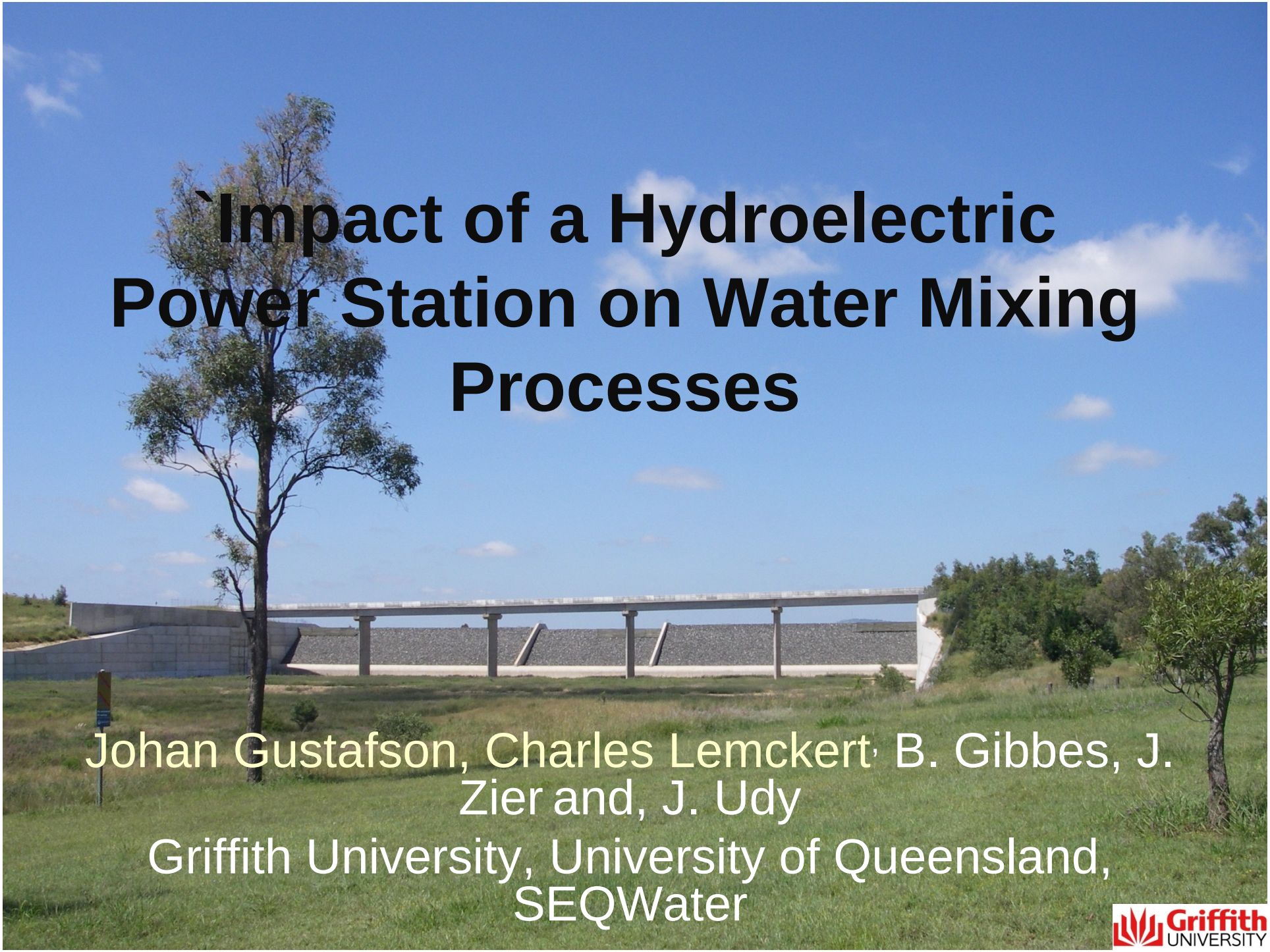
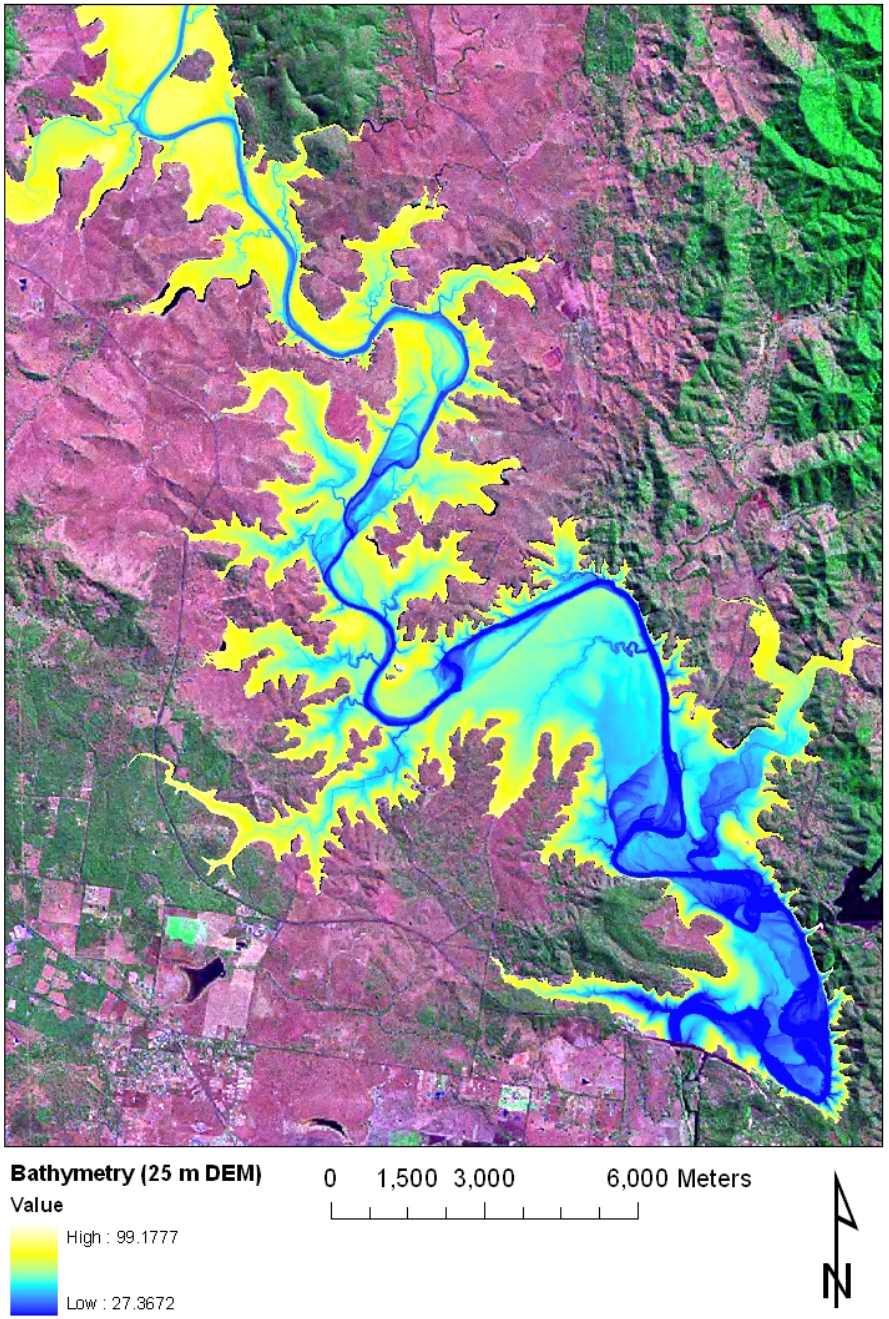


