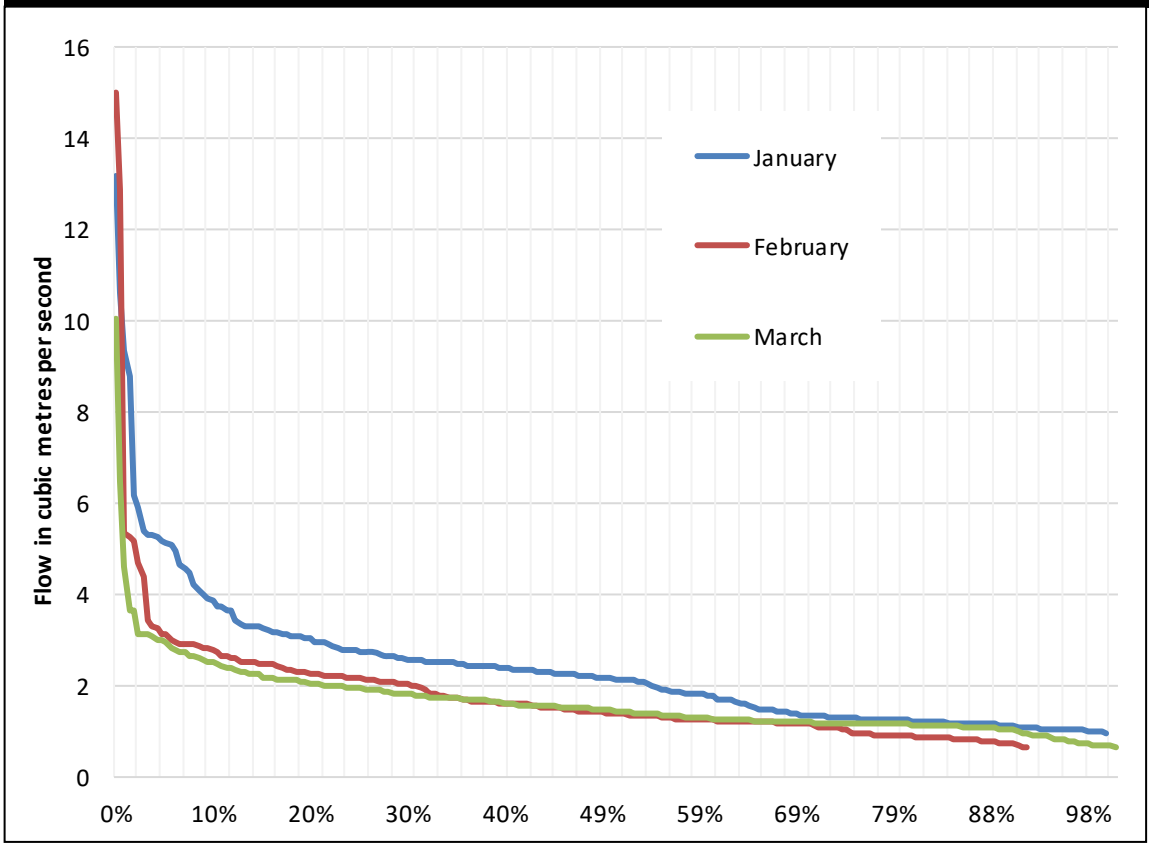
**Figure 10: Flow duration – Arrow River 2011 – 2017 annual. % of time above the flow shown**



the time (and 70% of the time above that flow).

Figure 12 shows the percent of time the Arrow River is above defined flows for the driest seasons of summer and early autumn (based on measured flows at Cornwall Street and after abstractions).[8] Approximately 80% of the time in March – the driest month – the River flows below, or near below, 2 $m^3/s$.

**Figure 12: Flow duration – Arrow River 2011 – 2017 monthly. % of time above the flow shown**




[8] There are different counts for the data sets for each month due to missing data; and showing them on the same chart means they do not align perfectly with the horizontal axis. Each curve should ideally end at the 100% mark. However, this would require showing each month on individual charts.

