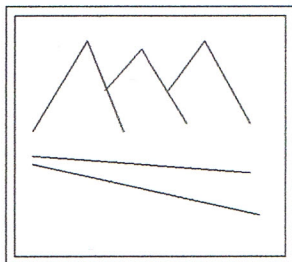


PROFESSIONAL GROUND WATER AND ENVIRONMENTAL SERVICES



- . RESOURCE CONSENTS
- . ASSESSMENT OF EFFECTS
- . WATER RESOURCE EVALUATIONS
- . HYDROGEOLOGIC STUDIES

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Hydrological Assessment of Donalds Creek, Featherston

Report prepared for:
South Wairarapa District Council
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1. Introduction

Professional Ground Water and Environmental Services (PGWS) were requested by South Wairarapa District Council (SWDC) to undertake an assessment of the hydrology of Donalds Creek in the vicinity of the Featherston wastewater treatment plant (WWTP). The principal reason for completing this assessment was to provide some initial hydrological information that could be incorporated into Council's Water Permit application for the WWTP and to assist in an assessment of options to upgrade the existing treatment plant and discharge system.

2. Setting

Donalds Creek originates in the foothills of the Tararua Ranges to the north of Featherston township (Figure 1). A major tributary (Boar Creek) is located in this upper catchment, which has a total area of approximately 10.5 km². Upon leaving the foothills, the creek travels for approximately 6km before combining with Abbots Creek and thence discharging to the northern end of Lake Wairarapa. The WWTP is located approximately 1.5km upstream of the confluence of Donalds and Abbots Creeks.

3. Hydrology

3.1 Background

There are no continuous flow monitoring sites located in the Donalds Creek catchment. PGWS installed a temporary flow monitoring site adjacent to and just upstream of the WWTP in February 2016. Some preliminary data from this site is presented in Section 3.4.

Upon leaving the foothills Donalds Creek loses water to ground water. In the vicinity of SH 2 the creek is often dry during the summer months. The downstream section of Donalds Creek gains water from ground water inflow, one major spring fed tributary (Torohanga Stream) and minor discharge from the Longwood water race. The section of Donalds Creek immediately adjacent to the WWTP ponds appears to be relatively neutral i.e. neither gains nor loses water.

The only flow data that exists for the lowland section of Donalds Creek are spot flow gaugings. The existing Water Permit for the WWTP requires the flow in Donalds Creek be measured quarterly at sites immediately upstream of and 100 metres downstream of the wastewater discharge to the creek, with the gaugings coinciding with quarterly water quality sampling. These flow gaugings have been undertaken since February 2010 and provide the bulk of the available flow data for Donalds Creek.

All available flow gauging data for Donalds Creek has been compiled in Appendix 1. Gauging site locations are shown in Figure 2. Mean gauged flow for the monitoring site situated immediately upstream of the wastewater discharge is 229 l/s, ranging from 15 to 665 l/s. During low flow conditions the majority, or all, of the flow at this site is from the Torohanga Stream tributary. A current Water Permit allows pumping of up to 16 l/s from the Torohanga Stream for irrigation purposes on the neighbouring dairy farm. Some of the historical low flow gauging results for Donalds Creek at downstream sites will be influenced by this water take i.e. natural flows may be approximately 16 l/s higher than recorded. The irrigation take has

