BAY OF PLENTY REGIONAL COUNCIL
TOI MOANA

Consent Holder Annual Report on Okere Gates (Consent 65979) and Ohau Weir (Consent 65980) - 1 June 2016

Bay of Plenty Regional Council
Operations Publication 2016/02
June 2016

5 Quay Street
P O Box 364
Whakatāne
NEW ZEALAND

ISSN: 1176-5550 (Print)
ISSN: 1179-9587 (Online)

Consent Holder Annual Report on Okere Gates (Consent 65979) and Ohau Weir (Consent 65980) – 1 June 2016

Operations Publication 2016/02
ISSN: 1176-5550 (Print)
ISSN: 1179-9587 (Online)

June 2016

Bay of Plenty Regional Council
5 Quay Street
PO Box 364
Whakatāne 3158
NEW ZEALAND

Prepared by: Graeme O'Rourke
Principal Engineering Officer/Surveyor

Cover photo: Ohau Weir – 10 June 2016

Document control

Document information

Document name:	Consent Holder Annual Report on Okere Gates (Consent 65979) and Ohau Weir (Consent 65980) – 1 June 2016
Contact person:	Graeme O'Rourke
Status:	Final

Document review

Review timeframe:	Not applicable
Reviewers:	

Document history

Author	Description of change	Date	Version

Distribution control

Person	Role	Date of issue	Version
Mark Townsend	Engineering Manager	31 August 2016	

Authorised by: ..... Date: 5/9/16.

Reviewed by: ..... Date: 5/9/16.

Acknowledgements

Bay of Plenty Regional Council's (BOPRC's) Survey and Environmental Data Services (EDS) teams are acknowledged for their contributions.

Their work in groundwater monitoring, asset capture, cross section surveys, velocity monitoring and software support has contributed to the findings of this report.

The Consent Holder (Integrated Catchments Group) also acknowledges the Regional Council's Regulatory Arm to ensure both consents are managed in accordance with all 76 consent conditions.

Figure 1 *Okawa Bay Lake Level Recorder – Regional Council staff inspecting staff gauge on monthly lake level run.*

Executive summary

This report covers the 12 months of lake operations from 1 April 2015 to 31 March 2016 (referred to as 'this term' or 'this period') and will discuss:

- Actual distribution of lake levels compared to the target distributions.
- Actual flow rates compared to minimum flow rates.
- Operational difficulties.
- Stakeholder consultation.
- Complaints and investigations.
- Conclusions.

Resource Consents 65979 and 65980 approve the continued placement, operation and maintenance of the Okere Gates and the Ōhau Channel Weir structures that are located at the outlets of Lake Rotoiti and Rotorua respectively.

It has been a challenging 12 month period to manage lake levels within the various consented ranges. However, the consent considers the effects of extreme environmental conditions (both wet and dry) and has established guidelines in place to best manage lake levels accordingly.

For this term, lake levels and flow rates were well below normal rates following long periods of low rainfall and low inflows and compromised 'targeted' time in the various lake level ranges

The 'main operating range' from Reduced Level (RL) 279.10 m to 279.20 m was maintained for only 194 days or 53.0% of the term (70-85% allocated). This compares to the previous low rainfall term from 1 April 2013 to 31 March 2014 with 174 days recorded or 47.7%.

In the 'secondary range' from RL 279.05 m to 279.25 m, 282 days were recorded or 77.0% of the 12 month term (332 days allocated or 91%) again indicating below average rainfall for the 12 months.

For this reporting period, there were 362 rafting days (98.9% of term). This compares with 357 days or 97.8% in 2014 and 293 days or 80.3% in 2013.

The annual drawdown of Lake Rotoiti lasted 39 days beginning on 8 June 2015 and ending 16 July 2015. In 2014, the drawdown duration was 65 days.

There were only two occasions this term when lake levels exceeded RL 279.20 m following short rain events on the 21 September 2015 (RL 279.24m) and 2 February 2016 (RL 279.203m). This compares to lake level peaks in previous years of RL 279.224 m in 2014, RL 279.259 m in 2013, RL 279.381 m in 2012 and RL 279.367 m in 2011. Lake levels did not exceed the consented maximum of RL 279.40 m but fell below the consented minimum of RL 279.00 m for 20 days during the annual drawdown of Lake Rotoiti as a result of no rainfall.

Okere Gates outflows were greater than Ōhau Channel inflows for nearly 100% of the time except for a few hours each time on 21 May, 17 September, 29 October 2015, 1 January and 26 February 2016 as the Okere Gates were closed down to match inflows and manage low lake levels. There were no other potential reflux issues as greater outflows than inflows were maintained through the Okere Gates. Reflux occurs when outflows through the Okere Gates are less than the inflows causing Lake Rotorua water to then enter the main body of Lake Rotoiti.

The Ōhau Channel stoplogs were last installed on 22 October 2015 in response to declining levels in Lake Rotorua. Although outside this reporting period, the stoplogs were then removed on 24 June 2016 to alleviate rising lake levels.

Several complaints were received this term from a resident following low lake levels and these were addressed quickly or referred to the Regional Council's Regulatory Arm for action. General concerns regarding low lake levels were also addressed quickly with no further issue.

Communication was maintained across the various interest groups with ongoing communication with Iwi, Kaituna River Rafting, Rotorua Tourism, Fish and Game New Zealand and various lakeside residents over this period. Media were also kept informed at various times when needed.

Draft Cultural Management Plans (CMP's) have been received from the two kaitiaki groups, Ohau ki Rotoiti Kaitiaki Group and Okere ki Kaituna Kaitiaki Group, and are currently before the Consent Holder for review.

Cross sections of the Ōhau Channel were completed during the 'annual drawdown' period in July 2015 and indicated general stability in bed levels. Velocity monitoring at the same time was also completed and again with previous year's results continues to indicate negligible change or increase in velocities during the drawdown phase. This consent requirement will continue until reviewed.

Rotoiti beaches and lake level staff gauges continue to be monitored and photographed monthly to provide a robust and visual record of the lake environment for assessment and future consideration.

There were no significant operational difficulties to report apart from minor technical issues with remote communications. These were addressed quickly and did not compromise consent conditions.

At this stage, there are no recommendations to review any consent conditions until finalised Cultural Management Plans (CMP's) have been received from the two kaitiaki groups (Ohau ki Rotoiti Kaitiaki Group and Okere ki Kaituna Kaitiaki Group) and considered by the Consent Holder.

Contents

Tables and figures

Part 1: Introduction

1.1 Background

As Consent Holder, Bay of Plenty Regional Council's Integrated Catchments Group is required to submit an annual report by 31 August each year on the operation and performance of the Okere Gates and Ōhau Channel Weir in accordance with Resource Consent (RC 65979) Condition 15 and (RC 65980) Condition 12. However, the report is generally completed by 1 June each year to allow for distribution and review before annual meetings with the liaison and Kaitiaki groups in September/October each year.

Lakes Rotoiti and Rotorua levels are controlled by the operation of the Okere Radial Gates and the Ohau Channel Weir respectively. The gates also regulate the rate of discharge from Lake Rotoiti to the Kaituna River.

The Ohau Weir and Okere Radial Gates are Bay of Plenty Regional Council assets and are part of the Kaituna Catchment Control Scheme. They are operated by the Integrated Catchments Group in accordance with their existing resource consents.

The Ohau Channel Weir was constructed in 1989 as a simple weir structure (double broad crested weir) with stoplogs. The purpose of the Ohau Weir is to control the level of Lake Rotorua but predominantly to prevent undesirable low levels.

The purpose of the Okere Gates is to increase the outflows from Lake Rotoiti to permit floodwater to be discharged when required, and to reduce outflows to prevent undesirable low lake levels. The impacts of the Okere Gates operation on Lake Rotorua levels are generally minor but significant to ensure all Lake Rotorua water passes through the gates to prevent reflux or mixing with Lake Rotoiti water.

The Okere Gates structure was constructed in 1982 and is a substantial radial triple gate structure.

Prior to the construction of the Okere Gates in 1982, there was a natural rock ledge (at approximately RL 278.5 m) about 35 m downstream of the existing gates, which naturally controlled Lake Rotoiti levels.

