Nadjung Mada Study

A holistic hydrological approach to protecting sensitive habitats and groundwater dependant ecosystems

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Presentation Outline

- Introduction
- Stage 1 – Data Collation/Review
  - Understanding Habitats and Data
- Stage 2 – Modelling and Impact Assessments
  - Holistic Hydrological Modelling
  - Model Development and Mitigation Evaluations
  - Impacts
- Conclusions

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Introduction

- Conservation of environmentally significant habitats: A global priority
- Meeting housing needs for Australia's growing population
- Nadjung Mada Nature Reserve: home to diverse woodlands and grasslands, including the Striped Legless Lizard
- How can we design future development and mitigate impacts to protect these habitats?

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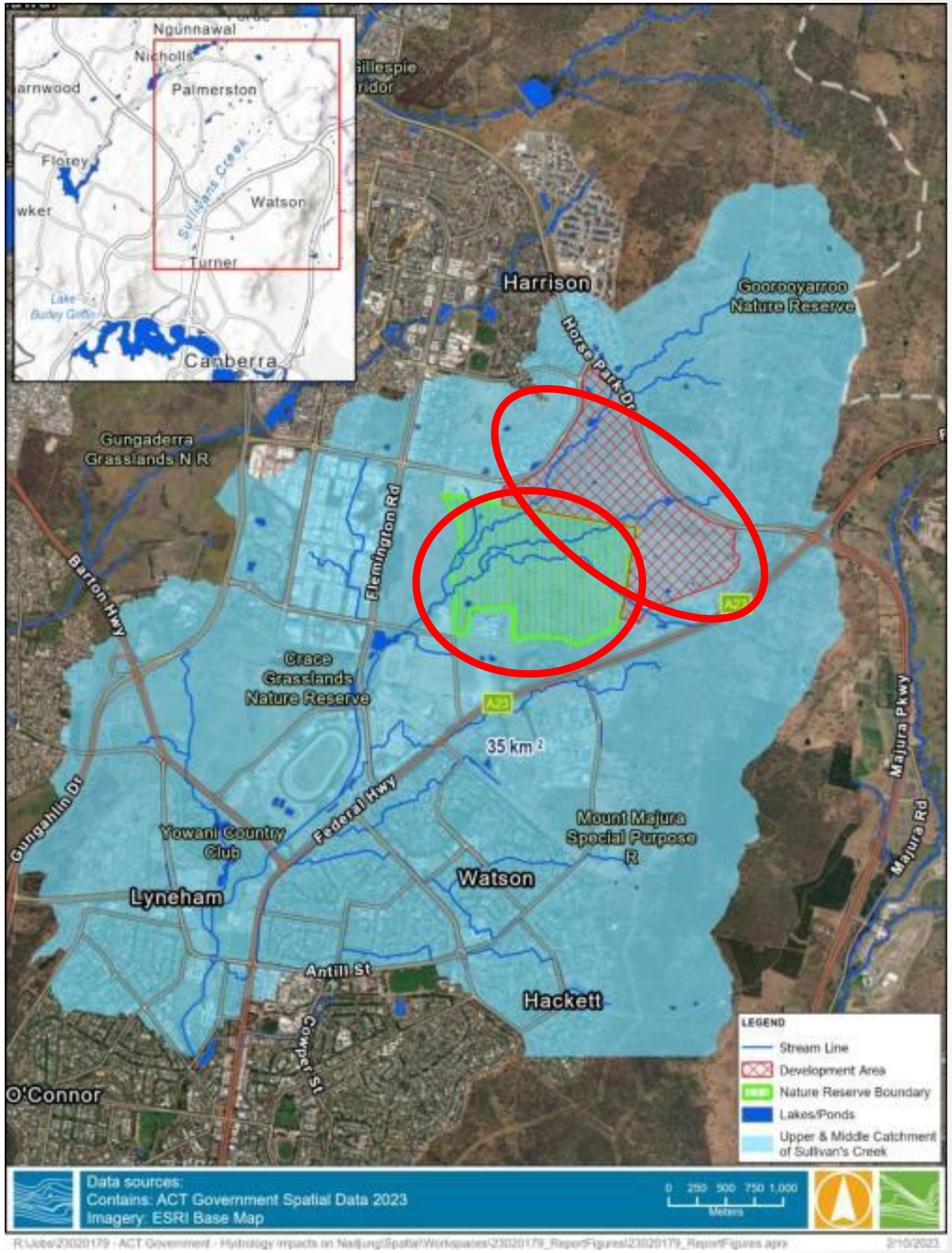

Development requires management of additional stormwater runoff to protect the Reserve’s environmental significance and crucial habitats

What do we know?

How do we model it?

What needs to be done?

