Urban Water Security Research Alliance

Evaporation Reduction
Phase 1: Evaluation of Techniques to Measure Evaporation from a Large Water Storage

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System Losses

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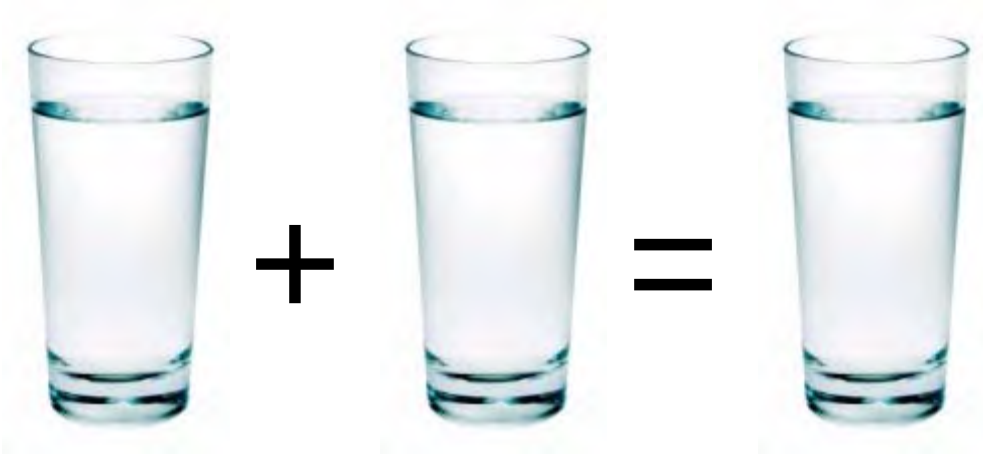
How much do we lose to evaporation in SEQ?

- In SEQ the volume of water lost through evaporation each year is roughly equal to that supplied through the reticulation system



- There is much benefit to be gained through the development of new and innovative techniques for reducing evaporation.

Findings from desktop study

- Desktop study investigated:
  - Floating covers
  - Surface films
  - Shade structures
  - Windbreaks
  - Storage shape modification
  - Destratification
  - Impacts of farm dams
  - Potential of runoff enhancement

- Floating covers and surface films showed the greatest potential for further investigation

- While application to very large storages is unlikely, partial treatment or treatment of smaller storages within the catchment was highlighted

Surface Films

Hasn't this research been done before?

- Yes but…
  - Most studies very short
  - Evaporation estimates have been crude
  - Economics have changed
  - New products available
  - Water quality effects not well understood