Both control structures were put in place as part of the Kaituna Catchment Control Scheme. Pre-scheme, there was no lake level control on either Lake Rotorua or Lake Rotoiti (apart from the natural rock ledge), with the result that lake levels fluctuated naturally with climatic conditions. The structures were designed so that the lake level ranges could be managed within the range set by the former National Water and Soil Conservation Authority (NWSCA), in 1975. These levels were included in BOPRC's Transitional Regional Plan, and are referred to in the existing consents granted for damming the outlets of both lakes.

The Ohau Weir and Okere Gates are operated and maintained as part of the Rivers and Drainage Asset Management Plan (AMP). The AMP outlines the requirements to inspect and maintain the structures over their expected life cycle.

The 35-year resource consents for Ohau Weir and Okere Gates were renewed and approved on 21 March 2012.

Figure 2 Locality map.

1.2 Reporting

It is a requirement of Bay of Plenty Regional Council Resource Consents 65979 and 65980 to report annually as follows.

Resource consent condition/s state:

(i) *RC 65979 – Condition 15 (Okere Gates – Lake Rotoiti)*

ANNUAL REPORTING

By 31 August each year for the term of this consent, the consent holder shall provide a report to the Chief Executive of the Bay of Plenty Regional Council or delegate, the Rotorua Te Arawa Operational Liaison Group (RTALOLG) and the Ohau ki Rotoiti Kaitiaki Group setting out:

(a) *the actual distribution of lake levels compared to the target distribution;*

(b) *the actual flow rates of the Okere Gates compared to the minimum flow rates;*

(c) *any difficulties experienced by the consent holder in achieving the target lake level ranges and minimum Okere Gate flow rates;*

(d) *a summary of any consultation undertaken with stakeholders in accordance with Conditions 9, 10, 11 and 14 of this consent;*

(e) *a summary of any investigations undertaken as a result of complaints about the adverse effects of the lakes;*

(f) *methods for how any difficulties in achieving target level ranges and Okere Gate minimum flows have and will be resolved and how any complaints about the adverse effects of lake levels have been responded to; and*

(g) *methods proposed to resolve any issues that may have risen including operational difficulties, water quality, and extreme weather events, and any changes required to the Operational Management Plan.*

(ii) *RC 65980 – Condition 12 (Ōhau Channel Weir – Lake Rotorua)*

ANNUAL REPORTING

By 31 August each year for the term of this consent, the consent holder shall provide a report to the Chief Executive of the Bay of Plenty Regional Council or delegate, the Rotorua Te Arawa Operational Liaison Group (RTALOLG), the Ohau ki Rotoiti Kaitiaki Group and the Okere ki Kaituna Kaitiaki Group setting out:

(a) *the actual distribution of lake levels compared to the target distribution;*

(b) *any difficulties experienced by the consent holder in achieving the target lake level ranges and minimum Okere Gate flow rates;*

(c) *a summary of any consultation undertaken with stakeholders in accordance with Conditions 10 and 11 of this consent;*

(d) *a summary of any investigations undertaken as a result of complaints about the adverse effects of the lakes;*

(e) *methods for how any difficulties in achieving target level ranges and Okere Gate minimum flows have and will be resolved and how many complaints about the adverse effects of lake levels have been responded to; and*

(f) *methods proposed to resolve any issues that may have risen including operational difficulties, water quality, and extreme weather events, and any changes required to the Operational Management Plan.*

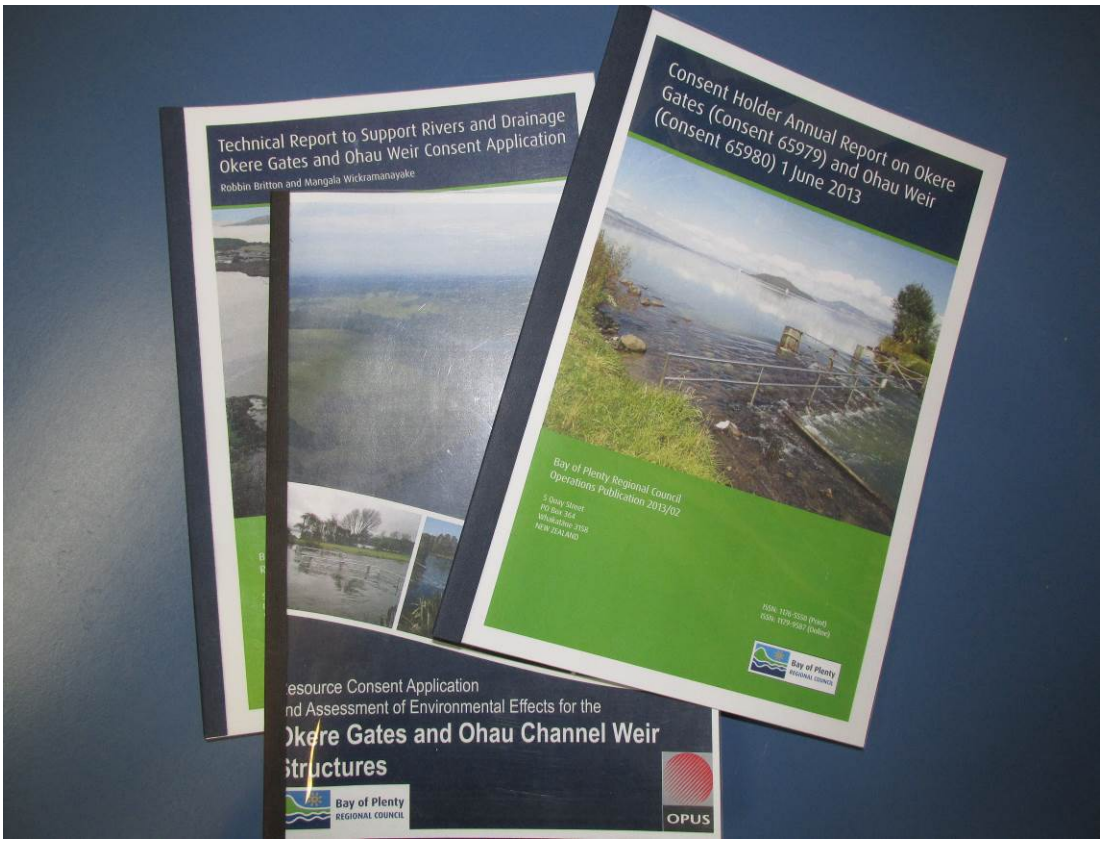

Figure 3 Various Okere Gates and Ohau Weir reports.

Part 2: Actual distribution of lake levels against target distribution

2.1 Lake Rotoiti lake level distributions

Lake level distributions are determined by Consent Number 65979 Condition 7.4(a)-(c) (Operational Limits) and are best expressed in the graphical envelope shown in Figure 4 below.

