Hydrology of the Waikato Catchment:
From Chapter 3 of Waters of the Waikato

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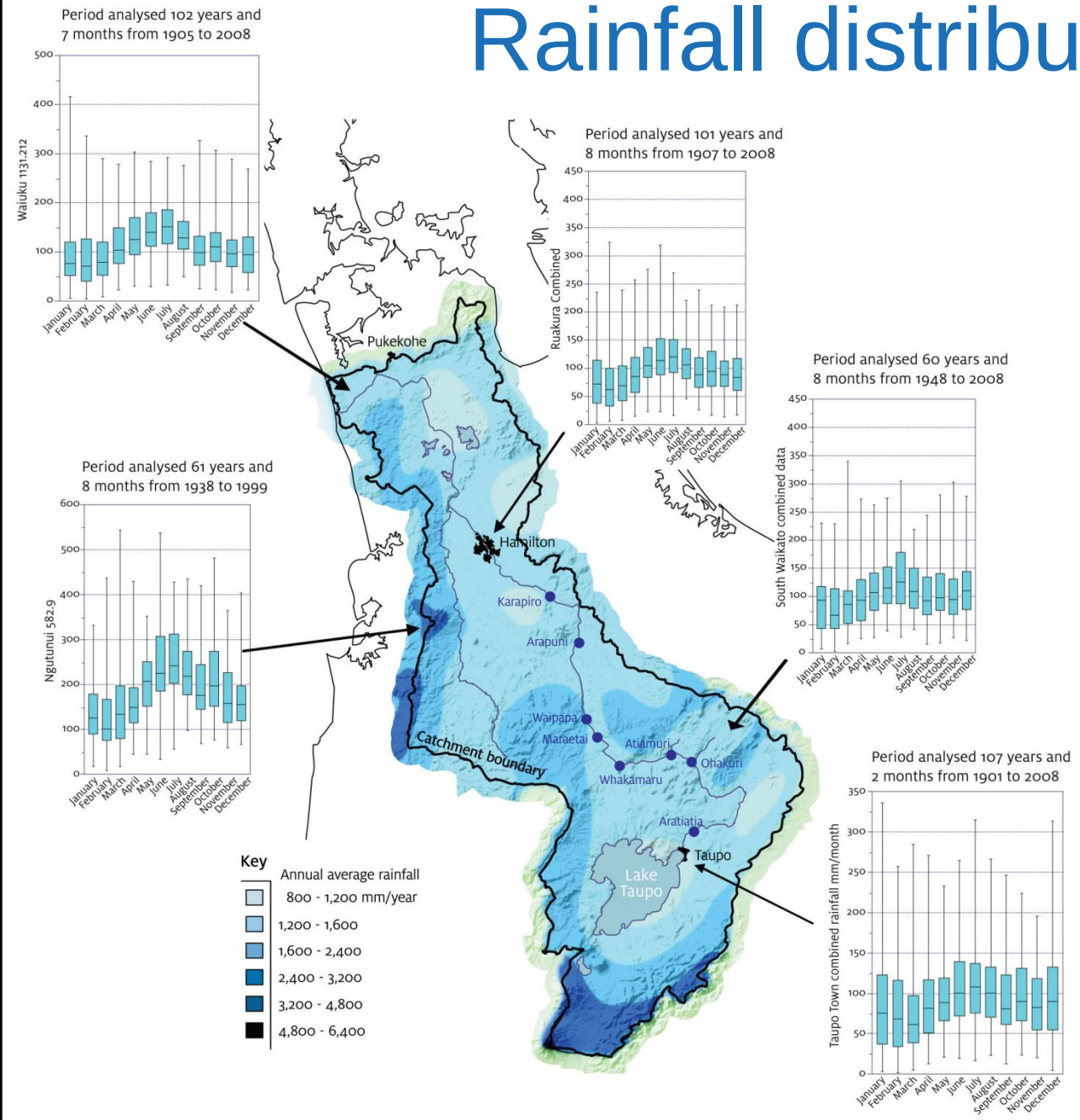
Presentation format

- Hydrology of the Waikato River
  - Rainfall
  - Groundwater
  - River flows
- Water Allocation of the Waikato River
  - Water use
  - Investigations

The Waikato Catchment

- Catchment area 14,440 km^2
- Largest lake in NZ - Lake Taupo 611 km^2
- Longest NZ river 425 km
- Average discharge 420 m^3/s
- 30 m^3/s sourced from outside the catchment via diversions for power generation
- Major Hydro influence – 8 Dams and control gates on Lake Taupo.
- Land use is dominated by pasture and forestry