Field measurement plan

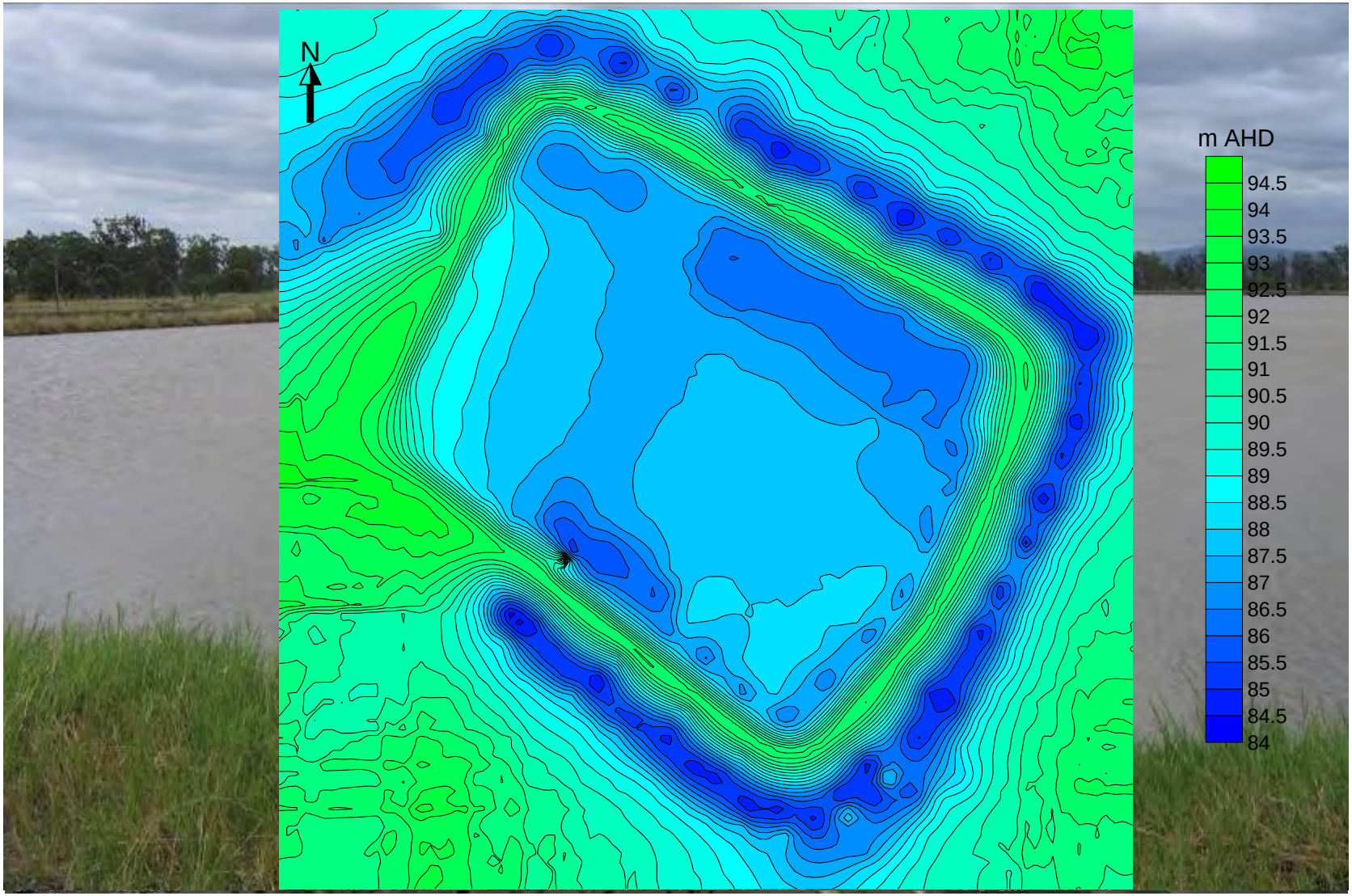
- Phase 1 : Testing of ability to measure evaporation and collection of baseline water quality data
- Phase 2 : Testing of evaporation reduction techniques (in conjunction with CRC Polymers) and further water quality assessment
- Phase 3 : Development of evaporation models for application to other locations
- Phase 4 : Assessment of applicability of technique and potential benchmarking of large scale storage facility in conjunction with stakeholders and monitoring of changes in evaporation over time.
- Each stage is dependent on the success of the previous one.

Phase 1

- Main goal :
  - to assess the potential to confidently measure evaporation rates
- Not a trivial exercise when considering the spatial variation in evaporation
  - Particularly when surface films are to be applied in the future