`Impact of a Hydroelectric Power Station on Water Mixing Processes

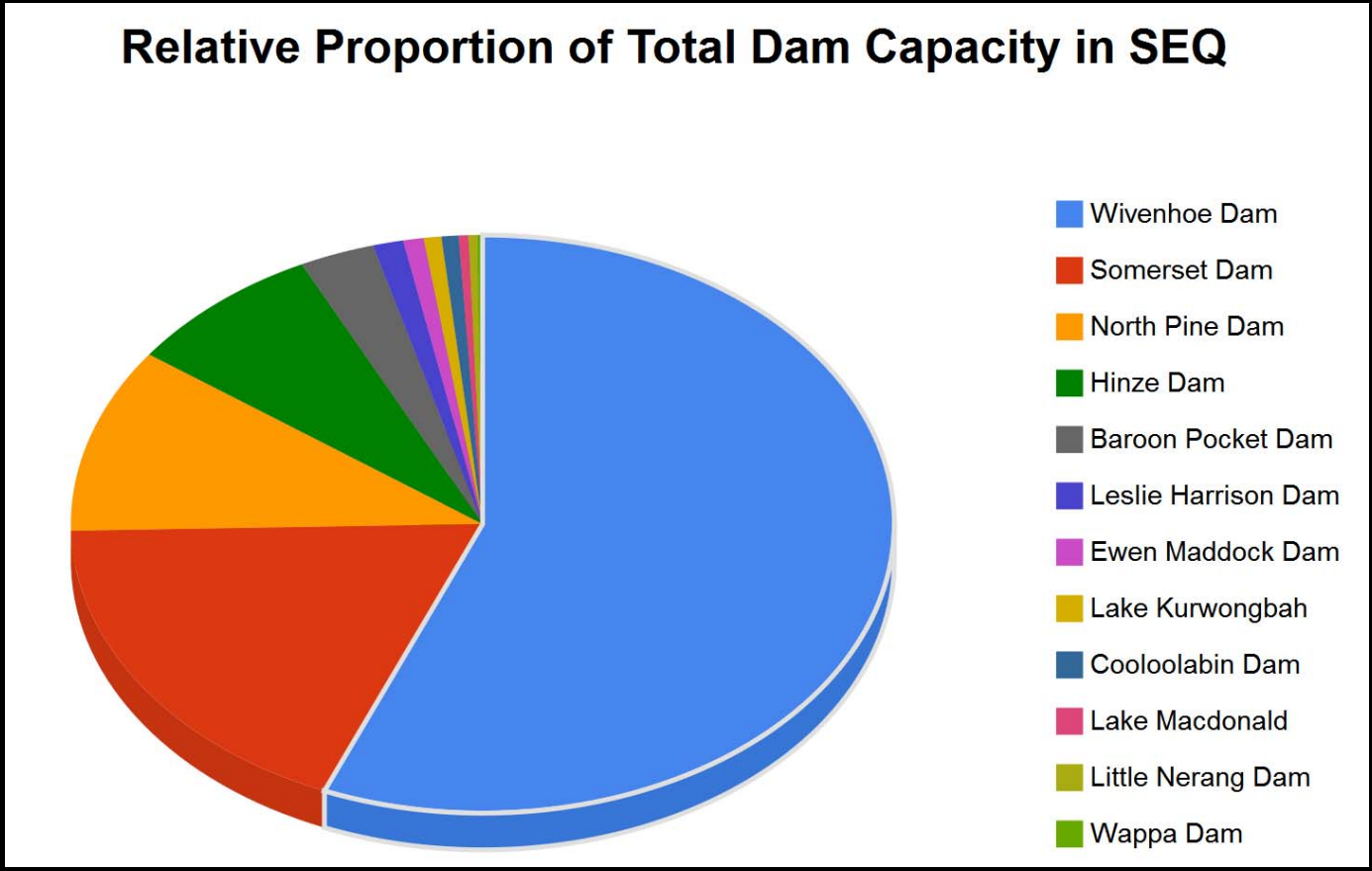
Johan Gustafson, Charles Lemckert, B. Gibbes, J. Zier and, J. Udy

Griffith University, University of Queensland, SEQWater

Wivenhoe Dam



Scale of Wivenhoe Dam



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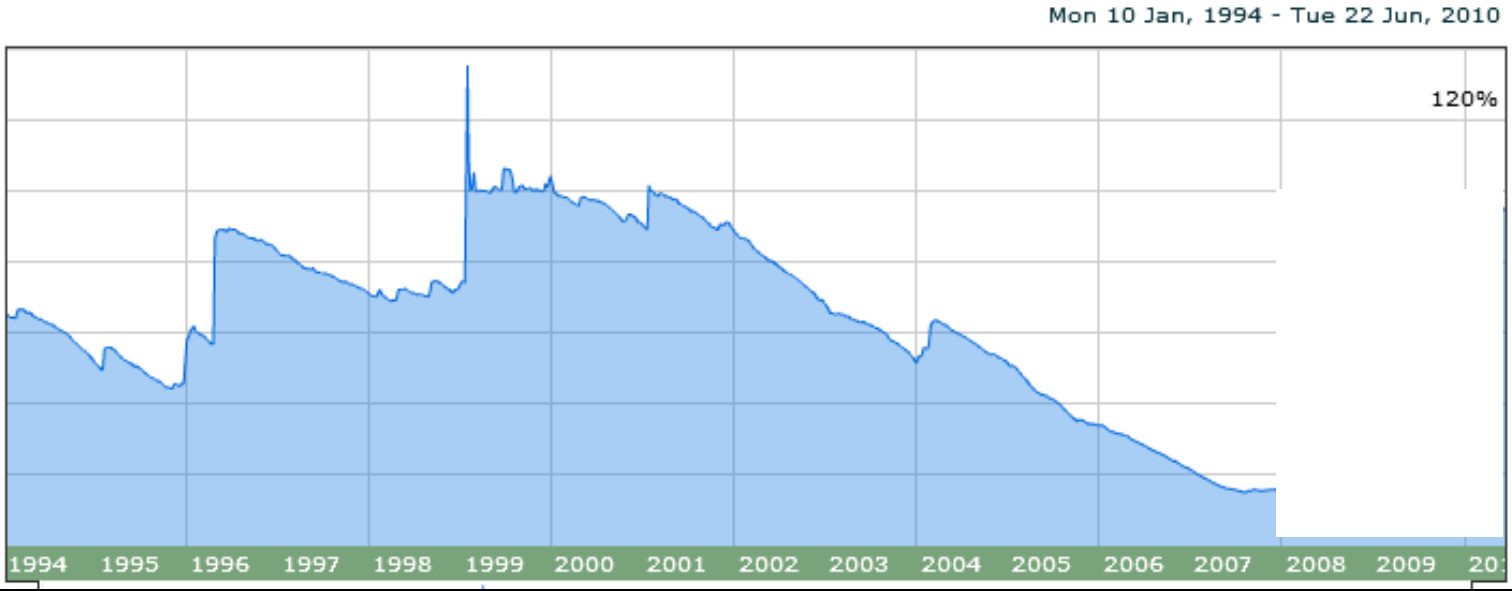
Historic water levels in Lake Wivenhoe



