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Water and Environment

IAH-Hydsoc Workshop

Alternative groundwater management approach

4 May 2009

Sustainable Yield (Groundwater)

- SY = groundwater extraction regime
- Measured over a specified timeframe
- Allows acceptable levels of stress (impacts)
- Protects dependent values:
  - Environment – Economic – Social
- **Objective**: extraction volume, specified timeframe & quantified impacts
- **Subjective**: are impacts acceptable and are the values well-protected?

Current Mgt = recharge water balance

- Current SA mgt = water balance approach
- Mostly based on recharge estimates, esp. for shallow/unconfined systems
- Typically, allocation or extraction is limited to aquifer recharge volume estimate
- But, that can lead to local hotspots with adverse trends, and leave aquifer capacity in other areas quarantined (no future use)
- **Not optimum, Not sustainable**

Recharge or Adaptive Mgt?

- Is recharge the best way to manage a hydrologically variable system?
  - Recharge is **very** difficult to estimate
  - Climate change recharge deficits expected
- Alternative management principles?
  - Incorporate environmental constraints
  - Provide for environmental requirements first
  - Then share to development/extraction
  - Need investigations ($, time) to establish environmental constraints

Alternative Mgt = EWR/EWP

- Ecological Water Requirements (EWRs):
  - water regime necessary to sustain key ecological values
  - Implicit: no major development stress
- Environmental Water Provisions (EWPs)
  - water provided to sustain **minimum** ecosystem function
  - some stress (extraction) applied
  - allows for economic and social interests

Alternative Mgt = EWR/EWP

- Ideally: EWP = EWR: provisions = req'ts
- In practice: EWP < EWR: provisions < req't

- Need investigations of groundwater dependent ecosystems to set EWR/EWP
- Need groundwater models to investigate, predict impacts of extraction and explore the balance

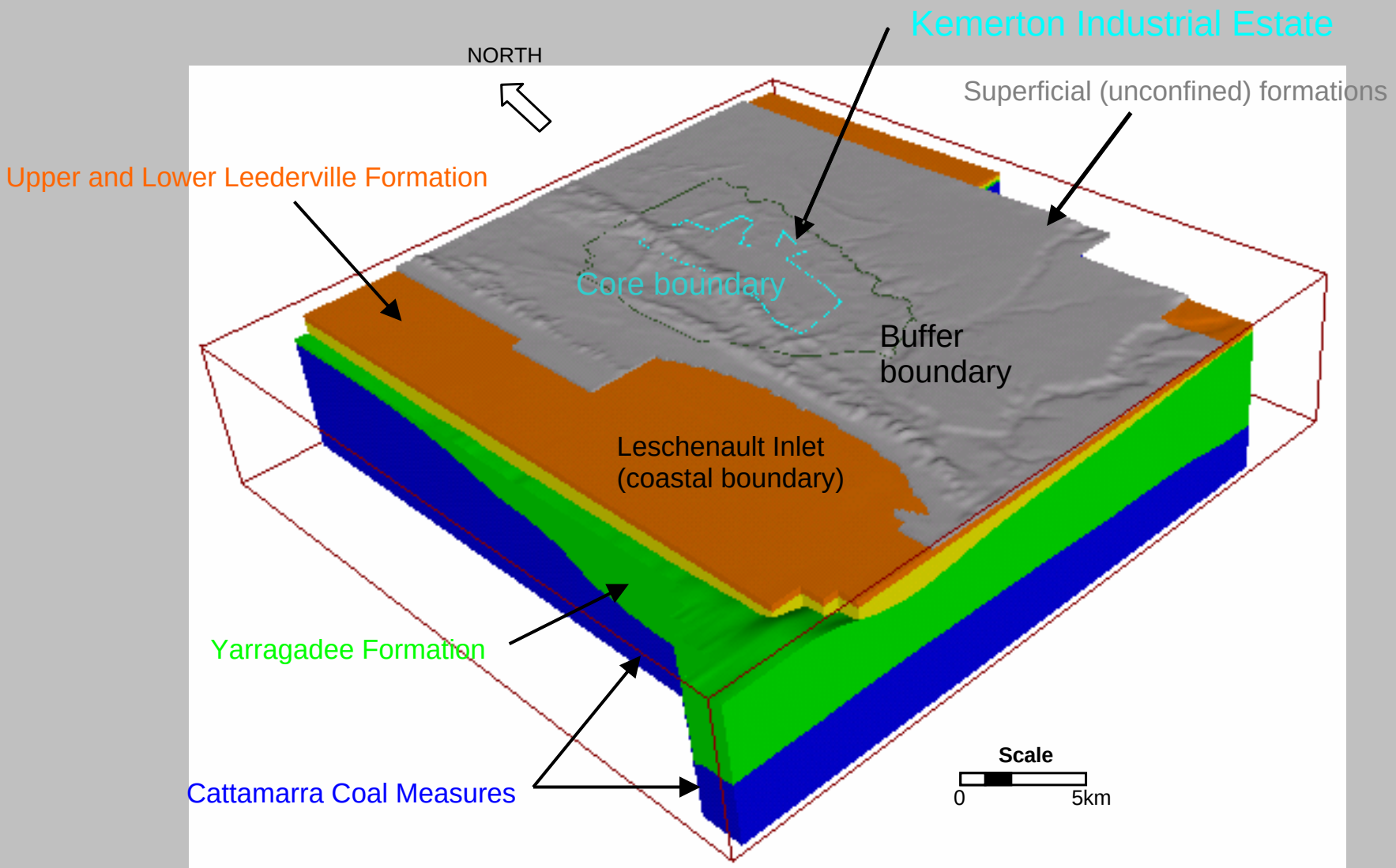
- Example: Kemerton (south of Perth, WA)