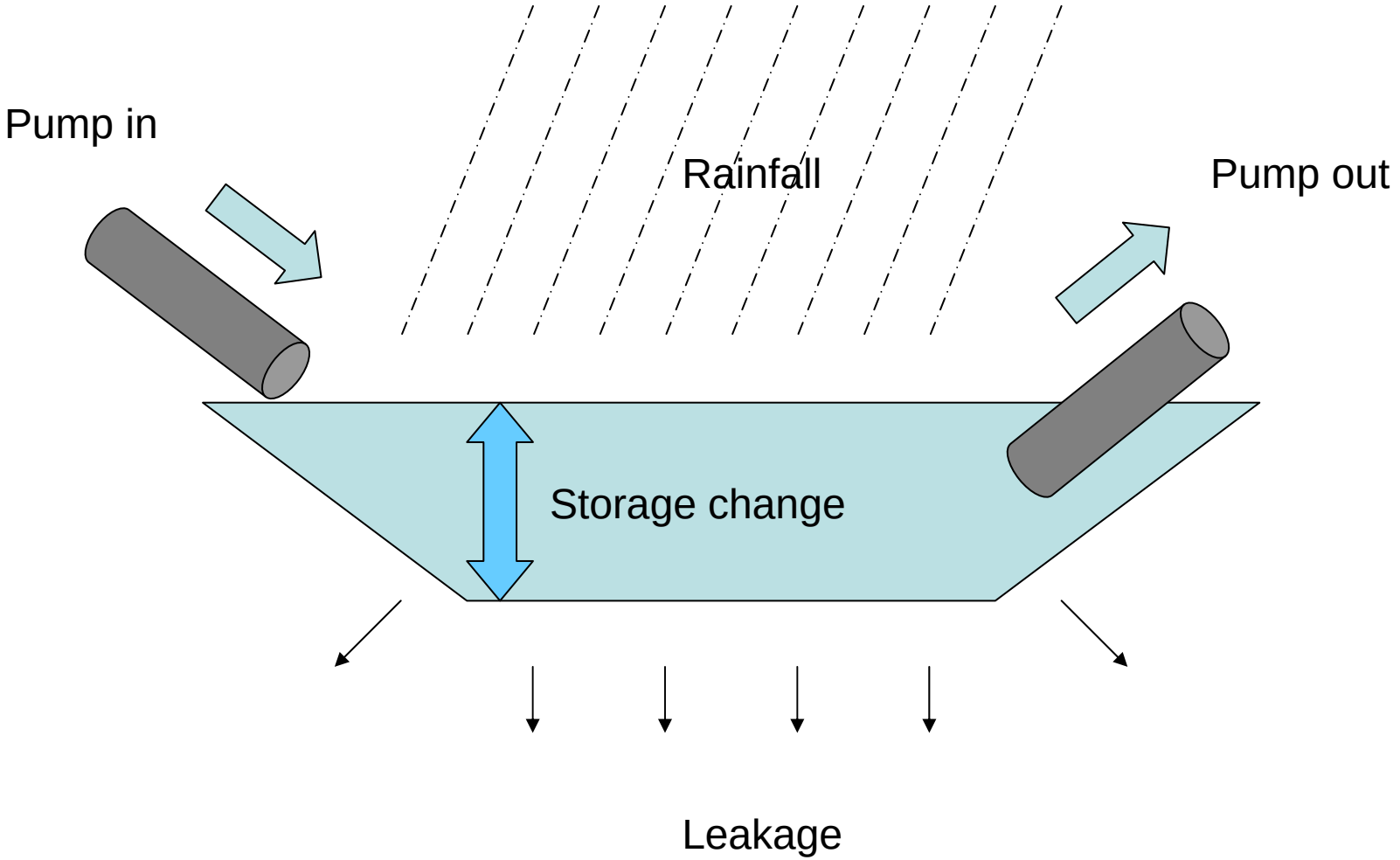
Site Selection

Logan's Dam



Technique 1: Water Balance

Evaporation = (Pump in + Rain) – (Pump out + Change in storage + Leakage)