# 6 Consultation summary

Two public consultation sessions on the Plan Change were held up to the end of November 2017. The first included three drop-in opportunities followed by a stakeholder meeting, each held at:

- Drop-in, Arrowtown: 26 June 2017 (Arrowtown Bowling Club) 1.00 pm - 3.00 pm and 6.00 pm - 8.00 pm.
- Drop-in, Frankton: 27 June 2017 (Queenstown Events Centre) 12.30 pm – 2.30 pm.
- Key stakeholder session, ORC offices Dunedin Friday 30th June at 10am – 11.30am.

Ninety people attended the three drop-in sessions in Arrowtown and Frankton and five attended the stakeholder meeting in Dunedin. Participants provided information on the day relying on various feedback methods (including the data for Figure 8 on page 25). Comments included that a perception that low flows in the Arrow River limited recreational use, but no additional data was provided (such as when, what activity and what flow).

Specific written feedback included (of relevance to in-river water quantity issues for recreation and tourism):

***New Zealand Professional Fishing Guides Association****: Currently we have noted:*

- *The Arrow river is a major trout spawning tributary, so a minimum flow enabling fish passage in Autumn and Spring is essential.*
- *The Arrow river is a fishery in its own right, so a minimum flow that enables fish survival and sustains food supplies is essential.*
- *The Arrow river is a significant economic fishery in that it provides an option for Queenstown based anglers, and influences their choice to base themselves in the Queenstown catchment.*
- *There has been a significant decline in water quality since Millbrook resort became operational with heavy fertilisation of the green areas and the associated run off. While we do not have scientific data, this is based on comments from our members that have been fishing the area for 40+ years.*

***Public Health South****: The Arrow River is widely used for recreational purposes such as swimming and tubing (it is only very infrequently able to be used for kayaking because of low river flows). It is of primary importance that water quality is maintained at a level that is safe for example for children's swimming. A nationally representative survey found more than nine out of ten New Zealand adults want water in our streams and rivers to be safe for swimming, fishing and food gathering (Horizon Research 2014), as this is how most of the general public engage with our waterways. Minimum flow levels should therefore provide a healthy river ecosystem that protects public health, promotes recreational use, and enhances water quality. Recreational use - flow rates that allow swimming and wading, tubing and adequate swimming hole depth for use of rope swings. Watersports - flow rates are usually too low for watersport use, but it is widely used for tubing when flow rates are sufficiently high.*

***Otago Fish & Game Council****: The Arrow River and its tributaries support a productive trout fishery and central part of the landscape character in the local area. As a fishery, it boasts self-sustaining populations of brown trout and rainbow trout, both of which can reach large sizes, and is visited by a consistent angling population. Most fishing occurs*

*at or below Arrowtown, with more dedicated anglers taking the opportunity to fish the higher, remote reaches up to Macetown. The opening of the fishery has been pushed back to November to protect the majority of the rainbow trout spawning season but still catches the tail end of the run, which provides an opportunity to catch large, adult rainbow trout. In this sense, the fishery is relatively unique. Similarly, the ease of access in the lower reaches of the Arrow provides an opportunity for junior anglers to catch larger fish. This is important as this demographic is often restricted in their ability to access more remote or productive fisheries.*

*The catchment also provides spawning habitat and acts as a nursery or rearing area for regional populations of brown and rainbow trout. These species spawn at different times, creating multiple runs of adults up the river each year from April – November. Fry and juvenile trout migrate out of the Arrow progressively and can find their way into the Kawarau River, Lake Wakatipu and the Upper Clutha systems. Because of this, the regional significance of the Arrow's nursery function should be noted. The Arrow fishery also contributes to the local economy as a tourist and guided angling destination. It provides an option for angling tourists, who typically spend at higher rates than the average visitor to New Zealand, and incentive to stay in Queenstown. The river is also valued by local guides in helping to provide a spectrum of angling opportunity to their clients. In addition, the nursery population contributes to recruitment in Lake Wakatipu where it has been estimated that one third of fishing trips are guided. As with many ecosystem services, the contribution of the Arrow catchment to the local economy has not yet been quantified; however, it is an important factor to recognise.*

