Committee G Environment –
Case studies involving planning, construction and operation of dams demonstrating environmental and social benefits

Environmental Aspects of Hydroelectric Power Production: River Scheme Operation and Fish Habitat: Campbell River Hydro-power Scheme, British Columbia, Canada

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With acknowledgement to BC Hydro

Definitions

- **Run of river** – little or no capacity to store or control the flow of water upstream of the power generation stations (except small pondage for peaking): the amount of electricity that can be produced depends on the daily flow of the river (The World Bank, 2012)

- Compared to **Peaking stations which** are designed to provide power when it is required. As such they tend to store water for use in generating power when required. This means that they tend to alter the natural hydrological regime of a river.

It is important that the station is operated with the impact of the associated environmental effects of operation in mind.

Environmental Effects

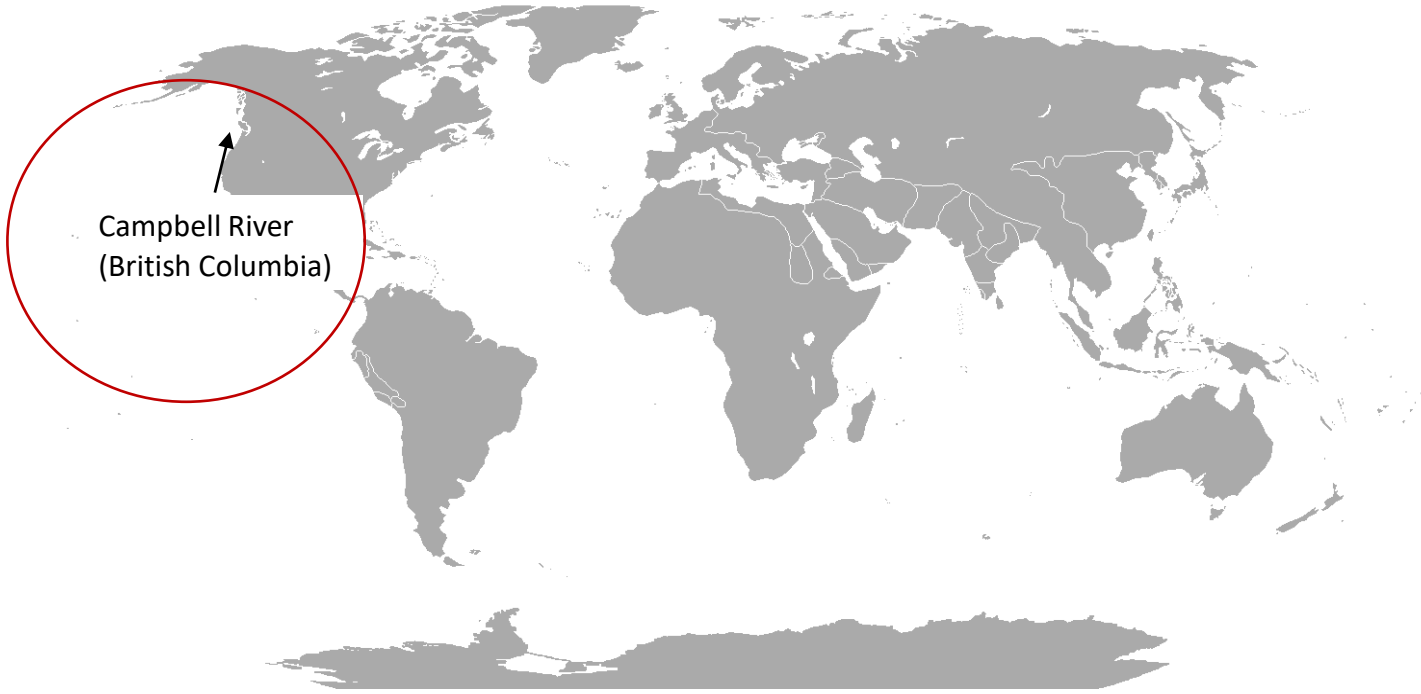
Environmental effects that may be considered include and are not limited to :