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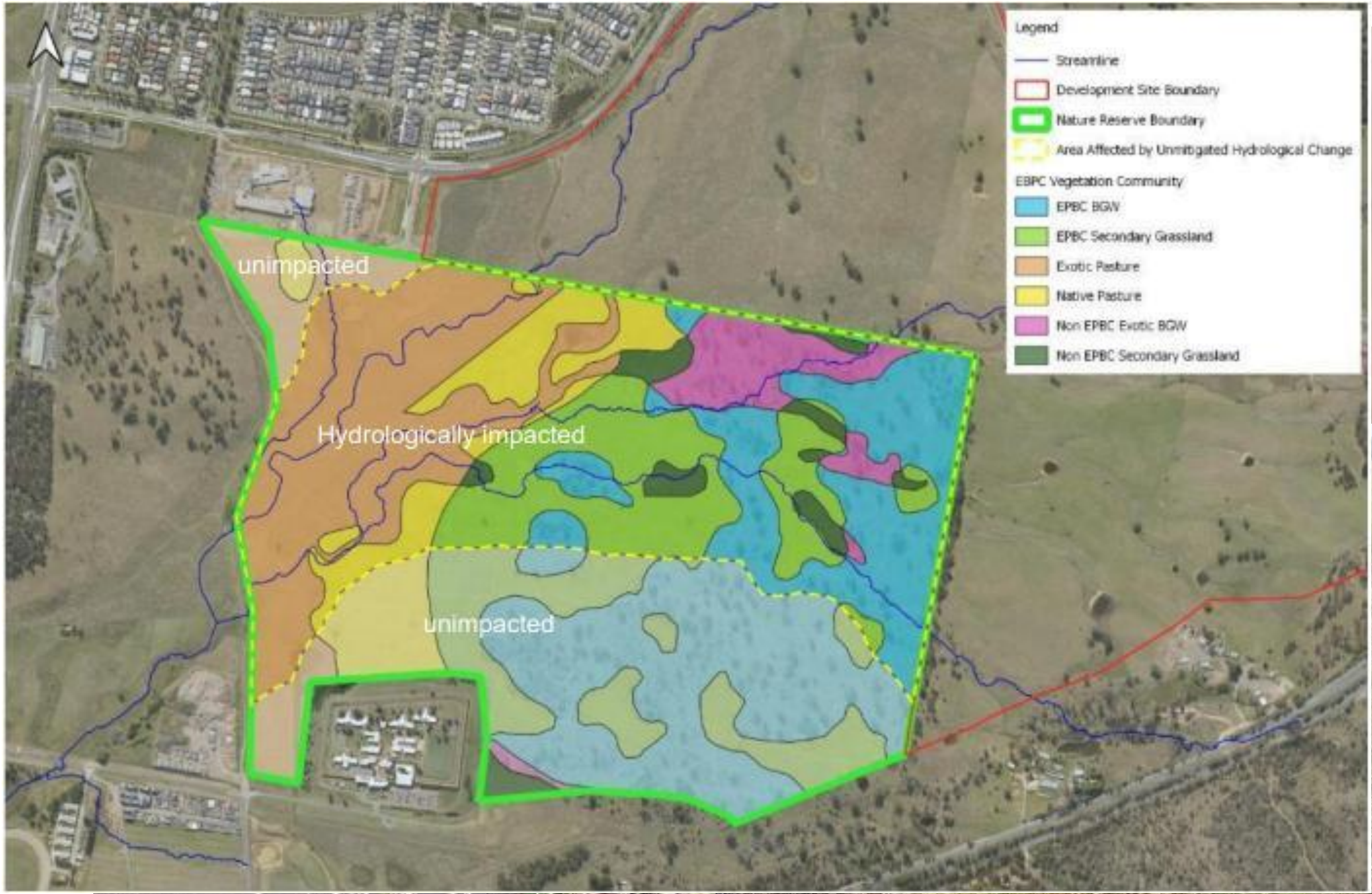
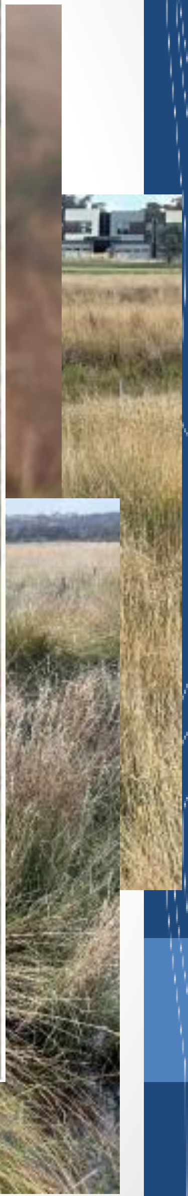
Stage 1 - Understanding Habitats and Data

- Surface Water
- Groundwater
- Geology
- Ecology

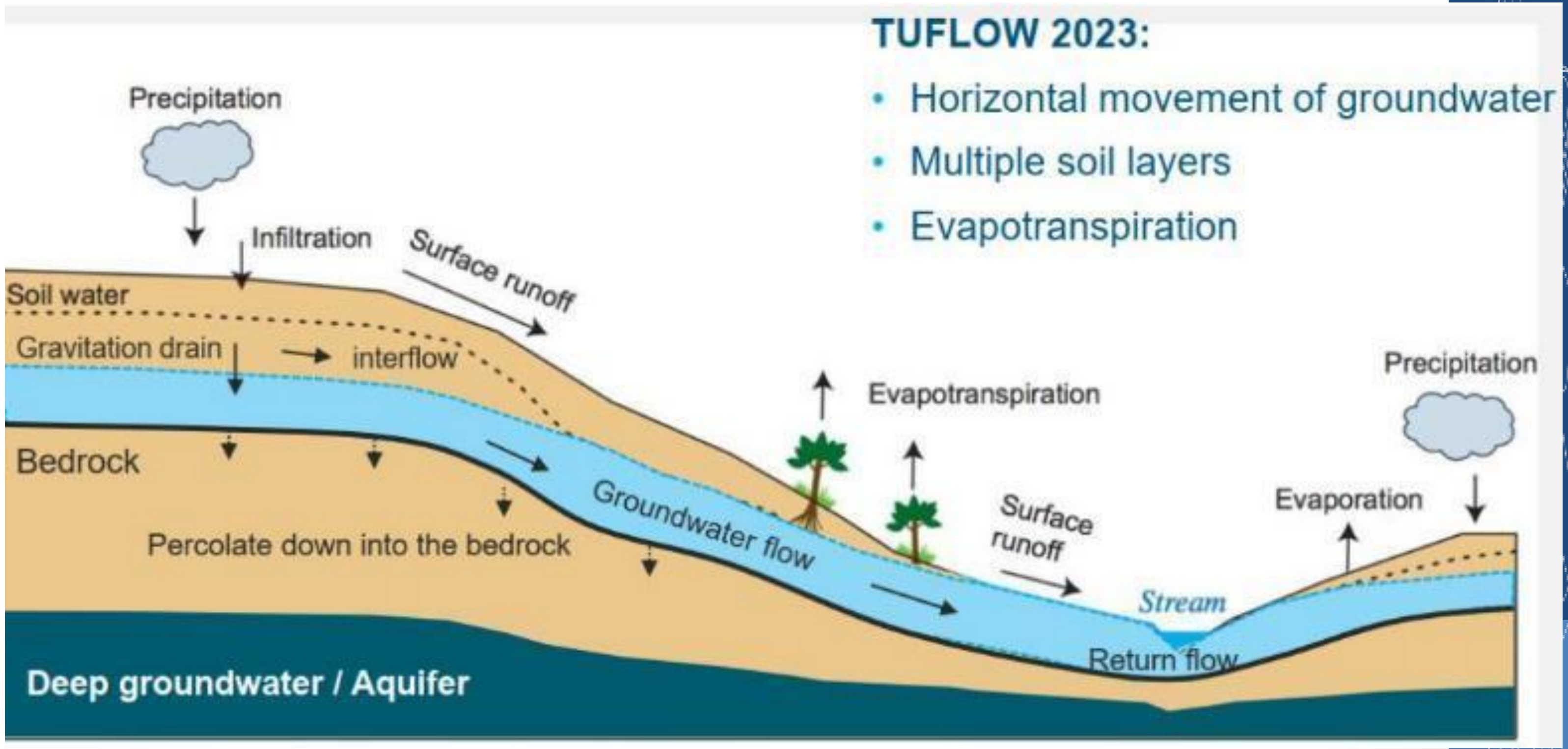




Stage 2 - Holistic hydrological modelling

A model like no other!!