Rainfall distribution

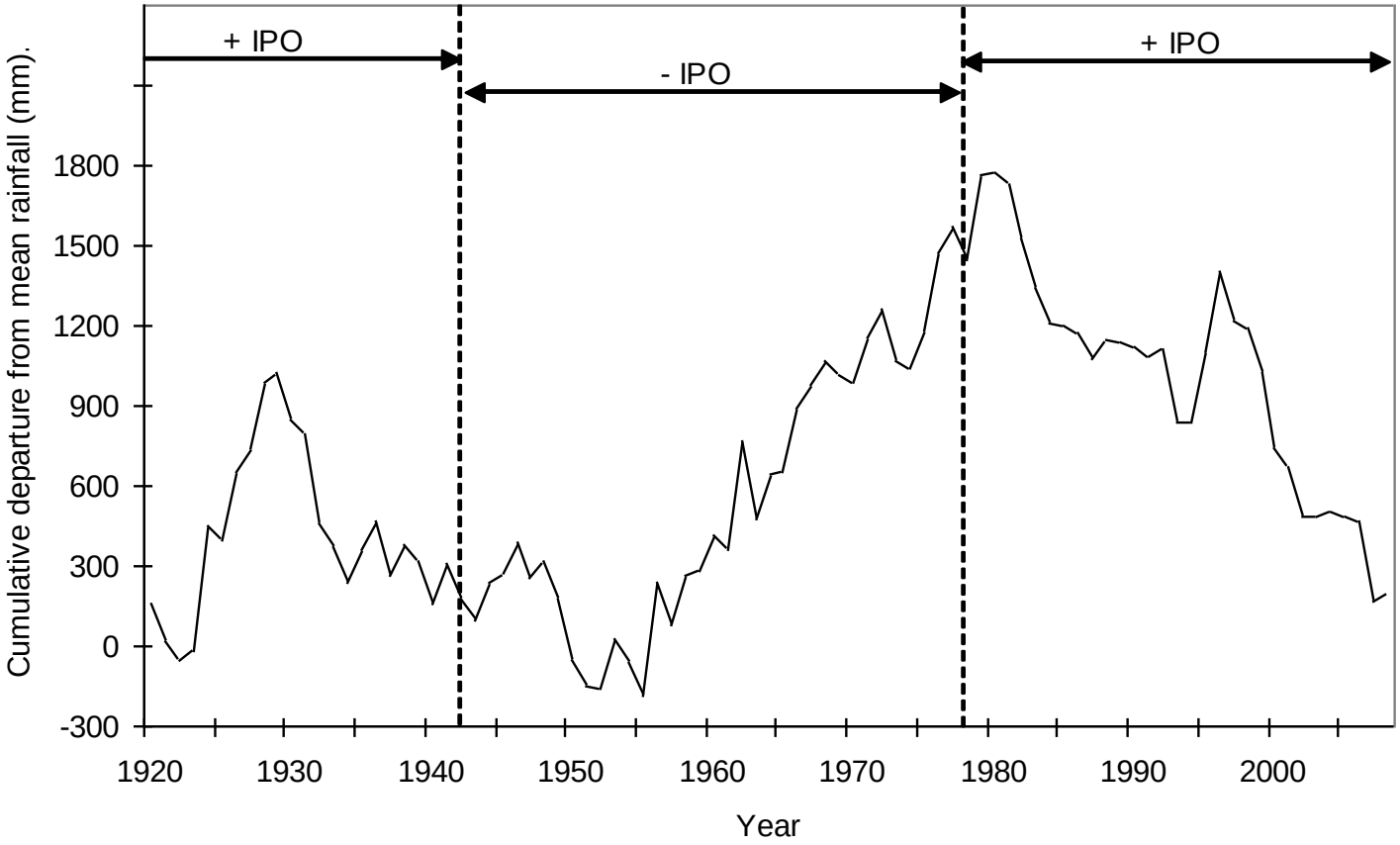


- Westerly wind
- 1000-1800 mm/yr for much of catchment
- Topographic influence on distribution
- Highest rainfall in winter (June – Aug)
- Extremes anytime of year

