

Dairying and Clean Streams Accord Puwera Stream Catchment Study



2007 Baseline Monitoring Report

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Northland Regional Council
Private bag 9021
Whangarei 0140
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INTRODUCTION

On 6 July 2006 a 12 month base-line monitoring project commenced in the Puwera Stream catchment. The purpose of the project was to collect a comprehensive body of environmental information that would enable the benefits of implementing the Clean Streams Accord to be identified over time.

This report presents the findings for the first 12 months of data collected.

CATCHMENT DESCRIPTION

The catchment is approximately 8 kilometres south of Whangarei and covers a land area of about 9 km². The Puwera Stream is a tributary of the Otaika Stream which flows into the Whangarei Harbour.

It is a small stream, with highly variable, rainfall dependent flow. The stream channel has been heavily modified, mostly by straightening. It flows in west to east direction with numerous small unnamed tributaries flowing in from the north and south. Two of these tributaries are approximately 1km long, with the rest being less than 600 metres (Figure 1).

Descriptive information for the Puwera stream catchment is given in Table 1.

Table 1 Features of the Puwera catchment, Northland

Area	9 km ²
Number of dairy farms	6
% area in dairy	70
Number of dry stock farms	4
Farm oxidation pond discharges	3*
Other discharges (truck wash)	1
Irrigation disposal systems	3
Slope range	flat-steep
Riparian canopy	<5%
Annual mean rainfall	1440 mm

*Only discharge when conditions are not suitable for land application.

CATCHMENT LAND USE OVERVIEW

The Puwera Stream is located in a predominantly dairy farming catchment (at least 70% of the catchment land use is dairy farming). The balance is drystock farms with the recent addition of some "lifestyle" blocks.

There are six dairy farms in the catchment with a total of some 1800 milking cows. One of the six dairy farms straddles the catchment boundary, with effluent from the dairy shed discharging to another catchment.

Less than 10% of the stream has stock exclusion and with the exception of a few small areas of willows, riparian canopy is absent.