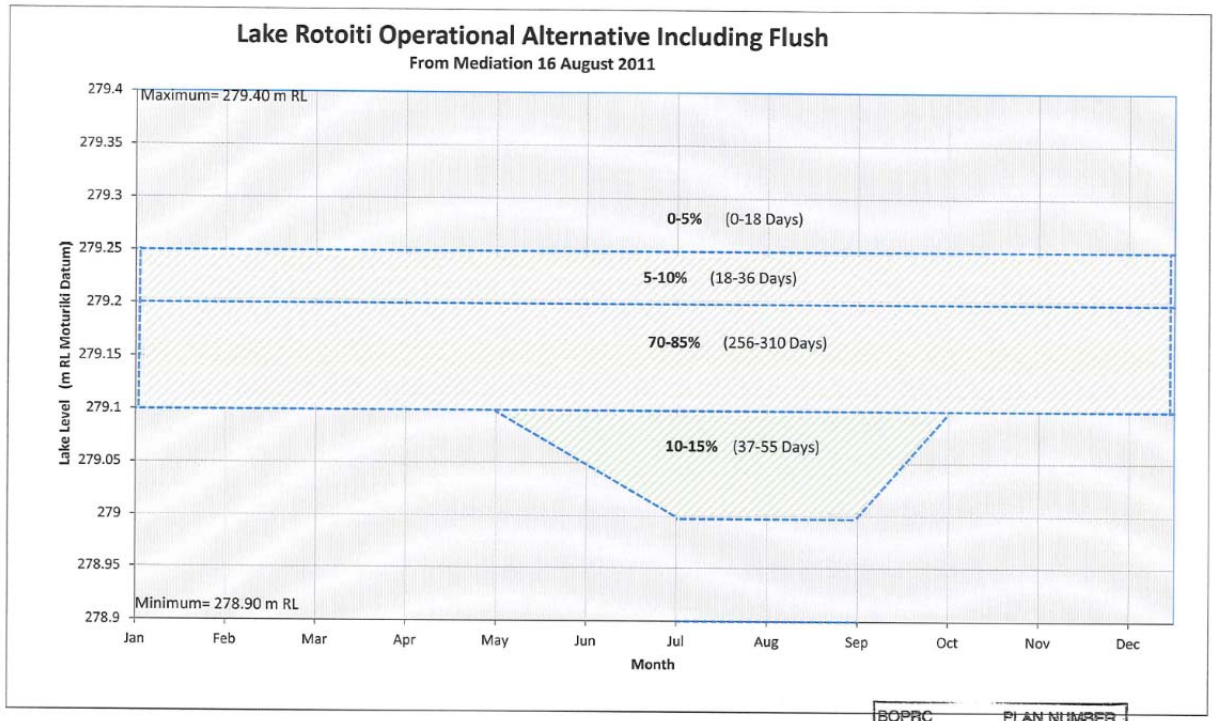

Figure: Schematic of Lake Rotoiti possible alternative operating envelopes

Figure 4 Lake Rotoiti operational envelope – target distributions.

2.2 Data collection and management

Lake levels and flow rates are assessed each morning from HydroTel (BOPRC telemetry and environmental data management software).

HydroTel data is generally recorded at 15 minute intervals and from this the 0700 hours dataset is extracted as a spot reading and recorded in an 'operational spreadsheet' along with rainfall volumes, weather conditions and general commentary. A more comprehensive dataset can be extracted from the HydroTel archive for further analysis if required.

2.3 Lake Rotoiti

Figure 5 below shows the 12 month trace of levels for Lake Rotoiti from 1 April 2015 to 31 March 2016.

Figure 5 Lake Rotoiti levels measured at Okawa Bay Marina from 1 April 2015 to 31 March 2016.

Key observations:

- The annual drawdown of Lake Rotoiti programmed between 1 May and 30 September commenced on 8 June 2015 and concluded 16 July 2015 totalling 39 days or 10.7% of year. This compares to 65 days or 17.8% of the previous year.

  Consented time for 'drawdown allowance' is 36 to 55 days per year or 10-15% per annum.

  Note: The 'annual drawdown' occurs during the winter months to improve confidence of a lake refill following lowering of the lake.

- The ‘target’ lake level minimum of RL 279.00 m (and below) was maintained for approximately 20 days from 14 June 2015 to 3 July 2015 allowing communities three weeks opportunity to observe the effects of the lower lake level for assessment and future comment.

  Lake levels continued to decline after the 14 June as greater outflows were maintained to preserve the water quality of Lake Rotoiti.

- A rain event on the 16 July 2015 restored lake levels to back inside the main operating range of RL 279.10 m to 279.20 m.

- A subsequent and unconsented drawdown condition occurred in March 2016 when lake levels dropped below the consented minimum following a very dry summer. The Okere Gates were closed to minimum settings to reduce outflows as much as possible while ensuring these flows were greater than Ōhau Channel flows but overtime saw a recession in Lake Rotoiti levels.

- Lake levels fell below the ‘main operating range’ of RL 279.10 m for 170 days for the 12 month term. This includes the 39 days permitted under the annual drawdown.

Table 1 below summarises ‘lake level’ distributions against ‘consent target distributions’ from 1 April 2014 to 31 March 2015.

Table 1 Lake level target distributions verses actual distributions.

Consent number 65979 Okere Gates				**Actual results**		
Condition	**Range (RL m)**	**Target distribution (per calendar year)**		**Consent evaluation period 1 April 2014 to 31 March 2015**		**Variation %**
		days	**%**	**days**	**%**	
7.4(a)	279.00-279.40	365	100	346	94.8 x	-5.2
7.4(b)(i)	279.05-279.25	332	91	282	77.0 x	-14.0
7.4(b)(i)(a) Drawdown zone from 1 May to 1 October 2012	279.00-279.10	36-55	10-15	39	10.7 ✓	0
7.4(b)(i)(b)	279.10-279.20	256-310	70-85	194	53.0 x	-17.0
7.4(b)(i)(c)	279.20-279.25	18-36	5-10	2	0.5 x	-4.5
7.4(c)	>279.25	18	5	0	0.0 x	-5.0

Figure 6 below summarizes mean lake levels on Lake Rotorua and Lake Rotoiti from 1 January 1997 to 31 December 2015. It can be shown that Lake Rotoiti levels are on average lower under the new consent (red Line) than under the old consent (green dash line) while Lake Rotorua levels are marginally higher (yellow line).

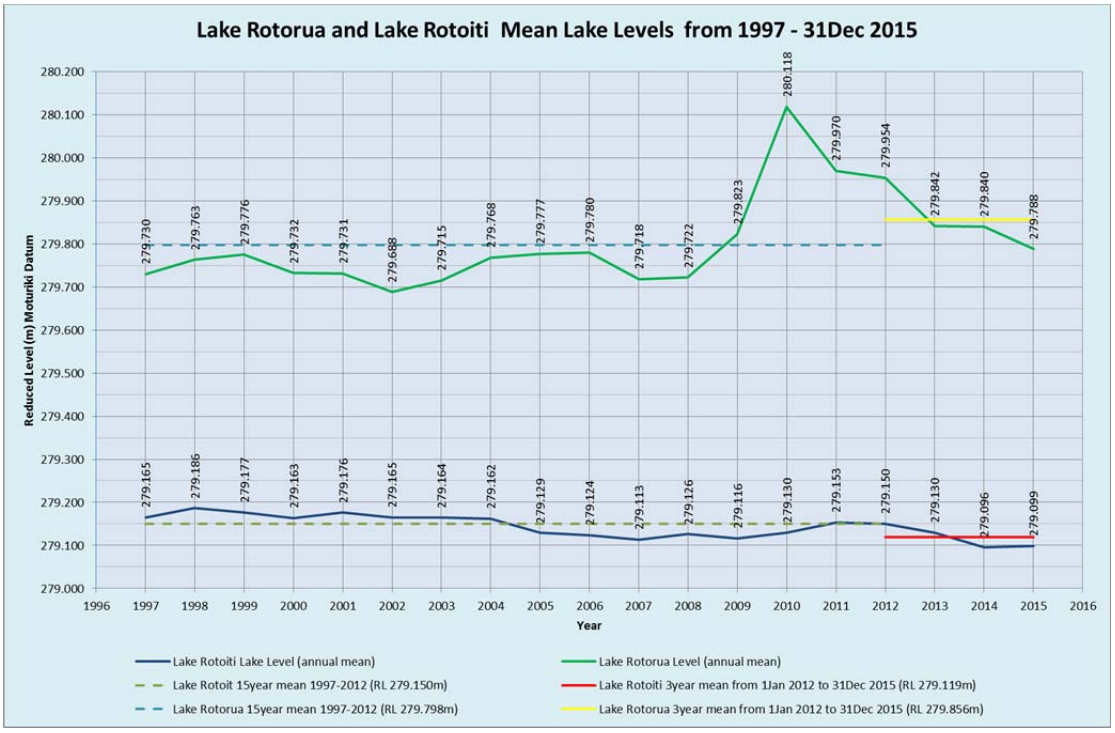

Figure 6 *Graphical summary of Lake Rotorua and Lake Rotoiti mean lake levels from 1997 to 31 December 2015.*

Figures 7 and 8 below show beach profiles at Te Rauto Bay and Hinehopu during the winter drawdown phase in June 2015.

Figure 7 *Te Rauto Bay during annual drawdown – Lake level RL 279.002 m on 15 June 2015.*

Figure 8 Hinehopu during annual drawdown – Lake level RL 279.002 m on 15 June 2015.

2.4 Lake Rotorua

Figure 9 below shows the 12 month lake level trace for Lake Rotorua from 1 April 2015 to 31 March 2016.