- Physical effects: rate of river shoreline inundation, sediment release, shoreline erosion,
- Biological effects: oxygen content, water temperature, flow rate
- Socio economic effects: impacts on public safety, agricultural and grazing practices, and on recreation.
- Cultural differences, indigenous or First Nation rights

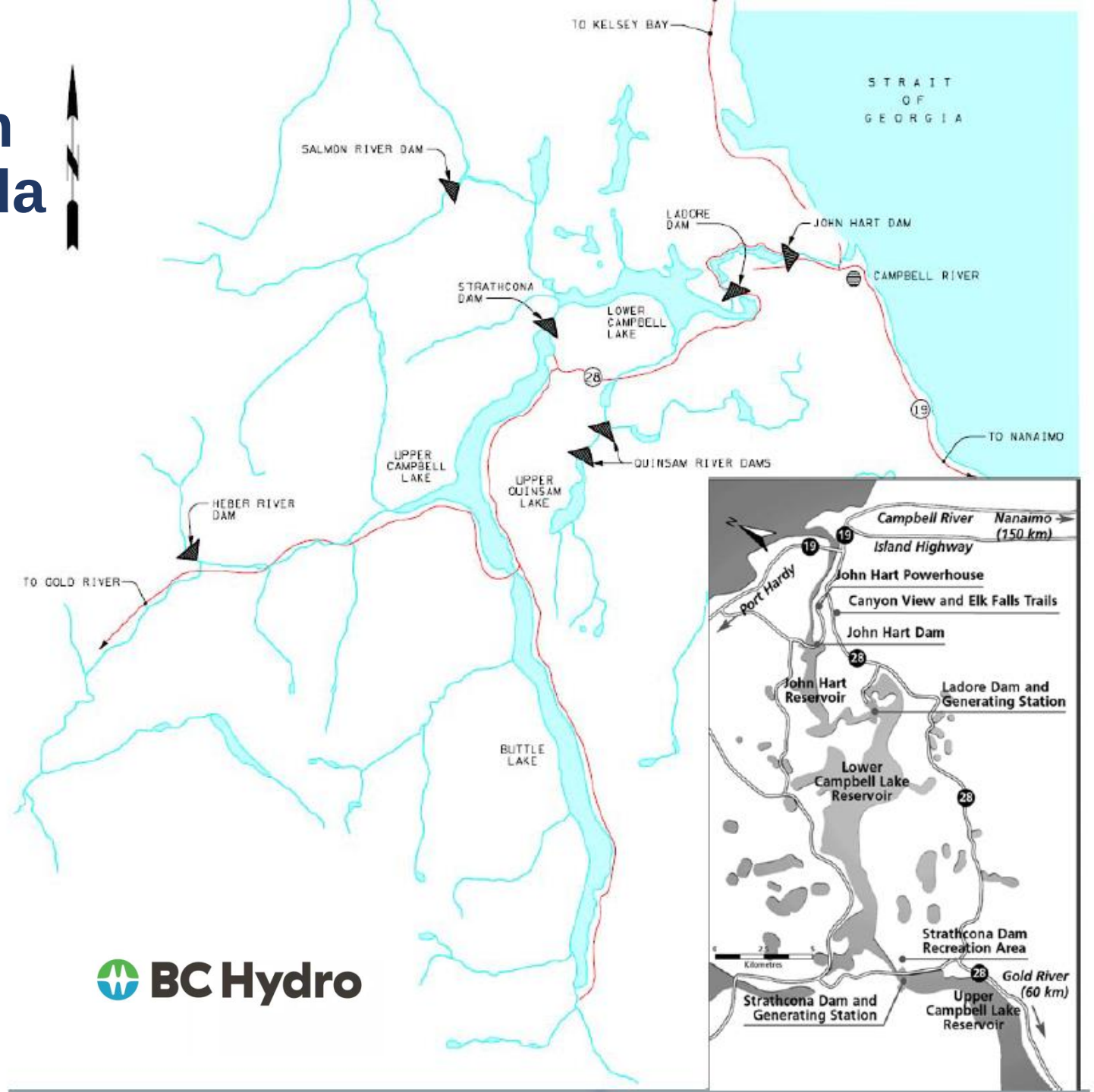
