

# South Esk – Great Lake Water Management Review

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## **Scientific Report on Downstream of Upper Brumbys Creek and Weston Weir**

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## DOWNSTREAM UPPER BRUMBYS AND WESTONS WEIR

### 1. ASSESSMENT OF ISSUES AND STATUS

As part of the South Esk – Great Lake Water Management Review Community Consultation Stage (August 2000), stakeholders were invited to raise issues and concerns relating to waterways within the South Esk – Great Lake Catchment. Two stakeholders raised concerns regarding upper Brumbys Creek and Westons Rivulet and the associated weirs on both of these waterways. Both stakeholders are farmers who own properties adjoining Westons Rivulet and/or Brumbys Creek, and rely on one or both of these streams for irrigation supply, and stock and domestic water. In addition to these two stakeholders, there are at least eight others who are similarly affected by these issues.

The issues investigated as part of this study related to seasonal flows downstream of the upper Brumbys and Westons weirs, including summer low flows and risks posed by flooding.

#### **Lack of Summer Flow**

Historically, Westons Rivulet has flowed all year-round, despite diversion of its upper reaches into Great Lake. According to some farmers who abstract water from Westons Rivulet, the summer of 1999/2000 was the first time they could remember the rivulet ever drying up. They attributed this to increased abstraction for irrigation by farmers upstream of their properties.

#### **Winter Flooding**

Flooding in Westons Rivulet and Brumbys Creek is a natural phenomenon that was occurring before the diversion weirs were constructed. Both these streams continue to flood even though they are now diverted because:

- neither of the weirs are large enough to impound a sufficient volume of water to prevent flooding; and
- during rain events, the catchments of the streams downstream of the weirs are sufficiently large to produce floods in the streams.

Flooding of these streams is a problem for farmers because it creates saturated soils in spring, preventing them from planting crops.

#### **Infrastructure and Operations**

Westons Diversion (comprising the diversions of upper Brumbys Creek and Westons Rivulet) is located on the Great Western Tiers at the north-eastern edge of the Central Plateau (see Figure 1). The diversions are within the Central Plateau Protected Area, which is administered by the Tasmanian Parks and Wildlife Service. Land use downstream of the diversion includes agriculture, primarily sheep farming and cropping. Water is extracted from the diversions for irrigation, stock and domestic use.