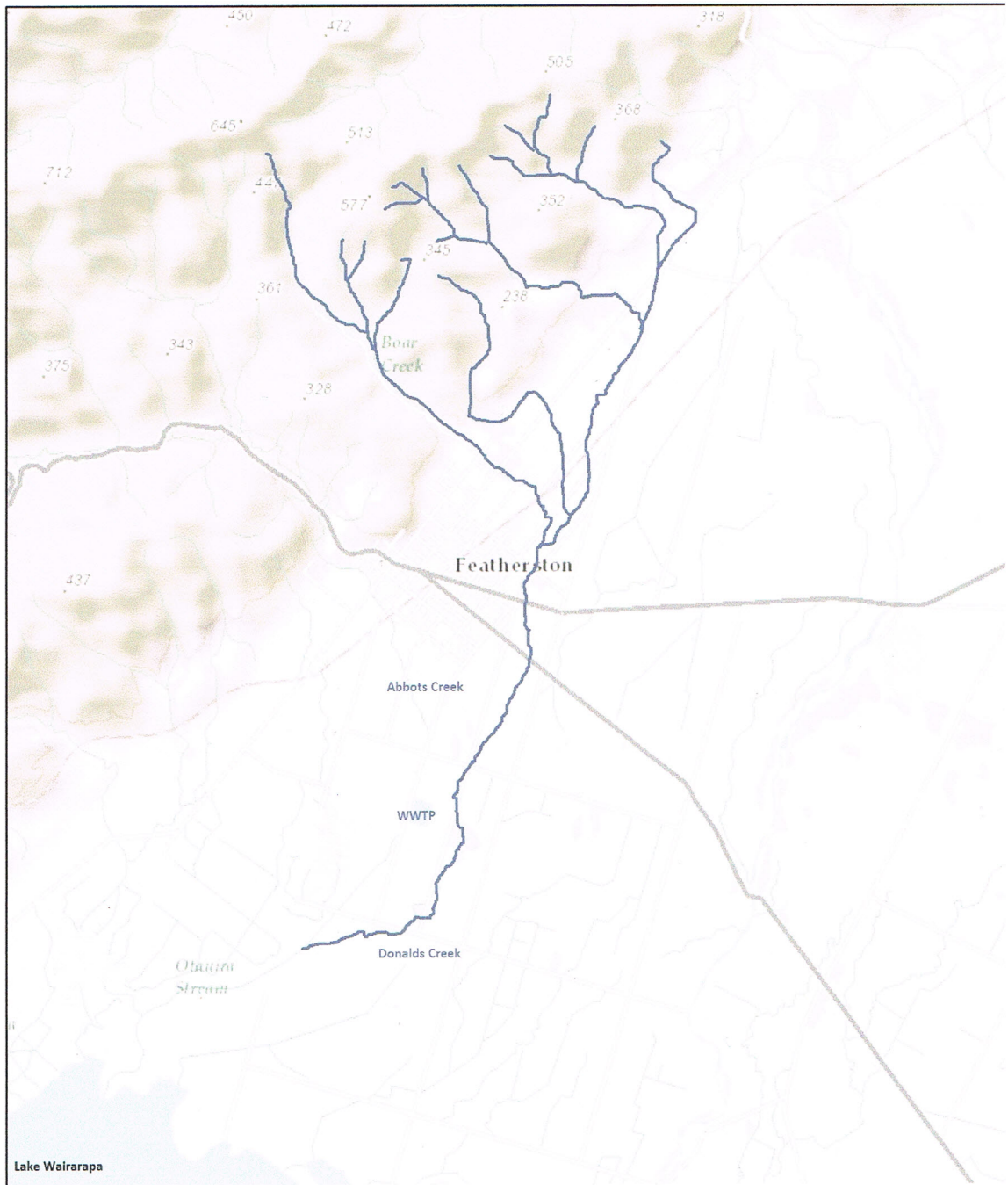


Figure 1 Location

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Figure 2 Location of flow gauging sites

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occurred since the early 1980's. This water take did not occur during the 2015/16 irrigation season as the irrigation water was sourced from a new deep bore.

As the spot gaugings were done at different times depending on site, comparisons between the sites should not be made. For example, the sites upstream and downstream of the wastewater discharge include winter time gaugings, whereas the remaining sites are almost entirely low flow gaugings. A concurrent gauging run was completed in April 2016 to highlight the downstream variation in flows. These results are presented in Section 3.3.

In an attempt to obtain a more robust flow record, flow gauging data for the upstream site adjacent to the WWTP was correlated with several other Greater Wellington river or ground water level sites with longer term continuous record. These sites were the Tauherenikau River at Gorge, the Otukura Stream at weir and an adjacent ground water level site (bore S27/0009). The best correlation was achieved with the Otukura Stream site (Figure 3). The correlation coefficient was 0.91. Flow data is available for the Otukura Stream site from 17/12/1997 to 7/10/2015. As some of the early flow record for this site had a number of 'gaps' or missing data the correlation was carried out for data from 14/1/2000 onwards. The Otukura Stream flow is influenced by upstream water takes during the irrigation season, which was allowed for in the assessment. As the correlation was for low to medium flows only the higher flow synthetic data should be used with caution.