Technique 1: Water Balance

Rain gauges

Flow meters

Pressure transducers

Technique 1: Water Balance

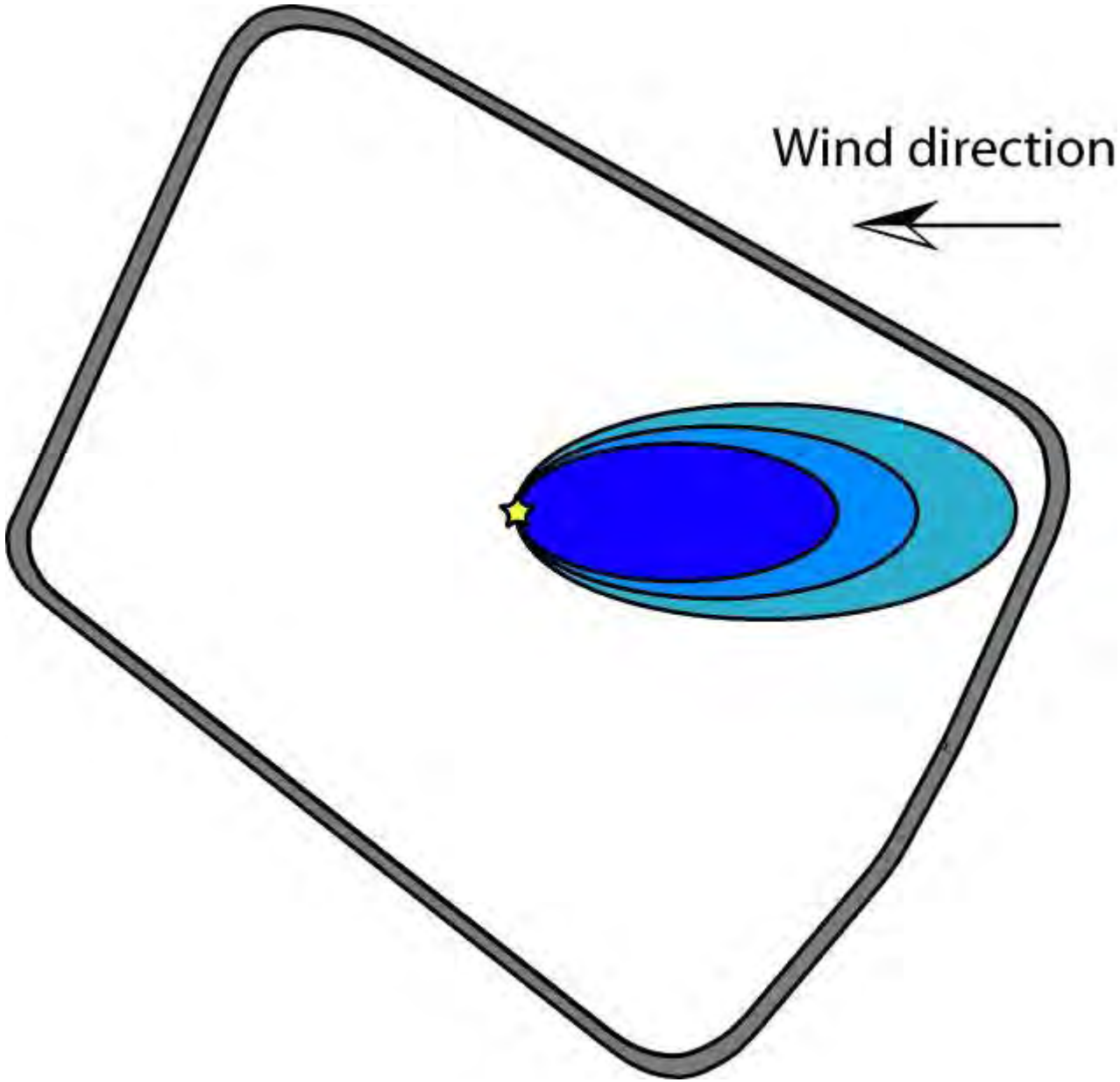
Water balance not likely to be feasible for many storages

Technique 2: Eddy Covariance

- Measures the turbulent fluxes at high frequency
- High frequency and accuracy measurements of water vapour and temperature can give the fluxes (sensible heating of the atmosphere and evaporation)
- With changes in heat storage and net radiation the full energy balance is given

