

# Brief hydrogeological investigations of the Fluertys Creek Catchment, Birchs Bay

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## Abstract

The potential hydrological impacts to surface water flows related to pumping rates from an irrigation water bore at Birchs Bay were investigated. Initial investigations indicated that the bore is located in a groundwater recharge zone of a confined aquifer and is not affecting the base flow of Fluertys Creek. Low flow rates in the creek appear to be due to recent low rainfall and vegetation clogging the drainage line in the upper section of the catchment.

## Introduction

The Department of Primary Industries, Water and Environment (DPIWE) requested advice from Mineral Resources Tasmania (MRT) on potential hydrological impacts to surface water flows related to pumping rates from an irrigation water bore (MRT BORIS Site\_ID 17251; 519 832 mE, 5 217 558 mN), located approximately two kilometres southeast of Birchs Bay.

Ms Jenny Deakin (DPIWE) and Andrew Ezzy (MRT) undertook a preliminary hydrogeology investigation of the Fluertys Creek catchment on 15 January 2003.

The objectives of the investigations were to:

- Determine the geological nature of the host materials present in the catchment;
- Identify groundwater recharge and discharge zones;
- Examine the quality of the surface and groundwater; and
- Identify if a potential hydraulic connection between the irrigation bore and surface water could affect base flow in Fluertys Creek downstream of the bore.

General information on the irrigation water bore is presented in Appendix 1.

## Site Description

### *Geology*

The Tasmania Department of Mines 1:50 000 scale Kingborough geological map (Farmer, 1981) indicates that the geology of the Fluertys Creek catchment comprises Jurassic dolerite, lower Triassic sedimentary rocks and a small zone of Quaternary unconsolidated sedimentary rocks. Geological mapping undertaken on 15 January 2003 confirmed the bedrock geological setting as Jurassic dolerite in the western half of the catchment which discharges east onto lower Triassic consolidated sedimentary rocks. Because of the lack of observed hornfels metamorphism within the sedimentary rocks (and fracture density within the dolerite), the local north/south contact between these two lithologies is interpreted as a fault. Cover materials prevented the observation of any outcrop at the contact.

### *Hydrology*

The Fluertys Creek catchment is approximately 2.5 kilometres along a west to east axis, with the creek discharging into D'Entrecasteaux Channel one hundred metres south of Fluertys Point. Australian Bureau of Meteorology rainfall station 094036 at Kingston is the closest rainfall station with publicly accessible information. The chart of average monthly recorded rainfall is shown in Figure 1. The average annual rainfall for the station is 676.7 mm, with the highest monthly rainfalls occurring in the last quarter of the calendar year (October to December).

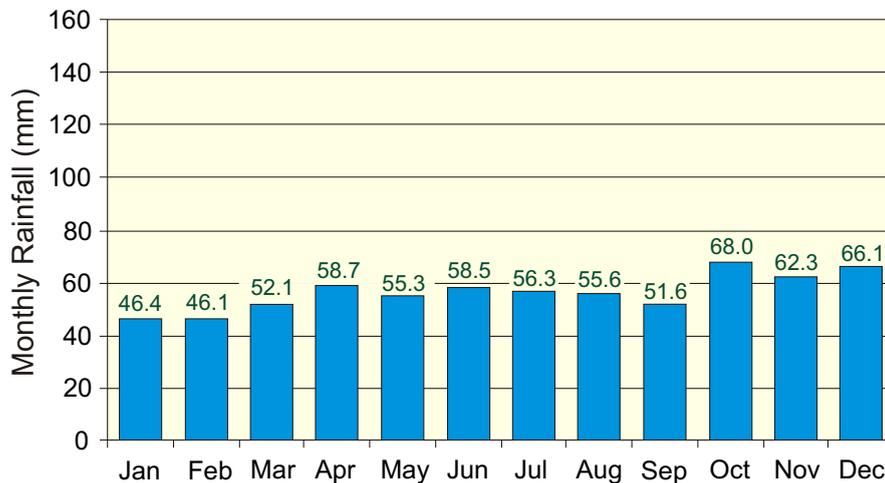


Figure 1

Average monthly rainfall for Australian Bureau of Meteorology rainfall station 094036

## Investigation methods

### Test pitting

One test pit (FC 2003/1, 519 826 mE, 5 217 558 mN) was excavated in unconsolidated material west of the extraction bore. This pit intersected a combination of alluvial and colluvial deposits in the unconsolidated Quaternary (Tertiary?) overburden (Appendix 2). The test pit was logged in accordance with AS 1726-1993.