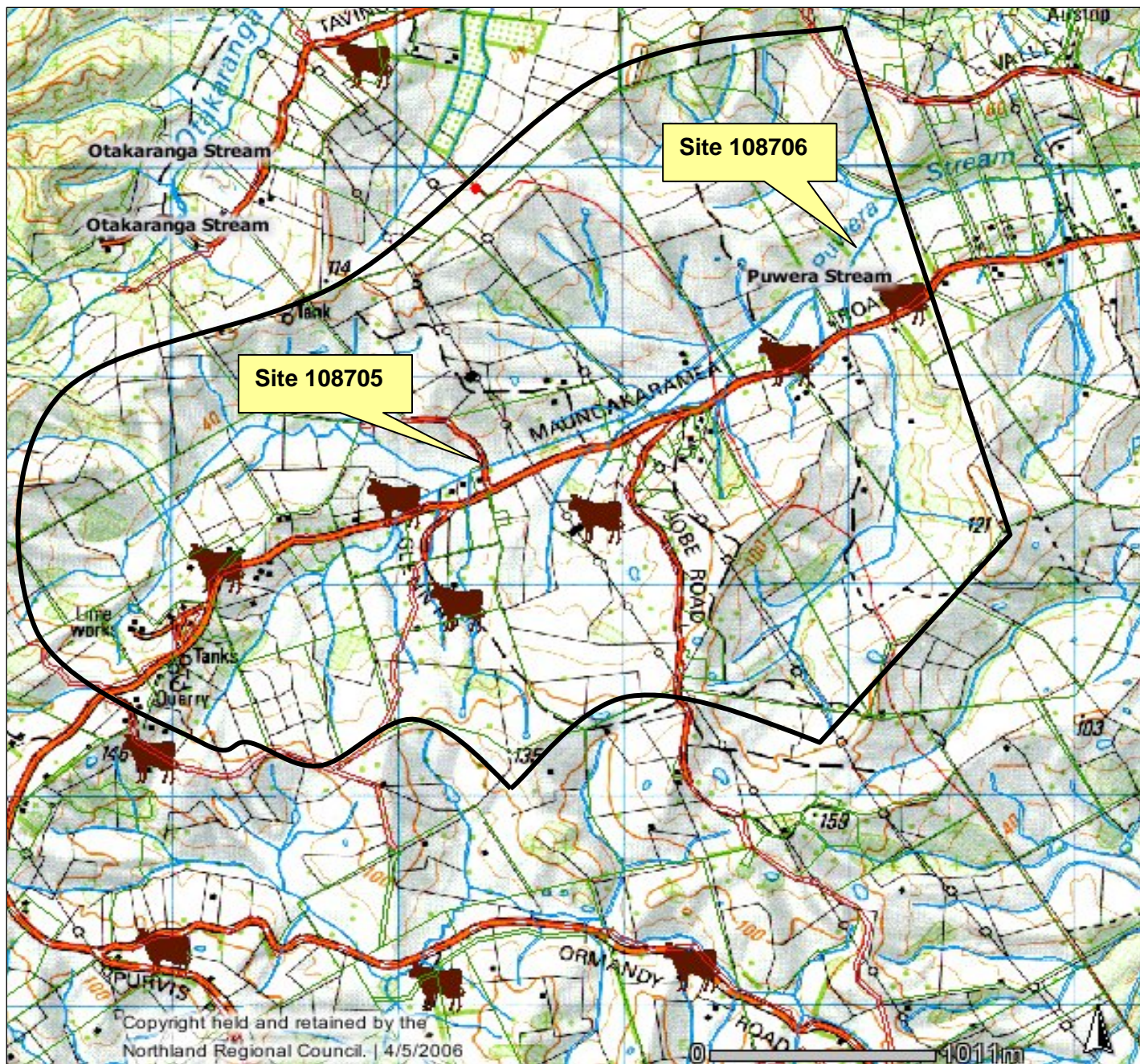


Figure 1 Location of sample sites (brown cows indicate dairy farm locations)

DAIRYING AND CLEAN STREAMS ACCORD

The Accord aims to promote sustainable dairy farming in New Zealand. It focuses on reducing the impacts of dairying on the quality of New Zealand streams, rivers, lakes, groundwater and wetlands.

The six priorities for actions and national targets outlined in the Accord are:

- Fonterra and Regional Councils to develop Regional Action Plans for the main dairying regions to implement this Accord by June 2004.
- Dairy cattle excluded from 50% of streams, rivers and lakes by 2007, 90% by 2012.
- 50% of regular crossing points to have bridges or culverts by 2007, 90% by 2012.
- 100% of farm dairy effluent discharges to comply with resource consents and Regional Plans immediately.
- 50% of regionally significant wetlands to be fenced by 2005, 90% by 2007.
- 100% of dairy farms to have in place systems to manage nutrient inputs and outputs by 2007.

The Regional Council and Fonterra co-signed the Dairying and Clean Streams Accord regional action plan for Northland in May 2004. The purpose of the regional action plan is to identify local commitments and to support the national Accord principles of developing actions that are adapted for local conditions, practical, cost effective (whilst recognising the practical and financial constraints of implementing timeframes) and that will make a real difference.

For more information on the regional action plan, check out the following link on the Regional Council website:

<http://www.nrc.govt.nz/upload/2238/Dairy%20&%20Clean%20Streams%20Accord.pdf>

FDE COMPLIANCE

No significant non-compliance with resource consent conditions or Regional Rules for Permitted Activities were identified at routine monitoring in the 2006/07 season on any of the farms.

MONITORING PROGRAMME

Water samples were collected at fortnightly intervals between 6 July 2006 and 21 June 2007 at two sites (Figure 1). Site 108705 at Keays Access Road is “downstream” of four dairy farms. Site 108706 at the Bennett’s property is “downstream” of all six dairy farms in the catchment.

Field measurements of DO and temperature were made using a portable meter (YSI model 85). Sample collection and processing for macroinvertebrate monitoring was done following the C1 & C2 protocols and P3 protocol, respectively, from Stark *et al.* 2001.

Flow measurements were taken at the time of sampling using standard hydrological flow measurement procedures. However there were periods of very low flow when flows were estimated, rather than measured.

Parameters

The parameters measured at both sites are listed in Table 2.