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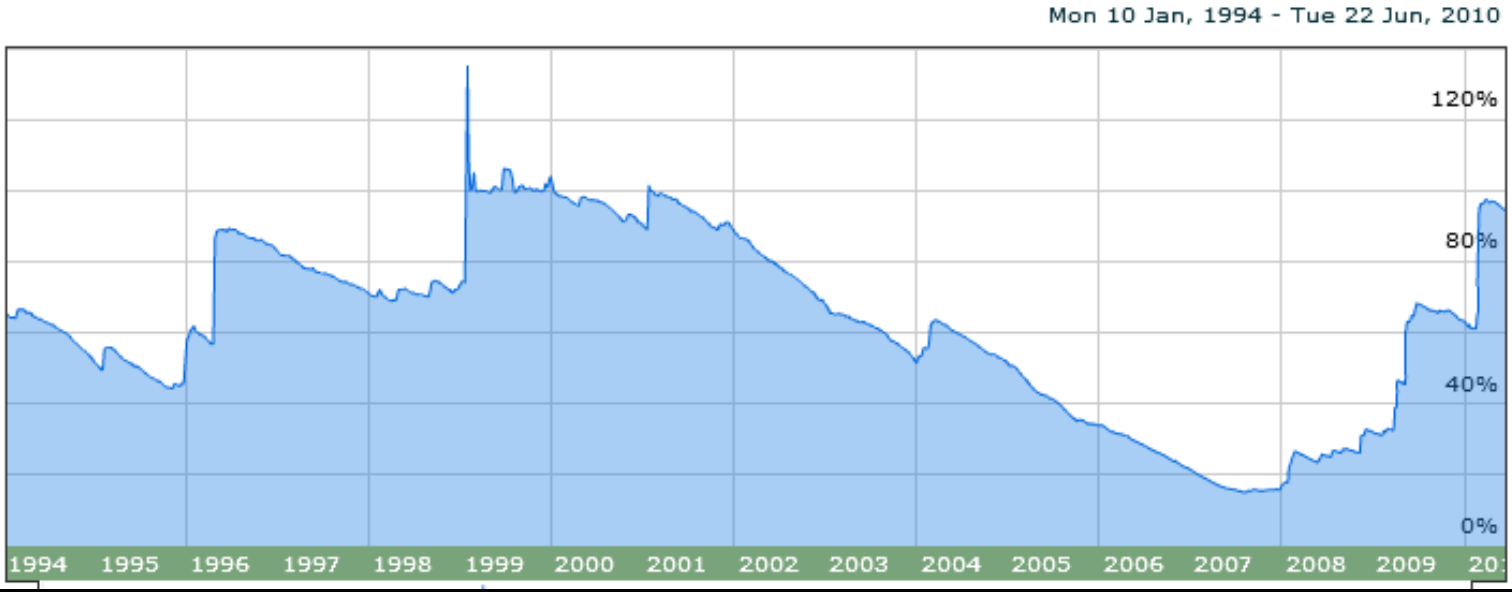
Historic water levels in Lake Wivenhoe



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Proposed Actions

- Water Restrictions
- Use of Evaporation Reduction Devices
  - Dam Covers
  - Dam Partitioning
  - Wind Breaks
- Use of Potable Recycled Water

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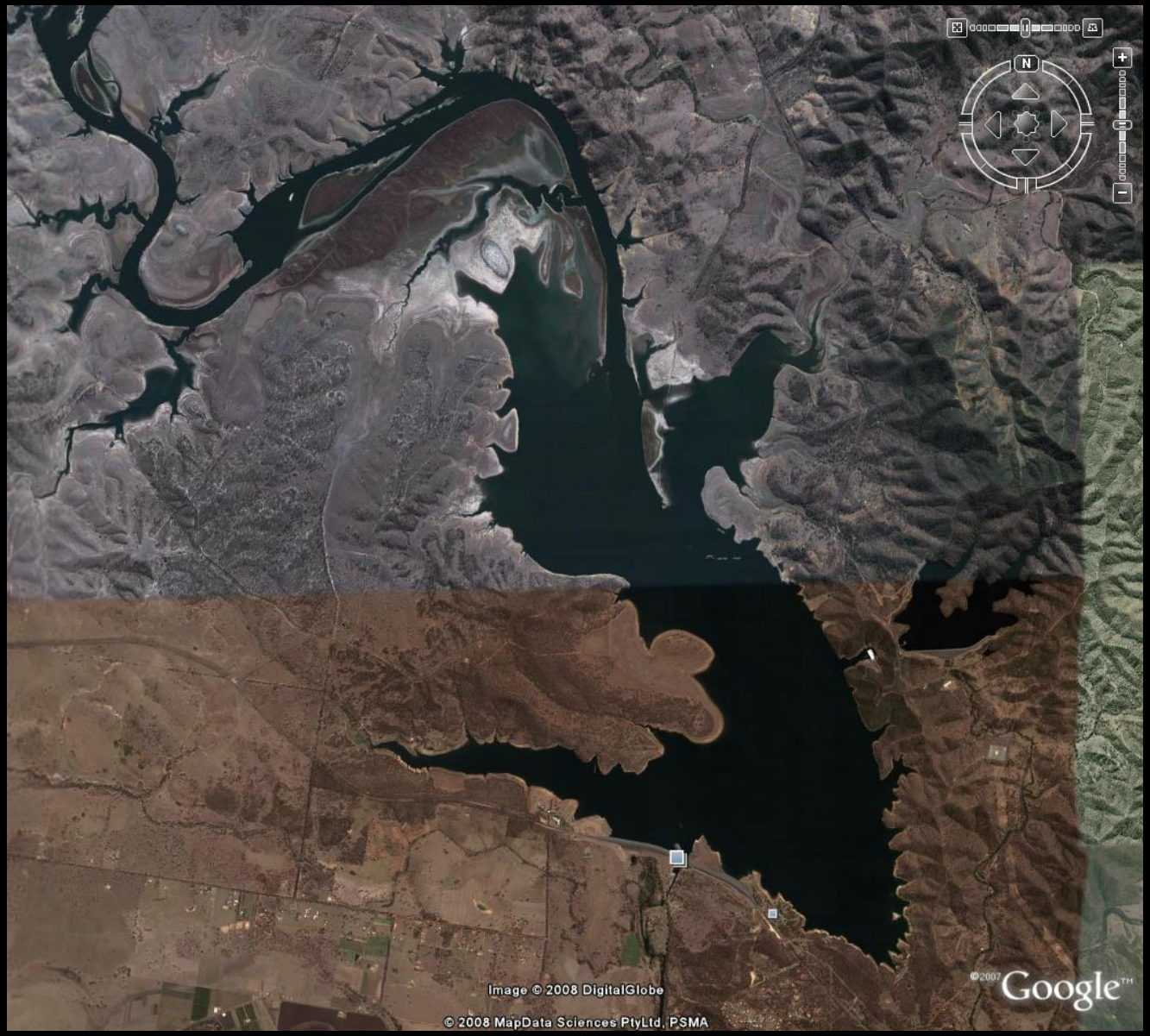