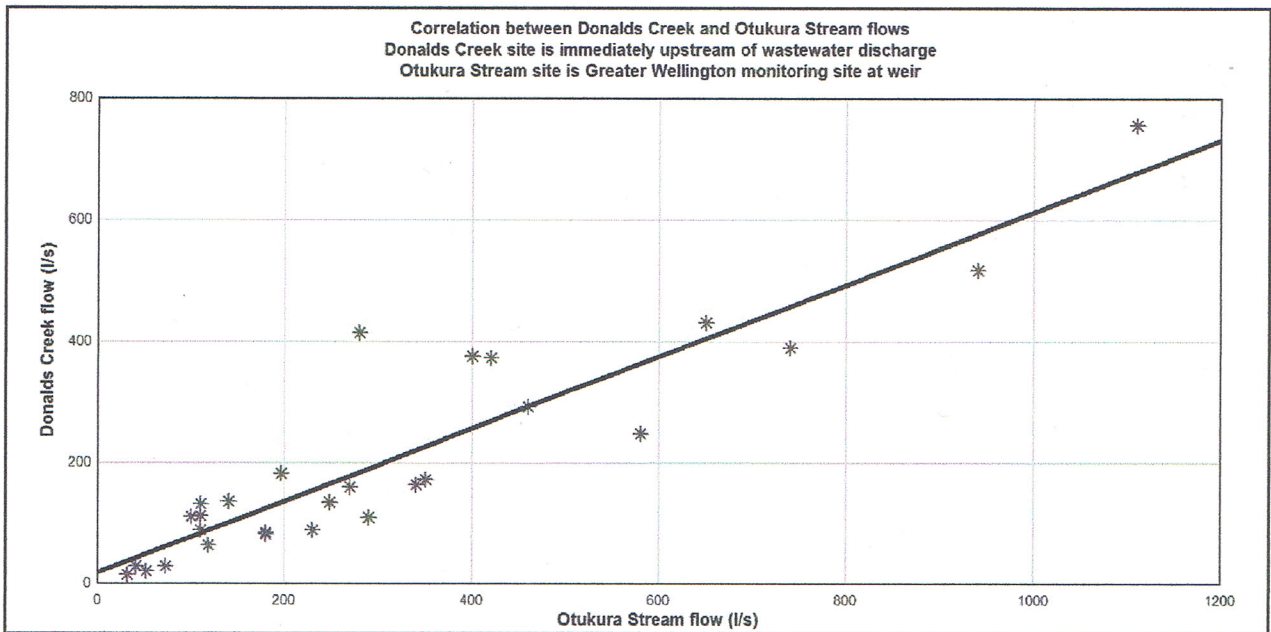


Figure 3 Donalds Creek - Otukura Stream correlation

Hydrographs for 2013 and 2014, derived from the synthetic flow data, are presented in Figures 4 and 5 respectively.

3.2 Flow statistics

The flow statistics presented below were derived from 15 years of synthetic flow data obtained from the correlation between Donalds Creek flow gauging data and Greater Wellington Otukura Stream flow data.