Notable observations are:

- The Ohau Weir stoplogs were removed on 20 August 2015 to manage rising lake levels and installed 22 October 2015 to reduce outflows and manage falling lake levels.
- For the 12 month period, lake levels remained well within the consented maximum of RL 280.076 m and consented minimum of RL 279.466 m.
- The lowest level recorded this term was RL 279.650 m on the 2 January 2016 or 0.184 m above the consented minimum of RL 279.466 m. Similarly, the lowest recorded lake level the previous term (2014-15) was RL 279.633 m.

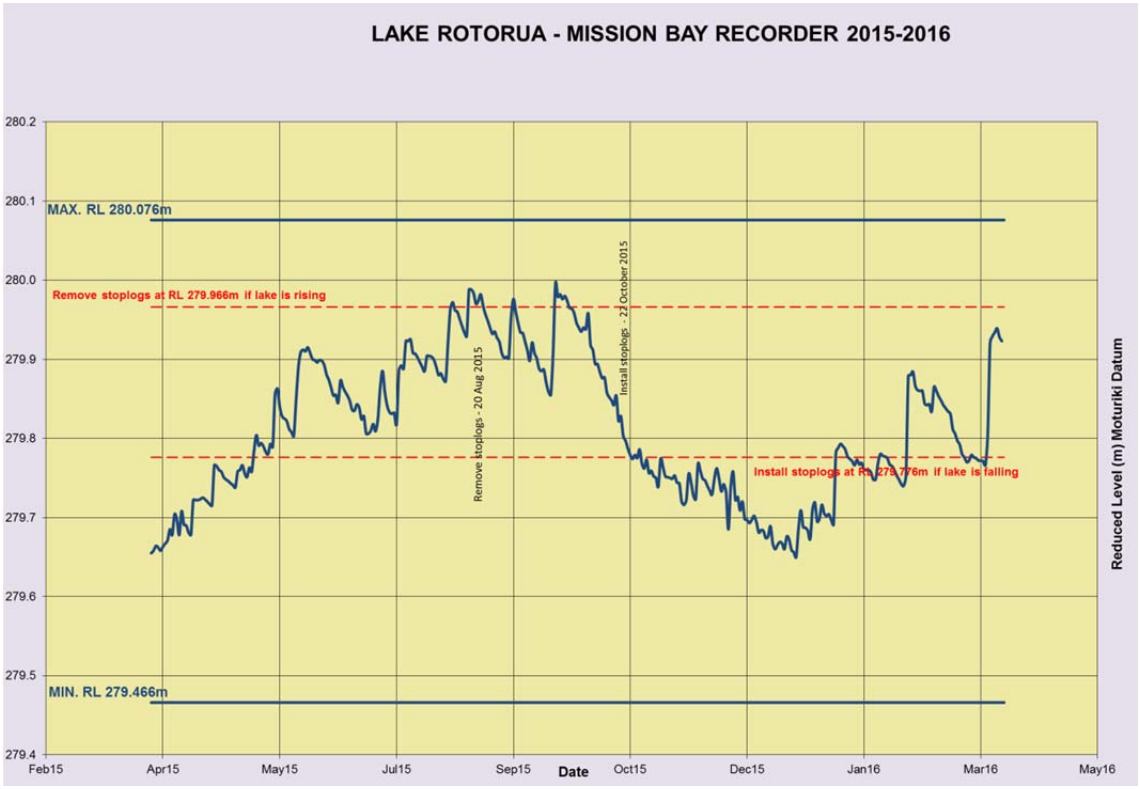

Figure 9 *Lake Rotorua levels measured at Mission Bay Recorder from 1 April 2015 to 31 March 2016.*

2.4.1 Discussion

For the 12 month period, Lake Rotorua levels remained below the maximum level of RL 280.076 m for 100% of the time or 365 days.

A photographic record along with staff gauge readings at the State Highway 33 Bridge at Mourea is maintained to record the relationship between Lake Rotorua, Ōhau Channel and Lake Rotoiti water levels levels. This will help provide better understanding of lake level effects on Ōhau Channel levels and flows, particularly during times of flooding or high lake levels.

It is noted that the Ōhau Channel Weir provides minimal flood relief once maximum lake levels occur as the weir becomes drowned. The stoplogs perform best during low lake levels to decrease outflows and maintain lake levels.

Figure 10 Removing Ōhau Weir stoplogs - 29 October 2010.

Figure 11 Ohau Channel stoplogs stored on site following refurbishment.

Part 3: Actual flow rates versus minimum flow rates

3.1 Consent number 65979 flow rate conditions

Operational limits 7.4(f) to (l) relate to flows through the Okere Gates and are specified in Consent Conditions 65979. In summary these conditions require that except under extreme droughts or an emergency:

- A minimum river flow (7.9 cumecs) with a seven day minimum of 9.84 cumecs.
- Greater outflows (Okere Gates) than inflows (Ōhau Channel) assisting to preserve water quality of Lake Rotoiti.
- Okere Gates ramping rates - closing (-5 cumecs/hour) or opening (+10 cumecs/hour) in consideration of river bank stability downstream when flows fluctuate.
- Recreational river flows for rafting and kayaking to be provided wherever possible within the other limits of the consent.

Comments on performance follow in paragraph 3.3.1 discussion notes.

3.2 Monitoring

Flow rates on the Ōhau Channel and Okere Gates are monitored by telemetry using NIWA's lake level recorder at Mission Bay on Lake Rotorua and the Taaheke River Gauge Station on the Kaituna River, located approximately 3 km downstream of the Okere Gates. Flow values are accurate to +/-8% of any given reading but for the purposes of management, the given reading at any time is recorded as the measured flow.

A consent priority is maintaining greater outflow (Okere Gates) than inflow (Ōhau Channel) to prevent reflux around the downstream end of the Ohau Diversion Wall. This measure assists in maintaining the water quality of Lake Rotoiti.

3.3 Results

Instantaneous flow rates for the Ōhau Channel (inflows in blue) and Kaituna River @ Taaheke (outflows in red) as recorded at 0700 hrs each morning are shown in Figure 12 below.

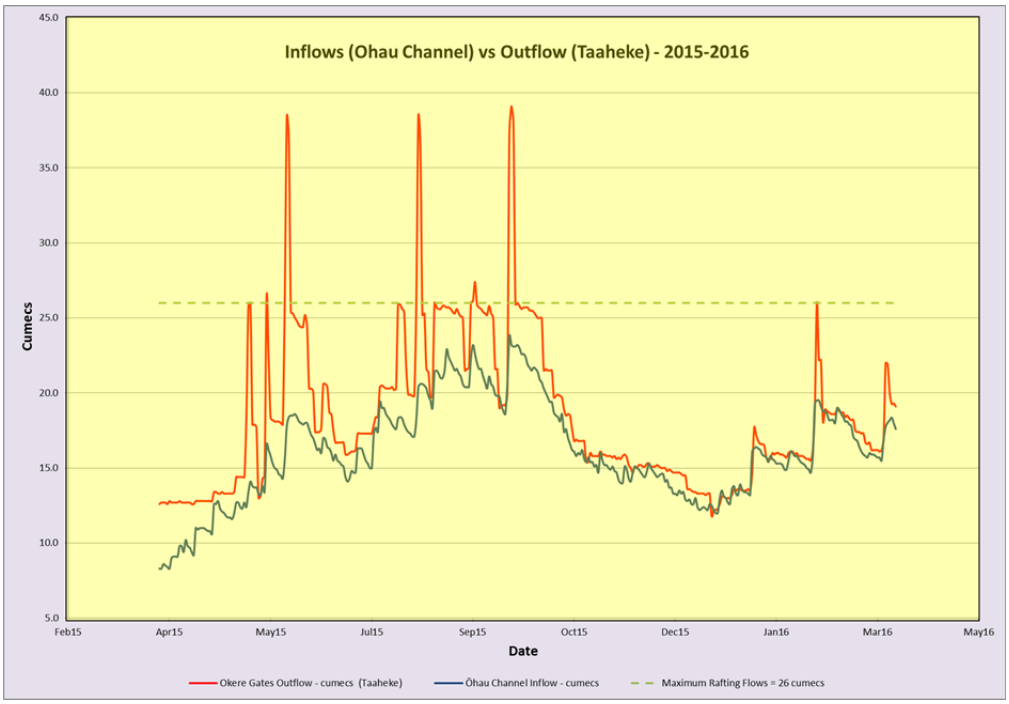

Figure 12 Lake Rotoiti inflow - Ōhau Channel (blue) and Okere Gates outflow - Kaituna River (red) - 1 April 2015 to 31 March 2016.