- TUFLOW rain on grid surface water model linked with shallow groundwater algorithm
- First commercial application
- Model outcomes compared against a list of surface and groundwater performance metrics



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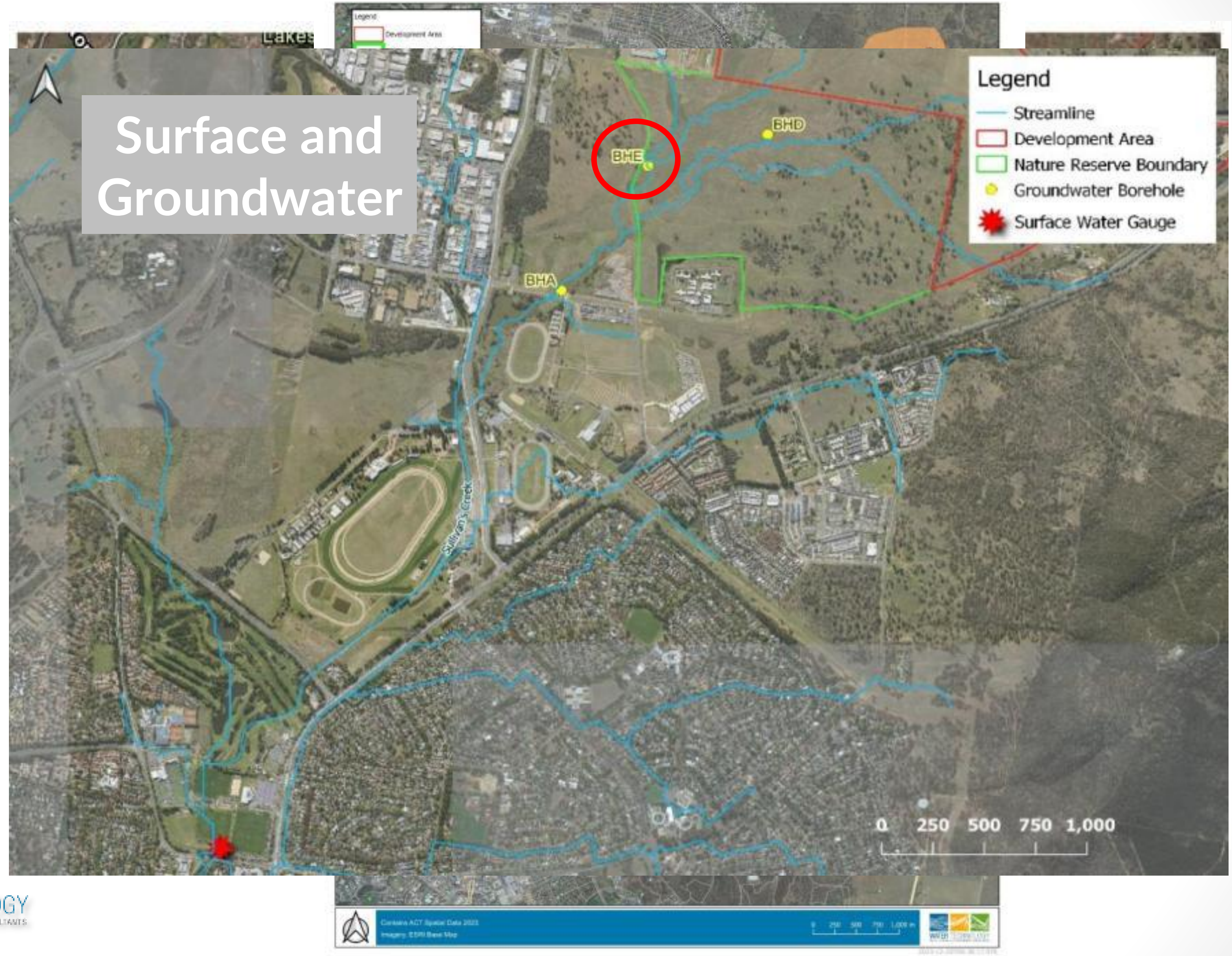
Surface and Groundwater

Model data



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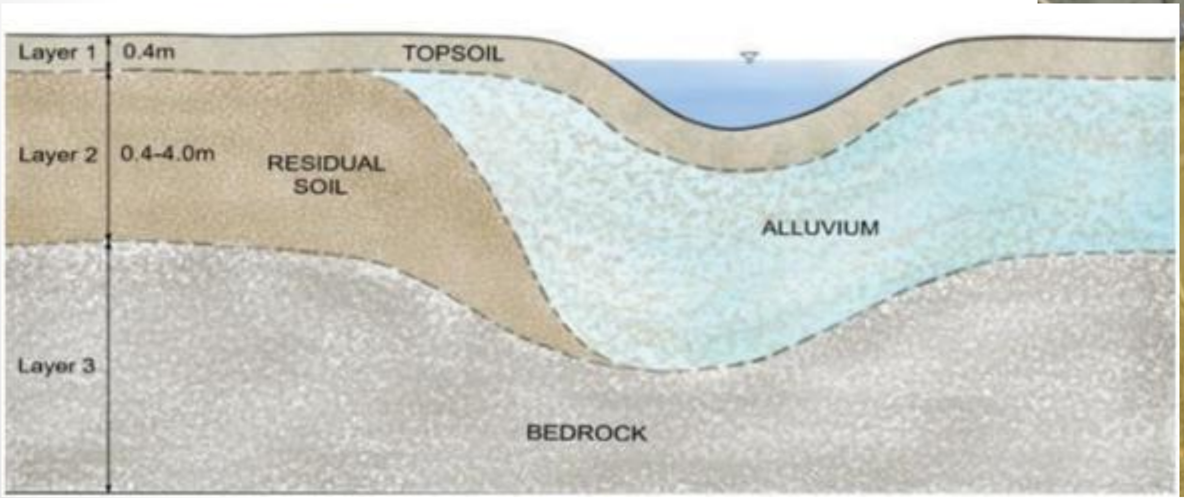
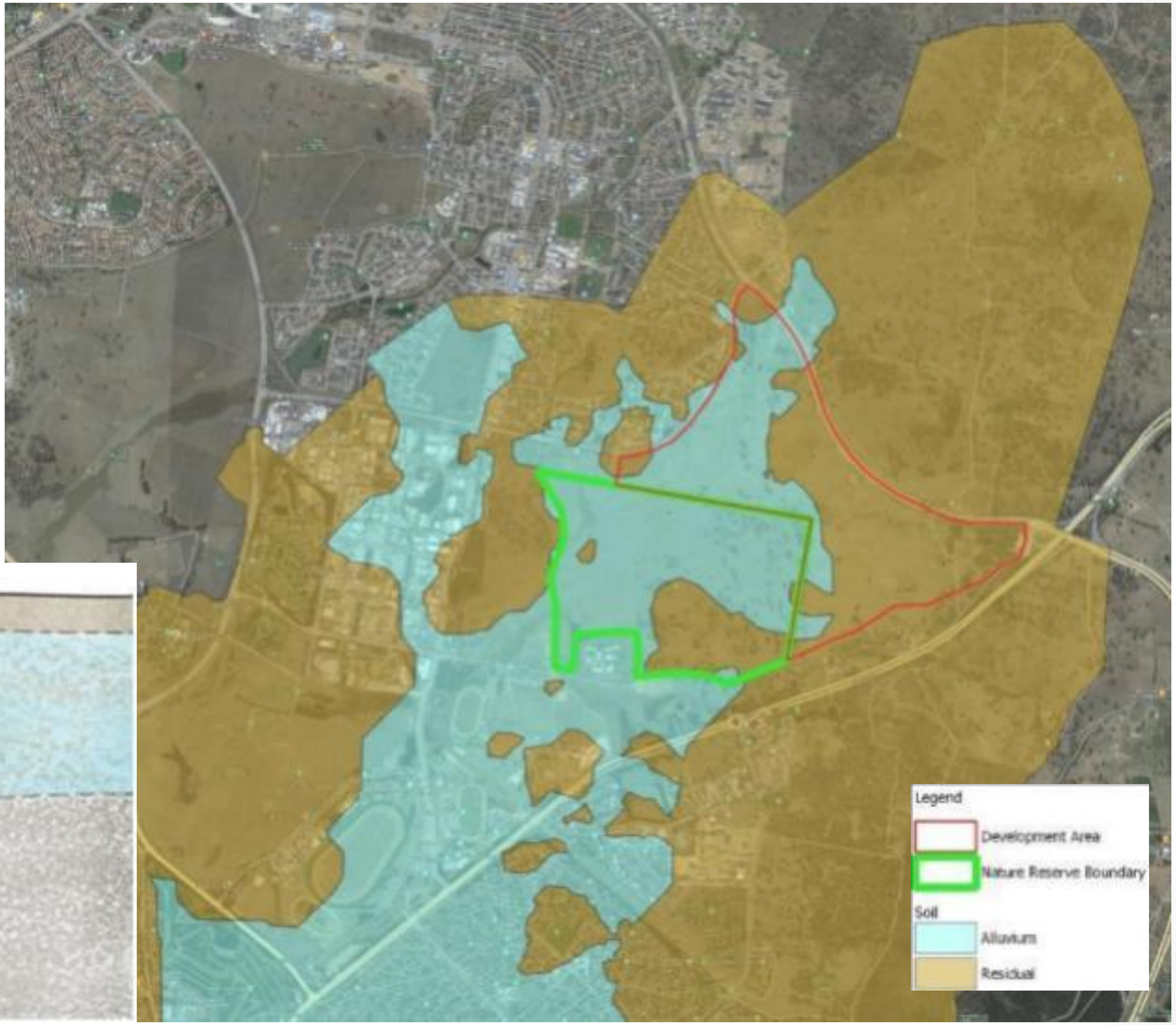
Complexity of soil data