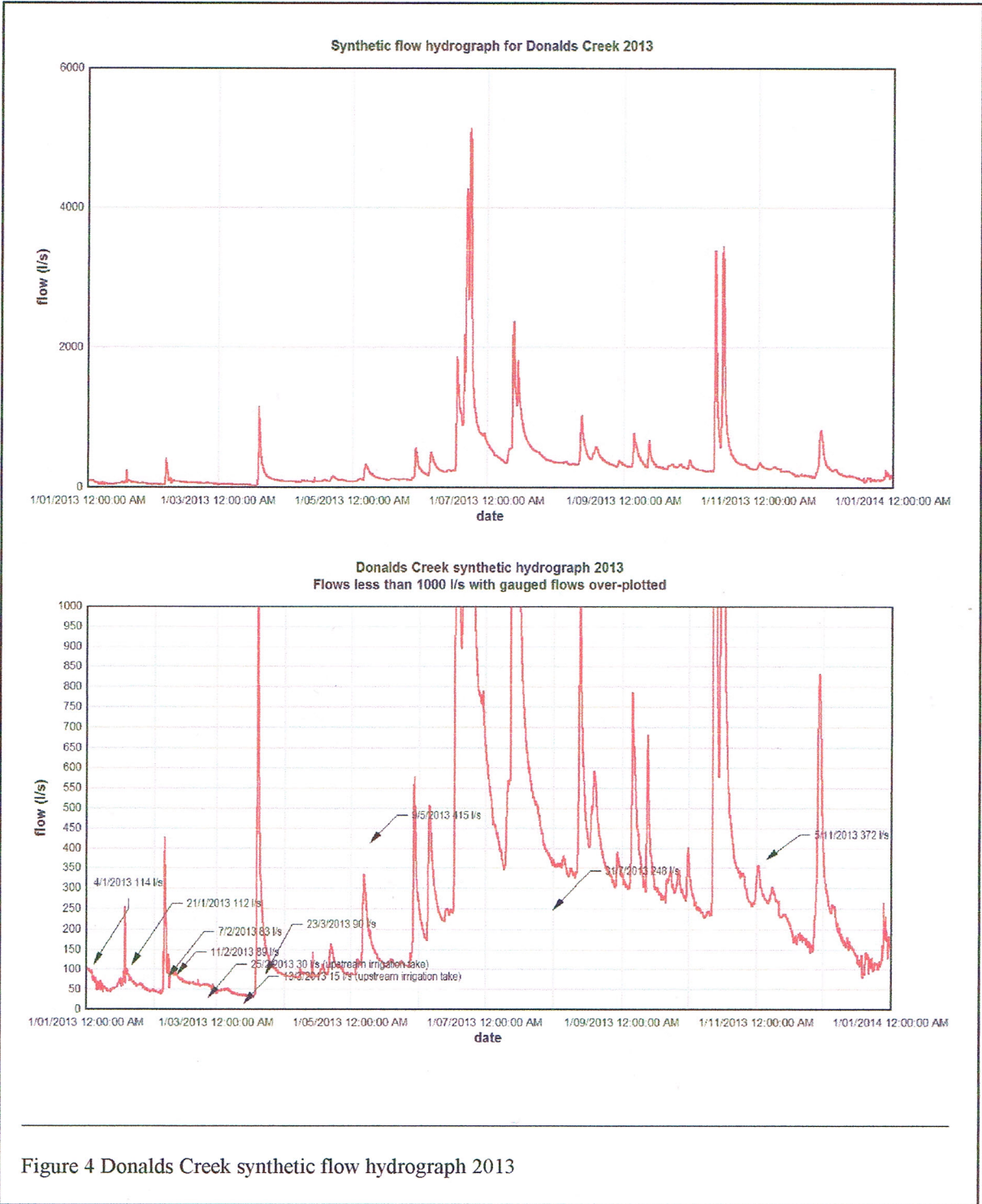
