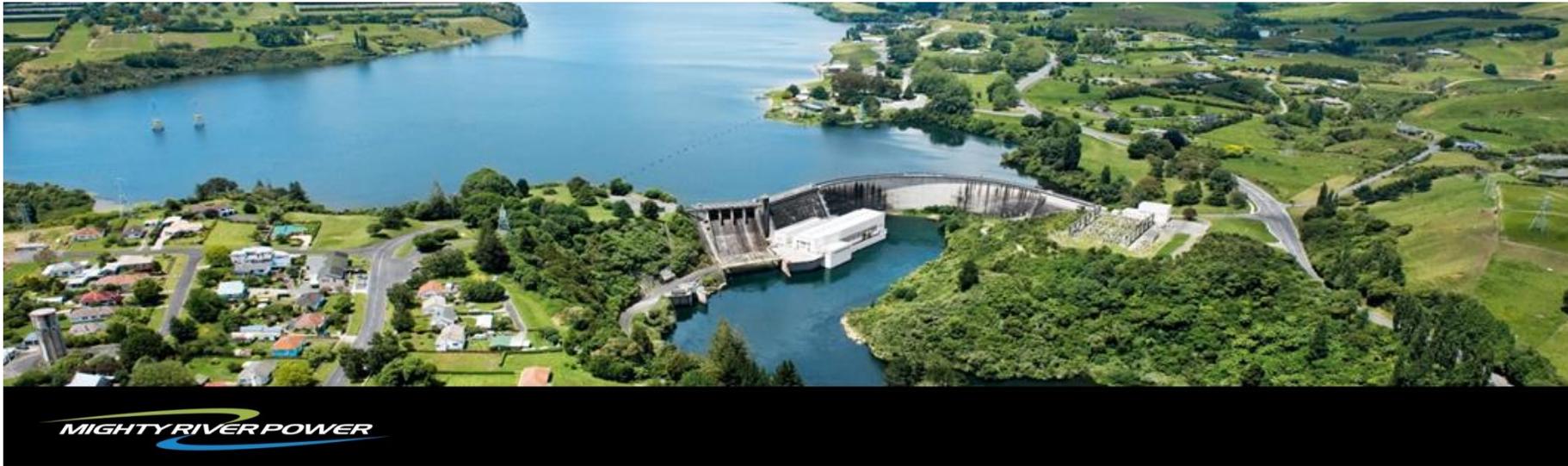


Discussion on Dams

# Healthy Rivers CSG

## Waikato Hydro Scheme



26 February 2016

Stephen Colson, Planning and Policy Manager

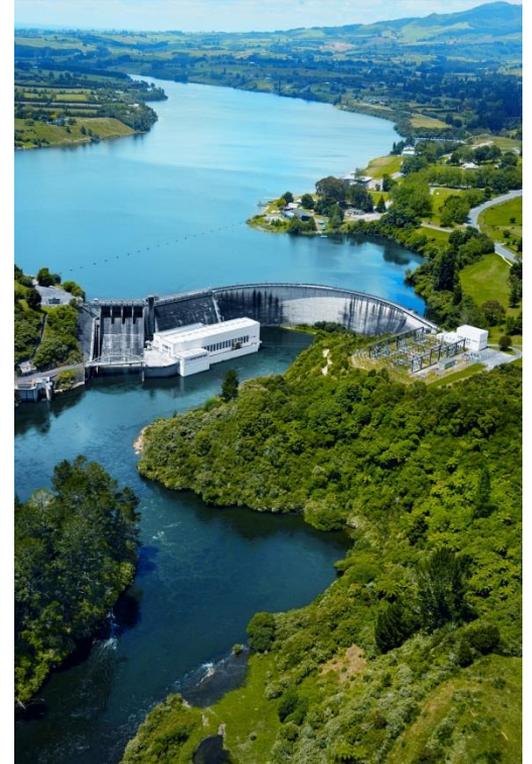
Permission is required from Mercury NZ Limited before reproducing any slides in this presentation.