- 3 soil layers
- Varying thicknesses
- Conductivities
- Soil porosity
- Initial moisture content

→ Calibration



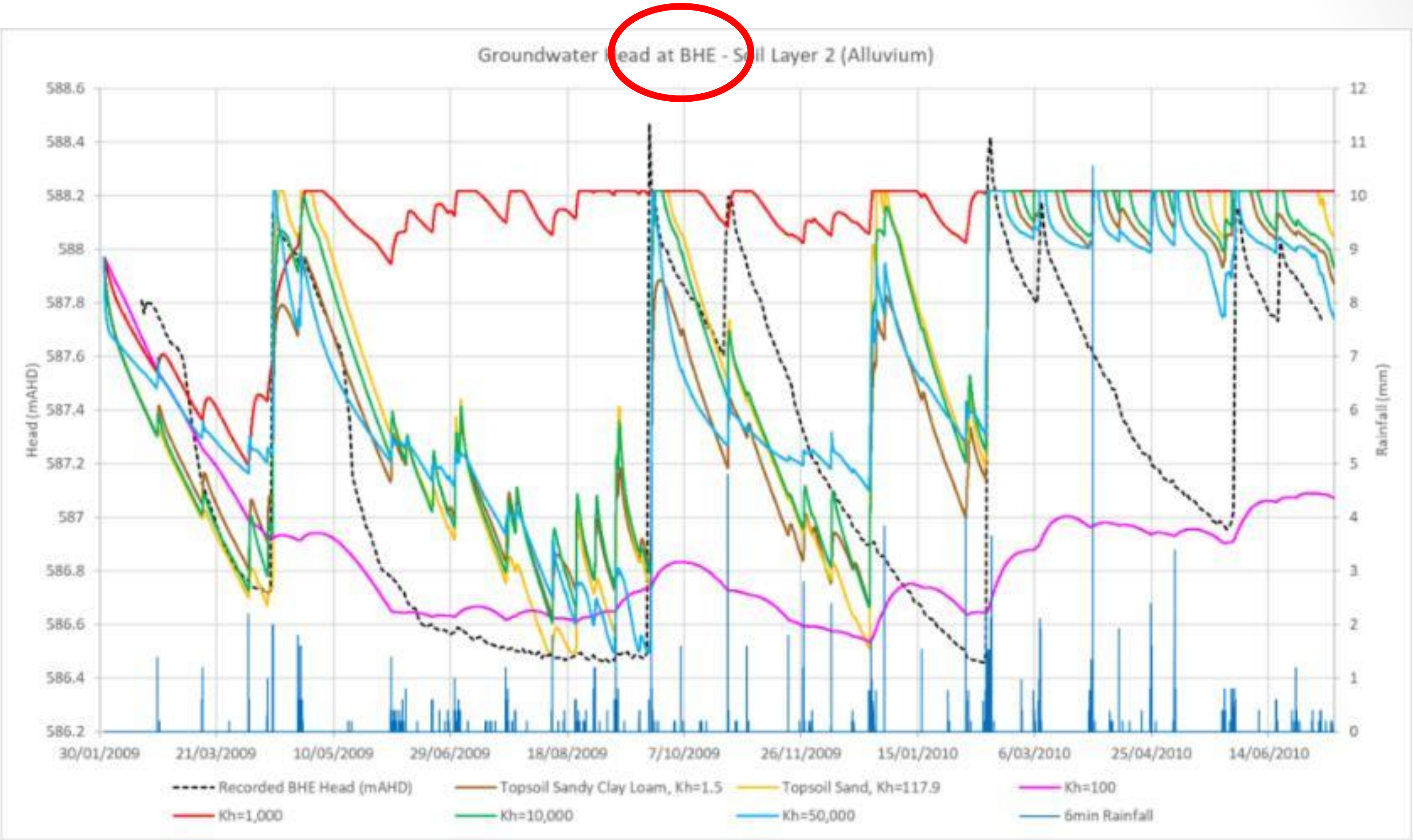


Calibration

- Surface water flow and groundwater level data to calibrate soil parameters

The challenge:

- Conductivities of 10 to 50,000 mm/hr tested
- Different topsoil types



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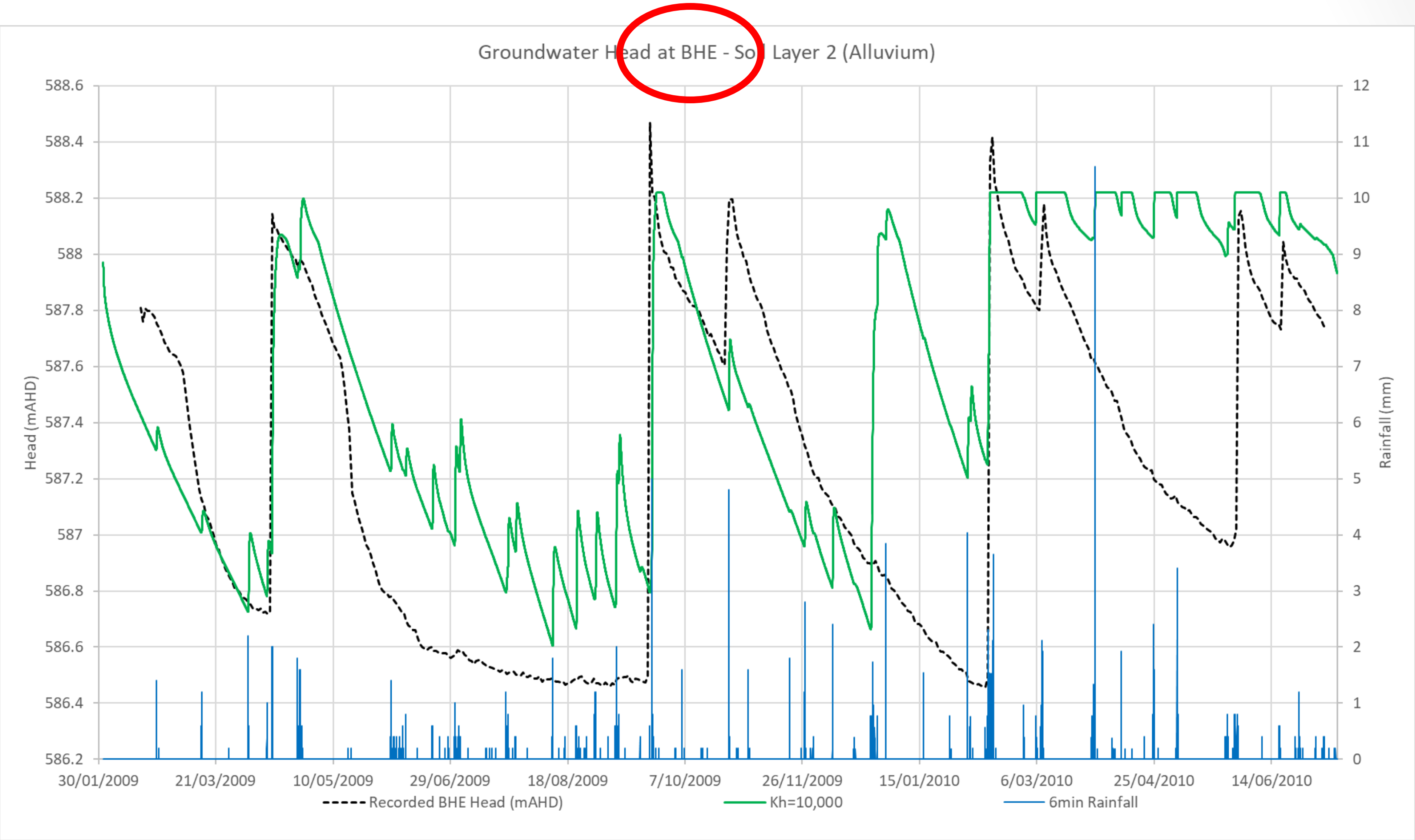
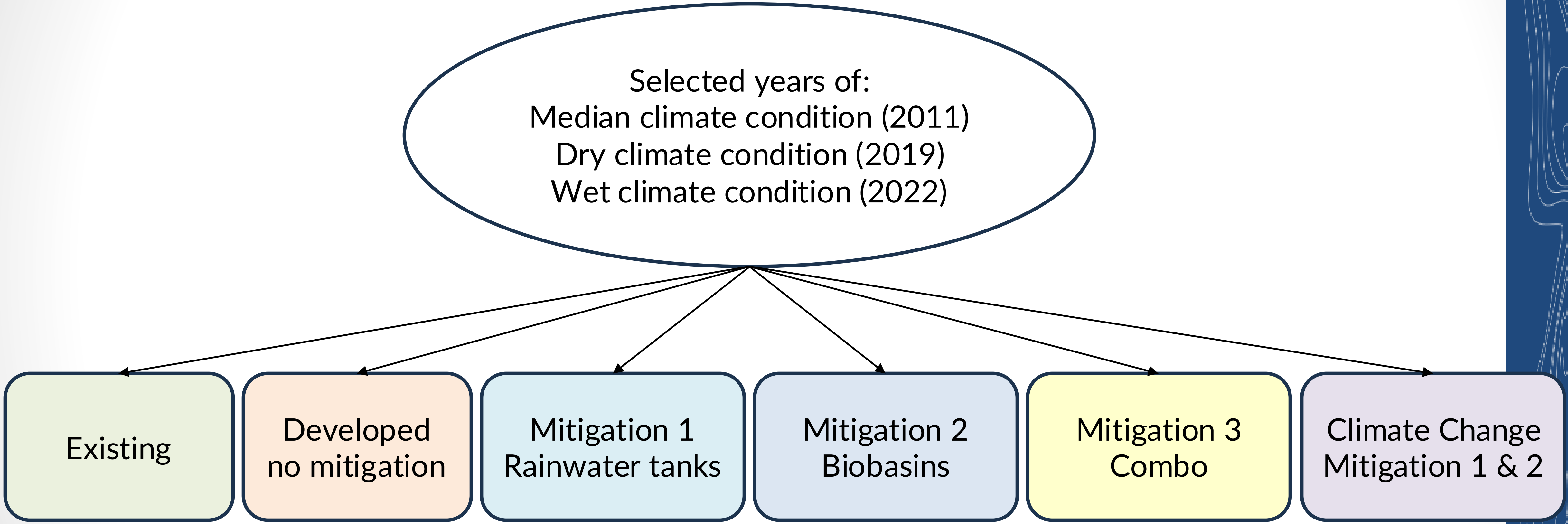
Calibration

- Example final calibration



Model Application and Scenario Testing



Hydrologic Change Thresholds

- **Maintaining water within the Sullivans Creek channel:**
  - No more than a 10% change in the frequency of surface water inundation of sensitive habitat locations.
- **Not allowing Sullivans Creek and major drainage lines to become disconnected from their floodplains:**
  - No more than a 10% change in the 90th percentile surface water flow from the catchment.
- **Minimising additional saturation of the floodplain adjacent to Sullivans Creek and within drainage lines:**
  - No more than a 10% change in the 50th percentile surface water flow from the catchment.