For interpretation of Figure 12 above, Kaituna River outflows (in red) are required to be higher than Ōhau Channel inflows (in blue) to satisfy the water quality equation – outflows are greater than inflows.

For a more comprehensive analysis to assess the six-hourly and seven-day flow averages, refer to Figure 13, 14 and 15 below. These results have been summarized in Table 2.

Note – In October 2015, a HydroTel data error was discovered between the Ohau Channel instantaneous and six-hourly flow rates showing that the instantaneous flow rate were approximately 2 cumecs greater than the six-hourly flow rate. During this time from 24 October 2015 to 31 March 2016, Ōhau Channel instantaneous flow data was used to manage flow rates through the Okere Gates to determine minimum gate settings to manage reflux. The net effect is that water was released through the Okere Gates at quicker rate than necessary causing lake Rotoiti levels to fall but on a positive note, reduced the risk of reflux occuring in Lake Rotoiti.

The software error was corrected 31 March 2016 and reported to Council's Regulatory Arm for record.

For the purposes of this report, operational data has been maintained as 'recorded instantaneous data' as operational decisions were based on this data.

Note - Lake level and Taheke flow data was not affected.

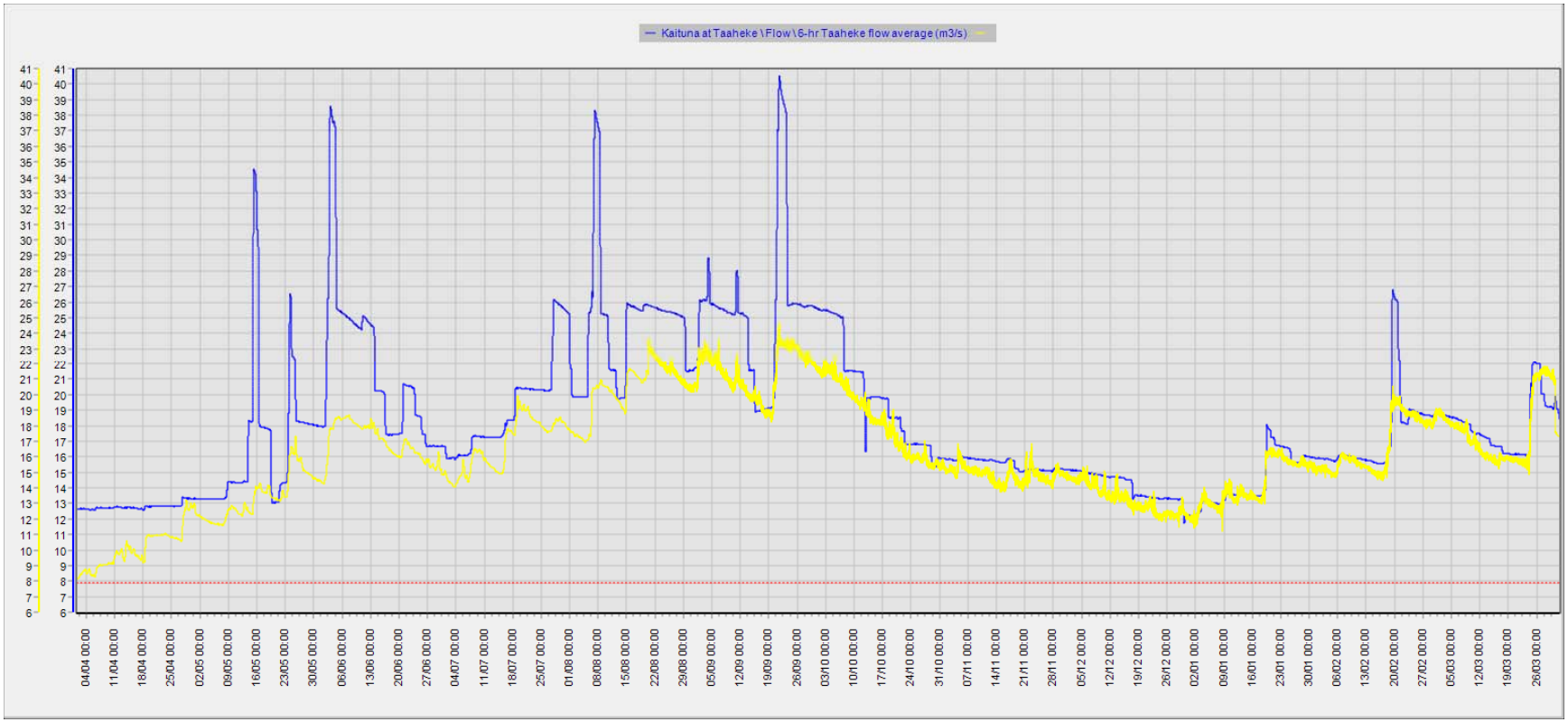

Figure 13 HydroTel summary (uncorrrected) of Ōhau Channel (yellow) and Kaituna River (blue) flow rates – six-hourly average.

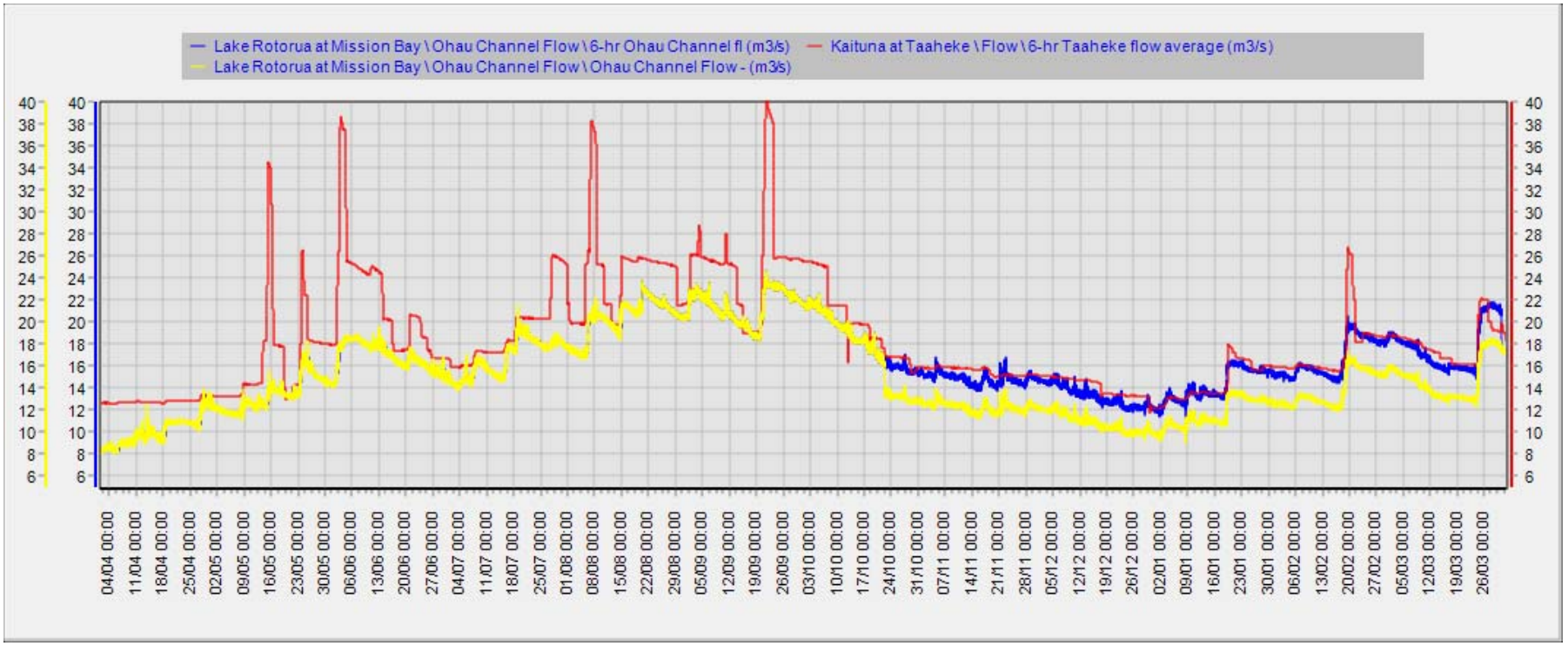

Figure 14 HydroTel summary (corrected) of Ōhau Channel six hourly average flowrates – Operational data shown in blue.