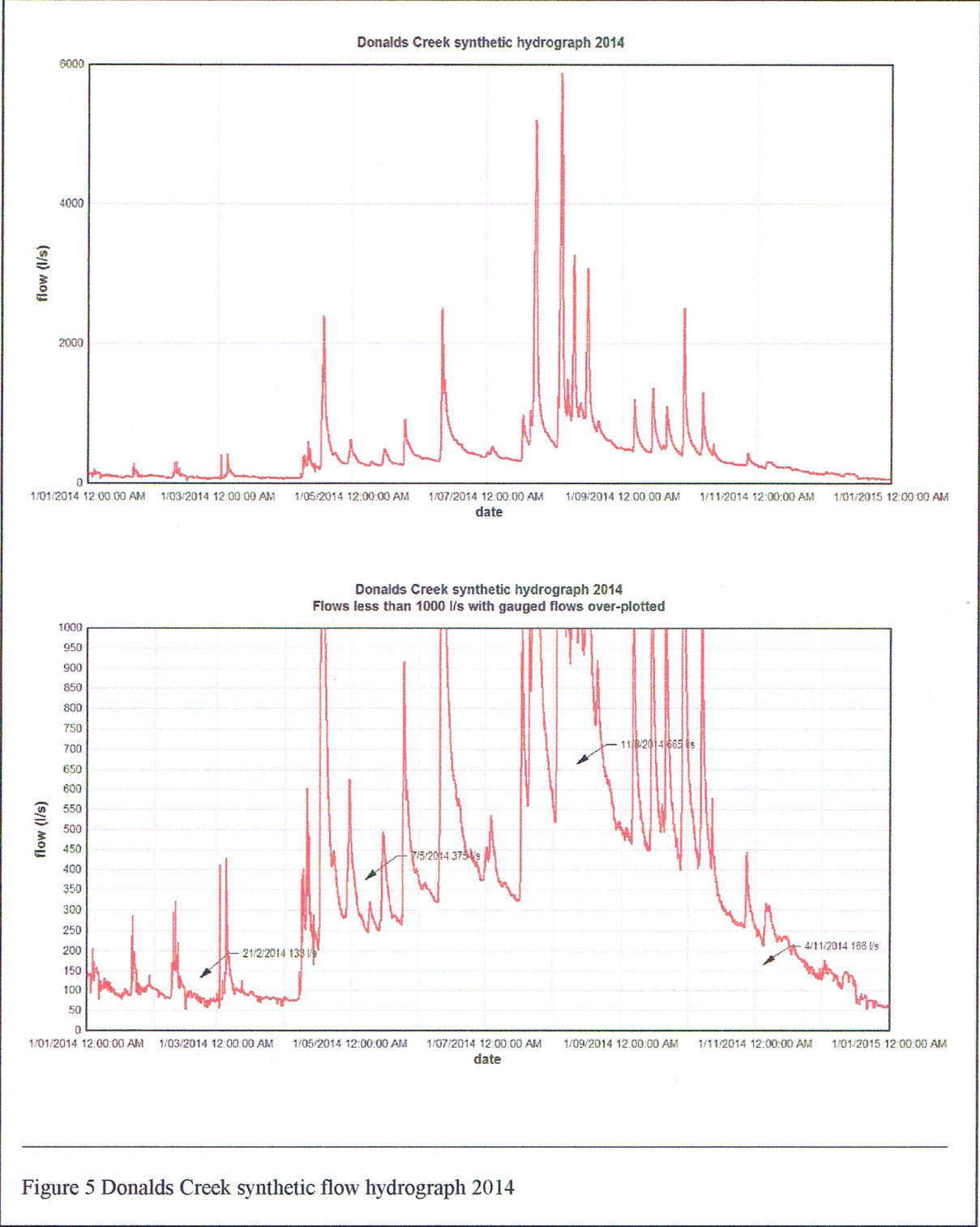