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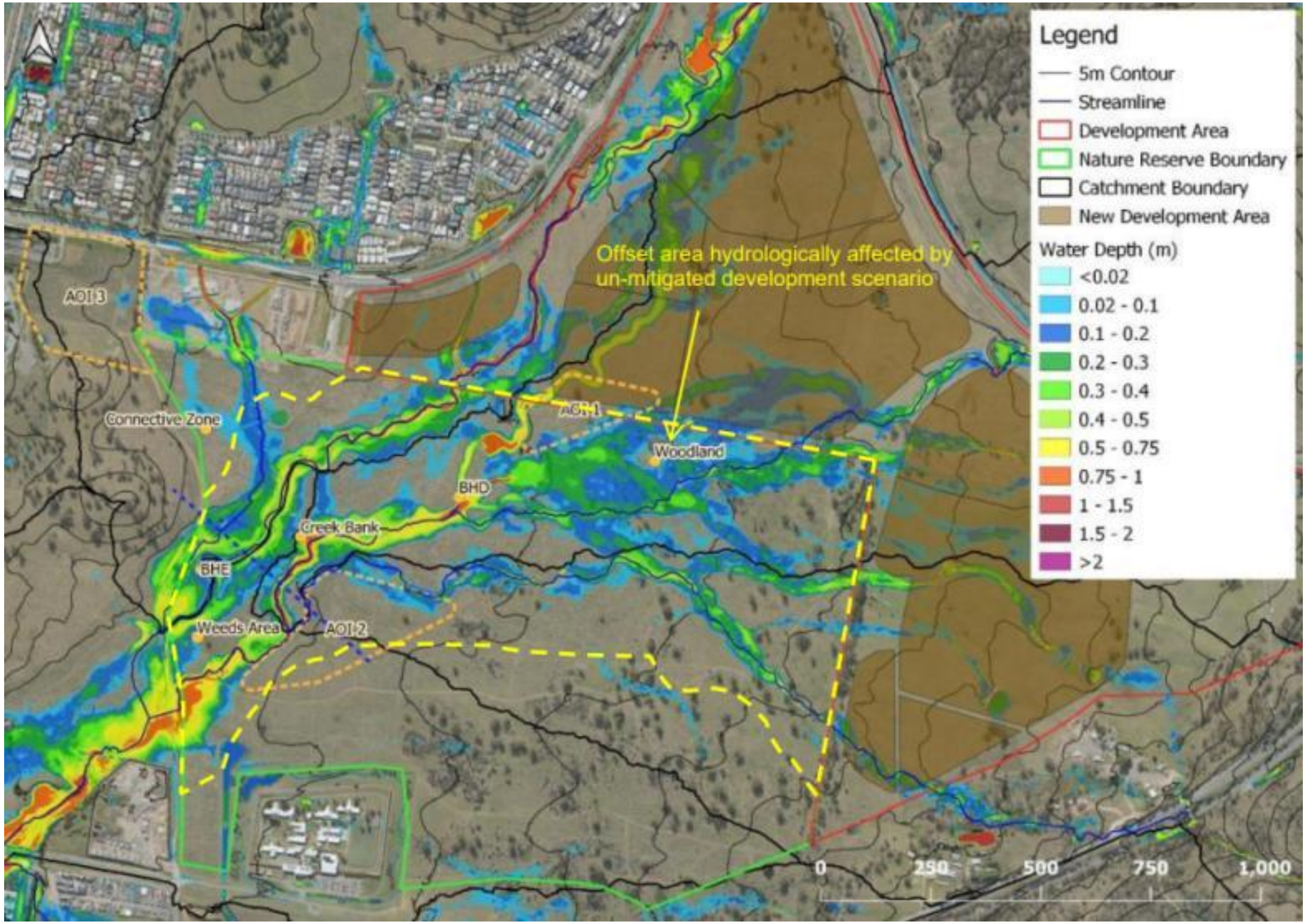
Hydrologic Change Thresholds

- **Minimising inundation and saturation of Sullivans Creek in the vicinity of the proposed retardation/detention basin immediately upstream of Morisset Road:**
  - No more than a 10% change in the frequency of inundation of sensitive habitat locations immediately upstream of Morisset Road.
- **Ensuring permanent or prolonged changes in groundwater levels are minimal and proportional to the existing distance below ground level (BGL):**
  - No more than a 10% change in the 50th percentile shallow groundwater depth BGL for sensitive habitat locations.
- **Ensuring short term changes in groundwater levels are not excessive:**
  - No more than a 10% change in the 10th and 90th percentile shallow groundwater depth BGL for sensitive habitat locations.

Impacted Areas, Surface Water and Groundwater Results



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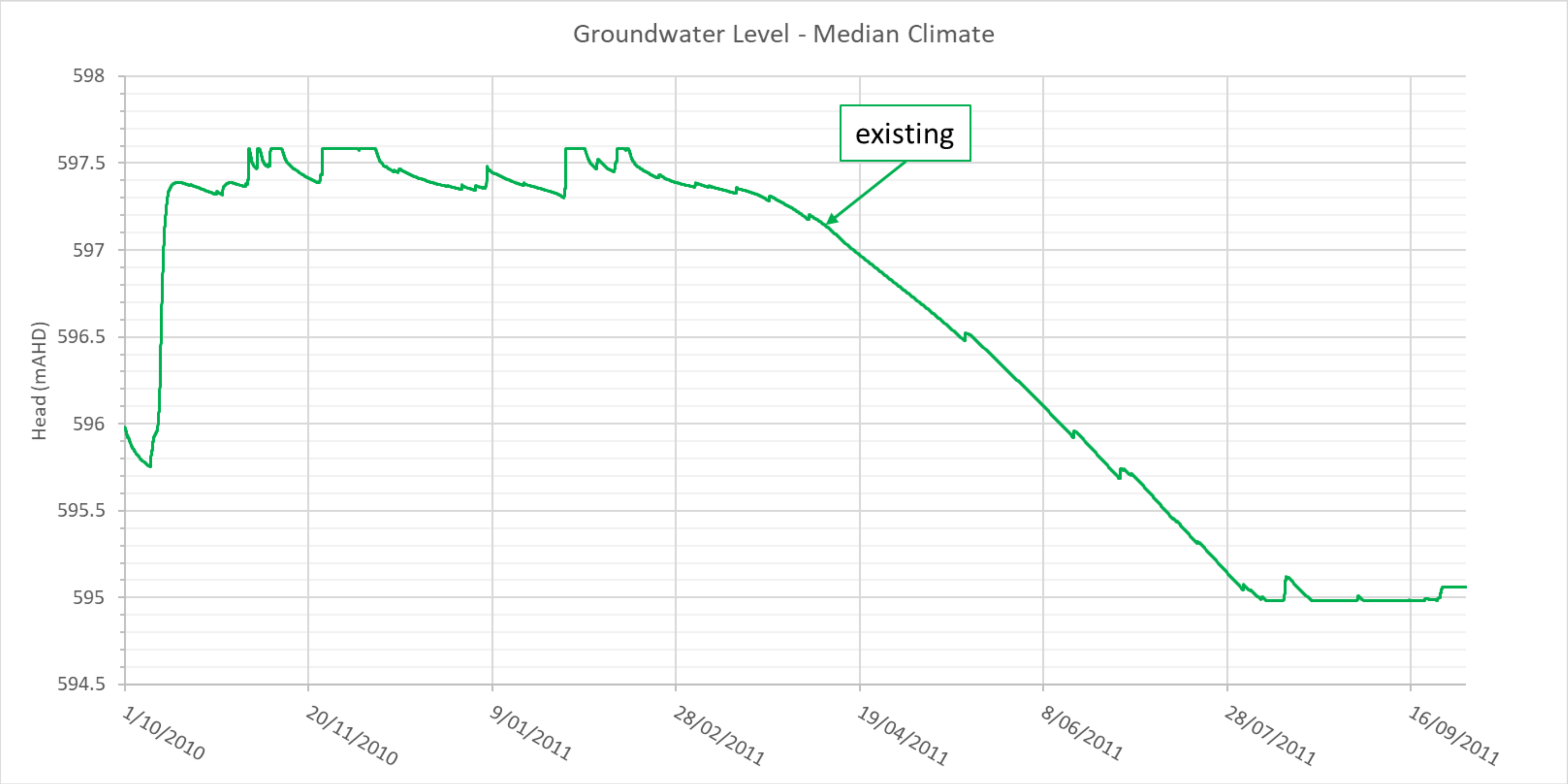