*As with many water systems in Otago which support urban and/or industrial uses, in this case both the urban and agricultural uses will be influential, the most substantial threats to aquatic habitat are water quality and quantity issues. It is also important to note that the timing of the opening of the fishery and tail end of the rainbow spawning run coincides with the beginning of the irrigation season. This may be placing extra pressure on water around this time as instream and out of stream demands can both be high. In addition, the rugged nature of the catchment above Arrowtown means that most water uses occur in one short stretch through the lower reaches so geographic proximity may exacerbate environmental issues or tensions between water users.*

*While Fish and Game does not presently have an accurate assessment of current out of stream water demand, on paper there is a clear potential for conflict as the total water allocated for consumptive use is more than 2x the synthetic 7-day mean annual low flow (MALF), or roughly 4x over-allocated based on the default primary allocation set by the Regional Plan: Water (RPW). Understanding the volume and character of water use and take in the catchment will be important for the minimum flow setting exercise. Water quality in the lower reaches of the river is an important factor in the success of the fishery and potentially its quality as a nursery… However, it is worth noting that water quality and quantity are intrinsically linked through dilution and the provision of naturally variable flow regimes to provide flushing flows or habitat creation. A minimum flow should be set at a level which provides for safe contact recreation opportunities and ensures this type of environmental function.*

*Being a minimum flow plan change, the ORC will need to take a wide variety of factors and perspectives into account and reflect a wide range of the community interests. The main purpose of a minimum flow has been described in the RPW as allowing the taking of water while providing for the aquatic ecosystems and natural character of the catchment water bodies. The purpose has alternatively been described in the RPW as*

*providing for the maintenance of aquatic ecosystems and natural character under low flow conditions. Either of these descriptions set a primacy in which providing for aquatic ecosystems and natural character as a pre-requisite for the abstraction of water during low flows – with exceptions in specific circumstances. In laymen's terms this could be referred to as setting an environmental bottom line. When setting an environmental bottom line for the Arrow catchment, it would be important to take into account at least the following: habitat quality; habitat quantity; species present and population, or metapopulation, viability and health; spawning success; species potentially present without abstraction of water at low flows; natural flow regimes and flow variability; cultural values; recreational opportunities present or potentially present without abstraction at low flows; contribution to landscape amenity; visual aesthetics; and the provision of ecosystem function and ecosystem services. The decision as to what levels are sufficient to provide for natural character and aquatic ecosystems is, to a degree, a subjective one. This will be the subject of further input through the plan change process. While it is important to consider the value of out of stream uses that may be impacted by a minimum flow, Fish and Game believes they should not be given precedence over setting an adequate environmental bottom line. In many ways minimum flows may generate additional value for the catchment, such as providing for water based tourism, recreational amenity, commercial water sport opportunities, safeguarding natural/landscape character, boosting biodiversity and returning ecosystem function.*

Additional written comments referred to the value of abstracted water for tourism and terrestrial recreation, such as for snow making and irrigating golf courses and parks. The value of these out-of-river water uses are considered in parallel technical assessments for the Plan Change (particularly economic values), and the water take required to support these is not considered here. However, it is important to note that several stakeholders referred to the need to maintain a balance between in-river recreation and other social values, and recreation and tourism values associated with irrigation and snow-making.

Two further workshops were held in Arrowtown in November 2017 (20th and 21st at the Bowling Club) and facilitated by the author of this report, with ten attendees (out of 16 positive RSVPs, with almost all non-attendees anglers). The purpose of these meetings was to investigate the potential to identify specific in-river minimum flow requirements. However, there was a strong perception that the Arrow River had an adequate flow, and flow variability, with the current operating regime, and users had not experienced a situation where the River had a flow low enough to curtail enjoyment (although the summer season of 1995/96 was recalled as particularly dry after very high and warm flows in November). There was no indication that any of the workshop participants needed to check the River's flow before visiting it.

The following notes were recorded and circulated to all 16 on the attendee list.