### In situ permeability testing

Because of the pump installation design and related steel cap on the collar, no hydraulic testing was undertaken on the irrigation extraction bore (Plate 1).



Plate 1

Collar of the irrigation extraction bore

## Conceptual hydrological model

The yield and drillers log for the extraction bore indicate the presence of a confined fractured aquifer in the Triassic sedimentary bedrock. Ezzy (1999) identified the controlling mechanisms on recharge and discharge occurring in fractured dolerite aquifers in southeast Tasmania. The contact between these two groundwater flow systems most likely strongly affects

any hydraulic link between the two aquifers. A third perched groundwater flow system within the Quaternary deposits (derived from the Triassic sedimentary rocks) appears to be occurring in the area of the extraction bore.

Because of the slope of the terrain in the upper western dolerite section of the catchment, the dolerite-fractured aquifer is interpreted as flowing towards and discharging into Fluertys Creek. Once Fluertys Creek crosses east of the contact, the topographical gradient decreases and surface water in Fluertys Creek appears to recharge the Quaternary unconsolidated deposits. These unconsolidated deposits are expected to be several orders of magnitude more permeable than the underlying Triassic confined aquifer. Valley walls to the south and north most likely recharge the Triassic aquifer.

## Surface and groundwater chemistry

A groundwater sample was collected from the outpour point into the storage dam on the northern wall of the valley. The bore was purged and the sample collected in accordance with AS/NZS 5667.11:1998. Table 1 shows data recorded during the groundwater sampling.

Four additional surface water sites were inspected in Fluertys Creek within the area of the geological contact between the dolerite and the sedimentary rock. Information recorded on these sites (including water sampling where flow permitted) is shown in Table 2.

Table 1

Data recorded during sampling of irrigation extraction bore outpour into northern storage dam

Easting (m):	519 790
Northing (m):	5 217 631
Flow (l/s):	0.5
pH:	6.38
Conductivity ( $\mu\text{S}/\text{cm}$ ):	468

**Table 2**

Information on four surface water sites inspected within the Fluertys Creek drainage line

Site	Easting	Northing	Surface flow	pH	Conductivity (µS/cm)	Sample name
1	519814	5217675	Moist	NA	NA	NA
2	519812	5217575	Yes	6.83	560	FC_Site2
3	519775	5217393	Yes	7.47	595	FC_Site3
4	519620	5217198	Trickle	7.23	562	NA

The MRT water laboratory report is included in Appendix 3. Figure 2 is a Piper plot of the analytical results. The surface and groundwater samples mainly have similar water chemistry. The groundwater contains less magnesium, plus bicarbonate and slightly more sulphate when compared to the two surface water samples.