**MIGHTY RIVER POWER** PRESENTATION FOR PURPOSES OF HEALTHY RIVERS CSG NOT FOR PUBLICATION WITHOUT PERMISSION OF MERCURY NZ LTD

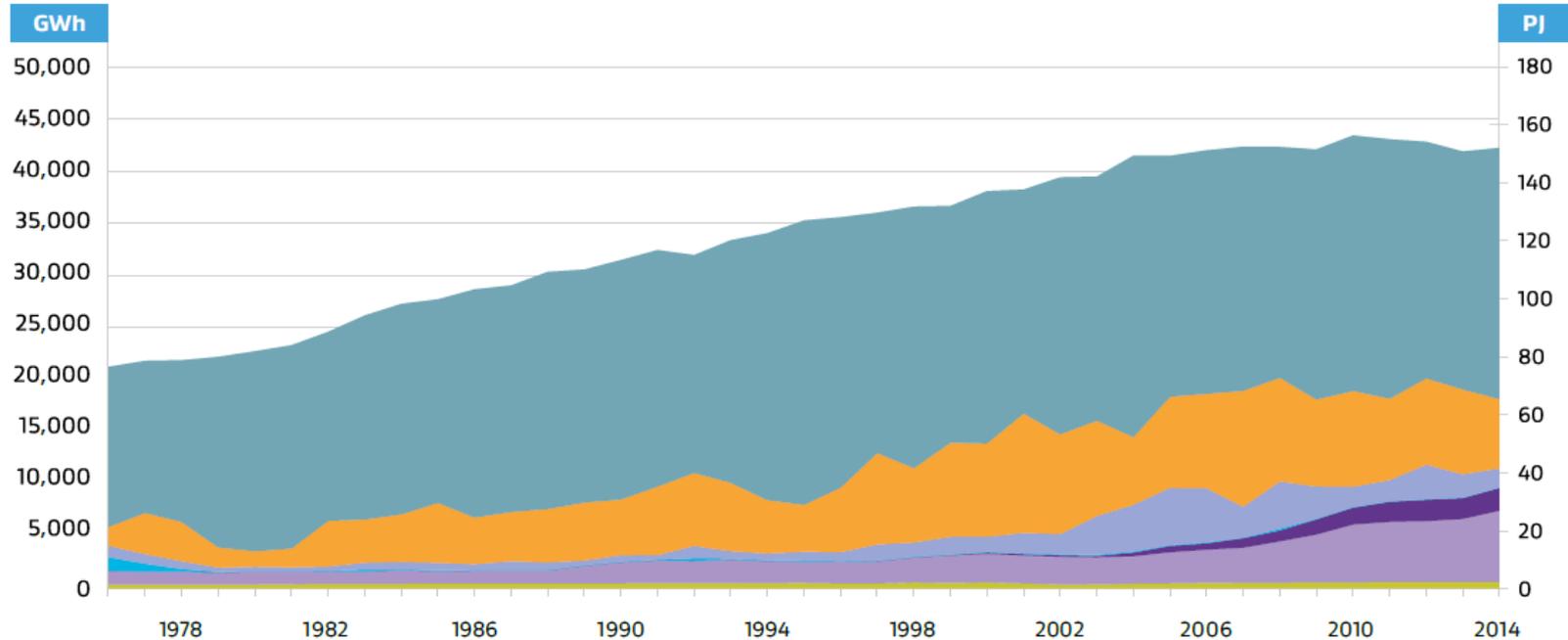
## ► PREVIOUS INFORMATION

---

- Presentations at Sector Hosting Day 23 September 2016, including Energy overview, Contact, Energy, Genesis Energy and Mighty River Power presentations and the catchment hydrology overview information as it relates to the Waikato Hydro Scheme.
- Hydrology Presentations CSG 13 on 2/3 July 2015 from Waikato Regional Council and Mighty River Power hydrologist.