**Recreation and tourism**

- The current flow regime (with the abstractions as they currently function and not the potential additional takes allowed under the consented environment (ie, over-allocation)) has been experienced as appropriate and 'is not broke' and therefore does not need fixing. Indeed, the River is considered to be largely in a natural state or 'free flowing' and not under threat (notwithstanding other local debates about the state of the riverbanks – with willows etc). The ability to provide visitors with an experience of a natural and accessible river – and one of which locals are proud – is an important advantage for the local tourism community (and perhaps one which has been taken for granted to date).

- The use of abstracted water to support existing tourism developments and other local uses is supported; but additional takes, or takes when the River is experiencing long periods of low flow, need to be prioritised to maximise the benefits to both irrigators and in-river values. Caution needs to be applied to potential additional takes considering the lack of local experience of higher abstraction levels, and the high level of acceptance of the current regime. At a regional level, it may be more appropriate to take water for new developments from sources other than the Arrow (although potential effects of these have not been considered).
- There was no concept of specific measured flows which might be suitable, but that long periods of low flows, particularly as experienced in the modified town section, were not attractive and (although rarely experienced):
    - allow the growth of weeds in an otherwise clean gravel section, and do not 'sweep' the banks of signs of heavy public use;
    - do not flush fine sediment deposited as a result of vehicles crossing the River upstream (an issue throughout the River), meaning any in-river activity creates sediment clouds which take a long time to settle (adversely affecting swimming for example, with the loss of visibility);
    - prevent gold fines from being flushed to the surface;
    - conflict with the concept of the Arrow as a swift and natural waterway.
- The existing Arrow Irrigation Company take has its own value as an historic feature – a long-term use of the River with its own value beyond its irrigation services.
- There is no experience of periphyton in the River, and although the catchment might be naturally resistant to it forming, any flow regime needs to maintain the status quo.
- A preferred flow regime might be defined by freshwater ecology needs, but what that might be and what it could mean for other uses (such as swimming and natural character) is not known.
- The short period of recorded flow data is a concern and does not include low flow periods experienced in, for example, the summer of 1995/96. Is it possible to model such flows based on rainfall data? Making additional water allocation decisions without that data poses a risk.
- Water temperature is important for fish – especially trout. Willows and the like provide important shading. If these are removed, the ecology of the River could alter and an alternative flow regime might be preferred. Such scenarios should be considered.
- Although visitors to the River might accept an alternative flow regime – since they have no local benchmark – locals need to be confident in presenting a well-managed river that is, as much as possible, in a natural state (particularly considering the national debate about freshwater quality and the Arrow being in a setting with a high international profile).
- The effects of low flows should be considered in terms of the speed of recovery for in-river biota. Is it acceptable to have periods of adverse low flows if they enable irrigation at critical periods (and reduce the chance of significant grass loss with long recovery periods) if the River naturally recovers quickly?
- Trout spawning requirements need to be considered (further discussed with the angling group).

- Beyond water quality, willow management needs consideration, and the management of, especially, the town section for its landscape character and access. As stated, excessive access by 4WDs has an adverse effect on water quality (disturbing fines).

**Angling**

- The Arrow River has recreational angling values but its main role is a hatchery for rainbow and brown trout. The flow regime should therefore be developed around maintaining habitat during spawning (September to November for rainbows and during autumn for browns) and while the fry develop.
- A healthy hatchery will benefit the entire Kawarau, Dunstan, Wakatipu fishery.
- The November to March season on the Arrow is set to protect the large rainbow entering the river to spawn. They are not resident, and were heavily targeted prior to the shortened season being set. Rainbows generally enter the River as three or four separate runs starting in September. If one spawning run and their redds are washed out after a flood, the next run will replace the loss.
- Every four or five years, the run might be late, and the start of the season can feature very large trophy rainbows. However, there is never any remaining by December, and the river only offers very small fish, which are occasionally caught by locals and a few visitors. The opportunity for large fish lasts from the start of the season to the first major rainfall – which is normally pretty common in November.
- Flows in November are generally relatively high, with angling good between a maximum of 4 to 5 cumecs. December can be much drier, but the lower, easy flows suit the kids and families who mostly use it then and later into March.
- Methods are generally spinning from the town area upstream and fly throughout. Spinning at the confluence can be quite productive – either from land or a boat.
- There are no trout above the weir [although ORC fish surveys show trout in Soho Creek above the weir, but not in the mainstem].
- The Arrow is not a big river and likely sensitive to changes in the flow regime. The current regime seems to be working well, and does not need to be altered. “It ain’t broke, but could be easy to break.”
- There was interest in how much water is prevented from entering the River by the massive growth of trees within the catchment. Is this an issue which will progressively affect flows and need to be accounted for in setting abstraction limits?
- Sediment disturbed by vehicles crossing the river can disrupt fishing downstream for extended periods, and smother redds.