- Actual Ōhau Channel flows shown in yellow – Note data correction after 24 October 2015.
- Kaituna River flow (red).

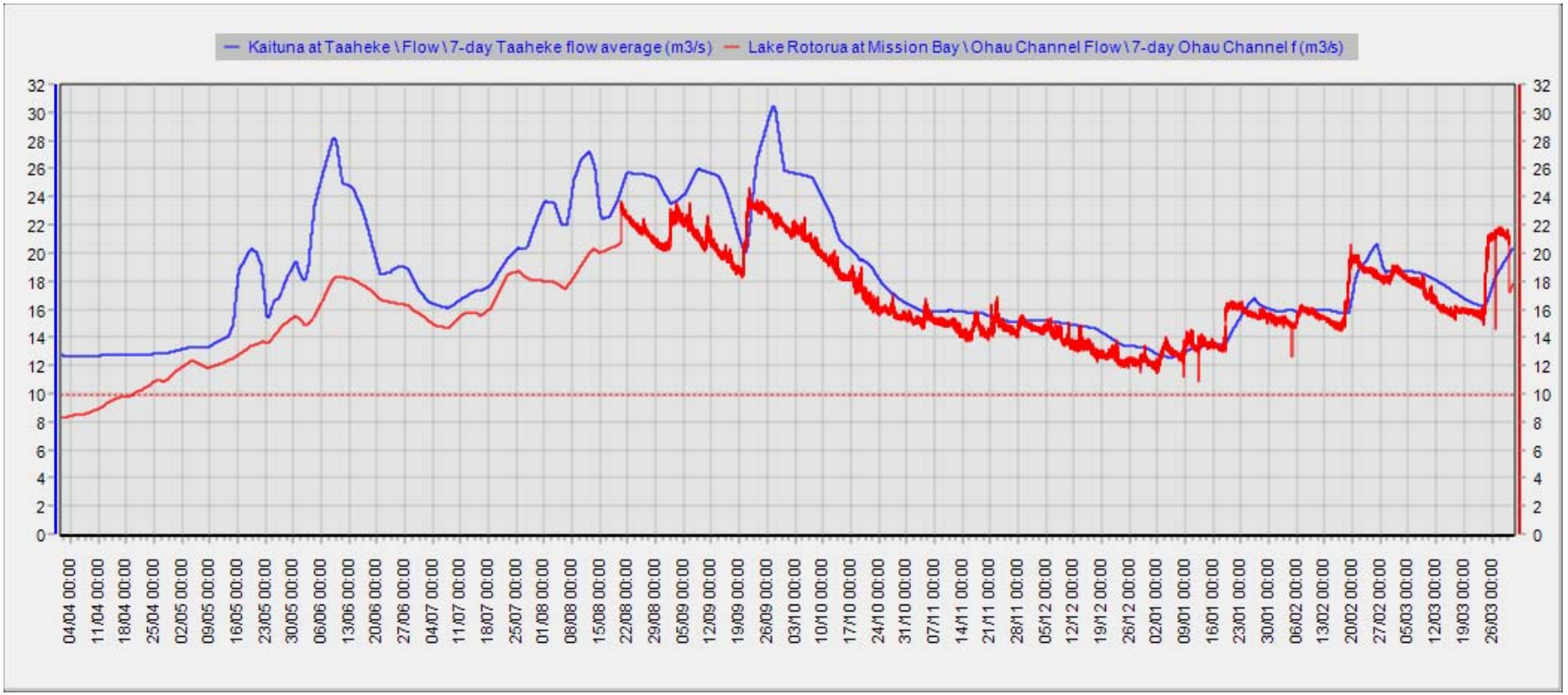

Figure 15 HydroTel summary of Ōhau Channel (red) and Kaituna River (blue) flow rates – <u>seven day rolling average.</u>

Table 2 Okere Gate flow distributions from 1 April 2014 to 31 March 2015.

Consent #65979 Okere Gates			Results		Variation from requirement	
Condition	**Flow requirement** (m^3/s)	**Target distribution** (per calendar year)	**Consent evaluation period** 1 April 2013 to 31 March 2014			
			Days	**%**	**Incident date**	**Comment**
7.4(f)(i)	Six-hourly average flow of 7.9 m^3/s. (Figure 13 – blue trace)	100%	366	100	None	Minimum flow recorded =11.7 cumecs on 30 December 2015.
7.4(f)(ii)	Seven day rolling average flow of 9.84 m^3/s. (Figure 14 – red trace)	100%	366	100	None	Minimum flow recorded =12.6 cumecs on 5 January 2016.
7.4(i)	Six-hourly average outflow through gates > six-hourly average inflow from Ōhau Channel. (Figure 13 – Yellow trace)	100%	353	96.4	20-21May = 2 15-17Sept = 2 12Oct = 1 22Nov = 1 21-23Feb = 2 26-30Mar = 4	Analysis is based on the uncorrected HydroTel record for this reporting period as operations were conducted in terms of this data. Breaches in conditions were reported to the Consent Authority with reason and mitigation solutions sort (internal reference A2333428)
7.4(j)(i).	When opening the gates, a maximum flow increment of 10 m^3/s per hour.	100%	366	100	None	Gates were opened and closed in accordance to consent conditions – all operations are recorded in daily operating spreadsheet.
7.4(j)(ii)(a)	When closing the gates, a maximum flow decrement of 5 m^3/s per hour when operating the Okere Gates below 30 m^3/s.	100%	365	99.7	16 May 2015	Transitional gate change from 3 @ 500 (26 cumecs) at 8 am to 3 @ 300 (18 cumecs) at 9 am – 8 cumec change in one hour – operator error. Any inquiries from the Regulatory Authority are answered in internal correspondence - reference A2373957.

Consent #65979 Okere Gates			Results		Variation from requirement	
Condition	**Flow requirement** (m^3/s)	**Target distribution** (per calendar year)	**Consent evaluation period** 1 April 2013 to 31 March 2014			
			Days	**%**	**Incident date**	**Comment**
7.4(j)(ii)(b)	A maximum flow decrement of 10 m^3/s per hour when operating the Okere Gates at or above 30 m^3/s.	100%	366	100	None	Gates were opened and closed in accordance to consent conditions – all operations are recorded in daily operating spreadsheet. Above this range, the gates were still closed in -5 cumec/hour increments for consistency of operation.

3.3.1 Discussion

Okere Gate minimum flow rates usually occur during the summer months when rainfall, inflows and lake levels are low.

The minimum Kaituna River/Okere Gate flow for this reporting period was 11.7 cumecs on 30 December 2015 compared to 9.0 cumecs recorded on 29 January 2015 and 8.6 cumecs on 8 March 2014. The minimum allowable flow is 7.9 cumecs.

The minimum Ōhau Channel flow for this reporting period was 8.2 cumecs recorded on 1st, 2nd and 6th April 2016. Flows are derived by a rating curve determined from lake levels measured at the Mission Bay Recorder with an accuracy of +/-8%.

The Kaituna River seven-day minimum flow was 12.6 cumecs on 5 January 2016 while the Ōhau Channel seven day minimum flow was 8.2 cumecs on 1 April 2015 (extracted from the HydroTel record).

Okere Gates outflows were greater than Ōhau Channel inflows for approxiamately 96% of the time. Report figures are based on operational data on the day and the operational decisions made at that time. However, for the 'corrected' record, the Ohau Channel flow clearly can be seen in Figure 14 from 24 October on when flows were reduced by approxiamately 2.5 cumecs.

Okere Gate ramping increments (change in flow rate per hour) were maintained 99.7% of the time as gates were adjusted in transitional stages (10 cumecs/hour when opening and 5 cumecs/hour when closing). This data is recorded in the daily operational spreadsheet and logbook.