Interdecadal Pacific Oscillation and Rainfall

- IPO climate cycles have some influence on rainfall

- Lower rainfall 1910-1945 & 1980-2008
- Greater rainfall 1945-1980

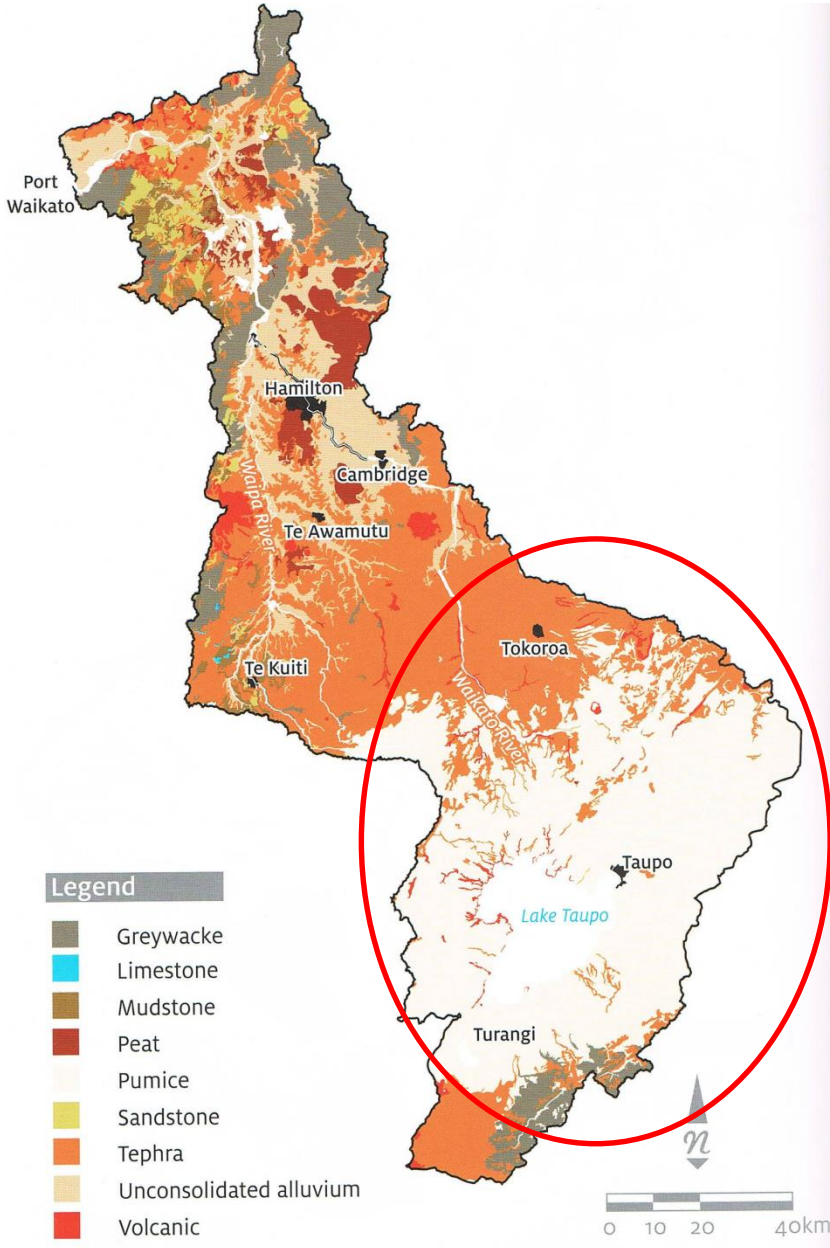


Evaporation

- 1 mm from Lake Taupo is equivalent to 7 m^3/s
- Loss from the River is quite small due to size of water surface compared to Lake Taupo

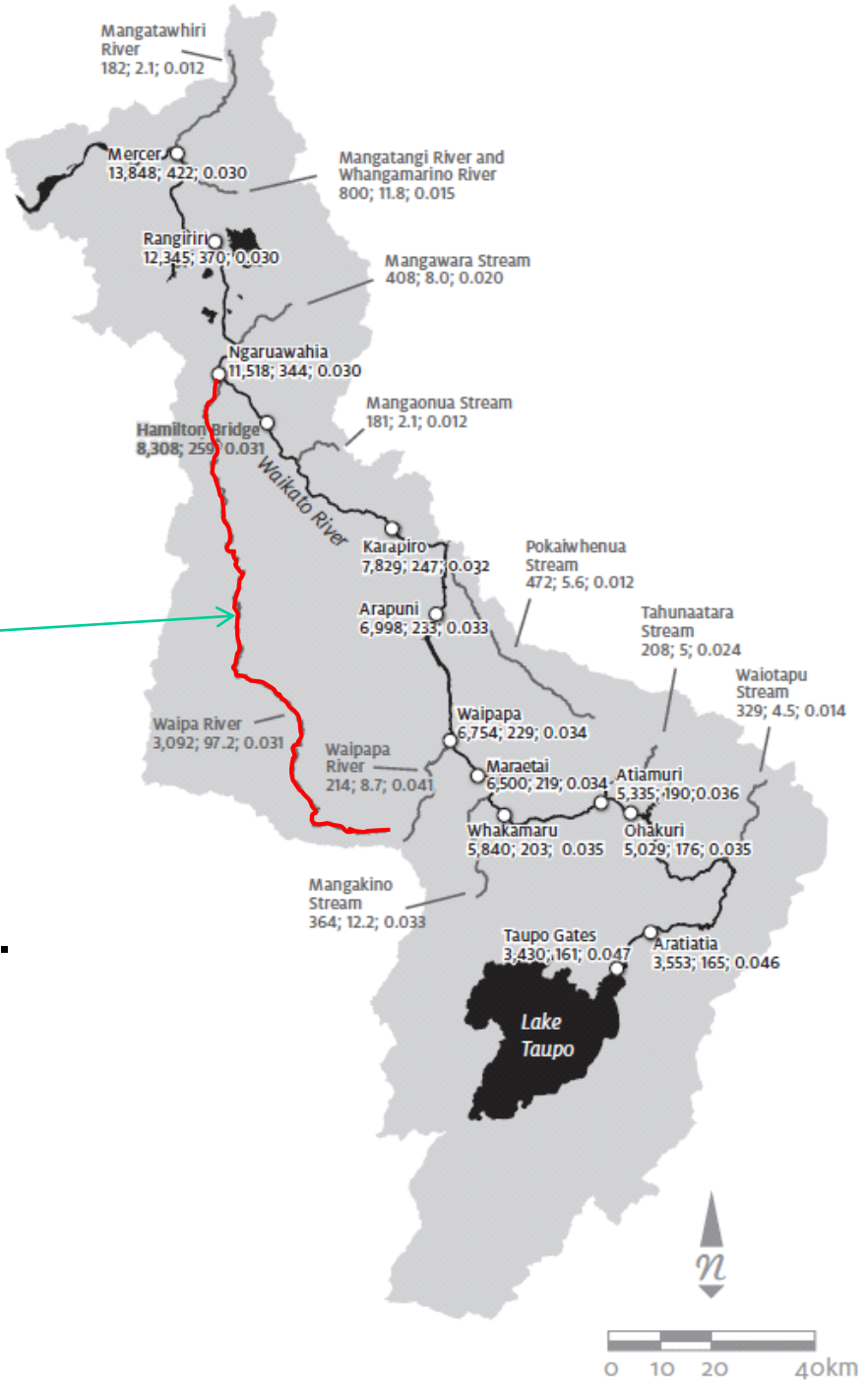
Groundwater

- Upper river is largely groundwater fed – sustained flows during droughts
- Large volcanic aquifers porous pumice and ignimbrites
- High infiltration rates