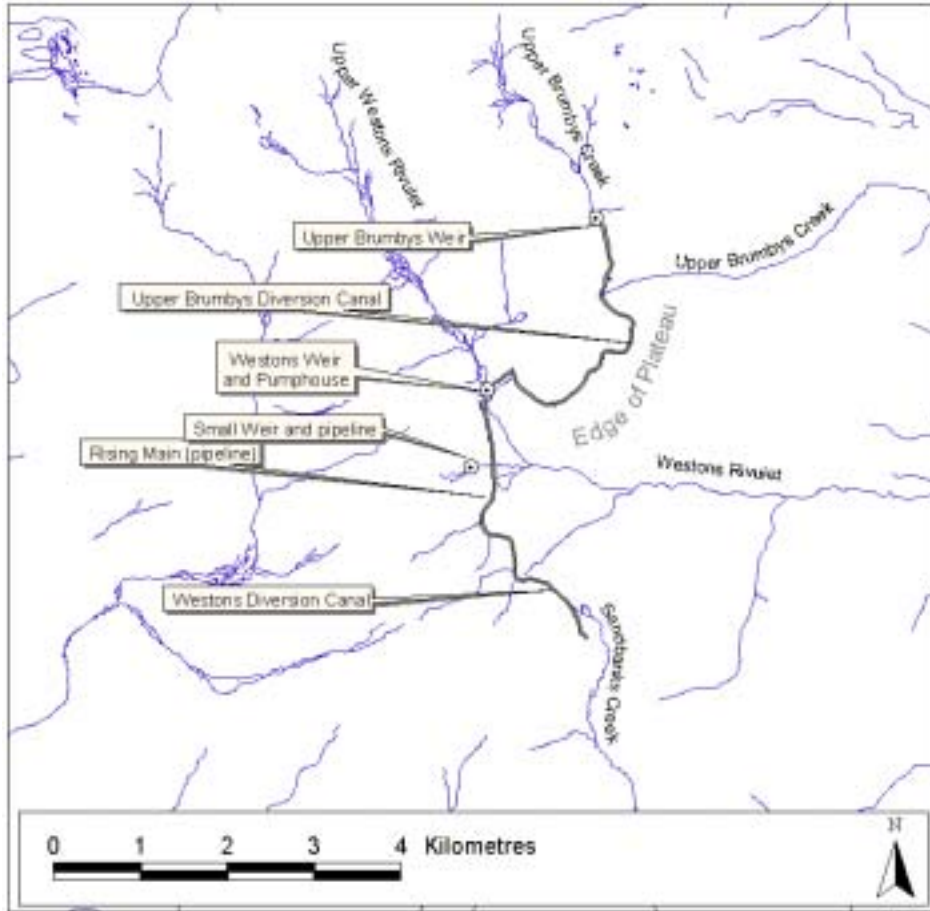


Figure 1: Site location of Westons Diversion

Westons diversion was completed in 1966 as part of the Poatina Power Scheme, to divert water from upper Brumbys Creek and Westons Rivulet into Great Lake. The diversion consists of Brumbys Weir and Canal, and Westons Weir, Canal and Pumping Station.

Brumbys Weir diverts water from upper Brumbys Creek into Brumbys Canal, which then empties into a pondage formed by Westons Weir, located on upper Westons Rivulet. Westons Pumping Station transfers water from this pondage (1,110 m above sea level) into Westons Canal (1,125 m above sea level) via a rising main. After exiting Westons Canal, water flows down Sandbanks Creek into Great Lake, where it is then utilised in the Poatina Power Station. Dimensions and hydrologic parameters of infrastructure associated with the diversions are shown below in Table 1 and Table 2.

Table 1: Dimensions and hydrologic parameters of Brumbys and Westons Weirs

Structure	Length (m)	Height (m)	Outlet (cumecs) [Diameter (cm)]	Spillway Length (m) [Capacity (cumecs)]
Brumbys Weir	48.5	0.9	0.03 [12.7]	14.7 [7]
Westons Weir	56	2.75	0.11 [20]	18 [8]

**Table 2: Dimensions and hydrologic parameters of Brumbys and Westons Canals**

Structure	Length (km)	Width / Diameter	Capacity (cumecs)	Spill (cumecs)
Brumbys Canal	3.94	1-3 m	0.85	15.57
Westons Canal	1.57	1-3 m	1.98	28.3 (side 5.66)
Rising Main	1.24	0.2 m	1.42	N/A

Westons pumping station houses a single pump of 1.5 cumec capacity, which is controlled by three automatic float switches that turn on and off according to the water level in the pondage. The pump starts just before the weir will start spilling, and cuts out when the normal minimum operating level (of approximately 0.2 m below full supply level) is reached. An emergency cut-off switch is also installed to prevent air being sucked by the pump.

During normal operation, the pump may function for periods of between 5 minutes and over 40 hours before the water level in the pondage is draw down to the normal minimum operating level. The duration of its operation depends on the volume of inflow from Westons Rivulet and Brumbys canal. The pump is limited to three starts per hour to protect its motor, but has been recorded to operate up to 500 times over a two-week period.

The reliability of the pump was found to be unsatisfactory during the autumn of 2001 and over different time periods during previous years, and an upgrade program was undertaken during June and July 2001 to improve the performance and reliability of the pump.

Riparian outlets are present in both Brumbys canal and Westons weir. The Brumbys riparian outlet is situated approximately one-third of the way along the canal between Brumbys weir and Westons pondage and drains into Brumbys Creek. Westons riparian outlet is situated in the wall of the pumphouse, and drains into Westons Rivulet bed. These riparian valves are left open during the summer to provide water for downstream users.

Spillways are present on both Brumbys and Westons weirs, and these structures spill water into the original streambeds. There are seven spillways along the length of Brumbys canal and three along the length of Westons canal. The overflow from the first two spillways on Brumbys canal eventually flows back into the original creek bed. Spill from all other spillways on both canals drains into Westons Rivulet.

## 2. FORMULATION OF STUDY OBJECTIVES

In order to assess these issues adequately and to determine the extent of impact that Hydro Tasmania has on them, two avenues were pursued. Firstly, targeted consultation with stakeholders was undertaken to clarify the issues that had been raised as part of the Water Management Review Community Consultation and, secondly, hydrological modelling was carried out to assess the relationship between the amount of rainfall in the catchments and the volume of stream flow produced.

### 3. DATA COLLECTION AND ANALYSIS

#### **Stakeholder Consultation**

Further targeted consultation with stakeholders was undertaken to clarify the issues initially raised for upper Brumbys Creek and Westons Rivulet through the South Esk – Great Lake Water Management Review Community Consultation stage.