## New Zealand's generation remains hydro dominated

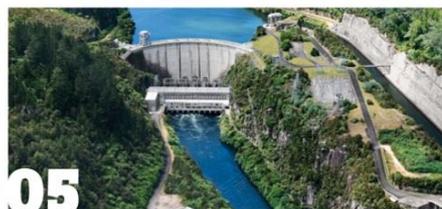


Source: MBIE Energy in NZ 2015

■ Bioenergy 
 ■ Geothermal 
 ■ Wind 
 ■ Other Thermal 
 ■ Coal 
 ■ Gas 
 ■ Hydro

## ► ASSETS

### North Island located generation portfolio



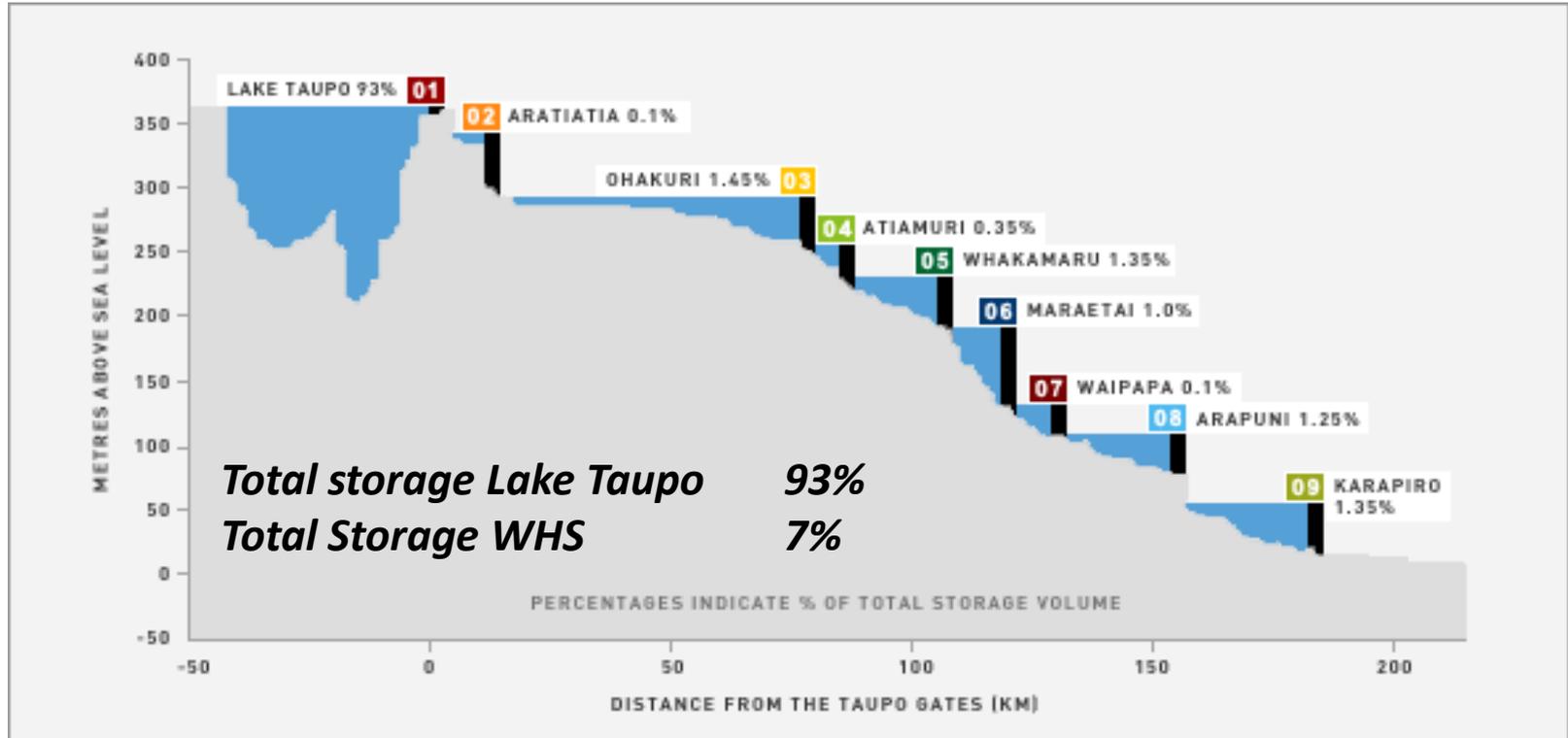
#### HYDRO GENERATION



01/ Aratiatia	78MW
02/ Ohakuri	106MW
03/ Atiamuri	74MW
04/ Whakamaru	100MW
05/ Maraetai I & 06/ Maraetai II	352MW
07/ Waipapa	54MW
08/ Arapuni	178MW
09/ Karapiro	96MW