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Tarong Energy – Splityard Creek Hydroelectric Power Station

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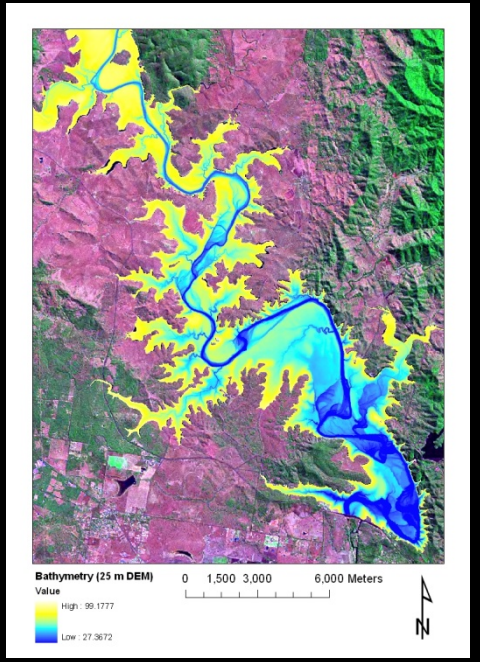
Hydraulic Conceptual model

- **Inflows**
  - Main river channel controlled by upstream dam
  - Side creeks flowing only during rain events
  - Direct rainfall onto water surface
  - Groundwater flows - unknown
- **Outflows**
  - Supply withdrawal and environmental release downstream
  - Groundwater discharge
  - Evaporation
- **Internal Recycling**
  - Wind driven mixing and advective cooling
  - **Power station – intermittent inflows and outflows**



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Measurements

- Power Station properties
- Flow measurements using
  - Transected ADCPs
  - Bottom mounted ADCPs
- Dye Tracer Study

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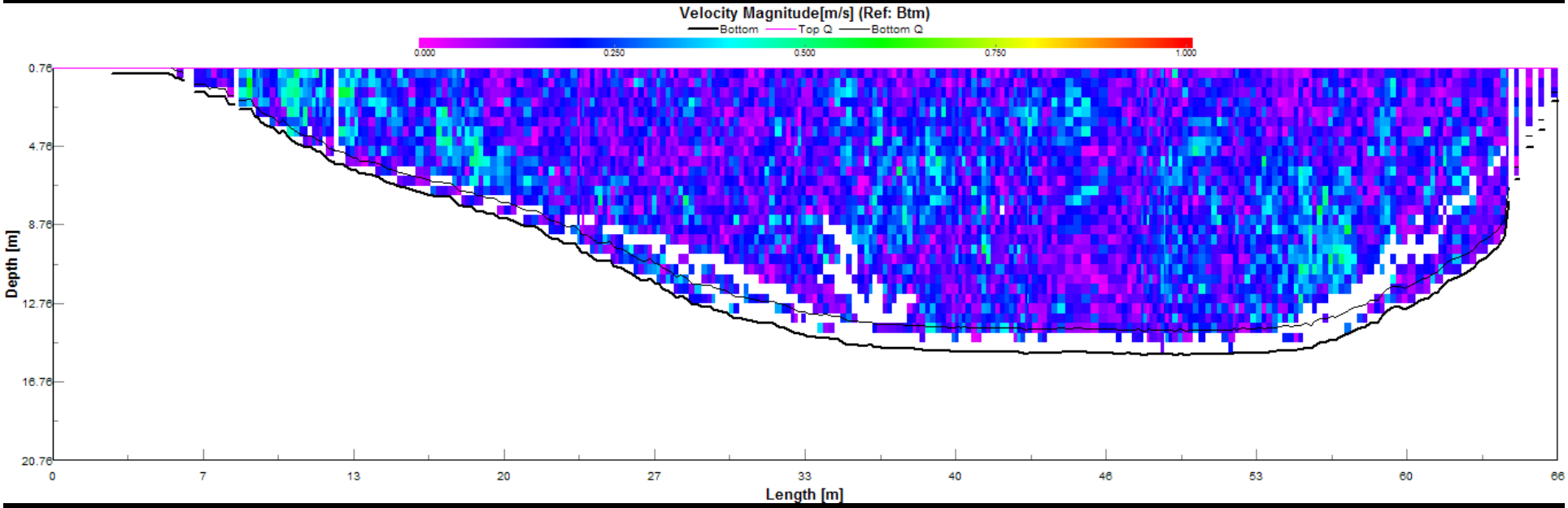
Power Station Not Operational