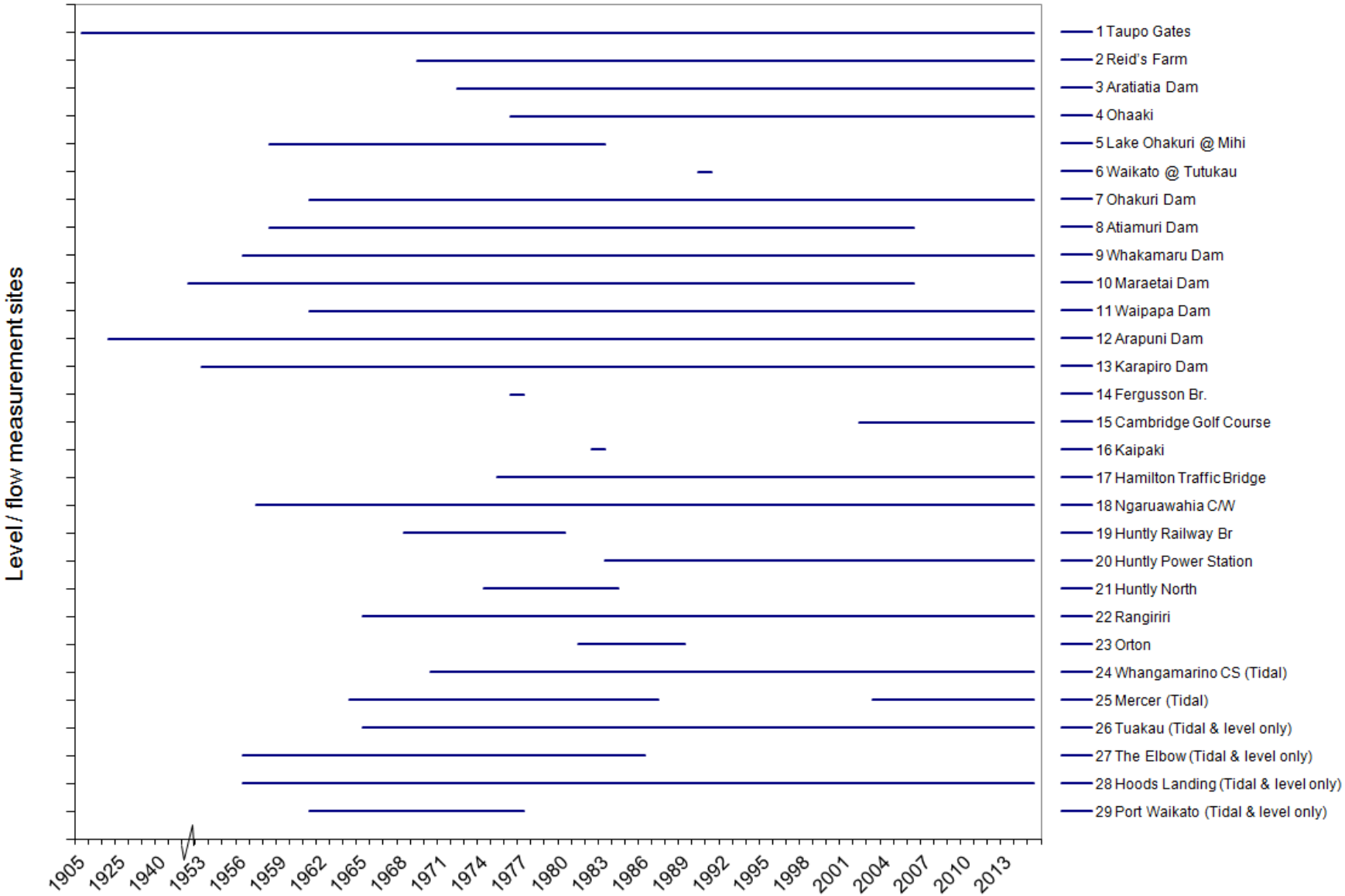


River flow - Tributaries

- 10 major tributaries
- Contribute 135 m^3/s
- Waipa largest 90 m^3/s
- During floods Waipa contributes 65% of flow but catchment is only 20% of area.