Figure 4 Donalds Creek synthetic flow hydrograph 2013



Mean monthly flows are presented in Table 1. Mean monthly flow varies between 137 l/s in February to 715 l/s in August. Mean annual flow is 354 l/s.

	Jan	Feb	March	April	May	June	July	August	Sept	Oct	Nov	Dec	Mean
Minimum	47	45	43	52	86	84	171	207	154	215	122	83	229
Mean	142	137	143	171	261	478	633	715	478	471	241	203	354
Maximum	303	882	474	538	580	978	1045	1511	961	1020	398	535	444

Monthly mean flows 14/1/2000 to 7/10/2015

Table 1 Mean monthly flows

Mean annual daily low flows are listed in Table 2.

Year	Minimum daily flow (l/s)
2001	24
2002	57
2003	31
2004	96
2005	59
2006	23
2007	33
2008	26
2009	36
2010	67
2011	30
2012	64
2013	29
2014	57
Mean annual daily low flow	45

Table 2 Annual minimum daily flows

Mean annual daily low flow is assessed at 45 l/s.

A flow distribution is provided in Table 3, which is shown as a flow distribution curve in Figure 6.

	0	1	2	3	4	5	6	7	8	9
0	10209	2478	1572	1246	1086	983	906	841	788	746
10	707	673	643	617	594	573	551	528	510	493
20	478	464	448	436	424	411	399	388	378	370
30	361	352	344	336	328	320	312	305	299	294
40	290	286	281	277	272	267	263	258	253	247
50	241	235	229	221	213	206	200	194	187	180
60	174	169	163	158	153	148	144	139	135	131
70	127	123	119	115	112	109	106	103	100	97
80	94	91	89	86	84	81	79	76	73	70
90	66	63	60	57	53	50	48	45	41	37
100	19									

Table 3 Flow distribution - percentage of time flow exceeded

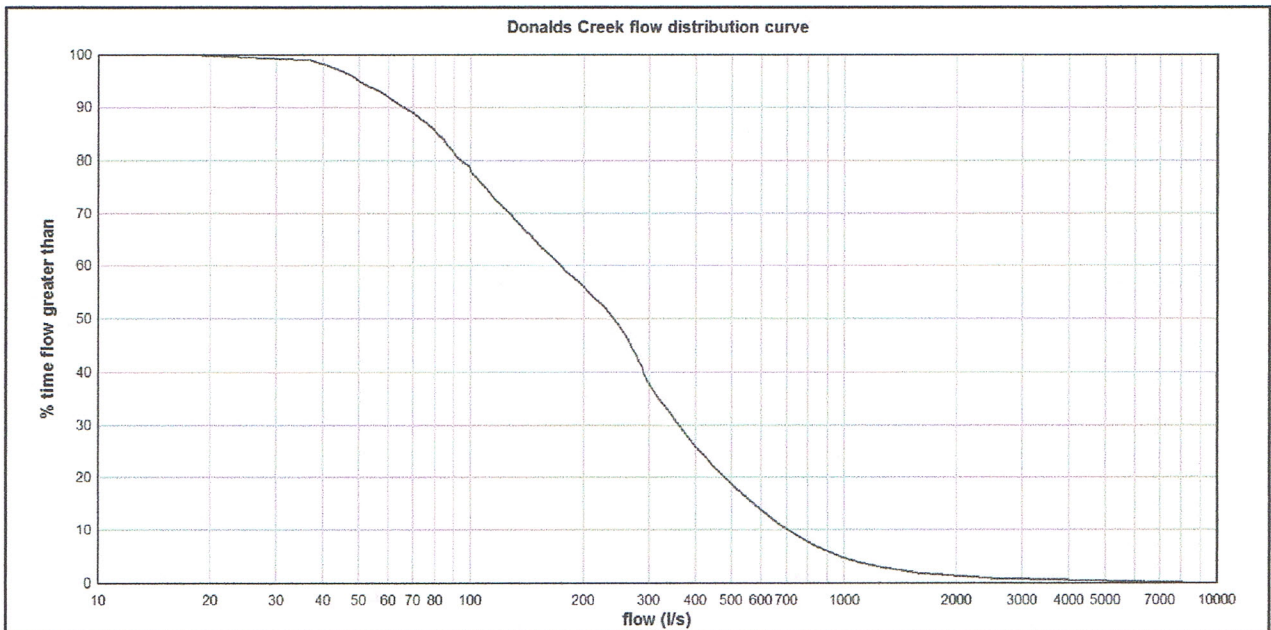


Figure 6 Donalds Creek Flow distribution curve

Median stream flow is assessed at 241 l/s

Estimated return period low flows are presented in Table 4

Return period	1 day	7 day	14 day	28 day
MALF	45	50	56	66
2.33	26	33	39	48
5	13	19	24	30
10	8	13	17	22
20	5	11	14	18
50	2	8	11	15
100	0	7	9	13

Table 4 Low flow return periods

3.3 Downstream Flow Variation

Donalds Creek in the vicinity of the WWTP appears to be fairly neutral i.e. neither gains flow from ground water seepage nor losses water to ground water. From a point approximately 1km downstream from the WWTP, where the stream changes direction to a more westerly course, the stream gains water from ground water inflow. Results of a concurrent flow gauging survey completed on 6/4/2016 are listed in Table 5. Gauge site locations are shown in Figure 7.