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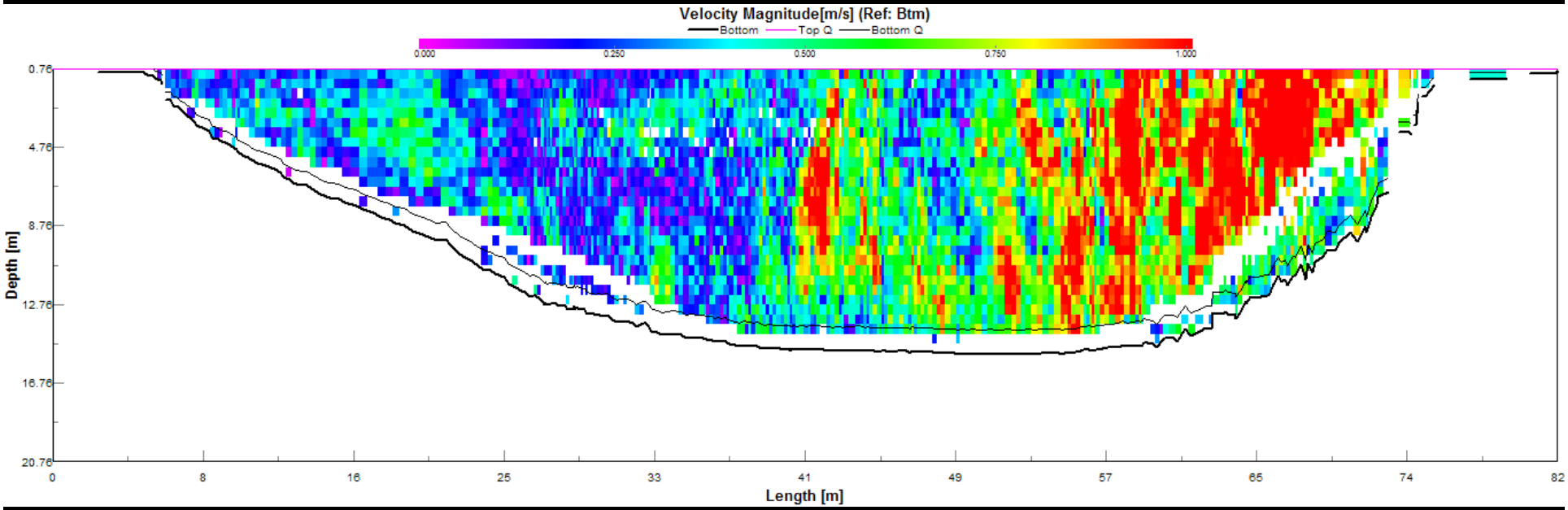
Power Station – Low Outflow



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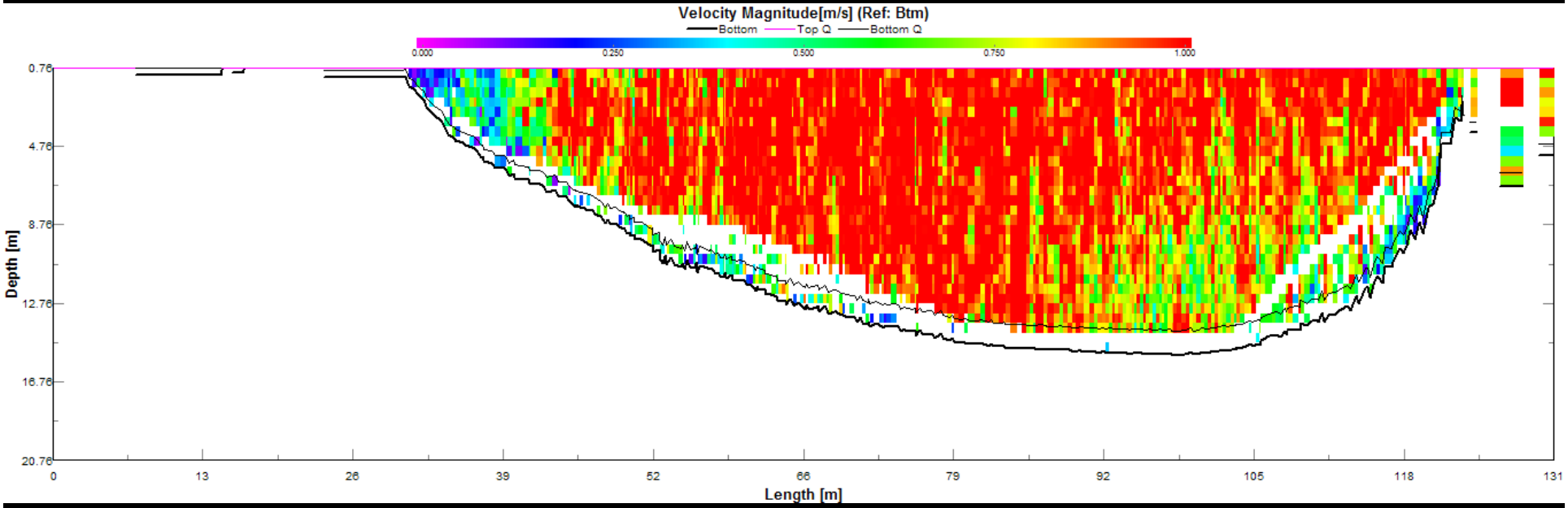
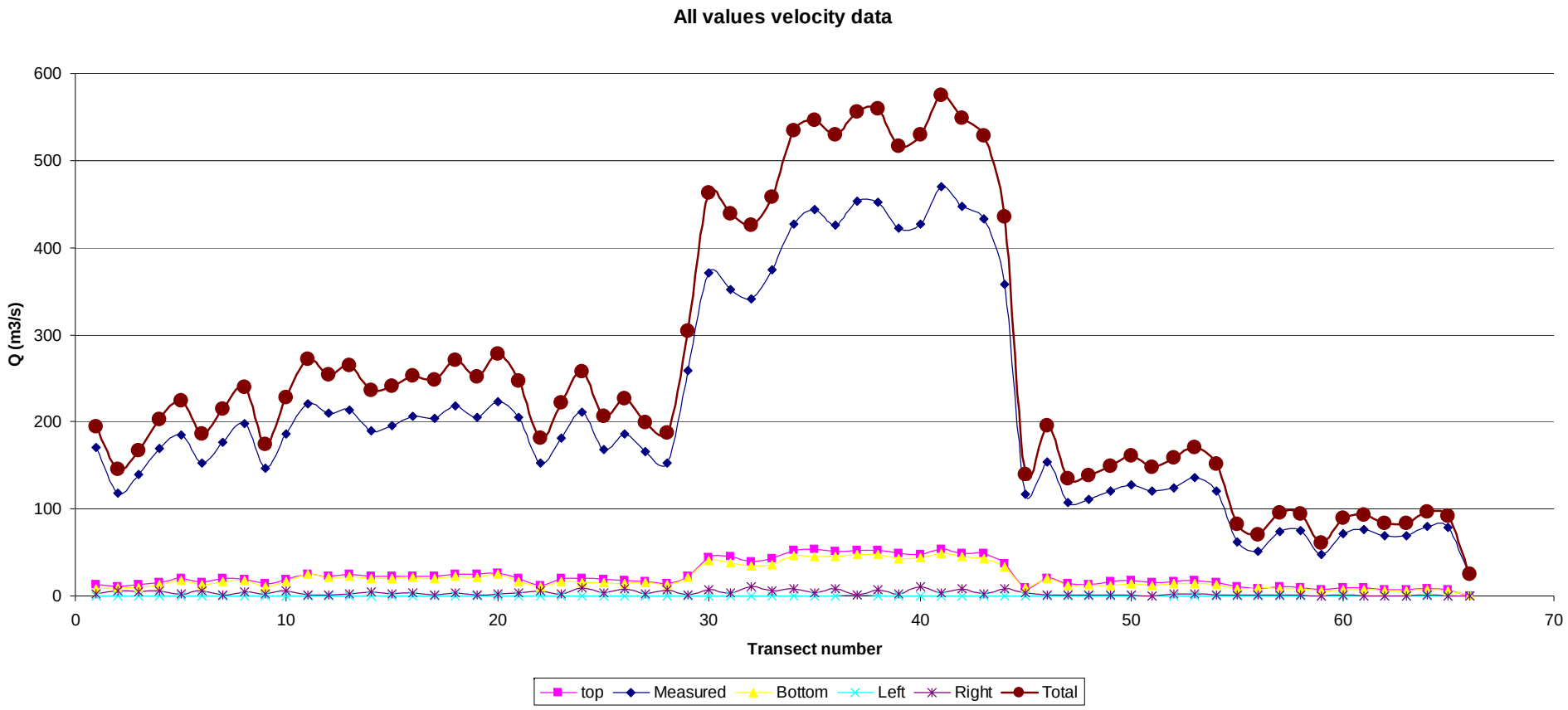
Power Station – High Outflow