# 7 Conclusion

Key findings are:

- The Arrow River is highly accessible and has strong local in-river recreation values focused on swimming, paddling (including on boards, tubes and the like), picnicking, angling, walking and cycling, and landscape and scenic values, particularly adjacent to and downstream of Arrowtown.
- Regional recreation values are centred on the River's use for tourism, including a very small amount of angling (with its main fishing value as a hatchery), 4WD excursions, walking and cycling, gold panning, and landscape and scenic values.
- While there were comments in early public workshops that water quantity was potentially an issue for recreation on the River (albeit without specifics), later workshops suggested that the existing flow regime was suitable for the recreation uses identified, and there was no recollection of flows sufficiently low to be problematic – although the 1995/96 summer was noted to have been unusually low, and was associated with heavy and warm rainfall which removed all snow-melt in November, followed by a dry summer. There are no flow records for this period.
- There is no recollection by stakeholders, or other data, to indicate periphyton ever being an issue in the River.
- There were stated concerns in early workshops about water quality issues, and the need to maintain dilution through good water quantity, but these have not been quantified. Stakeholders generally referred to the River as having very high water quality.
- Flows which sustain the River as a trout hatchery were agreed to be a minimum requirement for fishing. The River was described as always suitable for the activity of angling, with lower flows normally experienced through summer often better suited to the beginner style of fishing carried out at that time and below Arrowtown. More experienced anglers would be most likely to fish at the start of the season up to the weir for a short period in November when flows are normally high and variable (4 to 5 $m^3/s$).
- For landscape and scenic values, and local recreation, the current regime was considered quite acceptable (if not normal and taken-for-granted), with low flows in summer suiting kids swimming, and swimming holes having adequate depth – although such settings often come and go with gravel movement.
- Since water quantity was considered appropriate now, there was a reluctance to explore the potential for additional abstraction.

From the data available, it appears that a flow regime suitable for in-river recreation and scenic and landscape values can be delivered by:

- Identifying and maintaining flows which support the River's trout hatchery values;
- Maintaining abstractions at the level currently experienced, and delivering the existing flow regime which is considered appropriate; and
- Monitoring and maintaining water quality in the River below Arrowtown.

Support for the use of abstracted water in tourism and recreation is evident.

Much of the discourse over the past decade about the Arrow River has been focused on, for example, riparian values (exotic trees and weeds), the potential for poor water quality from stormwater and irrigation, effects on water quantity from exotic tree growth, and the effects of 4WDs on water quality (via disturbing fine sediment and trout redds).

# 8 References


Charles, G. 2013. *New Zealand Whitewater 5. 180 Great Kayaking Runs.* (5th edition) Graham Charles.

Department of Conservation, 2016. *Conservation Management Strategy for Otago 2016*. Department of Conservation

Egarr, G. Egarr, J. Mackay, J. 1979. *64 New Zealand Rivers.* NZ Canoeing Association.

Egarr, G. 1995. *New Zealand's South Island Rivers: A Guide for Canoeists, Kayakers and Rafters.* Nikau Press, Nelson.

Egarr, G.D. and Egarr, J.H. 1981a. *New Zealand Recreational River Survey: An Investigation into the Recreational Potential of New Zealand's Inland Waterways*. *Part 1: Methods and Conclusions.* Water and Soil Miscellaneous Publication no. 13. Published for the New Zealand Canoeing Association by the National Water and Soil Conservation Organisation, Wellington.