Case Study
Campbell River System

BC Hydro

- Six reservoirs and three hydropower stations
- Lower plants are run of river
- Strict licence controls on discharge based on improving fish habitat



Case Study
Campbell River System
British Columbia, Canada



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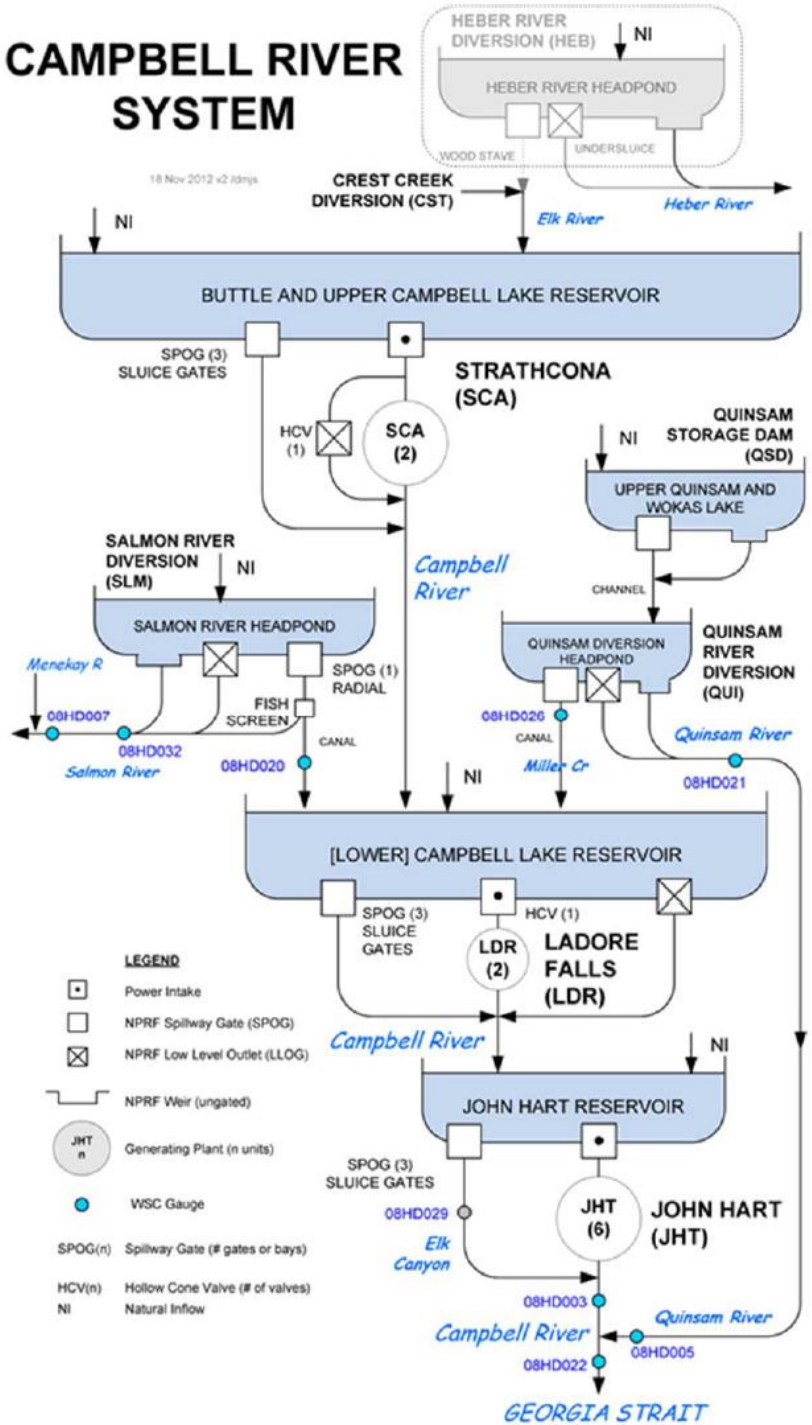