EWR criteria for Banksia woodland

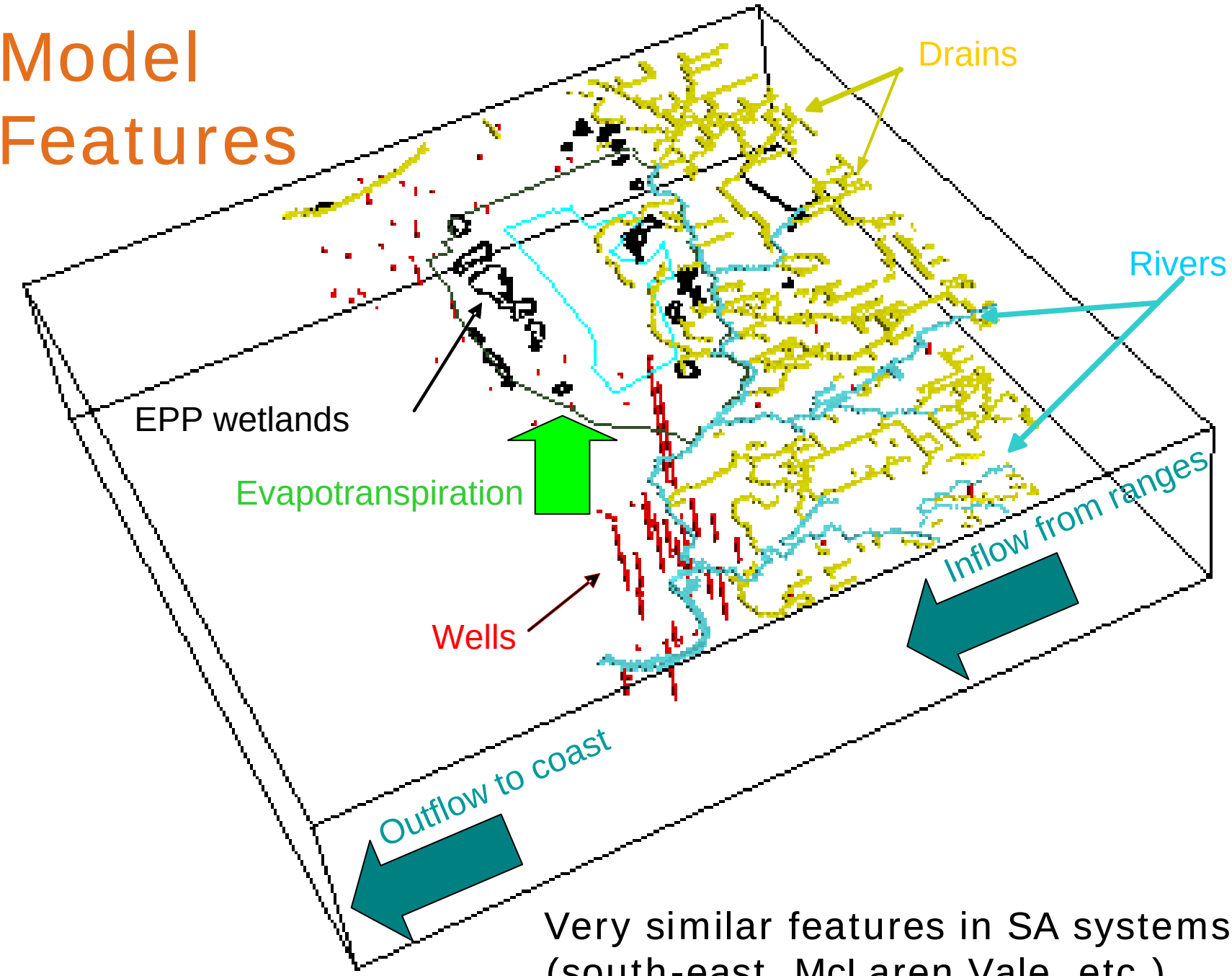
Category	Description	Critical Drawdown Level
1	0 – 3m depth to groundwater	0.75 m
2	3 – 6m depth to groundwater	1.25 m
3	6 – 10m depth to groundwater	1.75 m
4 (wetlands)	Maximum annual drawdown Maximum allowable drawdown	0.1 m/yr 0.25 m