The two stakeholders who had raised concerns within upper Brumbys Creek and Westons Rivulet were contacted, and the issues they had raised were clarified and discussed at length with them. As a result of these discussions, staff from Hydro Tasmania visited both stakeholders on their properties, so that a clearer idea about the issues could be gained through field observations and further discussion with the stakeholders. The following describes the issues as outlined by, and clarified with the stakeholders.

The owner of “Saundridge”, located on Saundridge Road near the confluence of Westons Rivulet and Brumbys Creek, and to the north of the Poatina Tailrace, was visited. He raised the fact that Westons Rivulet had dried up on a number of occasions over the summer of 1999/2000 – he had not known this situation to occur before and attributed this to increased irrigation abstractions by farmers upstream of his property. The owner of “Saundridge” was also concerned about winter floods that frequently occur on Westons Rivulet and flood large areas of his property. Resulting soggy ground prevents the planting of his crops until well into the spring.

The landowner of “Stoneyfield”, approximately 4 km along Blackwood Creek Road from its junction with Saundridge Road was also consulted. He also raised the issues of summer supply shortages and winter flooding. This property owner irrigates out of both Brumbys Creek and Westons Rivulet and wishes to increase his cropping area, but is concerned that there may not be a sustainable water supply during summer with which to do this. Parts of the property are protected from high winter flows in Westons Rivulet by levee banks; however, these have been breached in the past during large floods, which have resulted in a large amount of river cobble being spread over his paddocks. This landowner has noted that ‘about an inch of rain on the plateau’ results in a foot of water passing under the bridge at “Stoneyfield”.

Subsequent to these property visits, the Hydro was invited to speak to members of the Upper Brumbys Landcare Group at a specially convened meeting on 18<sup>th</sup> December 2000. The purpose of the meeting was to:

- 1) Give Hydro Tasmania an opportunity to explain to members of the Group the issues that had been raised regarding Westons Rivulet and Brumbys Creek during the consultation phase of the Water Management Review, and provide them with a better idea about the infrastructure and operation of the diversions.
- 2) To give the local community an opportunity to raise further issues and to discuss possible solutions to the concerns already raised.

Eight members of the Upper Brumbys Landcare Group attended the meeting. In summary, some stakeholders attributed low summer flows to an increase in abstraction for irrigation by farmers upstream, and did not attribute this to current

Hydro Tasmania management procedures. The Group was, however, interested in Hydro Tasmania providing larger volumes of water for irrigation during the summer seasons if possible.

## Hydrological Analysis

Hydrological modelling of stream-flow from a given rainfall event was undertaken in an attempt to:

- understand the factors influencing the movement of water within the catchment;
- determine the magnitude of inflows into the diversion; and
- establish to what extent Hydro Tasmania influences the issues raised.

No stream-flow data are available for the Westons Rivulet Catchment, therefore rainfall and stream-flow data from a similar (unmodified) catchment on the north-western side of Great Lake was used to model flows in Westons Rivulet.

The results from modelling indicate that, due to a number of factors, and even under natural conditions, flows in Westons Rivulet are likely to be unpredictable and appear to have limited correlation to rainfall events. Generally, however, flows tend to increase with increasing rainfall.

Three frequency curves were produced from this modelled data:

- peak daily rainfall;
- peak monthly rainfall; and
- peak discharge.

These curves give an indication of the probabilities assigned to peak rainfalls and flows at Westons weir, under natural conditions. It must be noted that a flow event of a particular annual exceedance probability does NOT necessarily correspond to a rainfall event of the same annual exceedance probability (i.e. a 1:5 flow does not necessarily develop from a 1:5 rainfall), as runoff is also dependant on the antecedent conditions.

From these curves, it appears that a rainfall event of 80 mm or more (having an annual exceedance probability of 1:2) is likely to result in flows in the rivulet at Westons weir of between 4 - 20 cumecs (median of 11 cumecs). This is equivalent to a moderate flood occurring about very second year. Given the storage capacity of the weir on Westons Rivulet and the capacity of the associated pump to divert water into the Great Lake catchment (1.5 cumecs), the weir is only likely to significantly impact on flood flows in the rivulet at the lower end of this range. During flows that exceed the capacity of the pump to divert water, the seven spillways along the length of the Brumbys Creek diversion canal (all of which flow back into the Brumbys Creek drainage system) are likely to ensure that excess water is not diverted to Westons Weir.

## 4. MANAGEMENT OBJECTIVES

There are essentially three issues raised by stakeholders in relation to downstream upper Brumbys and Westons weirs. These are:

- low flows in Westons Rivulet during summer months;
- flooding downstream of Westons weir during winter; and
- flooding in upper Brumbys Creek below Brumbys weir during winter.