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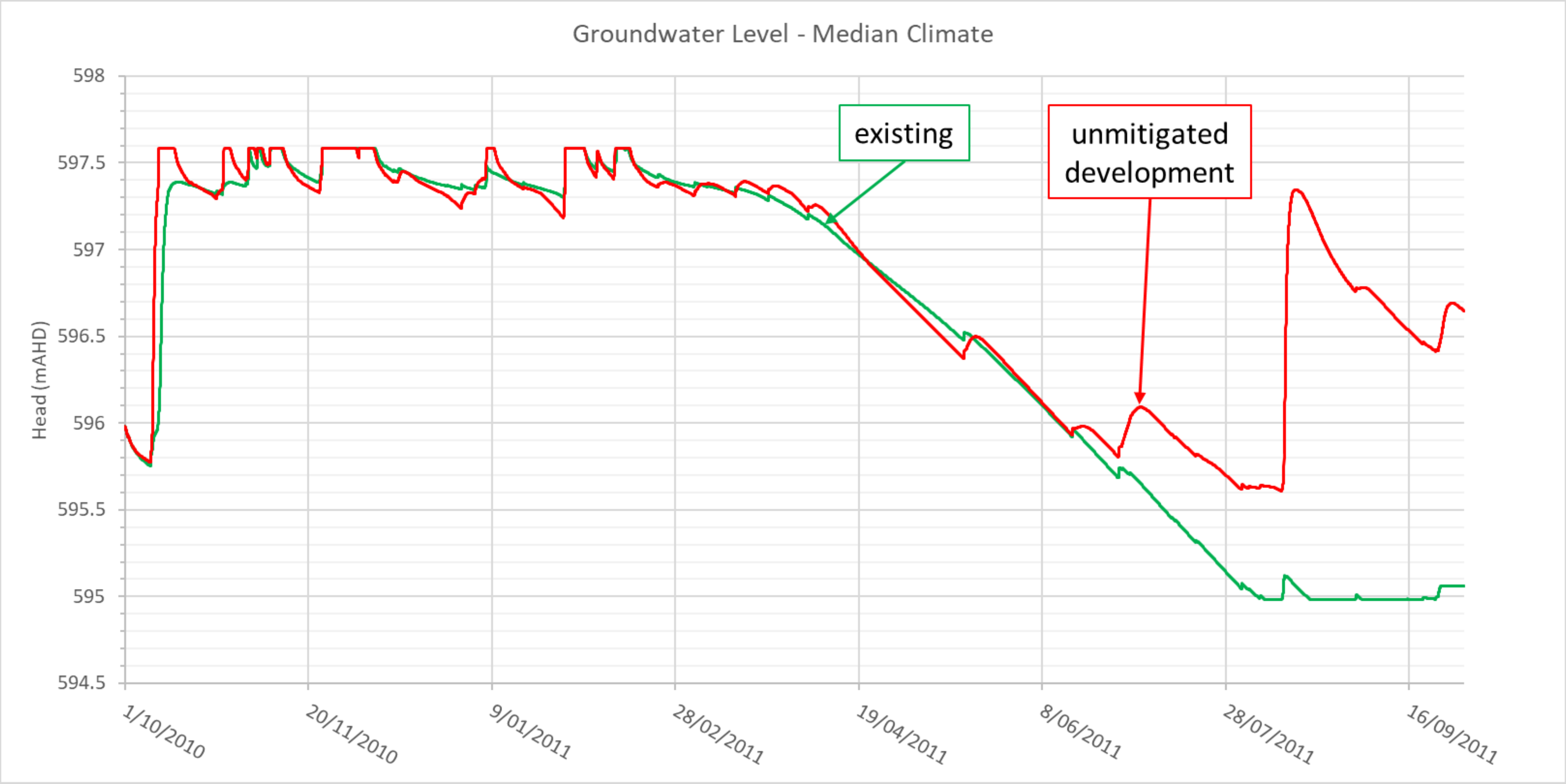