(Source: Froend & Zencich, 2002)

Kemerton Groundwater Model

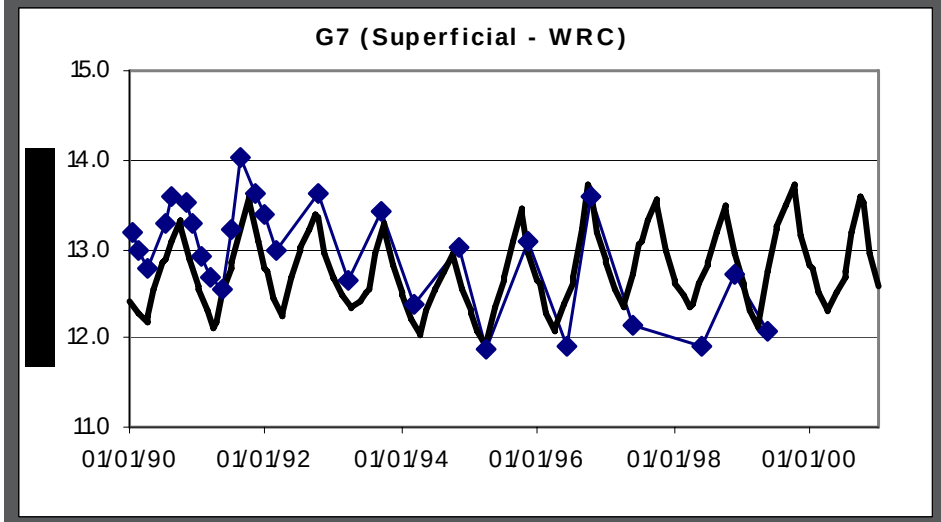


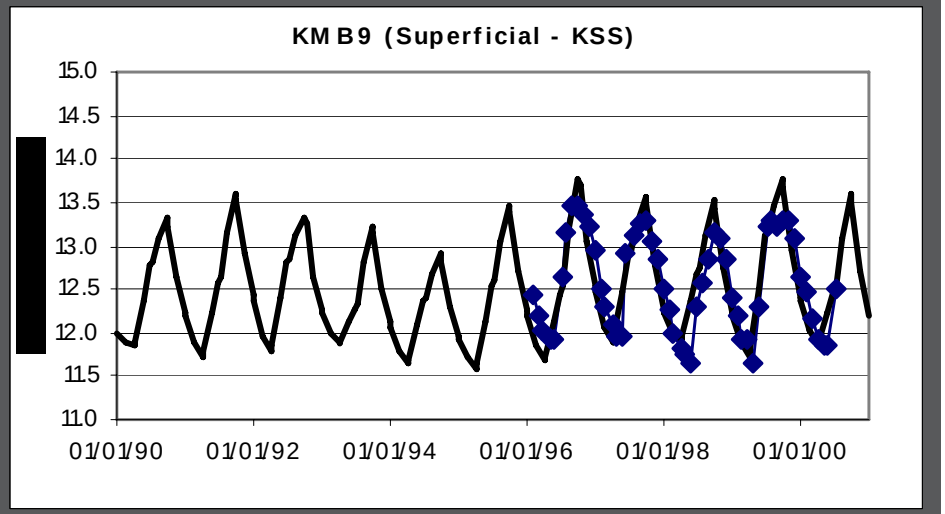
Model Features

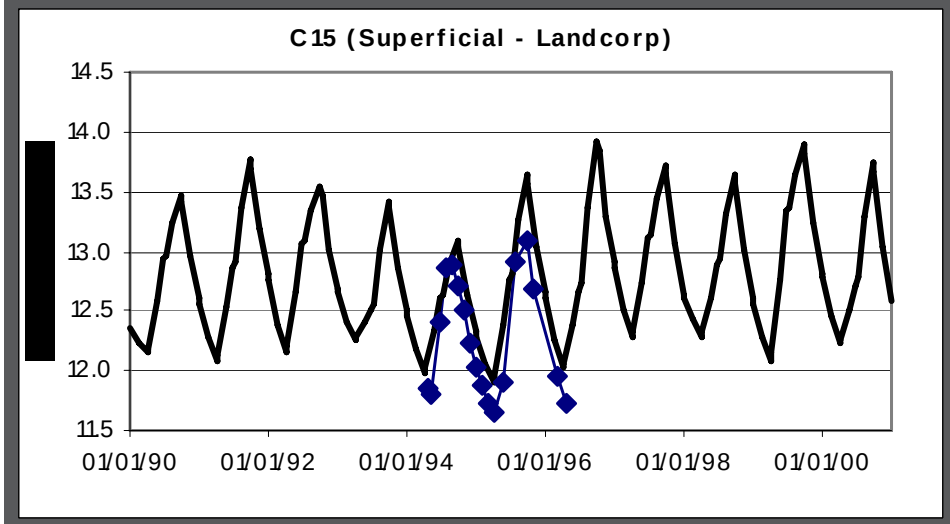


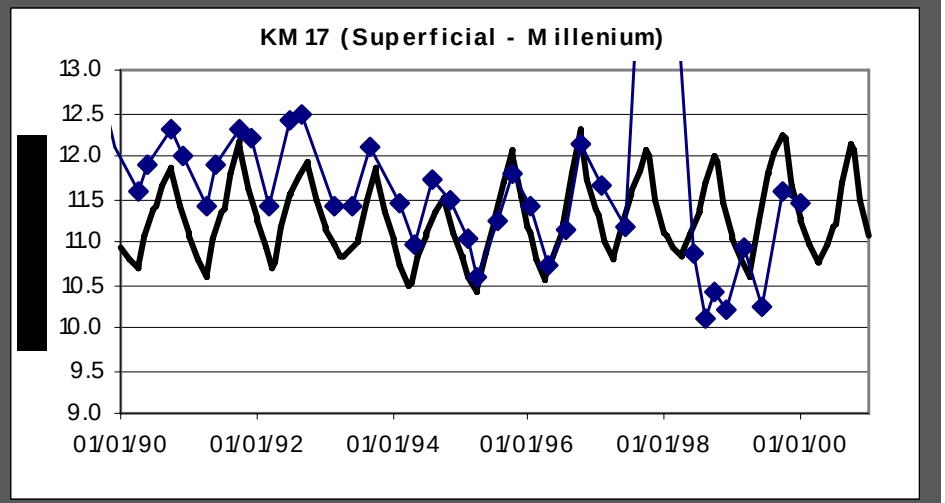
Very similar features in SA systems (south-east, McLaren Vale, etc.)