### Options for Management

The following section discusses the possible management options that would alleviate the concerns raised for downstream Upper Brumbys and Westons weirs by meeting the management objectives outlined above.

#### *Options to Manage Low Summer Flows*

In order to meet the management objectives outlined above, there are a number of management options that could be undertaken to improve summer flows in Westons Rivulet:

- better enforcement of abstraction/irrigation licences to ensure that water shortages over summer are not caused or exacerbated by illegal abstraction;
- open riparian valves in the weir earlier in the year, eg. October, to allow irrigators to fill on-farm storages, then shut the riparian valve until irrigation commences later in the year;
- increase the capacity of the riparian outlet in the weir to provide higher flows; and
- install telemetered water level sites at Stoneycroft and/or Saundridge Bridges to quantitatively assess flow levels.

Both Hydro Tasmania and the majority of stakeholders on Westons Rivulet consider summer water shortages are primarily the result of illegal abstractions from the rivulet. This would mean that other management options (such as the second and third options outlined above) would not prevent summer water shortages.

The policing of water abstractions are outside Hydro Tasmania's jurisdiction. Better enforcement of water licence provisions would be beneficial in ensuring a larger volume of water remains in the rivulet and is able to be used for stock and domestic supply as well as other legal uses.

Opening the riparian valves in the weir earlier in the year suggested by one of the farmers at the Upper Brumbys Landcare Group meeting but was disagreed with by other farmers present at the meeting. Those that disagreed believe there are currently sufficient flows at this time of the year to provide an adequate volume of water for filling on-farm storages. Therefore, if Hydro Tasmania did implement this option, it would likely be an unnecessary water release and reduce the volume of water flowing to Great Lake, impacting on Hydro Tasmania's generating potential.

Increasing the capacity of the riparian outlet in the weir was also suggested by one of the farmers at the Upper Brumbys Landcare Group meeting. This would be an expensive option since it requires infrastructure changes. In addition, as mentioned above, this option implemented alone would be unlikely to solve the summer water shortage.

The installation of telemetered water level sites would be expensive. It would, however, provide Hydro Tasmania with reliable water level data that can be used to influence the timing of riparian releases.

#### *Options to Manage Winter Flooding*

In order to meet the management objectives outlined in Section 4, the following options could be implemented:

- maintain pump reliability and maintenance, so there is a reduced probability of failure during times of high flow (Westons Rivulet);
- stream channel widening by the removal of willows to reduce water constriction and allow better water flows – as per Upper Brumbys Landcare Group Rivercare Plan (Westons Rivulet and Brumbys Creek);
- construct an open channel along the contour from behind Westons pondage to the existing Westons canal to allow for larger-scale water diversion (Westons Rivulet);
- raise the level of Westons and/or Brumbys weirs to impound larger volume of water that will provide a greater time-frame for the removal of water before the weirs spill (Westons Rivulet and Brumbys Creek).

As indicated by the hydrological analysis, flooding in Westons Rivulet occurs as a natural event. Hence, flood events do not appear to be the result of current Hydro Tasmania infrastructure or water management practices. These options may, however, help to reduce the extent of flooding.

The scheduled maintenance of the pumps should be conducted during autumn, so that there is reduced risk of pump failure over the winter during times of high flow in the catchment. This option has a high cost:benefit ratio it provides increased reliability of the system and minimal pump outages will ensure that the maximum volume of water is diverted into Great Lake to be used for generation at Poatina.

The removal of willows and subsequent stream channel widening is probably the most feasible option for mitigating flood events, as this will restore hydrological conditions closer to their original state. The Upper Brumbys Landcare Group has channel clearing as part of their goals for catchment management.

The third and fourth options were both suggested by participants at the Upper Brumbys Landcare Group meeting. Construction of open channel is seen by downstream stakeholders as the best option, as it removes the need for mechanically pumping the water and would provide larger volumes of water for electricity generation at Poatina. This would be potentially expensive, but some costs would be recovered due to increased electricity generation.

Raising the level of both Westons and Brumbys weirs is not seen as a worthwhile option as it would be very expensive for little benefit to stakeholders. Increased flooding is due to channel narrowing as a result of willow infestations rather than Hydro Tasmania's operation of the weirs. Even if the level of the weirs was raised, spills over the weirs would probably still occur during winter due to the limited potential storage area around the weirs, and spills from the canals would still occur due to their limited carrying capacity.

## References

Hydro Tasmania, 2000, *Community Consultation Report: South Esk – Great Lake Water Management Review*, Hydro Tasmania, Hobart.