**Principal conclusions**

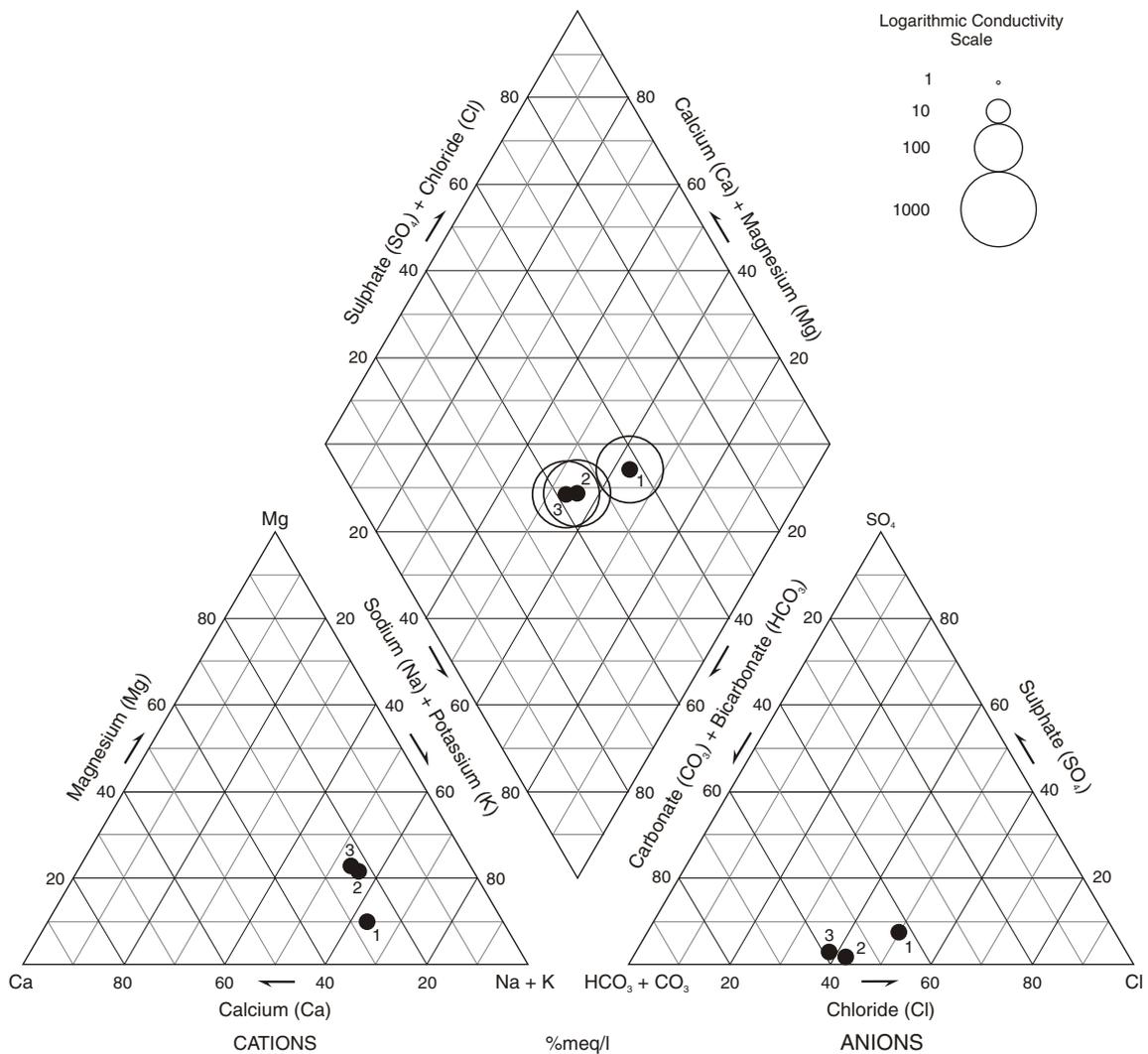
Initial hydrogeology investigations indicate that the irrigation bore is extracting water from a Triassic

confined aquifer and is not affecting the surface water base flow of Fluertys Creek. Recent low rainfall (October–December 2002) and natural evaporation and transpiration losses may be factors in the discontinued surface flow of water in the central area of the catchment. Clogging of the drainage line by grass roots in the upper western section of the catchment may also be a major contributing factor to decreased flows of surface water in lower sections of the drainage line.

**References**

EZZY, A. R. 1999. *Groundwater resources within Tasmanian Jurassic dolerite*. B.Sc. (Hons) thesis, University of Tasmania.  
 FARMER, N. 1981. *Geological Atlas 1:50 000 Series. Sheet 88 (8311N). Kingborough*. Department of Mines Tasmania.

[19 March 2003]



**Figure 2**

Piper plot for one groundwater and two surface water samples. 1 – MRT bore site ID 17251 (Wisby bore); 2 – FC\_Site\_2; 3 – FC\_Site\_3.