BC Hydro

Hydropower Operation

- Integrated generating system
- Lower reservoirs operate run of river
- Very little local runoff at lower reservoirs
- Water Use Plan (WUP) completed in 2004 with objective of “positive effect on fisheries and wildlife habitat, shoreline erosion, flood control and recreation interests”
- Endeavour to use available inflow for generation minus that required for fisheries flow
- Effect of WUP on overall generation expected to be minimal
- Maximum discharges and reservoir range set for each station
- Diversions utilised to maintain desired flows
- Ramping rates set by WUP

Hydropower Operation

Priorities for Operation

i. Dam safety is always first priority

ii. Maintain minimum fisheries flow requirements for Salmon and Quinsam Rivers and Elk Falls Canyon

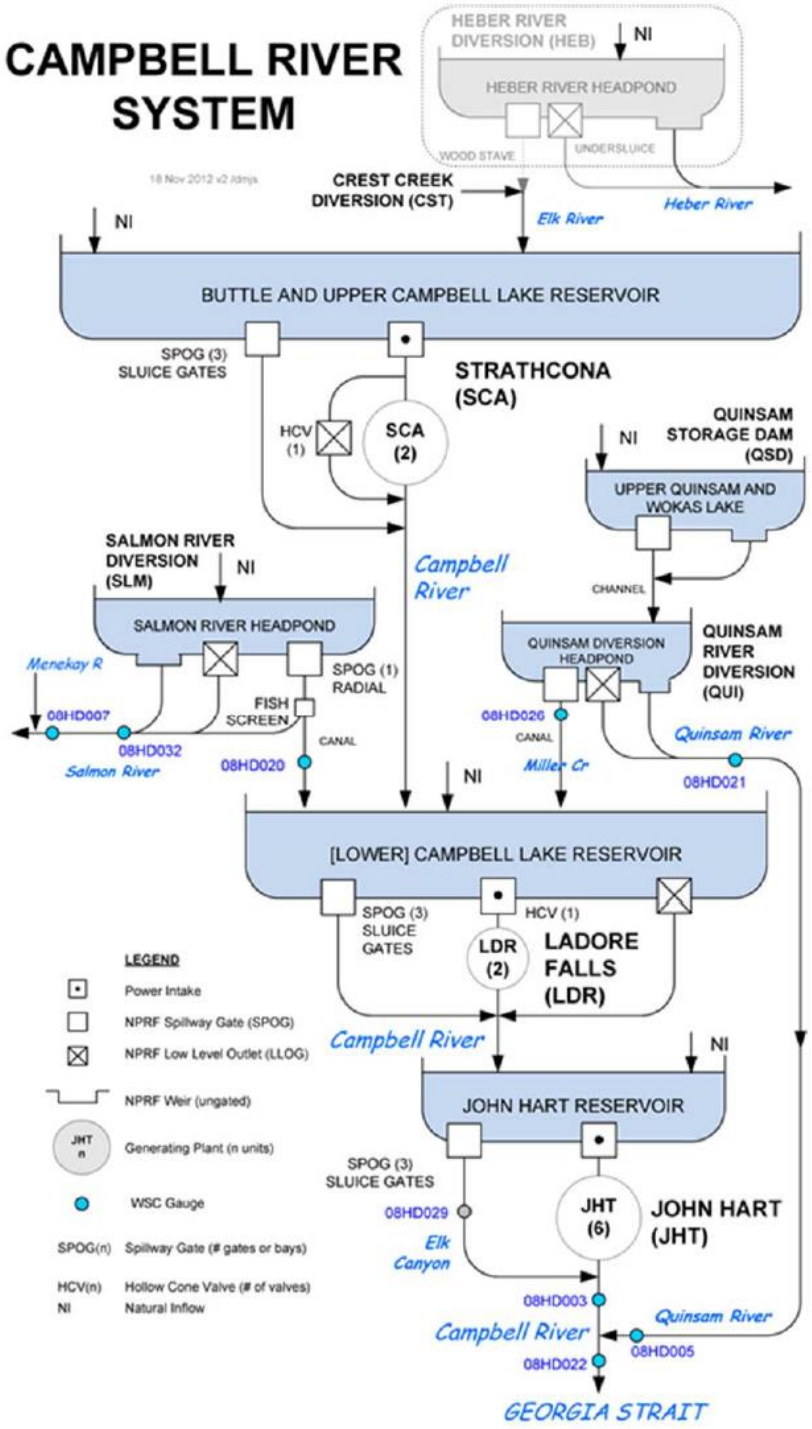
iii. Manage high flows and reservoir routing criteria according to rules in WUP