Table 2 Parameters measured at sites 108705 and 108706 and test methods used

Determinant – Chemical	Method of Analysis*
BOD ₅	5210B
Dissolved Oxygen	4500-O
Dissolved Reactive Phosphorous	4500-PG
NH ₄	4500-N
Nitrate + Nitrite	4500-N
pH	4500 H+
Total Kjeldahl Nitrogen	4500-N
Total Phosphorous	4500-P B & E
Total Suspended Solids	2540D
Turbidity	2130B
Determinant - Biological	
Chlorophyll a	10200H
E Coli	9223B
Faecal Coliforms	9222D
Determinant - Physical	
Conductivity	2510B
Temperature	2550

*APHA 1998 Standard methods

WATER QUALITY RESULTS (PHYSICAL & CHEMICAL)

A summary of water quality data is given in Table 3.

Table 3 Summary statistics of stream flow and water quality test parameters

Site	Flow	BOD ₅	CHLA	COND	DO	DRP	EColi	FC	NH ₄ -5	NNN	TKN	TN	TP	SS	TURB
	m ³ /s	g/m ³	g/m ³	mS/m @ 25°C	g/m ³	g/m ³ -P	MPN/ 100mL	Cfu/ 100mL	g/m ³ -N	g/m ³ -N	g/m ³ -N	g/m ³ -N	g/m ³ -P	g/m ³	NTU
108705															
Max	0.1390	21	0.163	115.4	10.1	5.12	1986	25600	22.9	1.44	34.0	34.0	10.1	105	79.0
Min	0.0000	1.0	0.003	32.7	0.1	0.025	10	10	0.01	0.039	0.40	0.493	0.076	1.0	0.7
Median	0.0078	1.5	0.006	38.5	5.8	0.102	393	305	0.05	0.383	0.75	1.18	0.220	3.0	4.5
Mean	0.0248	2.9	0.025	43.1	5.2	0.358	525	1408	1.11	0.393	2.17	2.54	0.706	8.5	9.1
SD	0.0346	5.2	0.056	16.0	3.1	0.988	508	4951	4.46	0.329	6.51	6.46	1.945	20.7	15.3
108706															
Max	0.2820	3.0	0.056	50.0	10.7	0.149	2098	2300	0.380	0.651	1.30	1.65	0.251	71.0	16.1
Min	0.0000	1.0	0.003	11.1	3.1	0.007	54	60	0.010	0.008	0.400	0.411	0.038	1.0	1.5
Median	0.0298	1.0	0.004	28.4	7.8	0.048	422	310	0.040	0.236	0.650	0.853	0.108	4.0	6.9
Mean	0.0532	1.4	0.015	29.6	7.3	0.049	630	543	0.075	0.237	0.727	0.955	0.115	8.7	7.1
SD	0.0712	0.6	0.018	7.89	2.0	0.032	563	516	0.087	0.219	0.257	0.371	0.057	16.1	4.0

WATER QUALITY RESULTS (BIOLOGICAL)

A summary of the invertebrate monitoring results is given in Table 4.

Table 4 Invertebrate monitoring results

	Species Richness	Abundance	MCI	QMCI	%EPT
108705					
Jul-06	23	624	84.3	3.63	13.0
Oct-06	18	1251	88.9	2.76	22.2
Jan-07	25	1769	83.2	3.44	8.0
Apr-07	13	118	73.8	3.47	0.0
108706					
Jul-06	19	583	84.2	3.76	21.1
Oct-06	16	831	77.5	3.56	12.5
Jan-07	19	1339	84.2	3.93	10.5
Apr-07	16	1015	77.5	4.05	6.3

The MCI values for both sites on all sampling occasions range from 73.8 to 88.9. The MCI values in July 2006, January 2007 and April 2007 were similar at the two sites with results for July and January suggesting probable moderate organic pollution and probable severe pollution for the April results. In October the MCI value for the upstream site was greater than the downstream site with the results indicating probable severe pollution for the downstream site (Figure 2).