good history-matched model needed for EWR/EWP analysis









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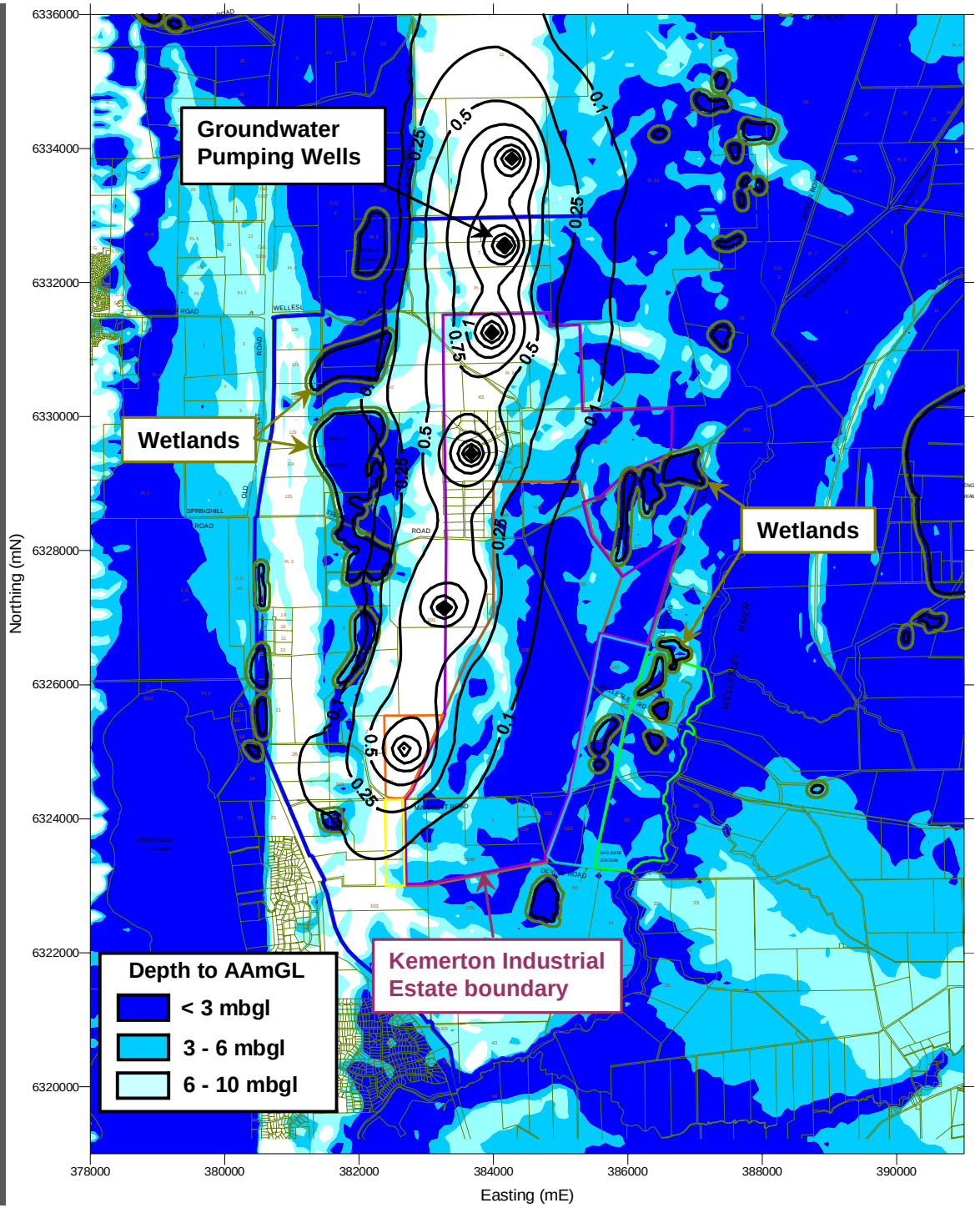
Model Predictions