iv. Operate Strathcona, Ladore and John Hart stations to manage flow in Lower Campbell River to preferred range in WUP.

v. Maintain all specified ramping rates

vi. Operate Strathcona, Ladore and John Hart stations to manage level of Upper Campbell Reservoir to preferred range in WUP.

vii. Operate Strathcona, Ladore and John Hart stations to manage level of Lower Campbell Reservoir to preferred range in WUP.

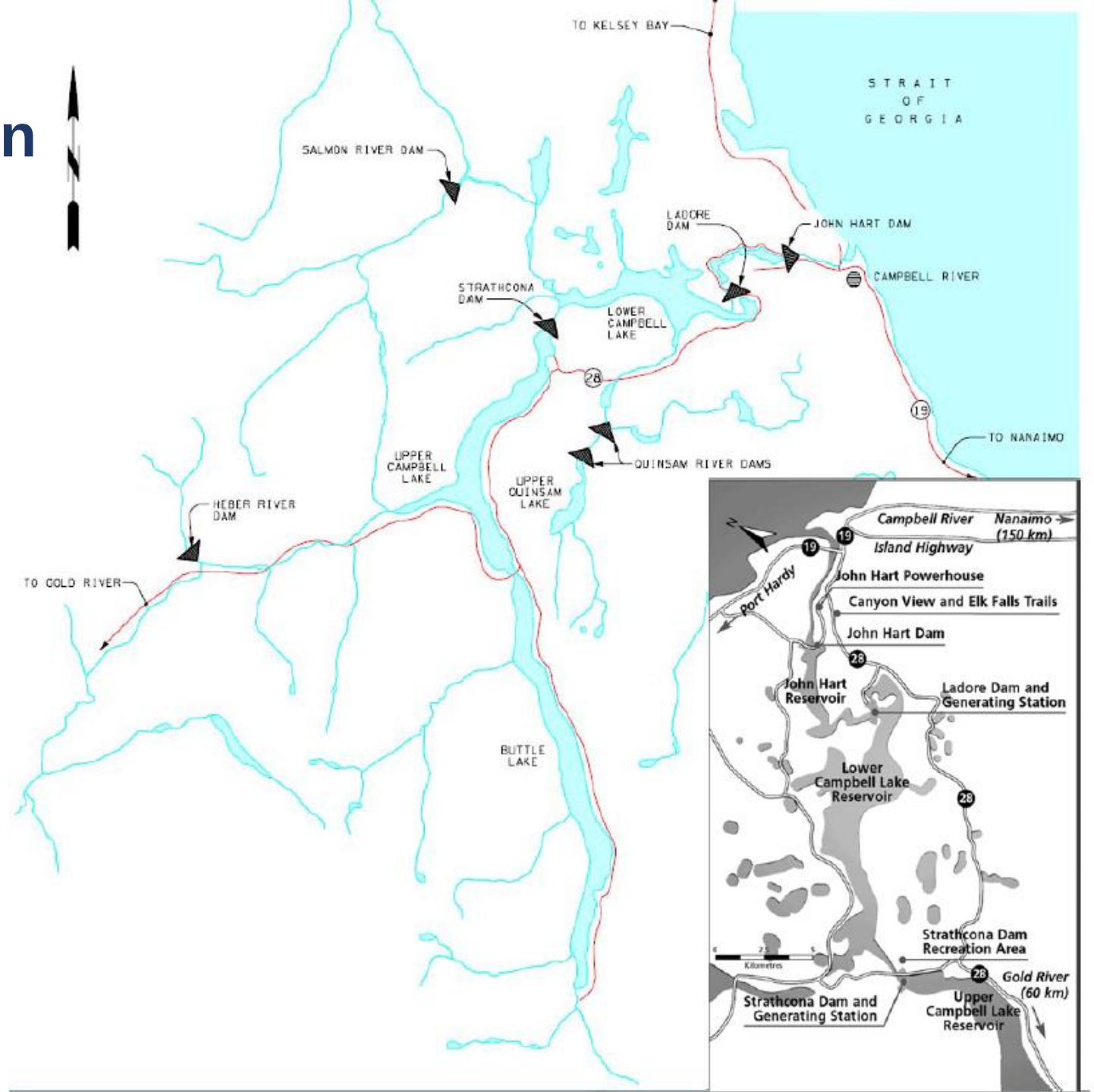


River Environment
Ecology and Water Quality

- **Ecology**
  - Fisheries interests dominate the priorities for flow operation.
    - Rearing and spawning habitats being enhanced.
    - Stable flow preferred but with short term (hourly or daily) fluctuations to intermittently meet target flows.
    - Ramping rates vary between stations based on prevention of stranding
  - Fish passage facilities on some stations.
  - Some trap and transfer.
  - Extensive monitoring of fisheries environment to determine negative effects
- **Water Quality**
  - Water quality downstream of the dam is primarily related to low flows both in terms of minimum flow and the time at which the low flows occur
  - WUP not expected to affect water quality

River Environment
Flooding and Erosion

- **Flooding**
  - Upper reservoir used to attenuate floods and snow melt
  - WUP expected to reduce frequency and duration of local flooding
- **Geomorphology**
  - Lake shore erosion studies concluded operation of the reservoir has not significantly increased the rate of erosion



River Environment
Flooding and Erosion

- **Recreation**