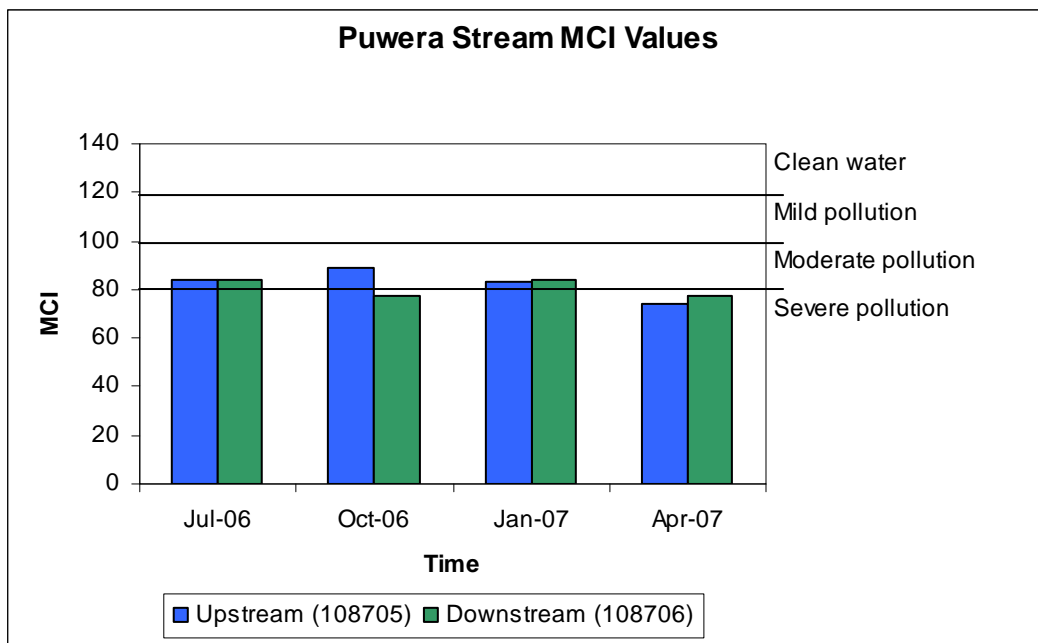


Figure 2 MCI results

The QMCI scores ranged between 2.76 and 4.05 indicating probable severe organic pollution with the exception of downstream site on one occasion just falling into the moderate pollution category (Figure 3).

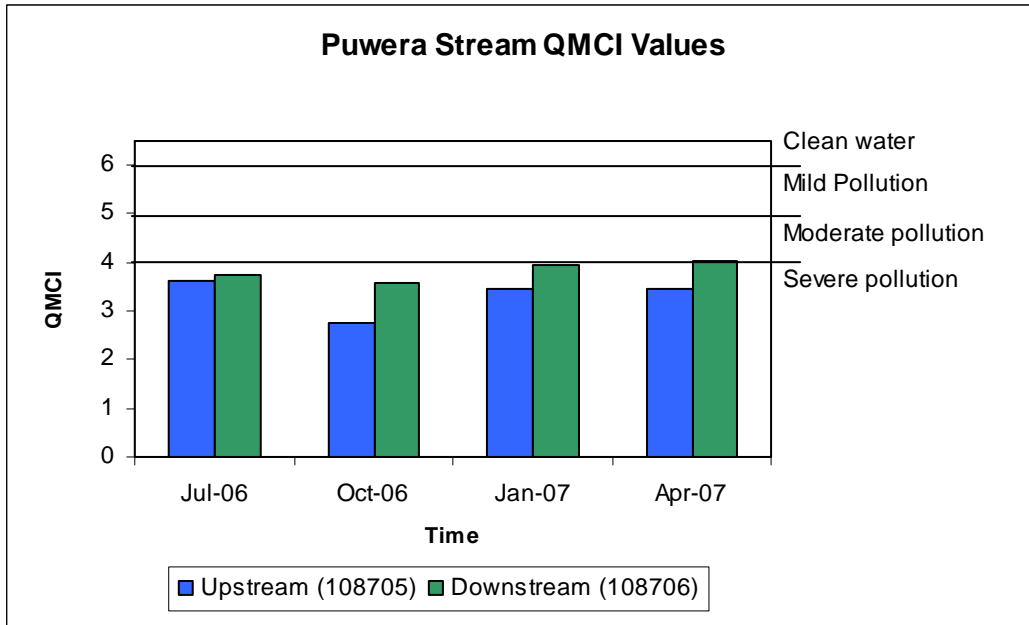
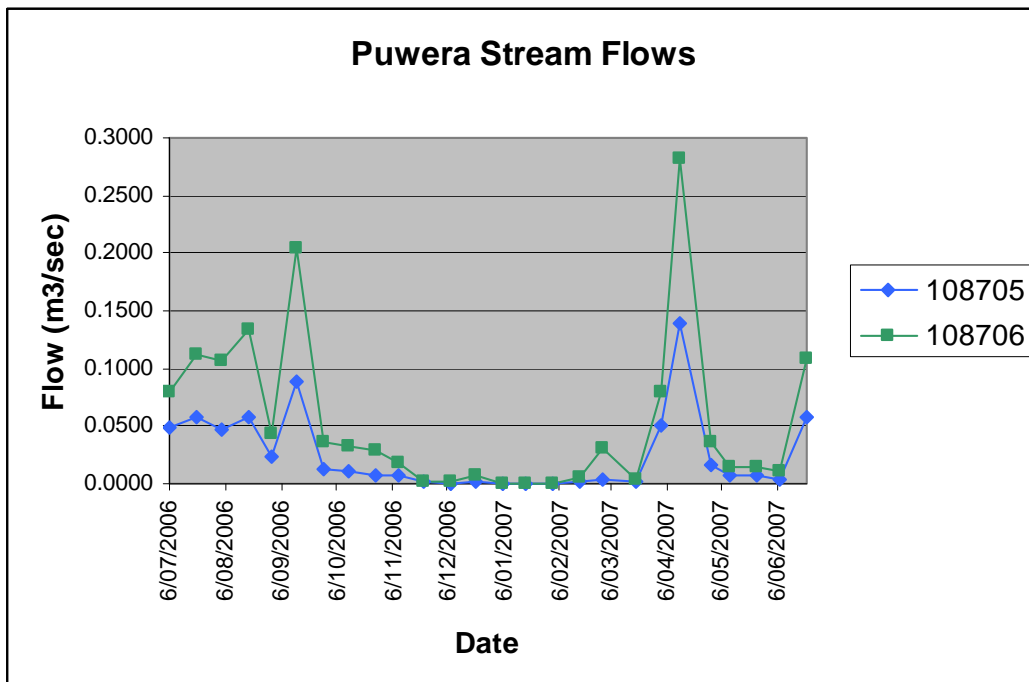