- Wellfield aligned with large dune (more depth to water table)
- Drawdown effects at wetlands acceptable



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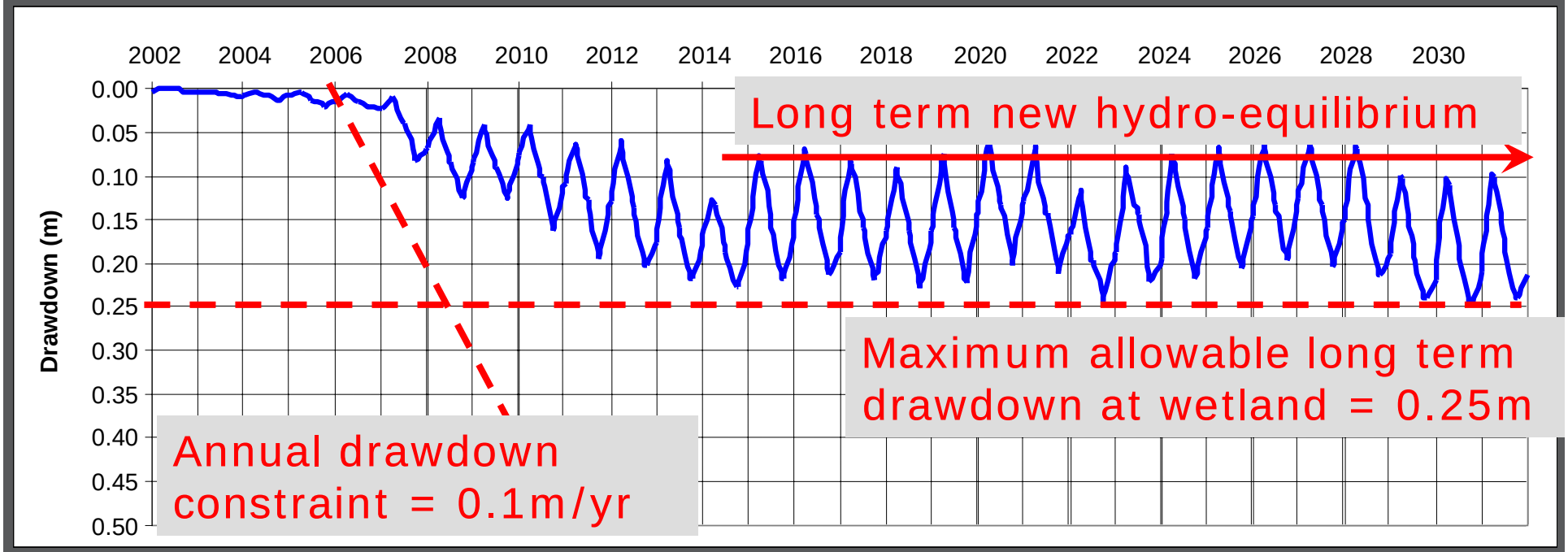
Kemerton EWPs meet EWRs in full