Recreational flows – Kaituna River:

- A requirement of Consent Condition 7.4(l) is to facilitate recreational flows for Kaituna River activities where ever practical.
- Rafting flows are achieved inside the 13-26 cumec range or at gate settings of 3 @ 200 and 3 @ 500 respectively. These 'commercial' flows have been determined by Maritime New Zealand. When Ōhau Channel inflows exceed 26 cumecs, rafting will cease on the Kaituna River as a greater flow is released through the Okere Gates (outflow>inflow).
- Every reasonable effort is made to accommodate rafting flows while maintaining consent conditions. Communications are regularly maintained to advise and assist the rafting community with planning and cancellations.
- For this reporting period, there were 362 rafting days (98.9% of year). This compares with 357 rafting days (97.8%) in 2014, 96.4% in 2013 and 80.3% in 2012.

Figure 16 Kaituna River 'low flows' below the Okere Gates – 12 March 2015.

Figure 17 Ohau Diversion Wall – Annual inspection – 18 May 2015.

Part 4: Operations

4.1 Discussion

Operationally, there were no significant difficulties to report this term as the physical structures and control systems performed well.

Environmentally, the challenges were significant as lake levels fell below their consented minimums for long periods following little rain. On 20 March 2016, Rotoiti lake levels fell to RL 278.988m or 12mm below the consented minimum of RL 270.100m

The challenge each year is staying within prescribed consent ranges and limits during times of climatic extremes. This year was particularly challenging after below average rainfall for many months resulting in low lake levels for extended periods. During periods of dry weather or drought, the challenge is maintaining lake levels as the consent balances water quality against water quantity while ensuring outflows (Okere Gates) are greater than inflows (Ohau Channel).

The Ōhau Channel stoplogs were removed 20 August 2015 following high lake levels and reinstalled 22 October 2015 in response to falling lake levels.

The Regulatory Authority will now be informed when lake level ranges are exeeded to ensure the operational Management Plan (OMP) is best adhered to minmize adverse effects when managing extreme conditions.

System improvements to HydroTel will now provide alerts to the operator if a reflux situation is occuring in Lake Rotoiti. An alert will now be issued if outflows Okere Gates) are less than inflows (Ōhau Channel).

Lake levels are proactively managed using long-range forecasts to manage lake levels early in an effort to preserve or release water based on those forecasts.

Remote control of Okere Gates was reliable with only minor issues at times with communication links that were quickly addressed.

Part 5: Consultation with stakeholders

5.1 Background – establishment of liaison and kaitiaki groups

Under the conditions of these consents, the Consent Holder was initially tasked with facilitating the establishment of a liaison group and two kaitiaki groups within three months of the commencement of the consent. The purpose of the groups is to essentially facilitate discussion and free flow of information between the consent holder and the community, These groups have now been in place since the issue of the new consent in 2012.

These groups are:

- Rotorua Te Arawa Lakes Operational Liaison Group (RTALOLG).
- Ohau ki Rotoiti Kaitiaki Group (OKRKG).
- Okere ki Kaituna Kaitiaki Group (OKKKG).

The Consent Holder is required to convene a meeting each year with the two kaitiaki groups and with the RTALOLG at least annually in the first three years and thereafter at least every third year.

For this term, Annual General Meetings were held on:

• RTALOLG	20 October 2015	Chaired W.Webber
• Okere ki Kaituna Kaitiaki Group	23 October 2015	Chaired H.Maxwell
• Ohau ki Rotoiti Kaitiaki Group	No meeting held	

BOPRC facilitated these meetings to present the 2014/2015 Okere/Ohau Annual Report. Meeting minutes were recorded and are made available to group members on request.

Annual reports were circulated to the chairs of the liaison and kaitiaki groups for distribution to members prior to the annual meetings occurring.

The Consent Holder has made improvements this term to ensure members of each of the groups receive notification or invitation to annual meetings.

The RTALOLG meeting was held in BoPRC's Rotorua office and chaired this term by Warren Webber in absence of Chairperson Phill Thomass.

The Okere ki Kaituna Kaitiaki Group meeting was held in the Tapuika office in Te Puke and chaired by Hohepa Maxwell.

The Ohau ki Rotoiti Kaitiaki Group meeting was initially delayed until November/December 2015 to provide time to complete the draft Cultural Management Plan (CMP) but was further delayed following review by the Council at which time the reporting year was concluding (31 March 2016).

5.2 Community communication

Every effort has been made to maintain regular communication with all stakeholders.

These communications include:

- BOPRC flood managers – Lake level and flow conditions.
- Iwi – Response to inquiries.
- Residents – Response to enquiries.
- Rafters – Gate settings and river flows.
- Rotorua tourism operators – Lake front issues.
- Media – Public notifications and media releases

Part 6: Complaints and investigations

6.1 Complaint summary – 1 April 2015 to 31 March 2016

All complaints were forwarded to or received by Council's Regulatory Arm for investigation and response.

Typical concerns expressed were:

- Low lake levels and boat access to jetties.
- Reflux around the Ohau Diversion Wall.
- Surface flooding at Mourea following heavy rain.

All concerns were addressed quickly and reported back to the complainant. Where appropriate, site visits were conducted and photographs taken for record.

The Consent Holder posts regular updates to the '@Okere Gates-Kaituna River Rafting' Group via email advising on:

- Lake level conditions.
- Okere Gate settings.
- Met Service forecasts and warnings.
- Programmed activities.

There were no flood issues reported for this 12 month period.

6.2 Investigations and monitoring

Investigations currently underway this term are listed in Table 3 below:

Table 3 Investigations in progress.

Investigation	Consent 65979 Condition No.	Location	Issue	Progress
Flood mitigation and beach vegetation.	12.2	Mourea	Flooding.	Bunding no longer required as existing ground levels meet design criteria. Condition to be reviewed and removed from consent.
	12.3	Hinehopu and Te Rauto Bay	Narrow beaches.	Apply herbicide to Hinehopu and Te Rauto beaches. This condition remains on hold' until Ohau ki Rotoiti Kaitiaki Group present their Cultural Management Plan. The Consent Holder continues to monitor beaches.
Velocity monitoring.	13.2	Ōhau Channel	Maintain fish migration during flush (Fish & Game New Zealand).	Report completed by BOPRC - EDS Section June and September 2015. Submitted Fish & Game New Zealand, 21 October 2015. Conclusion – No change in velocities during annual flush. Ongoing each year until revised.
Lake level/staff gauge monitoring and settlement.	8	Hinehopu, Gisborne Point, Okawa Bay, Te Akau Bay	Monitor settlement.	Ongoing. Lake staff gauges read monthly and record maintained to check against Okawa Bay Recorder Tower.
Ōhau Channel Cross Sections.	None	Ohau Channel	Monitor changes in channel bed.	Survey conducted bi-annually during drawdown minimum and post drawdown to assess any changes in Ohau Channel.

6.2.1 Condition 13.2 - Ohau Channel cross sections and velocity monitoring

Ōhau Channel cross sections are undertaken bi-annually at locations shown in Figure 18 to monitor bed levels during and after channel flush each year.

Figure 18 Ohau Channel cross section locations.

Several years of cross section monitoring indicate that the Ōhau Channel is reasonably stable with no significant changes occurring since introducing the annual flush/drawdown condition in 2012.

Cross Sections show that normal processes of erosion and aggradation are occurring naturally within the Ōhau Channel and the annual flush has negligible effect on mobilising sediments in the channel. Data analysis indicates a generally stable environment with only minor changes occurring through the Ōhau Channel reach.

The key objective of the lake level drawdown or flush was to potentially increase channel velocities to mobilise sediments to increase capacity therefore reducing flood risk.

This consent condition could potentially be reviewed to assess the ongoing benefits of the flush and whether it is considered necessary.

Figure 17 below shows an example of cross section 75/34 located downstream of State Highway 33 at Te Takinga Marae.