Site	Description	Flow (l/s)
1	upstream of Torohanga Tributary	0
2	downstream of Torohanga, upstream of WWTP	42.7
3	wastewater discharge	10.8
4	downstream of WWTP	53.5
5	midway between WWTP and Hodders Road	53.5
6	end of Hodders Road	53.8
7	midway HoddersRoad and Abbots Creek	89.7

Table 5 Concurrent flow gaugings 6/4/2016



Figure 7 Location of concurrent flow gauging sites

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The results listed in Table 5 are consistent with results of an earlier survey completed for Greater Wellington in February 2016.

3.4 Preliminary results from temporary flow recorder

A stage hydrograph for the temporary flow recorder established on Donalds Creek, at the site just upstream of the WWTP, is presented in Figure 8.

Flows have been very stable over the period of record, precluding the rating of the site at this stage. The two flow gaugings that have been completed are plotted on the hydrograph. Throughout the period of record Donalds Creek has been dry upstream of the Torohanga Stream tributary, apart from the 17/3/2016 and 3/4/2016 when some inflow occurred from the upper catchment due to rainfall events.

A photographic record (19/4/2016) of Donalds Creek just upstream of the Torohanga Stream confluence and just downstream of the flow recorder, and of Torohanga Stream at Longwood West Road, is presented in Figures 9-11.

Acknowledgment

Some stream flow data used in compiling this report was supplied by Greater Wellington Regional Council