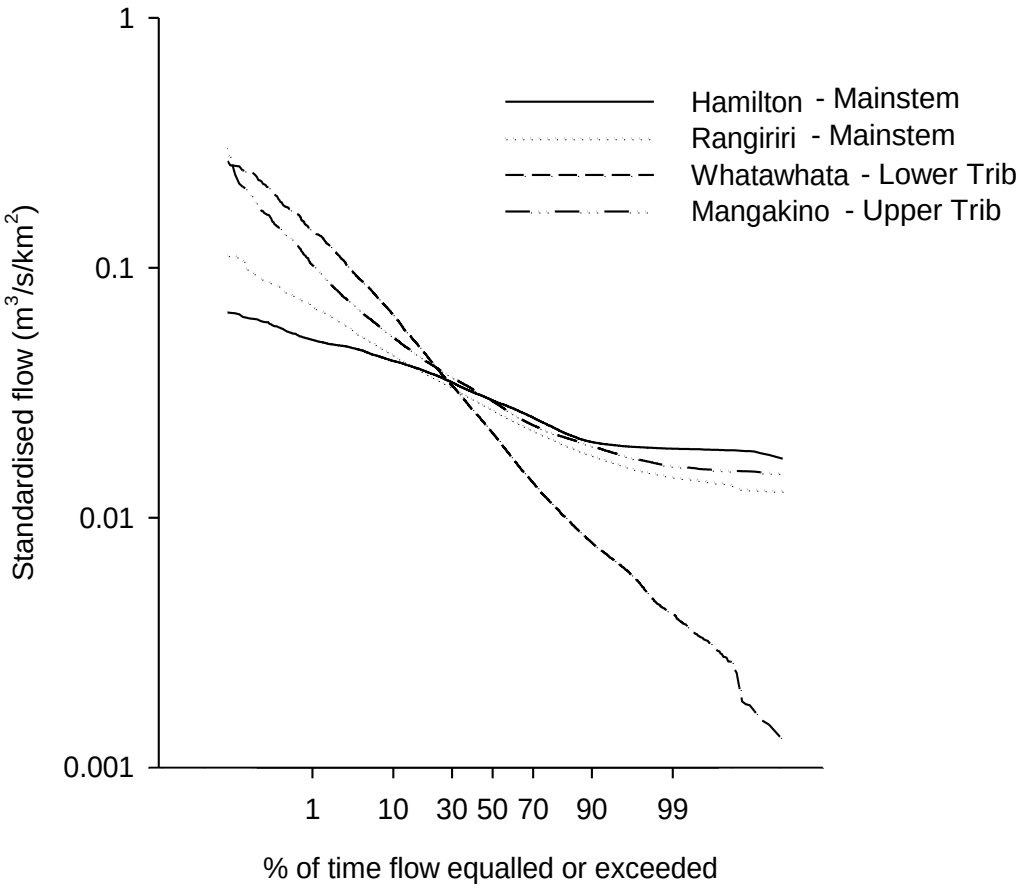
Main-stem flow measurement sites



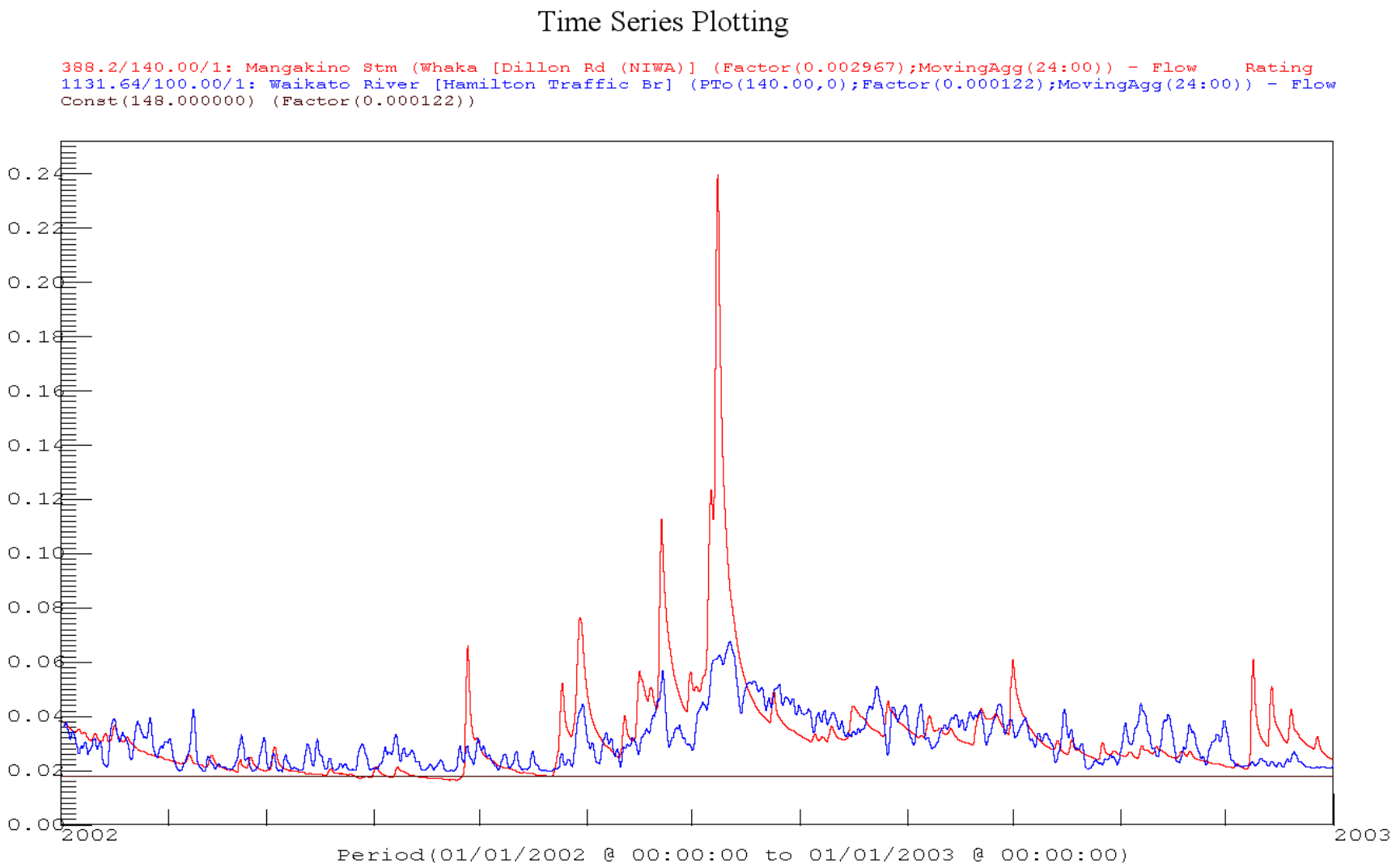
River flow - Regime

- Generally sustained baseflow and relatively subdued flood flows (pumice sediments and dams)
- Exceptions to this are in the tributaries of the lower river - less baseflow and larger floods

(tertiary siltstones)