## Waikato Hydro System dam elevations



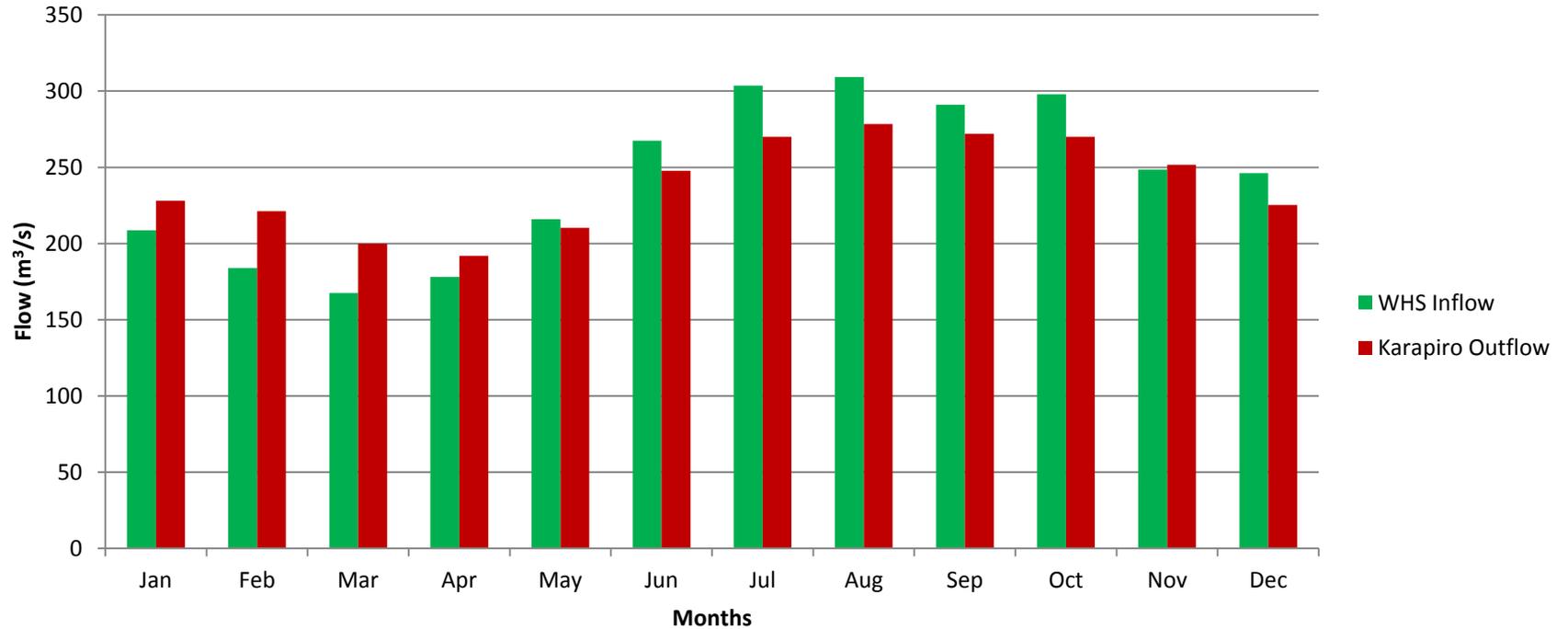
## ► MANAGEMENT OF LAKE TAUPO

---

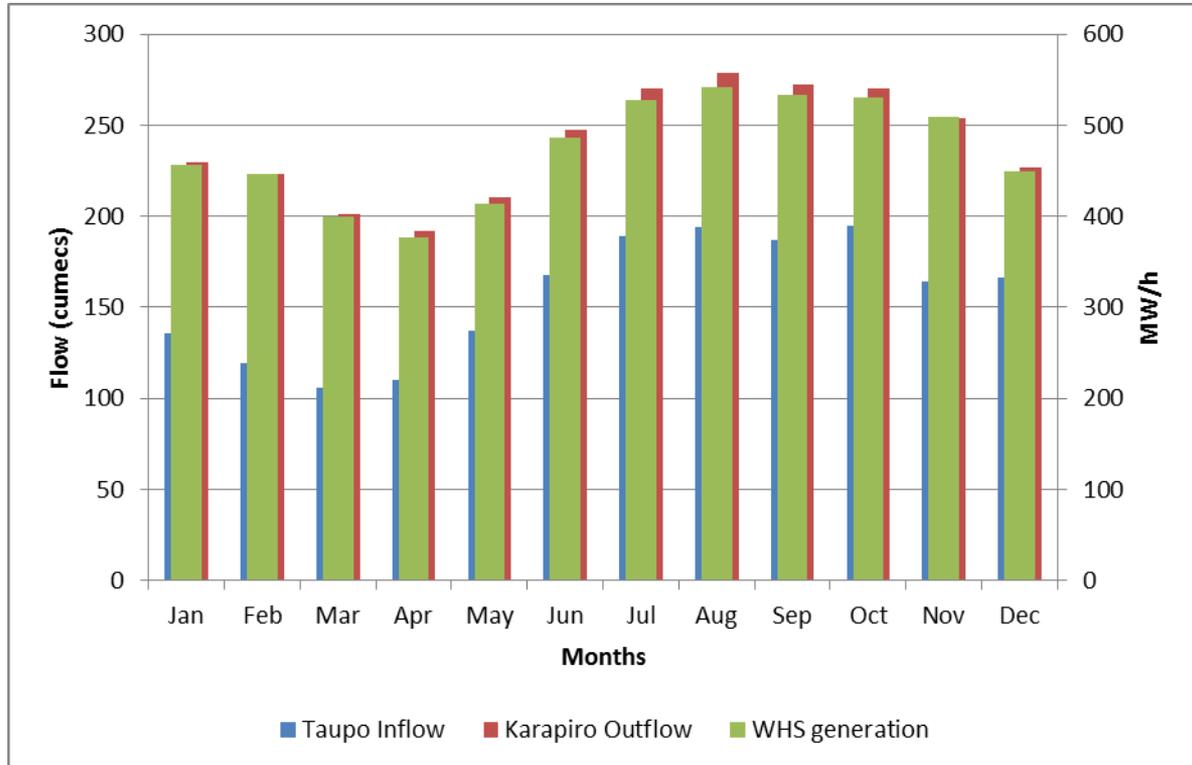
- Taupo Lake levels managed for hydro generation operations between the range 355.85 to 357.25 masl (1.4m)
- Lake Taupo is “inflow-driven” .
- The volume of water represented by this range released on average 5.8 times annually.