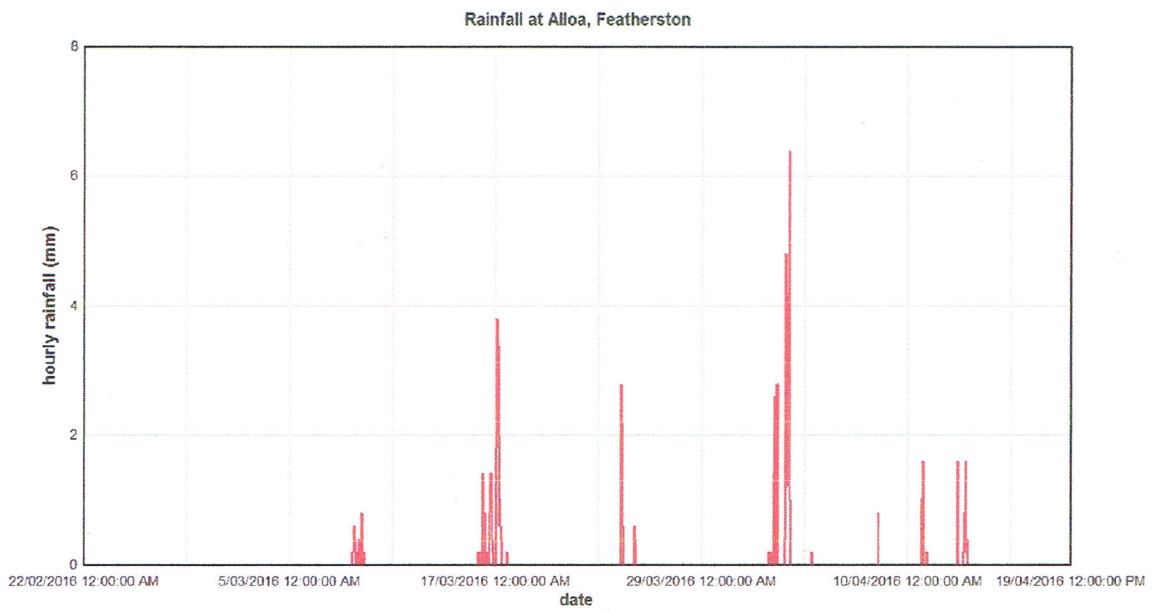
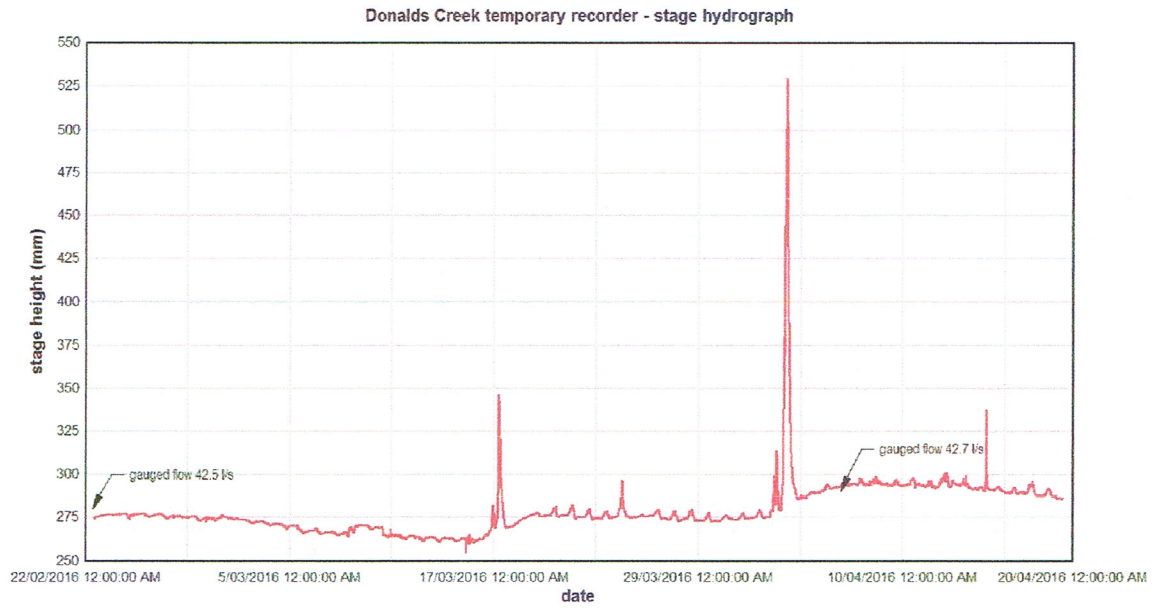


Figure 8: Stage hydrograph for temporary recorder on Donalds Creek and Alloa rainfall



Figure 9 Dry streambed of Donalds Creek upstream of Torohanga Stream confluence 19/4/2016



Figure 10 Donalds Creek downstream of temporary flow recorder 19/4/2016



Figure 11 Torohanga Stream at Longwood West Road 19/4/2016

Appendix 1

Compilation of Donald Creek flow gauging data

	Donalds Creek at Longwood West Road	Donalds Creek upstream of Featherston wastewater discharge	Donalds Creek downstream of Featherston wastewater discharge	Inferred wastewater discharge	Torohanga tributary stream	Donalds Creek at Hodders Road	Donalds Creek at Windy Farm	Donalds Creek at Scotts
11/04/1978#							106	
25/02/1981#							178	
15/10/1982#					83			
22/10/1982#	46					300		
28/10/1982#	62				87	379		
8/11/1982#	26				70	237		
15/11/1982#	15				72	268		
25/11/1982#					64	226		
17/12/1982#	187				100	412		
10/1/1983#					169	272		
26/1/1983#	11				61	197		
10/02/1983#	7				43	182		
16/3/1983#	182				15	182		
23/01/1995							200	
12/03/1998							136	
1/12/1998		227						
30/08/2000					78			
22/01/2001					20			
16/01/2004							204	
21/01/2005							339	313
1/02/2005							223	215
3/03/2005							111	110
21/03/2005								225
19/04/2005								457
20/01/2010							553	526
18/02/2010		184	192	8				
9/03/2010							186	185
20/05/2010		85	93	8				
14/07/2010		390	399	9				
23/08/2010		518	528	10				
24/11/2010		110	125	15				