River flow – Regime

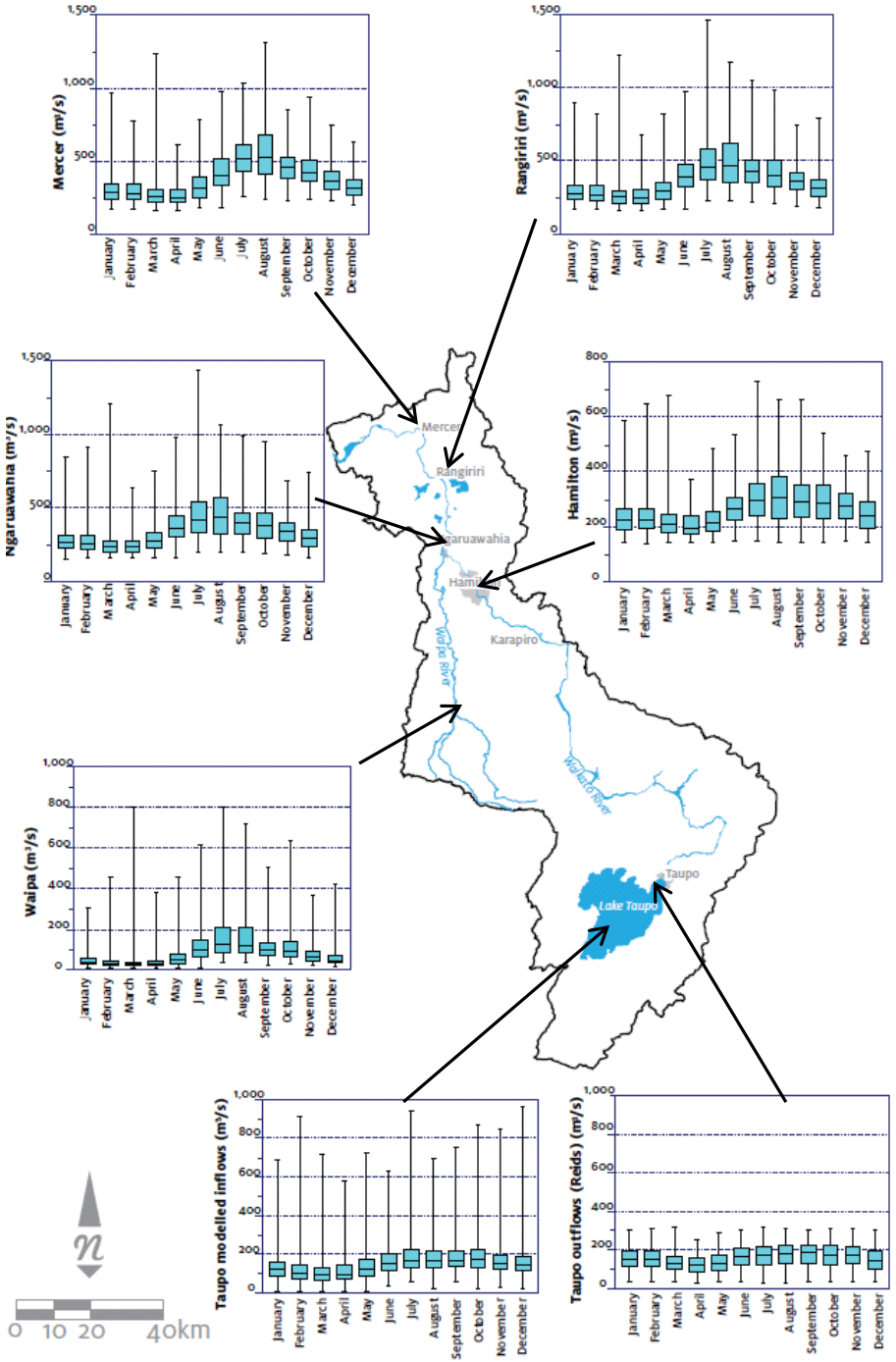


River flow - Regime

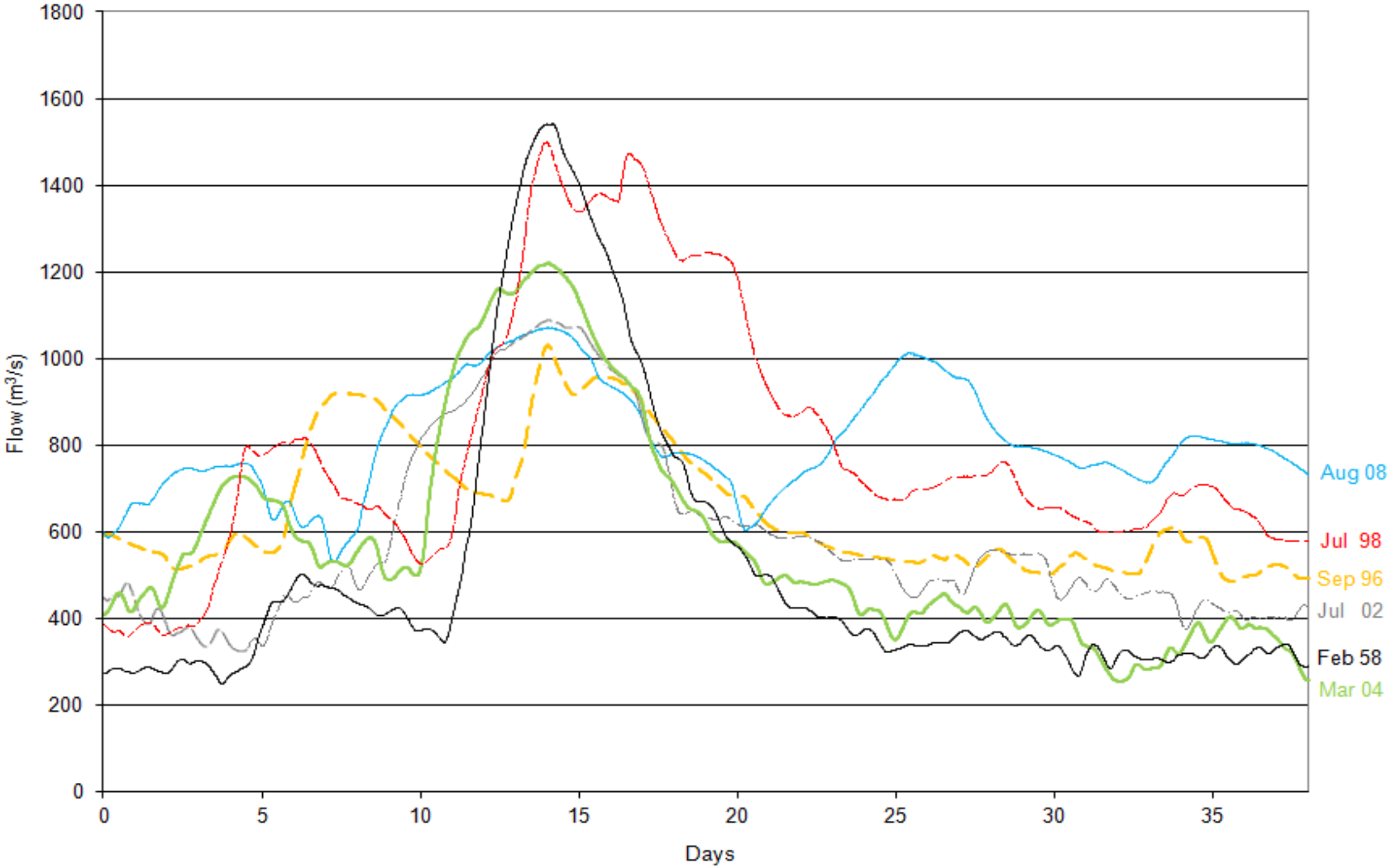
- Highest flows in winter
- Minor seasonal variability from Lake Taupo – control gates