Technique 2: Eddy Covariance

Technique 2: Eddy Covariance



Technique 3: Scintillometry

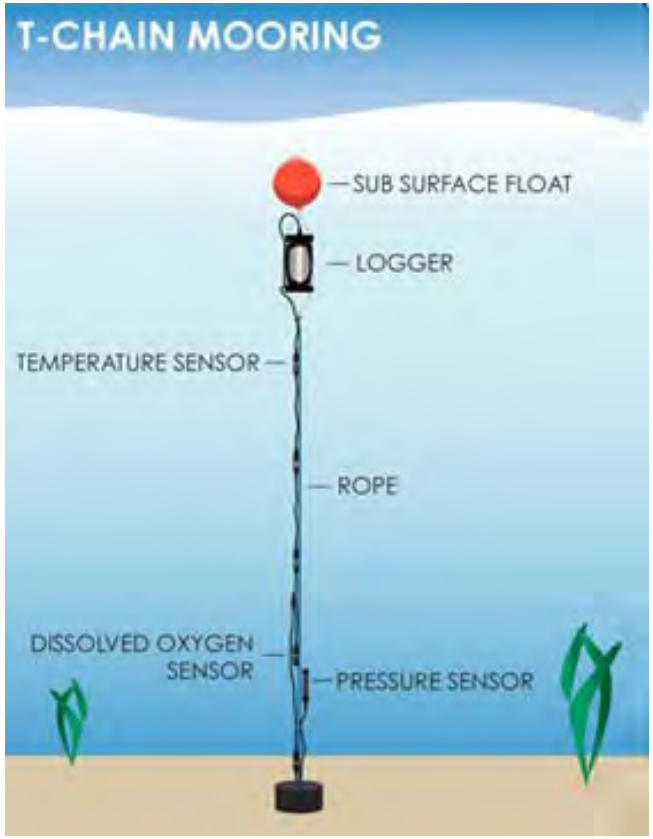
- Measures scintillations in the air caused by variations in temperature and humidity

- Magnitude of scintillations is related to the heat transfer from the surface to the air above (sensible heat flux)

Technique 3: Scintillometry

Evaporation = net radiation – (change in heat storage + sensible heat flux)