## Appendix 1

### General information on irrigation extraction bore

Owner:	Mr Wisby
Location:	Birchs Bay
Easting (m):	519 832
Northing (m):	5 217 558
Positional accuracy (m):	10
Date drilled:	13 January 1999
Drilling company:	Gerald Spaulding Drilling
Total depth (m):	30.5
Depth water struck (m):	25
Standing water level (m):	7.6
Casing diameter (mm):	127
Bore diameter (mm):	190
Yield (l/s)	3.16

#### *Drillers log*

<i>From (m)</i>	<i>To (m)</i>	<i>Rock type</i>
0	4.6	Clay
4.6	4.9	Shingle
4.9	11.6	Mudstone
11.6	22.3	Mudstone
22.3	22.6	Fractured mudstone
22.6	30.5	Hard mudstone

**Appendix 2**  
**Engineering log of test pit FC 2003/1**



# ENGINEERING LOG - TEST PIT

test pit no. **FC 2003/1**  
sheet 1 of 1

project	Fluertys Creek Catchment			location	Birchs Bay		
co-ordinates	55 519 826 mE	equipment type	Shovel / crow bar	pit commenced	15 January 2003		
	5 217 558 mN	bucket size	NA	pit completed	15 January 2003		
R.L.		width	0.6 m	excavated by	James Wisby		
		length	1.2 m	logged by	Andrew Ezzy		

penetration 1 2 3	support water	notes samples, tests	metres		graphic log	classification symbol	material <small>soil type: plasticity or particle characteristics, colour, secondary and minor components.</small>	moisture condition	consistency density index	field records/comments <small>insitu testing, soil structure, soil origin, additional observations</small>
			R.L.	depth						
				0.1		OH	SILT — grey, humic. (hand penetrometer 5.5 kg/cm <sup>2</sup> )	D	St	A horizon (Holocene?)
				0.2		CL	SILTY CLAY — medium plasticity, mottled orange and grey (hand penetrometer 11 kg/cm <sup>2</sup> )	D	St	B horizon (Holocene?)
				0.3						
				0.4		CH	CLAY — high plasticity, orange, rounded dolerite cobbles up to 140 mm (hand penetrometer 11+ kg/cm <sup>2</sup> )	D	F	Quaternary alluvial deposit
				0.5						
				0.6						
				0.7		CH	CLAY — medium plasticity, light brown, sedimentary rock fragments up to 7 mm (hand penetrometer 4.0 kg/cm <sup>2</sup> )	M	F	Quaternary / Tertiary (?) colluvial deposit
				0.8						
				0.9						
							End of hole			

## Appendix 3

### Mineral Resources Tasmania – Laboratory report

Reg #	20030004	20030005	20030006
Site ID	Boris Site ID	FC Site 2	FC Site 3
Date Sampled	?-01-2003	15-01-2003	15-01-2003
Date Analysed	05-02-2003	05-02-2003	05-02-2003
pH	6.2	7.5	7.8
Conductivity ( $\mu\text{S}/\text{cm}$ )	474	559	587
Ca <sup>++</sup> (mg/L)	25	26	29
Mg <sup>++</sup> (mg/L)	5.7	15.5	17.5
Fe <sup>++(+)</sup> (mg/L)	0.2	1.3	0.7
Al <sup>+++</sup> (mg/L)	<0.2	<0.2	<0.2
Na <sup>+</sup> (mg/L)	65	71	74
K <sup>+</sup> (mg/L)	3.5	2.3	2.5
Cl <sup>-</sup> (mg/L)	77	80	80
F <sup>-</sup> (mg/L)	<0.3	<0.3	<0.3
SO <sup>4-</sup> (mg/L)	16.5	5.9	8.1
NO <sup>3-</sup> (mg/L)	<10.0	<10.0	<10.0
CO <sup>3-</sup> (mg/L)	nil	nil	nil
HCO <sup>3-</sup> (mg/L)	115	185	210
TDS (mg/L)	314	369	380
Permanent Hardness (mg/L)	nil	nil	nil
Temporary Hardness (mg/L)	86	130	145
Alkalinity (mg/L)	94	150	175

Analyses by L. Hay, Senior Chemist, Mineral Resources Tasmania