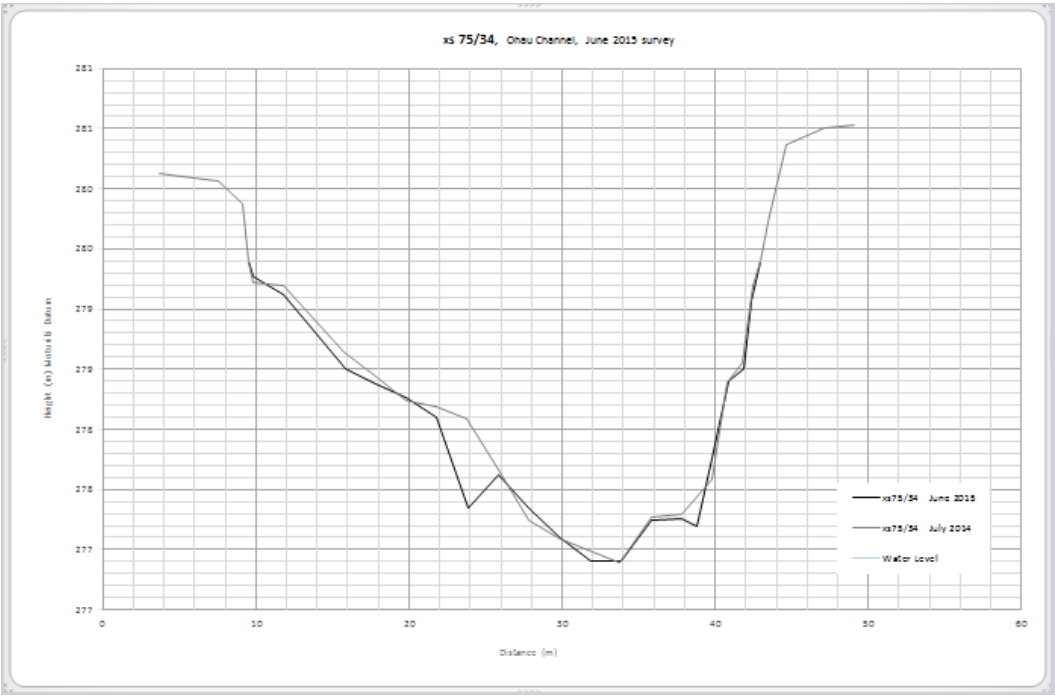

Figure 19 Cross section number 75/34 at Marae – 2014-15.

In July 2012, a staff gauge was fitted to the Ōhau Channel/ State Highway 33 Bridge to monitor the relationship between Lake Rotorua, Ōhau Channel and Lake Rotoiti water levels.

Figure 20 Ōhau Channel Staff Gauge on State Highway 33 Bridge – Mourea.

Following three years of monitoring, it is evident that the dominant influence on Ōhau Channel water levels at Mourea are Lake Rotorua levels and subsequent outflows through the Ohau Weir.

This observation was particularly evident during the 2014 drawdown phase when Lake Rotorua and Ōhau Channel levels remained high following the drawdown of Lake Rotoiti in July 2014.

Figure 21 below shows the relationship between water levels at Lake Rotorua, Ōhau Channel at SH33 Bridge and Lake Rotoiti. It also shows the corresponding Ōhau Channel flow in cumecs (cubic meters of water per second).

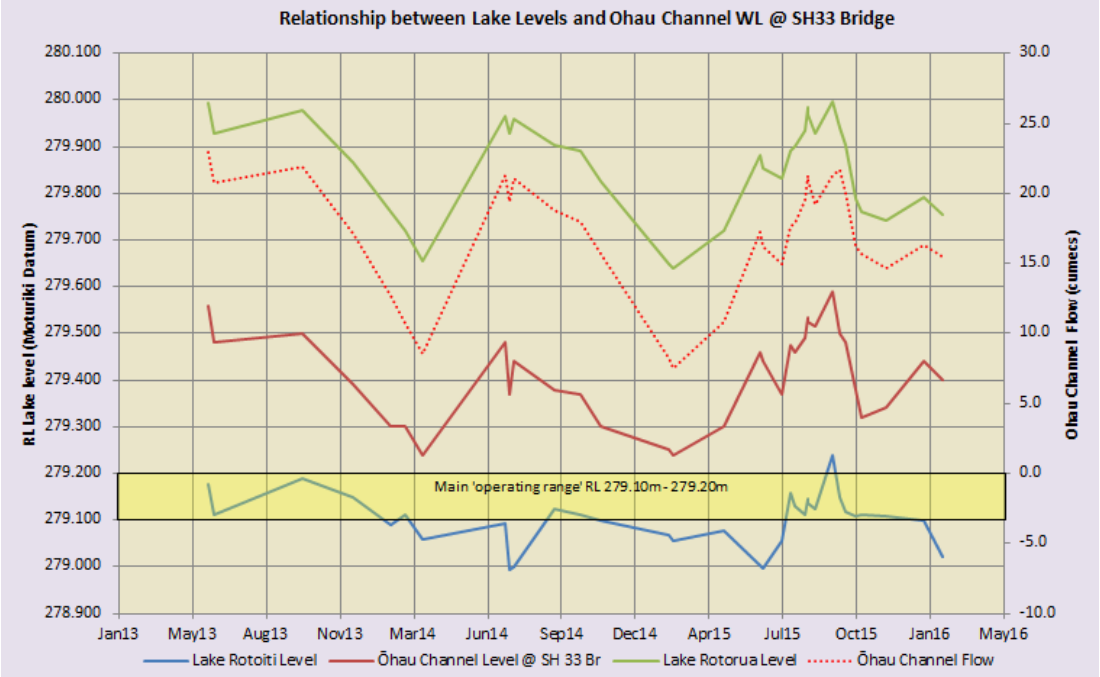

Figure 21 Relationship between lake levels and Ōhau Channel level at State Highway 33 Bridge at Mourea – (from monthly inspections).

6.2.2 Velocity monitoring

Annual monitoring is required under Condition 13.2 to address concerns by Fish & Game New Zealand to determine any effects the flush may have on Ōhau Channel velocities and fish migration.

Velocity measurements at several locations were conducted during the drawdown phase in June 2015 and repeated in October 2015 after lake levels were restored to normal levels.

The monitoring again concludes that no significant change in velocities occur during the flush and was reported to Fish & Game New Zealand.

This monitoring will continue annually or until reviewed if conclusions remain unchanged.

Figure 22 Velocity measuring equipment measuring Ōhau Channel flows at SH33 Bridge.

6.2.3 Ohau Diversion Wall - reflux monitoring

It is proposed to carry out further 'reflux' monitoring in the future under the Rotorua Lakes Programme. None was scheduled for this term.

Figure 23 BOPRC EDS staff measuring lake currents near the Ohau Channel Diversion Wall at Te Akau Bay – Lake Rotoiti (October 2012).

Part 7: Conclusion

2015/2016 has been another challenging year in terms of environmental conditions to maintain lake levels and flow rates within consent ranges.

Consents 65979 and 65980 have now been operational for over four years since the issue of the renewed consents in March 2012.

The biggest driver for Lake Rotoiti level management is water quality followed by water levels. The operational regime of these consents compliments the Rotorua Lakes Programme to improve water quality in Lake Rotoiti by ensuring outflows through the Okere Gates (Kaituna River) are always greater than inflows from the Ōhau Channel (Lake Rotorua).

Various monitoring programmes continue around the lakes and Ōhau Channel and provide valuable information for both Consent Holder and stakeholders in understanding lake dynamics and environmental effects.

Currently, there are two recommendations in process before the Regional Council's Regulatory Arm to cancel Condition 12.2 (bunding) and place on hold 12.3 (herbicide on beaches). At this stage there are no recommendations to review any other consent conditions until Cultural Management Plans have been received from the two kaitiaki groups for review and consideration by the consent authority.

The Consent Holder endeavours to maintain frequent communications and maintain the free flow of information with consent stakeholders at all times.

The Consent Holder has responded to complaints and concerns quickly and addressed any issues to potentially improve management of lake levels and flow rates. The Operational Management Plan has also been reviewed and updated to improve operational elements of the consent.

The Annual Meeting between the Consent Holder, RTALOLG and the two kaitiaki groups has proved a good opportunity to present the annual report and discuss any lake environment issues.

The Consent Holder deems that it has generally fulfilled its management and operational obligations for the 2015/2016 consent period as recorded in this annual report.