Flows from Power Station



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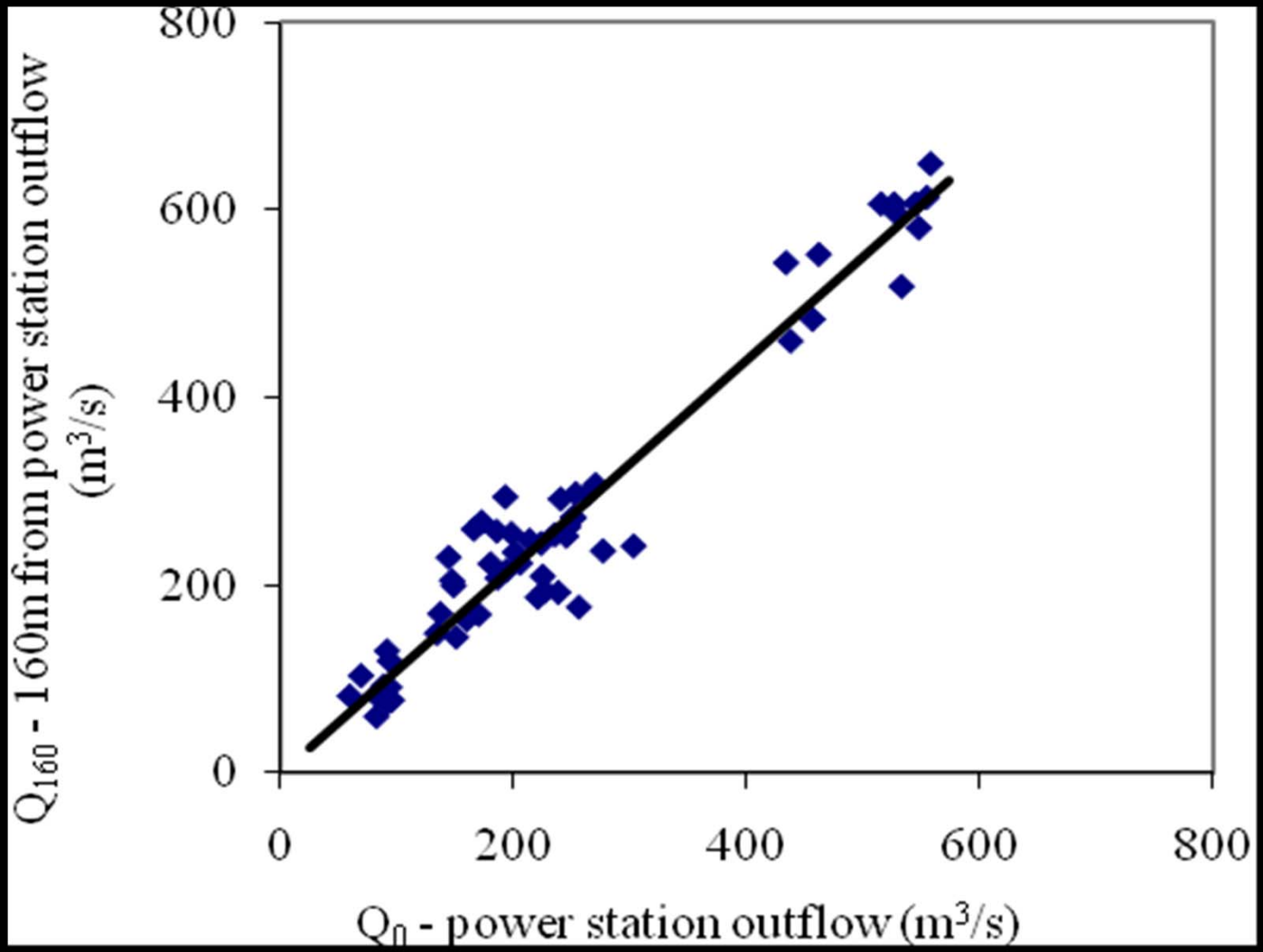
Near Field Dilution



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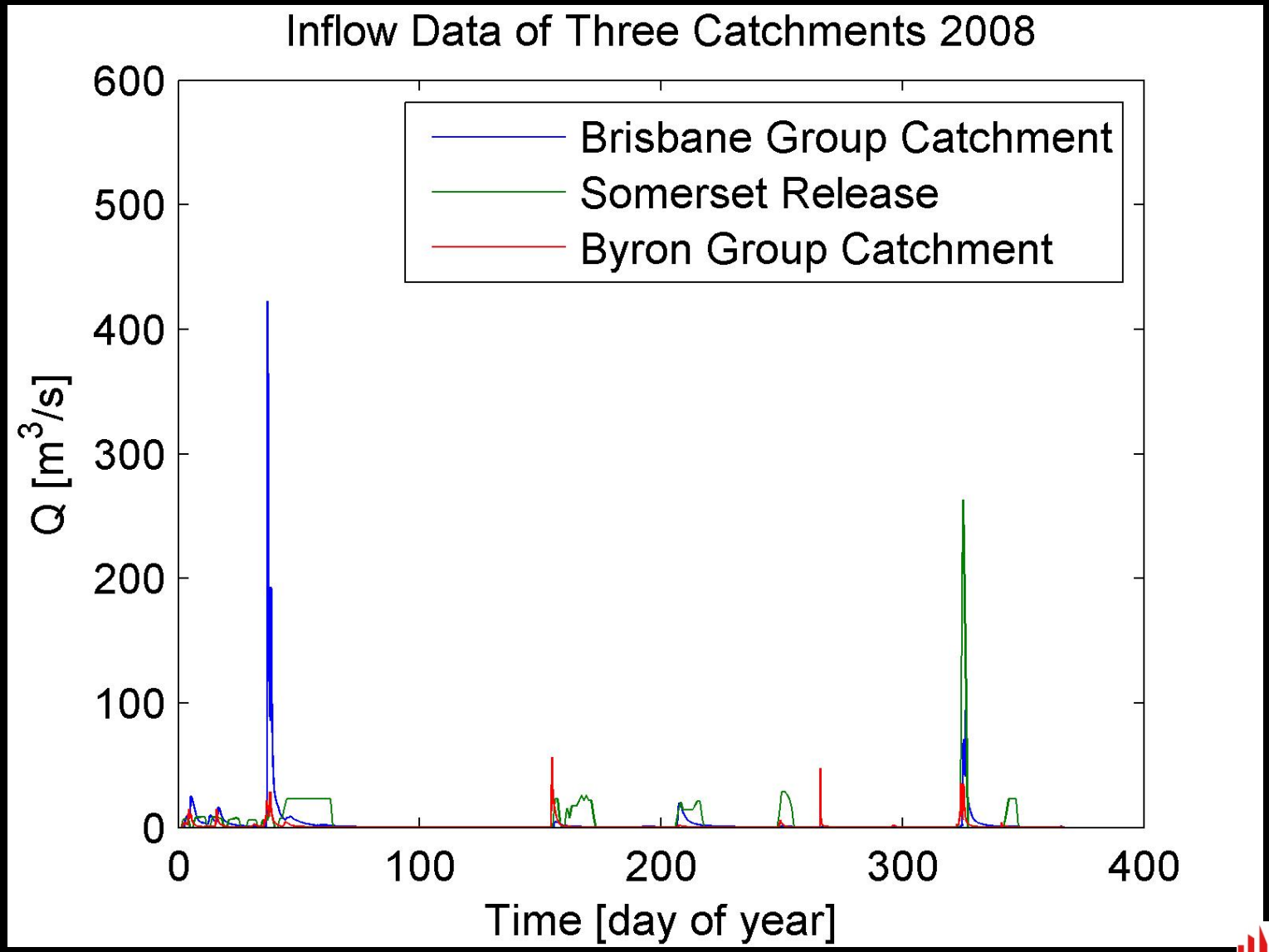
Natural Inflow Activity