- Given a lake area of 611 km<sup>2</sup> the usable volume for electricity generation purposes is 855.4 Mm<sup>3</sup>.
- During times of flood, inflows c.1,500m<sup>3</sup>/s (excluding diversions) versus outflows max 300m<sup>3</sup>/s
- Augment flows in lower Waikato R during dry seasons to benefit of instream values, infrastructure (water intakes, Huntly PS)



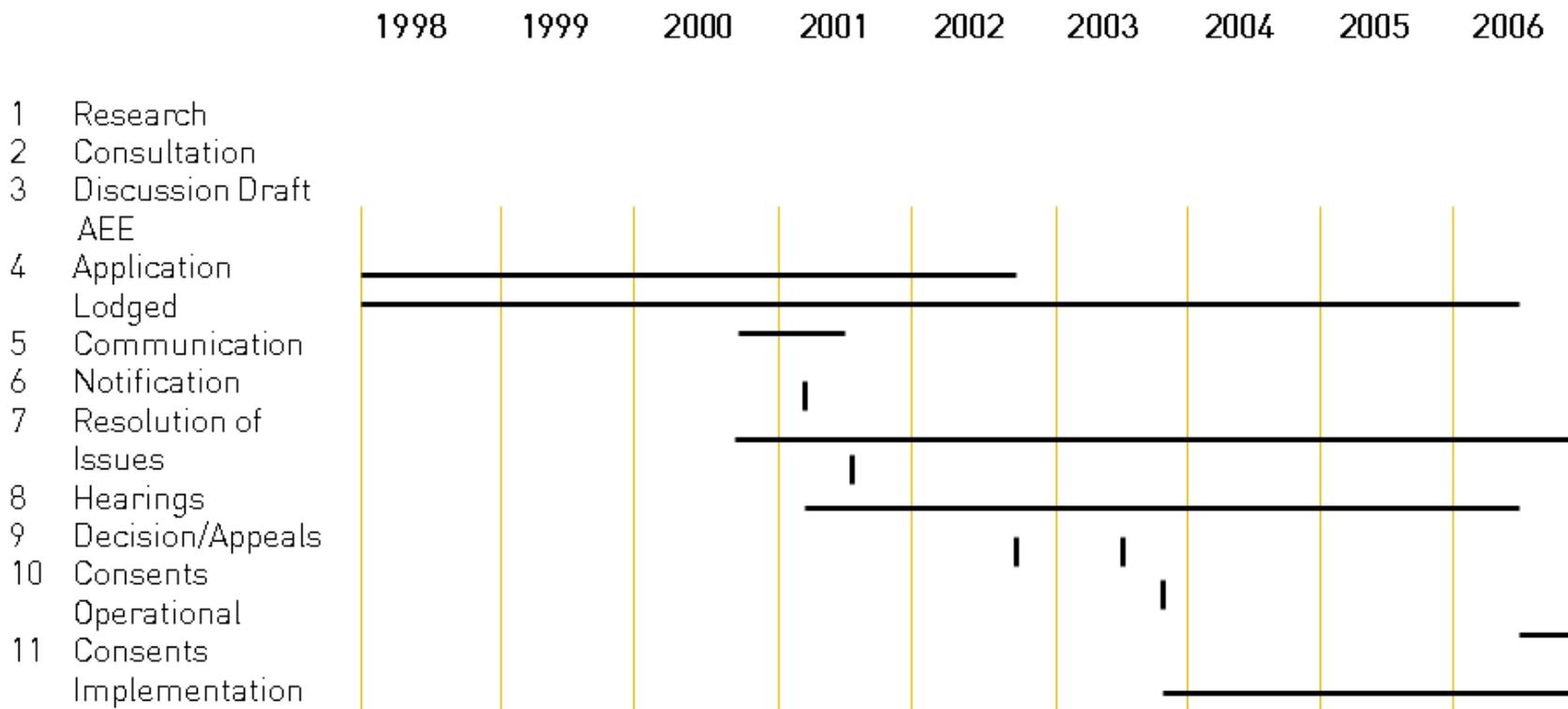
## Waikato Hydro System inflow versus Karapiro dam outflow