  (Ave flow 160 m^3/s)
- Greatest seasonal variability in lower river

  (Average flow 425 m^3/s)
- High flood flows anytime of year



High flows



Hydrographs of six largest flood peaks at Ngaruawahia (1958–2008). Modified from Mighty River Power (2001)

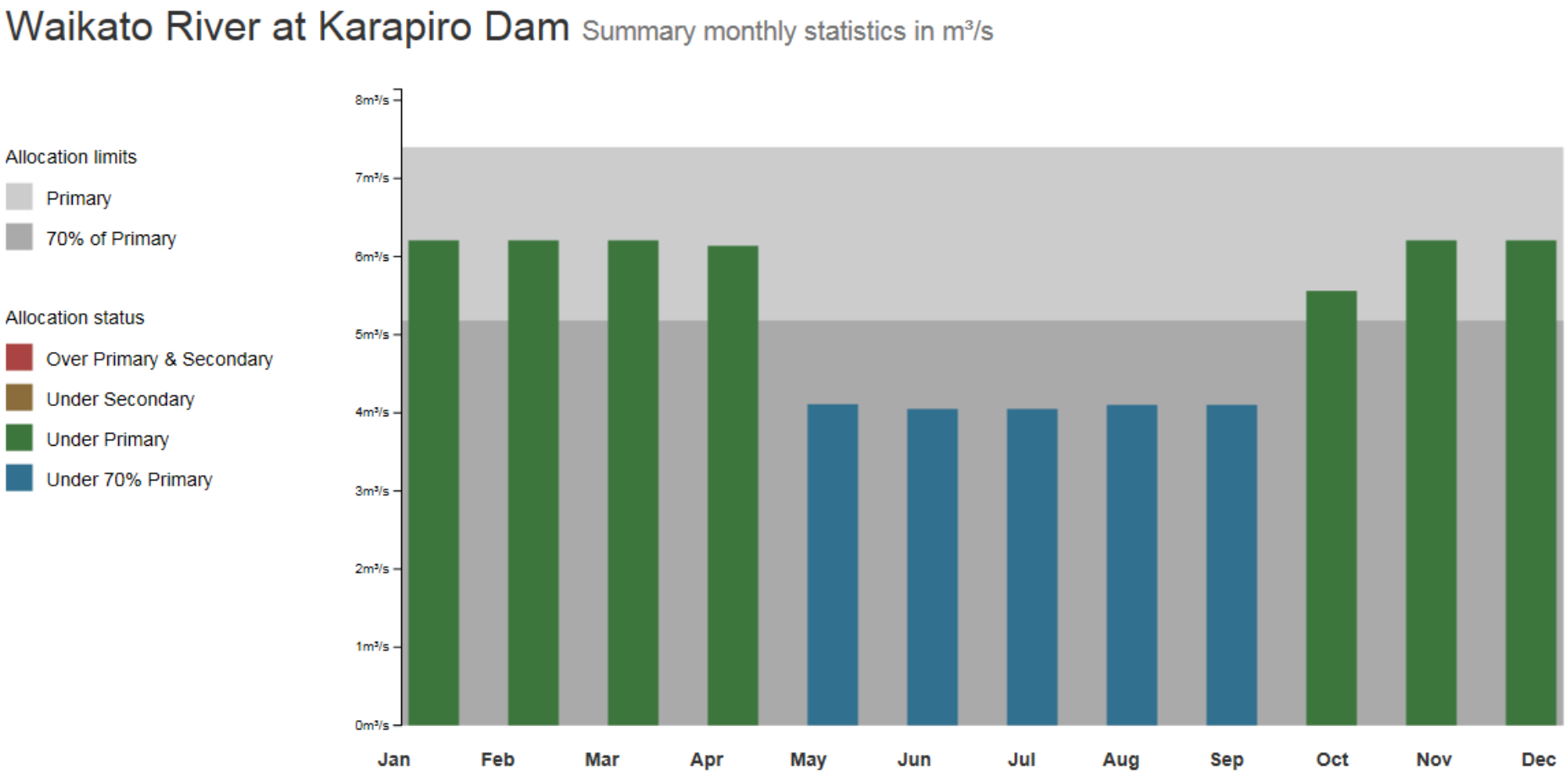
Water Allocation - Uses

- Nearly all water used is returned to river – non consumptive (2,900 m^3/s):
  - Hydro power generation
  - Power station and factory cooling and process
  - Each drop of river flow is used more than 7 times