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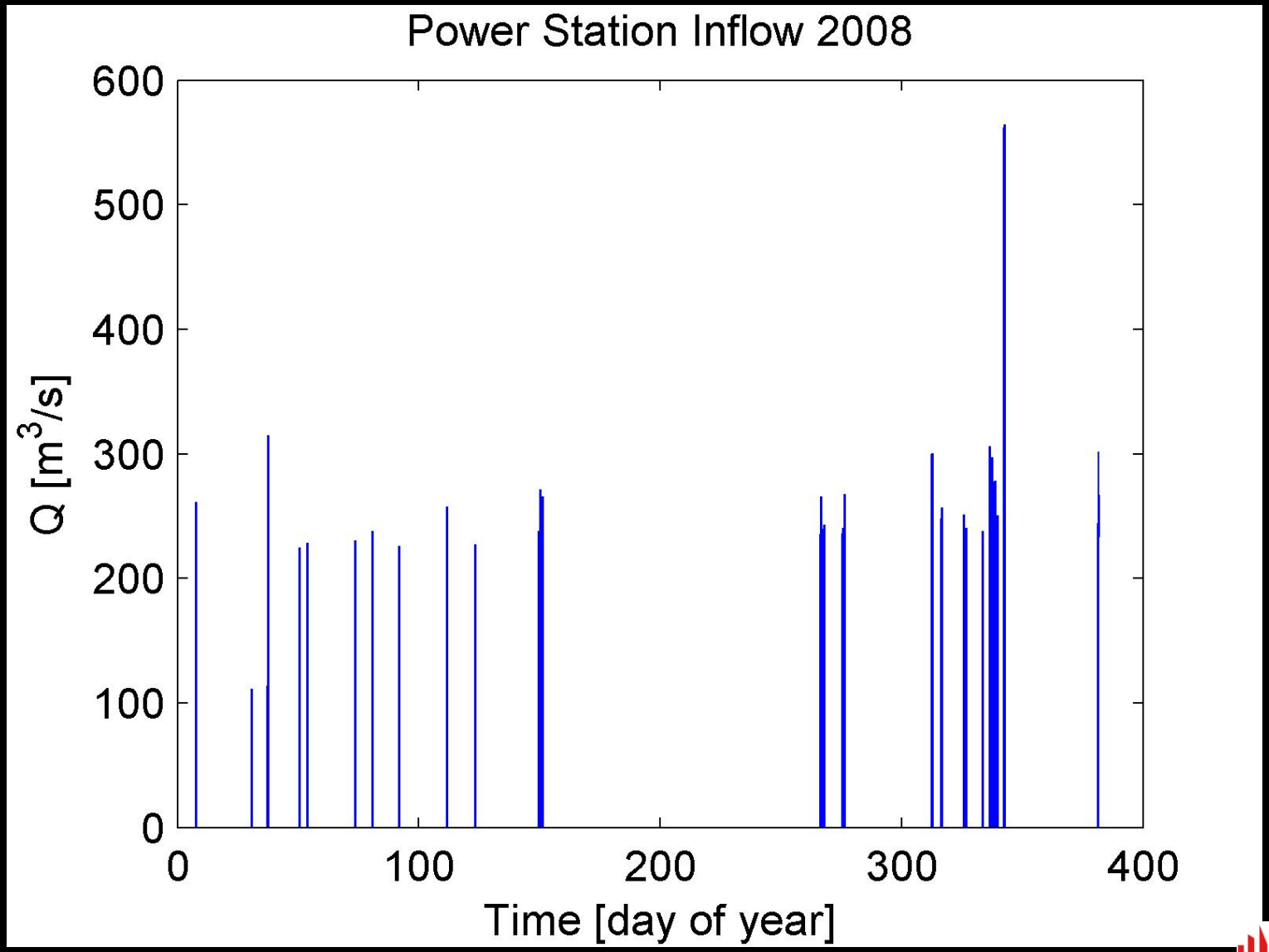
Power Station Inflow Activity



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Dye Study

- Power station released water at 100m^3/s
- Dye injected at 3m depth for 7 min
- Dye tracked using fluorometer with the aim to transect across the nose of the inflow at various distances from the release point