# ► RELATIONSHIP BETWEEN TAUPO INFLOWS, GENERATION AND KARAPIRO OUTFLOWS.



## ► WAIKATO HYDRO SYSTEM RESOURCE CONSENTS REPLACEMENT PROCESS



## ► WAIKATO HYDRO SYSTEM RESOURCE CONSENTS

### Structure of Primary Consents 105226, 105227, 105228 – 8 Sections

1. Purpose of Consents
2. Management of Lake Taupo
3. Management of the Waikato Hydro Reservoirs
4. Management of Karapiro Outflows
5. High Flow Operating Regime
6. Monitoring and Reporting
7. Operational Matters
8. Administrative Conditions

<p>MIGHTY RIVER POWER 16 SEP 2011 HAMILTON</p>	<h2>Resource Consent Certificate</h2>	 PO Box 4010 401 Grey Street Hamilton East Hamilton 3247 New Zealand ph +64 7 859 0999 fax +64 7 859 0998 <a href="http://www.ew.govt.nz">www.ew.govt.nz</a>
<p><b>Resource Consent Number:</b> 105226</p> <p><b>File Number:</b> 80 66 34A</p>		
<p><i>Pursuant to the Resource Management Act 1991, the Waikato Regional Council hereby grants consent to:</i></p>		
<p>Mighty River Power PO Box 445 HAMILTON 2015</p> <p><i>(hereinafter referred to as the Consent Holder)</i></p>		
<b>Consent type:</b>	Water	
<b>Consent subtype:</b>	Dam	
<b>Activity authorised:</b>	To use, upgrade, and maintain structures on the bed of the Waikato River, including any associated bed disturbance, for the generation of hydroelectricity and operation of the Waikato hydro system.	
<b>Location:</b>	Waikato River	
<b>Map References:</b>	NZMS 260 T16:447-200, T16:501-131, T17:553-054, U17:742-078, U17:796-058, U17:832-826, U18:771-757, T15:334-611, T15-416-434	
<b>Consent duration:</b>	Granted for a period expiring 6 May 2041	
<p><b>Subject to the conditions overleaf:</b></p>		

## ► **WAIKATO HYDRO SYSTEM RESOURCE CONSENTS**

### Resource Consents – examples of what they cover

- **1.4m level range in Lake Taupo**
- **Taupo gates 50 cumecs minimum flow**
- **Aratiatia 50 cumecs minimum flow**
- **Daily Aratiatia Tourist spill**
- **8 Hydro lakes have defined level ranges and exceedance**
- **Karapiro minimum flow 148 cumecs (summer) and 140 cumecs (winter)**
- **Flood / Drought flow management**
- **Ecological and Geomorphological Monitoring**
- **Flow and Level requests**
- **General scheme wide maintenance activities**
- **Lake weed management –discharge to land**