  - The main recreational uses downstream of the dam are fishing, whitebaiting, eeling, hunting, swimming, picnicking and jet boating
  - The main recreational uses of reservoir are fishing and boating.
    - Hazards include submerged objects so reservoir level related hazard
  - The prescribed level change, flow and ramping rates are not considered to be detrimental to these forms of recreation
- **Consultations with the First Nations (indigenous people)**
  - Consultation compulsory
  - First Nations hold a long enduring relationship with the catchment and interest in continued traditional access
  - WUP will eliminate previous inter-basin water transfer source of irritation between First Nations and Government.
  - Protection of heritage sites, archeological sites and cultural values from reservoir erosion recognised.

Campbell River Case Study Lessons Learnt
Key Impacts, Constraints and Mitigation

- Discharge driven by objective of improving fisheries
- Minimum flows and reservoir levels– affect spawning and rearing fisheries habitat
- Ramping rates for flows and levels – operational restrictions
- Flood alleviation – control of lake levels during predicted floods
- Geomorphology – downstream erosion control
- Fish passage – both upstream and downstream passage, screen sizes, deterrents to prevent fish entering turbines
- Recreational users – reservoir use affected by submerged hazards
- First Nations - protection of heritage sites, archeological sites and cultural values from reservoir erosion.

Achieved through widespread consultation