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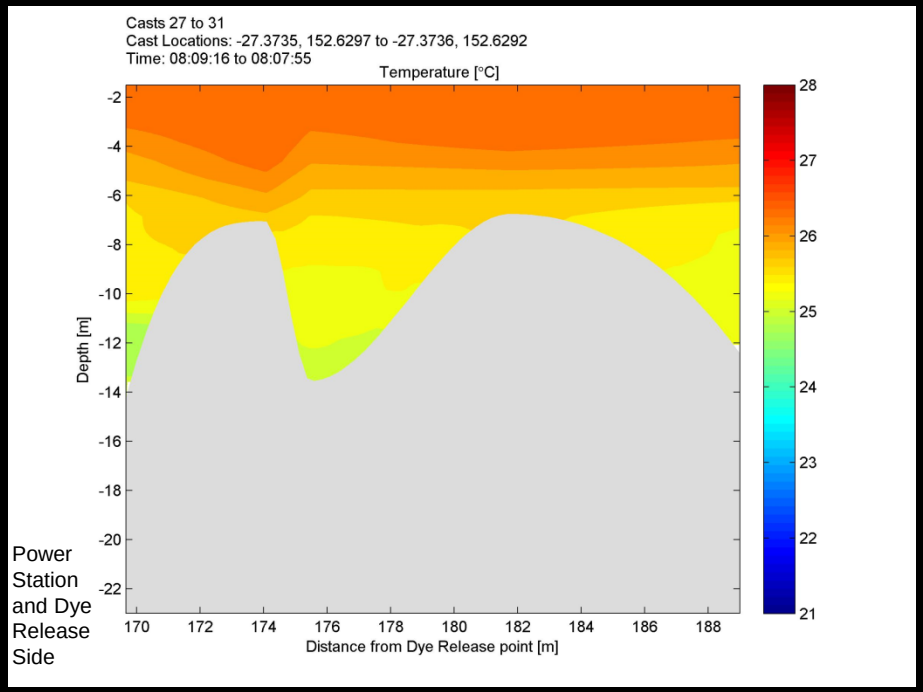
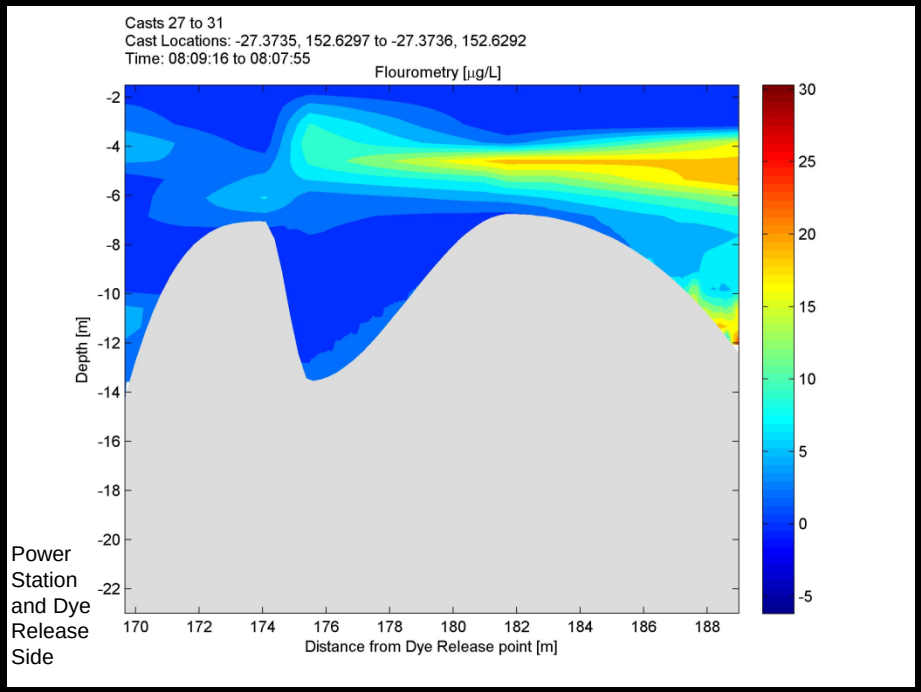
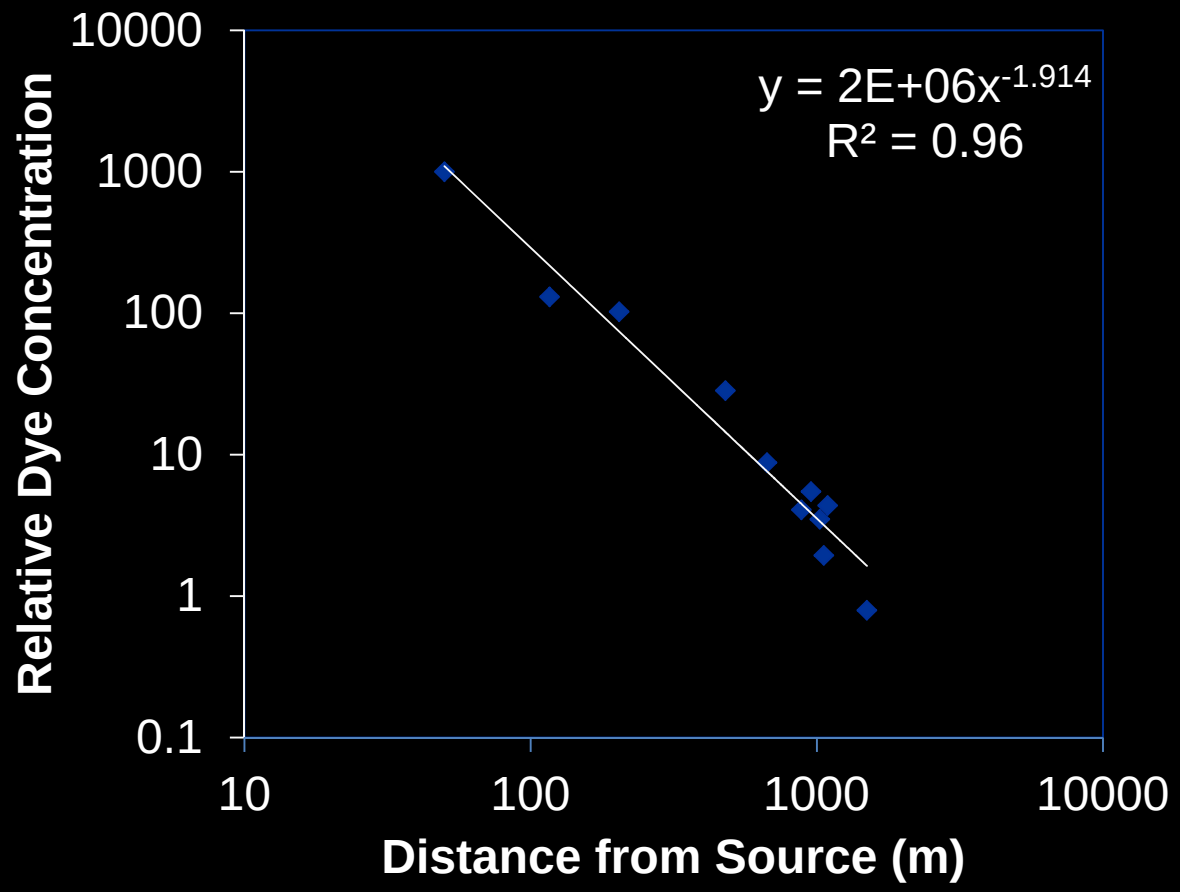
Dye Study of Water Released from Splityard Creek





Example of the concentration of dye released in the power station during an outflow even of 100m^3/s).

Peak Transect Concentration



Summary

- Flows (including mixing processes) within the water column are dominated by:
  - Water supply withdrawal
  - Natural inflows
  - Normal atmospheric forcing
  - Power station (inflow and outflow)