Heat storage



Net radiation

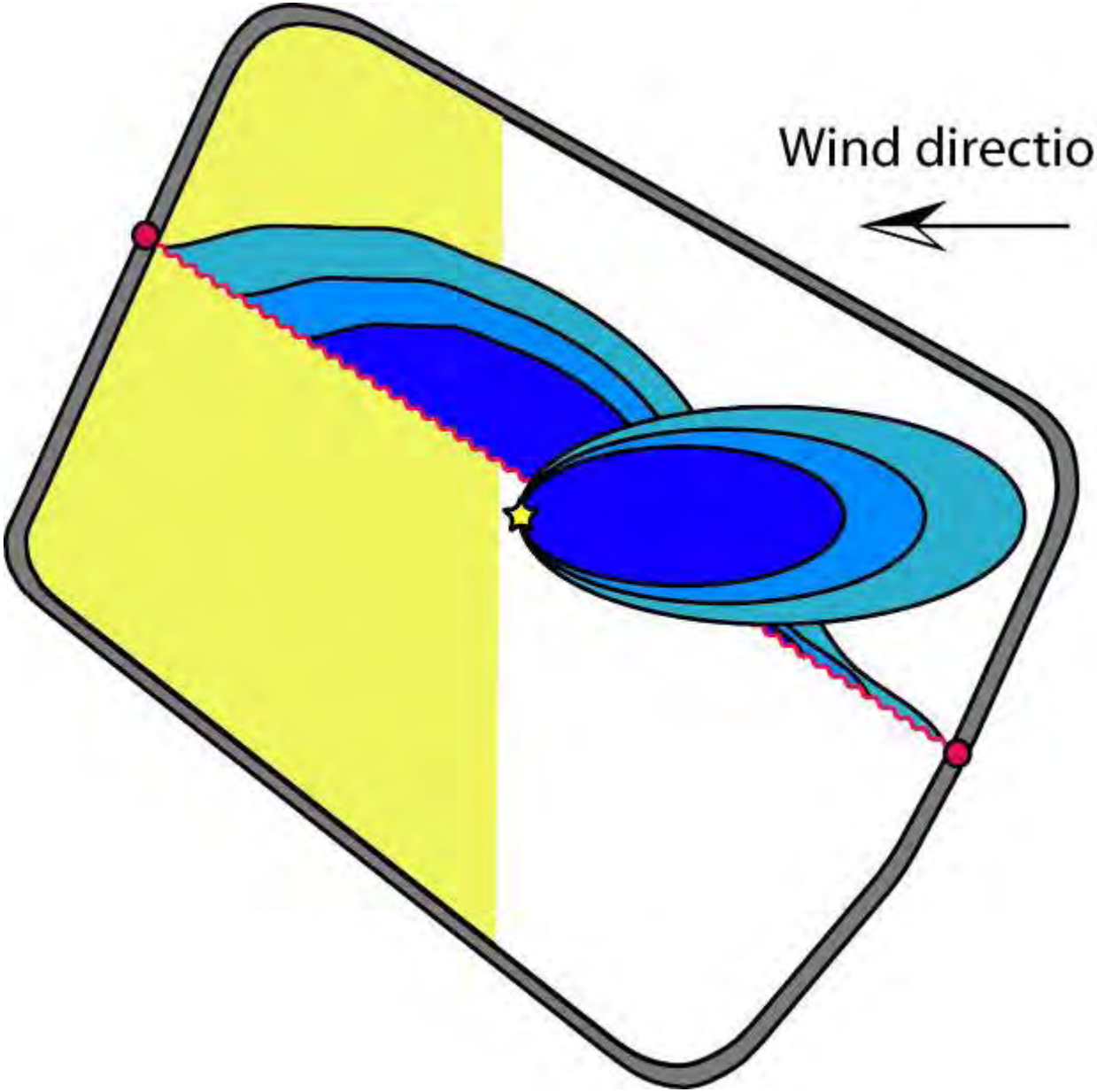
Technique 3: Scintillometry

Evaporation = net radiation – (change in heat storage + sensible heat flux)