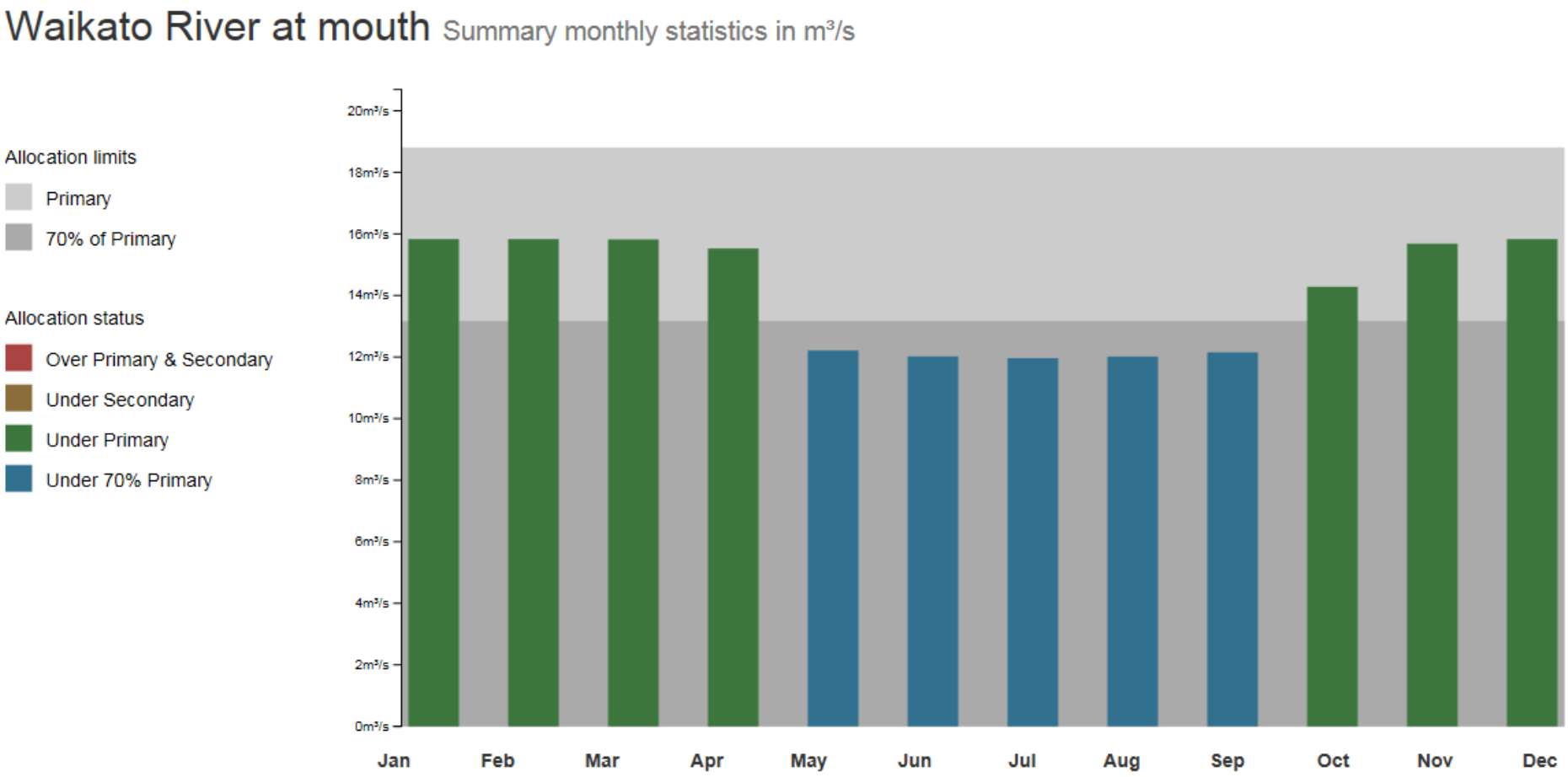
- Low level of consumptive use (16 m^3/s):
  - Pasture & horticulture irrigation
  - Stock water - Waikato Region supports 1/3 of NZ dairy cows
  - Provides water for NZ's largest (Auckland) and fourth largest (Hamilton) cities
  - Many industries – paper mills, milk factories, steel works…

- Groundwater is treated as a surface water take where the two systems are linked – especially upstream Karapiro Dam

Allocation State



Allocation State – Cont.



Water Allocation - Investigations

Timing for Investigations - Table 3-4a Waikato Regional Plan

Catchment or Sub-Region	Catchment Investigation Date - and on each 15th anniversary thereafter
Coromandel Peninsula (from the Waihou Catchment north)	1 July 2010
Waihou River including the sections of the streams which have their headwaters in the Waikato Region and their mouth in Bay of Plenty Region	1 July 2012
Piako River and all catchments flowing to the Firth of Thames along the Hunua and Hapuakohe Ranges	1 July 2014
West Coast (From Taranaki regional boundary to Auckland regional boundary excluding the Waikato Catchment)	1 July 2015
Waikato River (1) - Lake Taupo catchment above Huka Falls	1 July 2016
Waikato River (2) - Huka Falls to Karapiro Dam	1 July 2017
Waikato River (3) - Karapiro Dam to Ngaruawahia at confluence of Waipa (including the Waipa River)	1 July 2019
Waikato River (4) - Ngaruawahia at confluence of Waipa (excluding the Waipa River) to Mercer Bridge	1 July 2021
Waikato River (5) - Mercer Bridge to Waikato River Mouth	1 July 2023

Emerging issues

- Landuse change
  - Conversion from forest to pasture will see an increase in total flows and local flood peaks.
- Climate change
  - May see an increase in rainfall over next 20 to 30 years as the IPO changes from positive to negative.

End

- Thank you