Egarr, G.D. and Egarr, J.H. 1981b. *New Zealand Recreational River Survey: An Investigation into the Recreational Potential of New Zealand's Inland Waterways*. *Part III: Summaries of South Island Rivers.* Water and Soil Miscellaneous Publication no. 15. Published for the New Zealand Canoeing Association by the National Water and Soil Conservation Organisation, Wellington.

Fink-Jensen, K. Johnson, M. Simpson-Edwards, M. 2004a. *Freshwater recreational users. Survey of freshwater use in New Zealand*. BRC Marketing & Social Research for MfE.

Fink-Jensen, K. Johnson, M. Simpson-Edwards, M. 2004b. *Freshwater recreational users. Internet survey of freshwater use in New Zealand*. BRC Marketing & Social Research for MfE.

Galloway, S. 2008. *New Zealand Recreational River Use Study: Specialization, Motivation and Site Preference*. School of Physical Education University of Otago.

Greenaway, R. 2016. *Outstanding freshwater body assessment criteria and assessment methodology: Recreation values*. Prepared for Golder Associates as part of the Outstanding Freshwater Body Project.

Grindell and Guest (eds). 1986. *A list of rivers and lakes deserving inclusion in a schedule of protected waters*. Water and soil miscellaneous publications No.97

Grindell, D.S. (ed). 1984. *A national inventory of wild and scenic rivers.* Water and Soil Directorate, Ministry of Works and Development.

Harper, B. 2017. *Community Environment Fund: Outstanding Freshwater Bodies Project*. Hawke's Bay Regional Council

Jet Boating New Zealand (JBNZ). 2013. *Safety / year book for the subscription year 1st July 2013 to June 2014.* JBNZ Inc.

Kent, J. 2006. *South Island Trout Fishing Guide.* Reed Publishing, Auckland.

Kent, J. Magnano Madsen, P. 2003. *New Zealand's Top Trout Fishing Waters*. Reed Publishing (NZ) Ltd.

Kennedy, M. 2017. *Queenstown Trails Trust Trail Count Report for period: Oct 18 2012 – March 31 2017*. Board of Trustees, Queenstown Trails Trust

Ministry for the Environment. 2004. *Water Bodies of National Importance: Potential Water Bodies of National Importance for Recreation Value.* Ministry for the Environment, Wellington.

Moore, C. 2002. *Weekends for Trout Fishing in New Zealand.* New Holland, Auckland.

Olsen, D. Lu, X. and Ravenscroft, P. 2017. *Update of scientific information for the Arrow catchment: 2012-2017*. Otago Regional Council

Taylor, PC. 1993. *The New Zealand recreation opportunity spectrum. Guidelines for users.* Department of Conservation.

Teirney, L.D., Unwin, M.J., Rowe, D.K., McDowall, R.M., Graynoth, E. 1982. *Submission on the draft inventory of wild and scenic rivers of national importance*. Ministry of Agriculture and Fisheries. Fisheries Environmental Report No. 28.

The Ministry of Tourism. 2004. *Waters of National Importance for Tourism.* The Ministry of Tourism, Wellington.

Turner, B. 2003. *The Guide to Trout Fishing in Otago*. Fish & Game NZ

Unwin, M.J. 2013. *Values of New Zealand angling rivers Results of the 2013 National Angling Survey.* Prepared for Fish & Game New Zealand. NIWA Christchurch

Unwin, M.J. 2009a. *Attributes characterising river fisheries managed by Fish & Game New Zealand: a pilot survey of the Otago and Nelson/Marlborough regions*. NIWA Christchurch

Unwin, M.J. 2009b. *Angler usage of lake and river fisheries managed by Fish & Game New Zealand: results from the 2007/08 National Angling Survey*. NIWA Christchurch

Unwin, M. and Brown, S. 1998. *The Geography of Freshwater Angling in New Zealand: A summary of results from the 1994/96 National Angling Survey.* Prepared by NIWA for Fish & Game New Zealand. NIWA Client Report: CHC98/33, Christchurch.

Unwin, M. and Image, K. 2003. *Angler usage of lake and river fisheries managed by Fish & Game New Zealand: Results from the 2001/02 National Angling Survey*. Prepared by NIWA for Fish & Game New Zealand. NIWA Client Report: CHC2003-114, Christchurch.