Figure 3 QMCI results

FLOW DATA

A summary of stream flow data is given in Table 3. Stream flows for the two sites are shown in Figure 2. Stream flows at Site 108705 varied from 0 m³/sec in January to a peak flow of 0.1390 m³/sec in April 2007. At Site 108706 flows varied from 0 m³/sec in January to 0.2820 m³/sec in April 2007. There is a strong correlation between the flow at the two sites ($R^2=0.9751$), with the flows at 108706 being approximately double the flow at 108705.

The annual rainfall for the duration of the sampling period (July 2006 to June 2007) was 1276 mm compared with the annual mean of 1440 mm.



DISCUSSION

It is too early to draw any conclusions with regard to water quality and implementation of the Clean Streams Accord. The fact that many of the small tributaries of the Puwera Stream do not meet the Accord definition (“deeper than a “Red Band” (ankle depth), wider than a stride and permanently flowing”) may impact on the amount of improvement that can be expected in the Puwera.

The huge variation in flows is typical of many Northland catchments. Similarly, there are extremely large fluctuations in the water quality test results. For example, the ammoniacal-nitrogen concentration at site 108705 varied from 0.01 g/m³ up to 22.9 g/m³ and the suspended solids varied from 1.0 g/m³ up to 105.0 g/m³ at the same site. Generally, there was less variation in the water quality test results at site 108706 (Bennett’s property) where the flow was greater.

REFERENCES

APHA (1998). *Standard methods for the Examination of Water and Wastewater*, 20th edition. American Public Health Association: 1015 15th Street NW, Washington, DC 20005-2605.

NRC. (2004). *Dairying and Clean Streams Accord Regional Action Plan for Northland*. Available on the Regional Council website at the following link:

<http://www.nrc.govt.nz/upload/2238/Dairy%20&%20Clean%20Streams%20Accord.pdf>

Stark, J.D.; Boothroyd, I.K.G.; Harding, J.S.; Maxted, J.R. and Scarsbrook, M.R. (2001) *Protocols for sampling macroinvertebrates in wadeable streams*. Prepared for the Ministry for the Environment