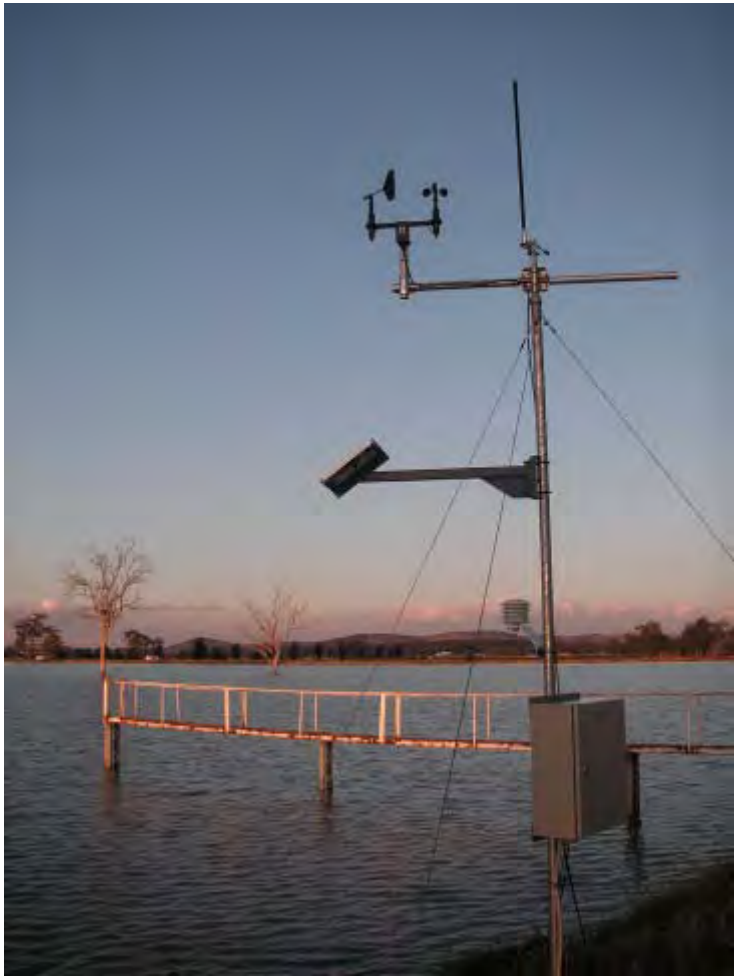
Receiver

Transmitter

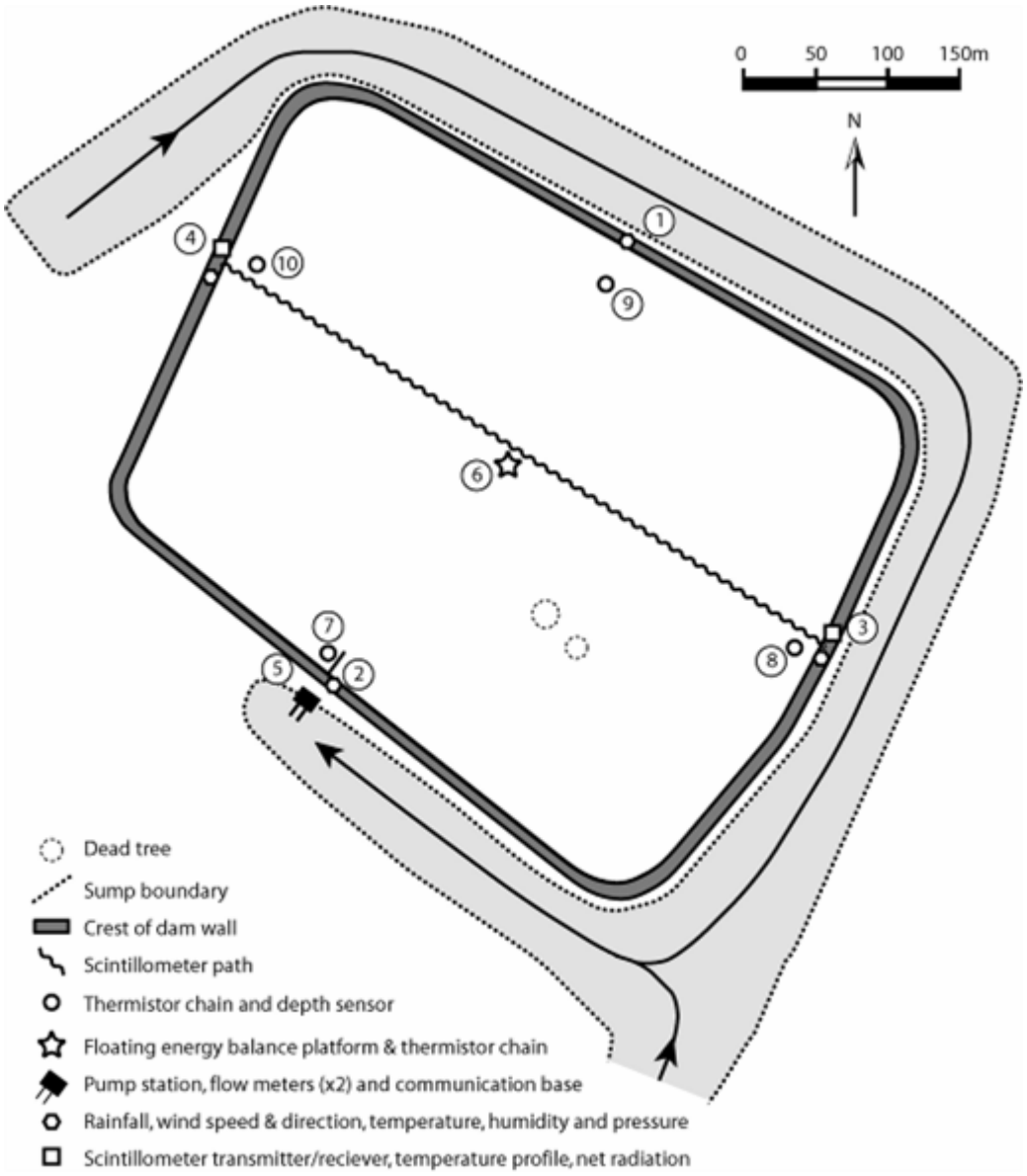
Technique 3: Scintillometry



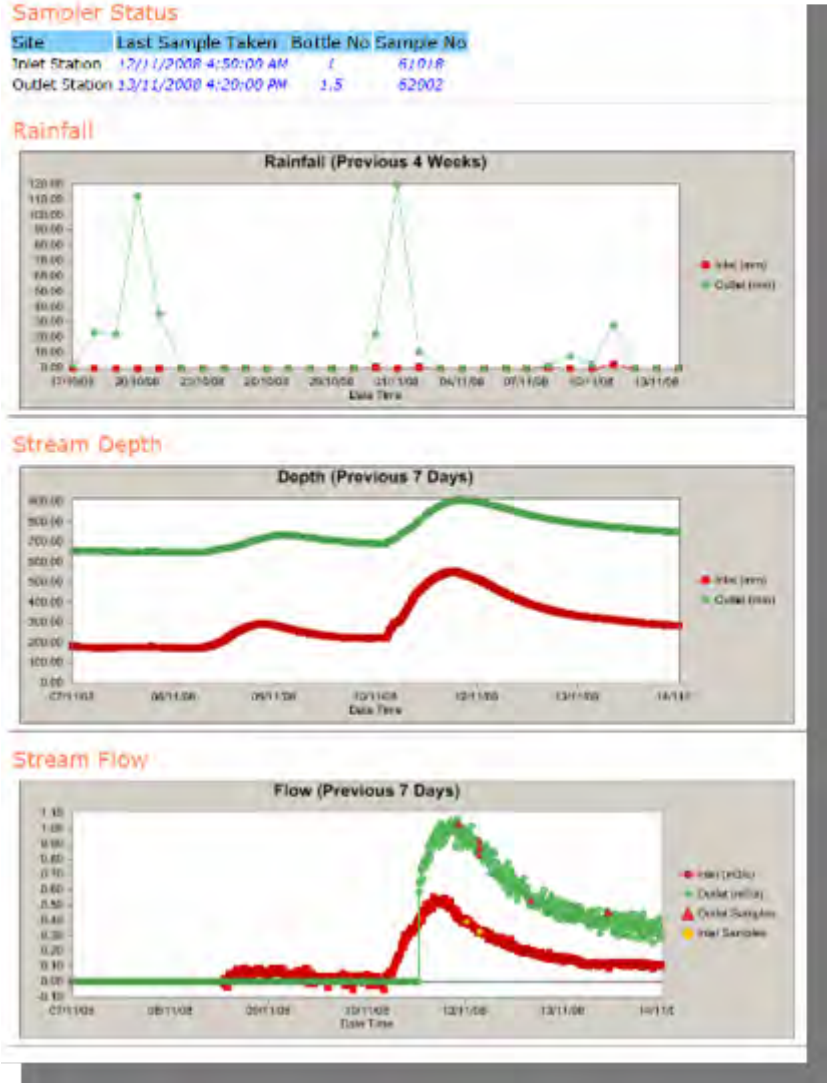
Supplementary Measurements



Experimental layout



Data delivery



- All instruments are connected to a base station using radio link telemetry
- Base station allows real-time data collection across the NextG network and storage to database
- Data visualisation provided through web interface

Progress

- Currently in installation phase (~75% complete)
- Expecting to be fully operations soon with 3 independent evaporation measures
- Extensive on-going data analysis will be required to ensure high quality data is collected
- Inter-comparison of techniques will need to be favourable for subsequent phases to proceed
- Stay tuned for interesting results on performance of techniques for moving into next phase…

Thank you

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