## ► ENVIRONMENTAL & COMMUNITY DELIVERY

### Waikato Hydro System



19  
Consents

100%  
Compliance

23  
Mitigation  
Agreements



PEER  
REVIEW  
PANEL

## ► WAIKATO HYDRO SYSTEM RESOURCE CONSENTS

---

### Resource Consents Operational on 12 April 2006

---

#### 3 Primary consents – dam, take/divert, discharge

- 93 Conditions

#### 12 General Maintenance Consents

- 43 Conditions

#### 4 Other – e.g. Weed Shredding, beach nourishment

- 48 conditions

Overall 19 Resource consents with 184 conditions

100% compliance

## ► PEER REVIEW PANEL

---

### Specialist panel of nationally recognised experts

---

#### Duties

- Check no unanticipated environmental effects of on-going WHS operations
- Provide opinion re effects of WHS is having on customary Māori interests, both ecological and cultural, in the Waikato Catchment
- Report and make recommendations to Waikato Regional Council

Erosion  
Fisheries  
Wetlands  
Algae

Customary Māori Interests  
Other Environmental effects

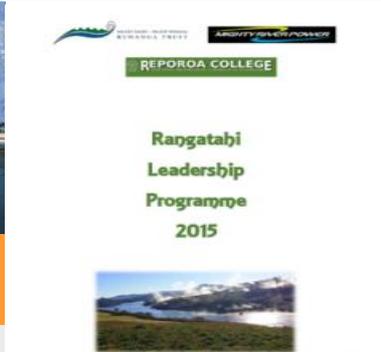


# ► RELATIONSHIPS

## Waikato River Iwi



Social



Educational



Environmental



Cultural



Economic





## WCEET History

- Formed out of the consultative process for parties with ecological interests in replacement of the resource consents for the Waikato Hydro System
- Collaborated on ecological research / interpretation
- Trusting working relationships evolved to collaboration on resource consent conditions, monitoring, independent quality assurance, agreed mitigation

Ecological enhancement resources delivered by collaboration

## Trust established in 2003

- Trust partners – DOC, Fish & Game NZ, ACRE, Forest & Bird and Mighty River Power (Waikato Regional Council has observer status)

## ► ENVIRONMENTAL PARTNERSHIPS

### Delivering for the Environment

Waikato **Catchment** Ecological Enhancement Trust



*Taking steps to improve our ecological heritage*

Collaboration with Ecological interests in Waikato Hydro consents process

Agreed conditions, monitoring & mitigation  
Multiple environmental wins!

Trust established 2003  
2016 is year 13 of 38 year life

184 projects to date  
\$3.96 M (\$1.17 M committed)



## ► AQUATIC WEED

### Responsibility

- LINZ lead agency responsible for weed control on bed of hydro lakes; collaborative effort with other agencies and lake users

### Extent

- Approx 1,500ha of weed in hydro lakes (versus total lake area 4,700ha)
- Approx \$1M direct annual control cost to Mighty River Power (intake screen clearing and general weed management for operational reasons), plus potential for significant business interruption costs

### Control

- Improved monitoring, planning and reliance on “toolbox” of management methods
- Spraying : approx 100-150ha treated annually; support WRC permitted activity status
- Harvesting: approx 200m<sup>3</sup>/day; disposal authorised by consent
- Shredding: approx 100m<sup>3</sup>/hour; operations authorised by consent

### Efficacy

- Direct costs of harvesting c.\$7,500 per ha versus c.\$1,700 per ha for spraying; approx \$11m to harvest all weed annually (assuming equipment available, without considering transport and treatment costs)