- short term d/d <0.1m/year (< annual constraint)
- long term d/d = 0.1 - 0.25m (< L-term constraint)
- new hydro-equilibrium within 10 years
- climate variability evident; C-change-ready model



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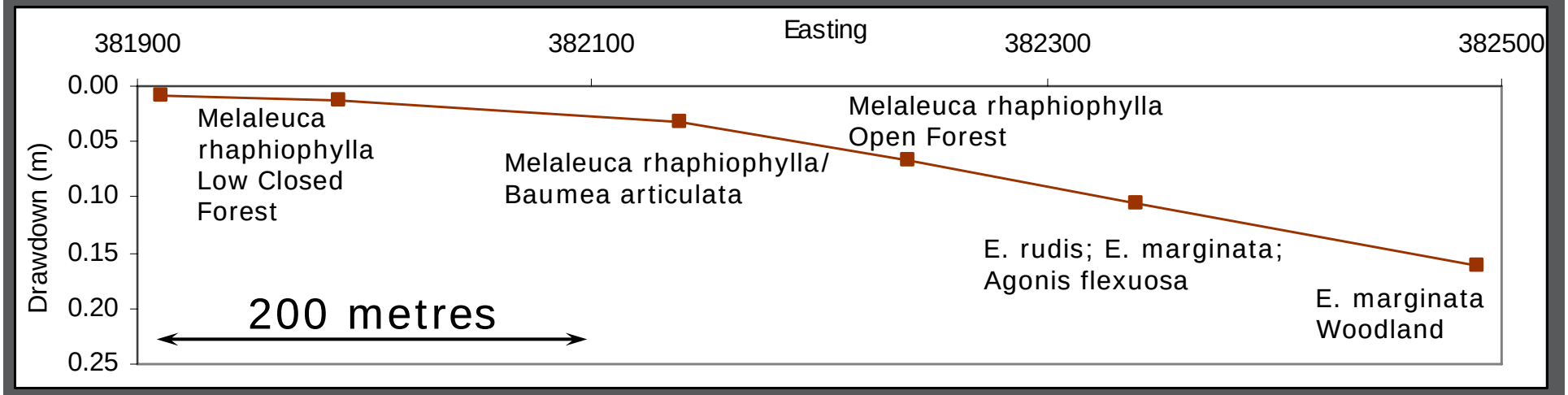
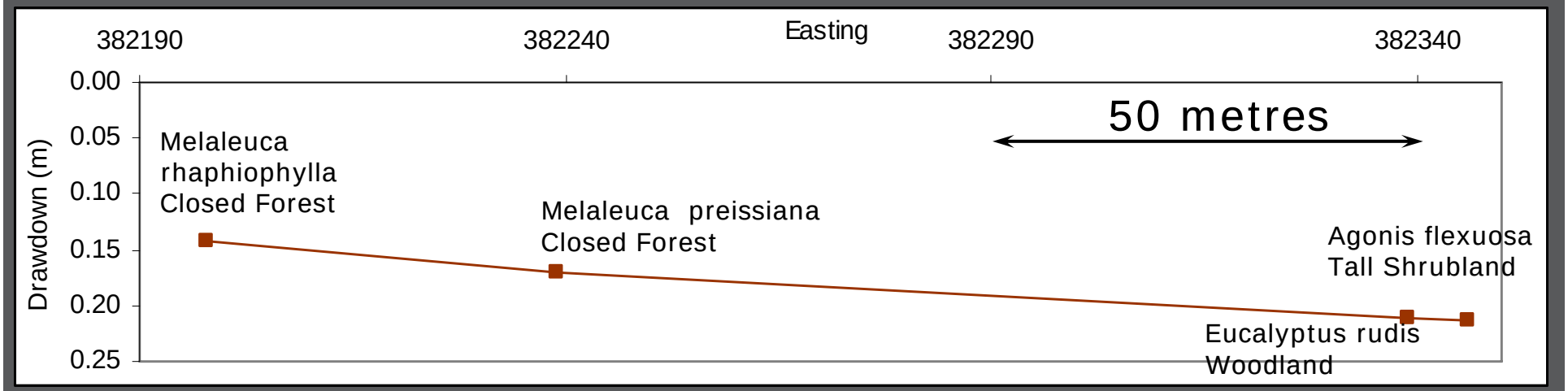
Wetland Veg & Drawdown Transects