## ► WEED MANAGEMENT

---

---

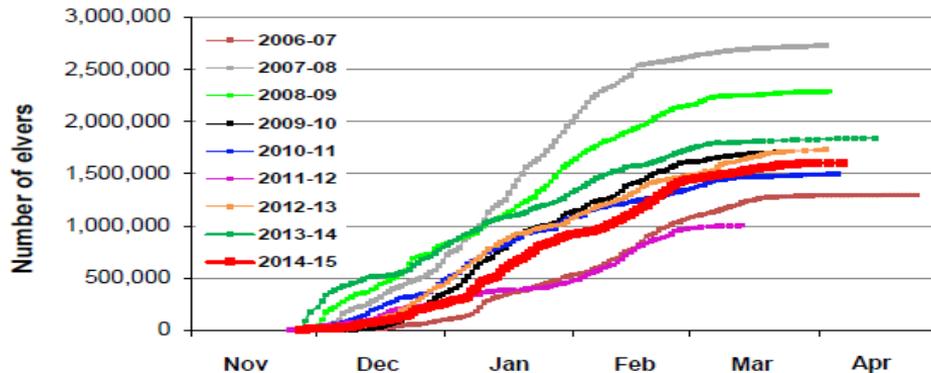
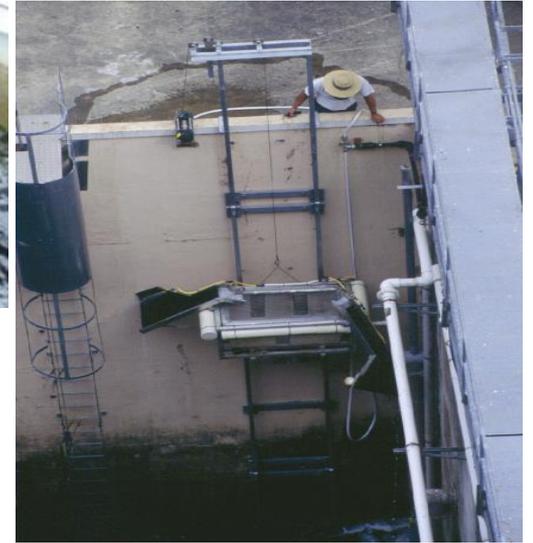
- **About 1,500ha of weed in the hydro system (versus total lake area 4,700ha); harvesting costs about \$7,500 per ha versus about \$1,700 per ha for spraying.**
- **Cost about \$11m to harvest weed (without consideration of any transport / treatment costs) versus \$2.5M to spray.**
- **Harvesting only takes top metre or so. Weed grows back, therefore this an annual cost.**
- **1,500ha of weed equates to about 5,500 tonnes dry weight of material; nutrient content of 5,500 tonnes dry weight equates to about 120 tonnes N and 15 tonnes P**
- **Removing weed as method to strip nutrients cost about \$100,000 to harvest 1 tonne of N**

## ► ENVIRONMENTAL PARTNERSHIPS

### Delivering beyond compliance with elver transfers since early 1990s

- Eel Enhancement Company (EECo) with Mighty River Power, Waikato River Iwi, Fish & Game NZ, MPI, WRC & NIWA
- Elvers captured at Karapiro Dam - transferred by EECo into Lakes Karapiro, Arapuni, Waipapa, Maraetai,

**Karapiro Dam**



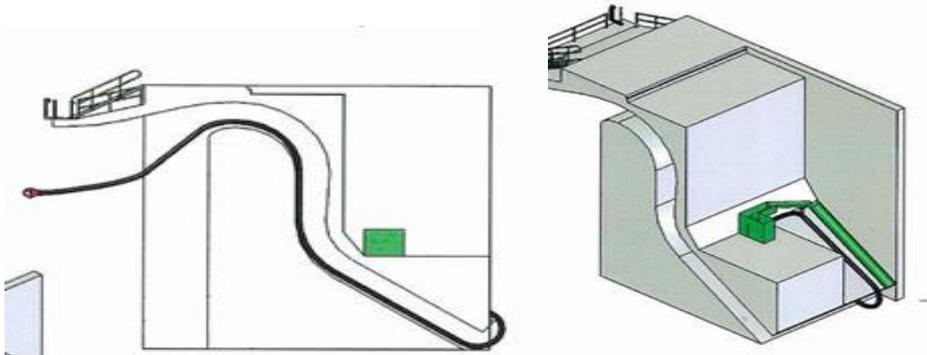
## ➤ ENVIRONMENTAL PARTNERSHIPS

---

### Delivering beyond compliance with downstream eel passage trials

---

- > Eels are an iconic species of high value to Maori
- > Trialling a bypass for migrating eels at Karapiro
- > Looking at ways to enhance the efficiency of downstream passage
- > Investigating new passage initiatives with commercial eel fishermen



## ► RIVER ENVIRONMENT TODAY

---

### Lakes now a valued part of the Environment

---