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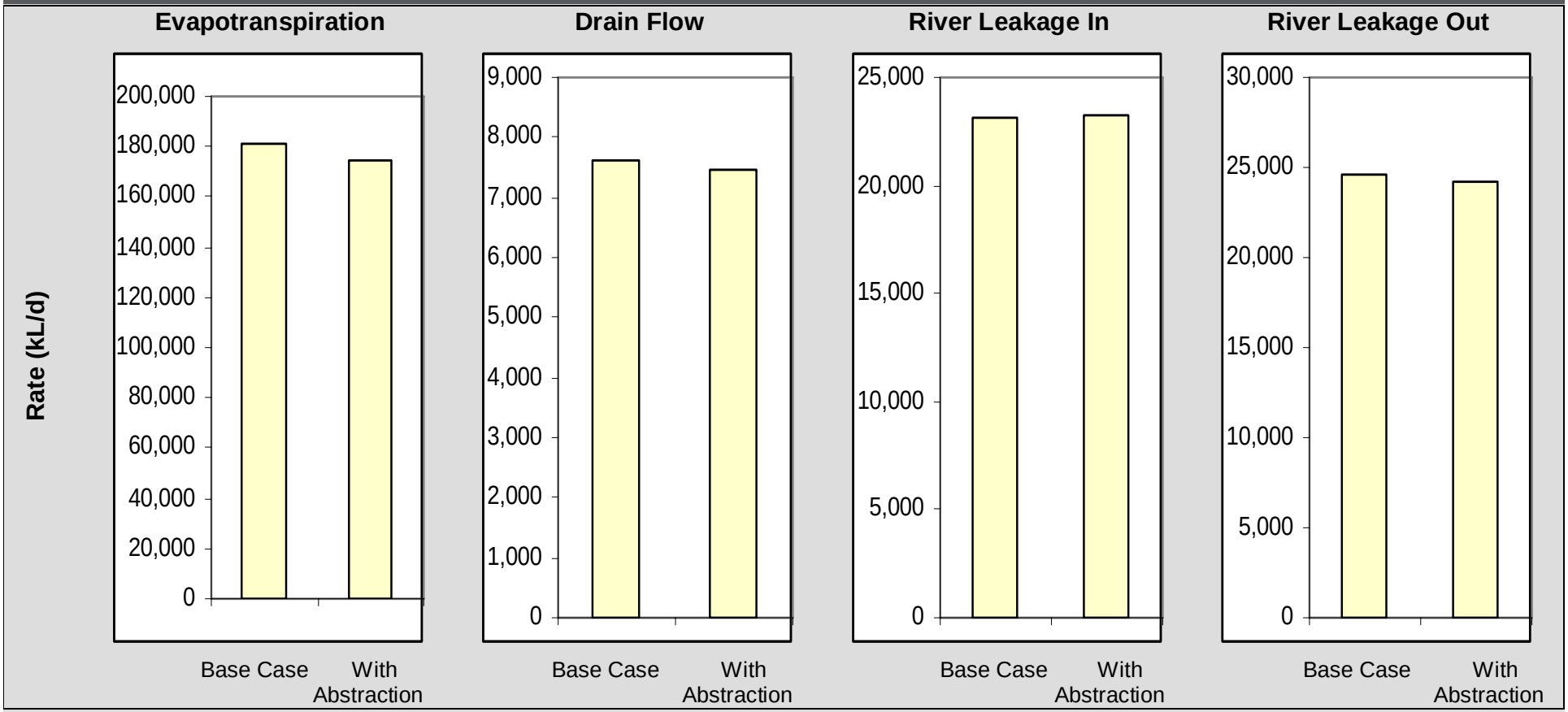
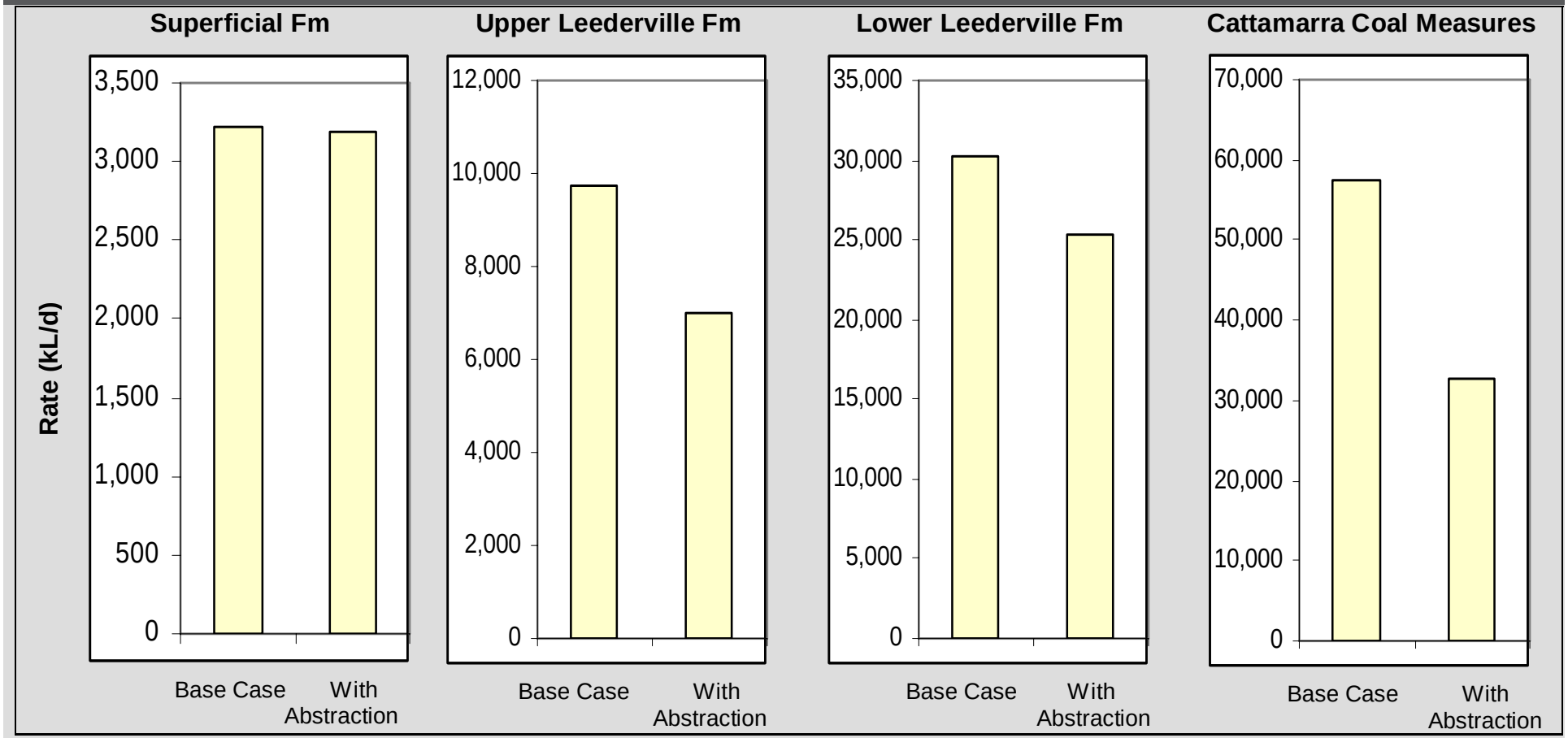
Predicted Annual Water Balance Change

EVT DRAINS Leakage from rivers Baseflow to rivers



Predicted Annual Coastal Outflow Change

Superficial Upper L/v Lower L/v Cattamarra



Alternative Mgt = EWR/EWP

- Protect water dependent ecosystems
  →meet EWRs in full if possible..... √
- Allow sustainable abstraction ..... √
  →provide EWP “allocation to environment”
- Sustainable abstraction scenario modelling:
  - To find balance between pumping, drawdown impacts (local/regional) and EWPs... √
  - To demonstrate new hydro-equilibrium... √
  - To demonstrate recharge events adequate to replenish aquifer resource (..... √)