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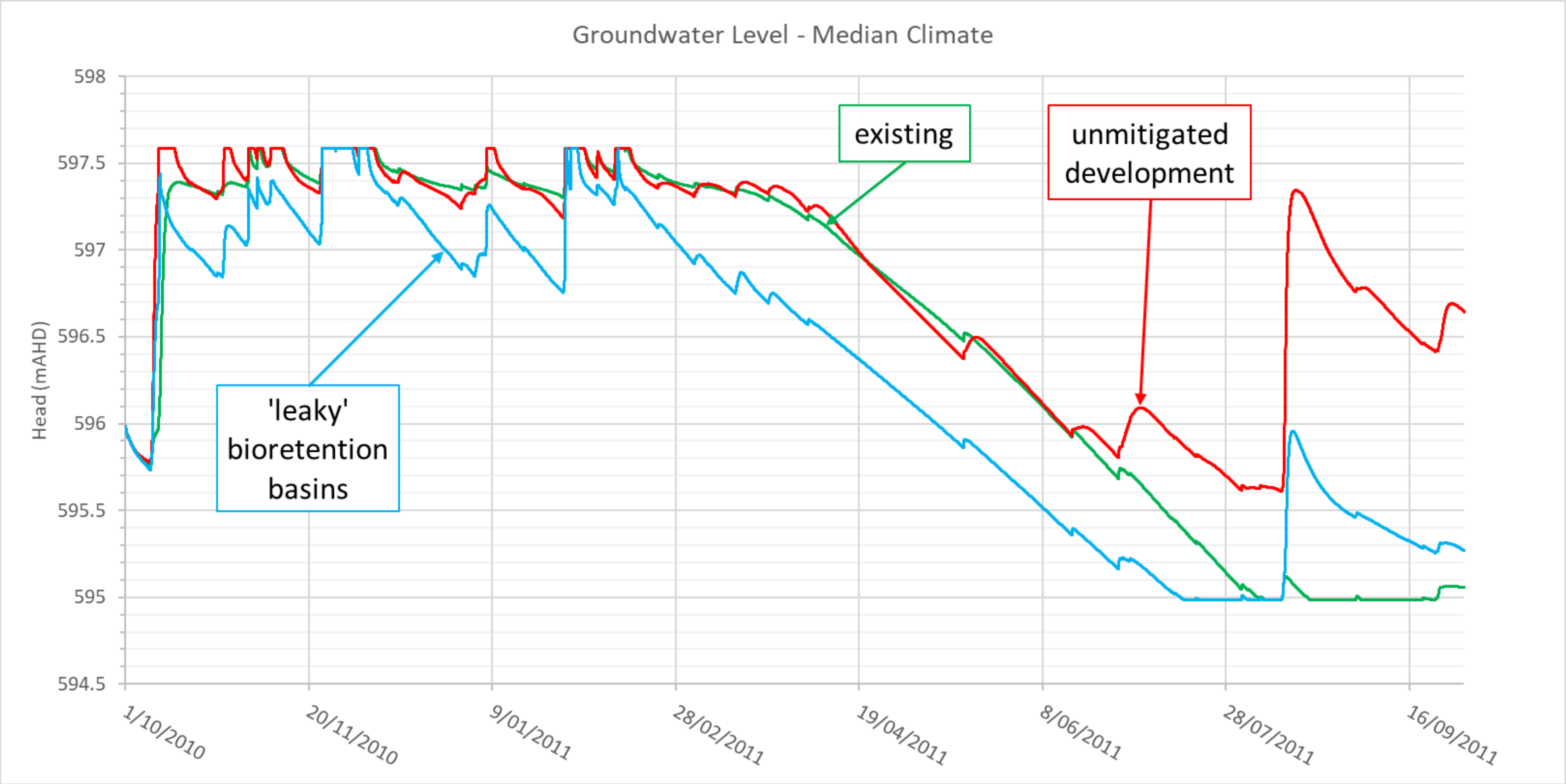

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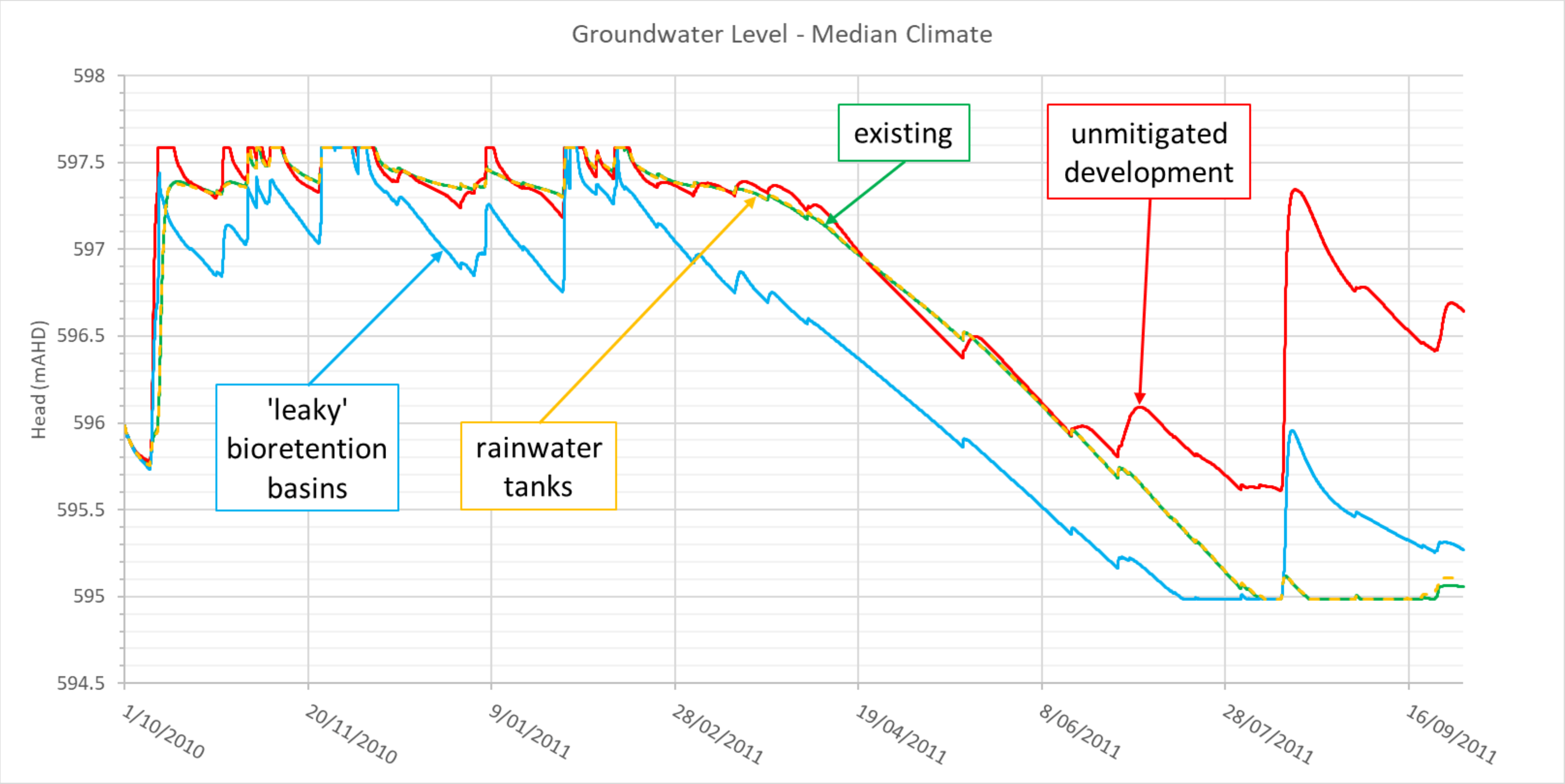

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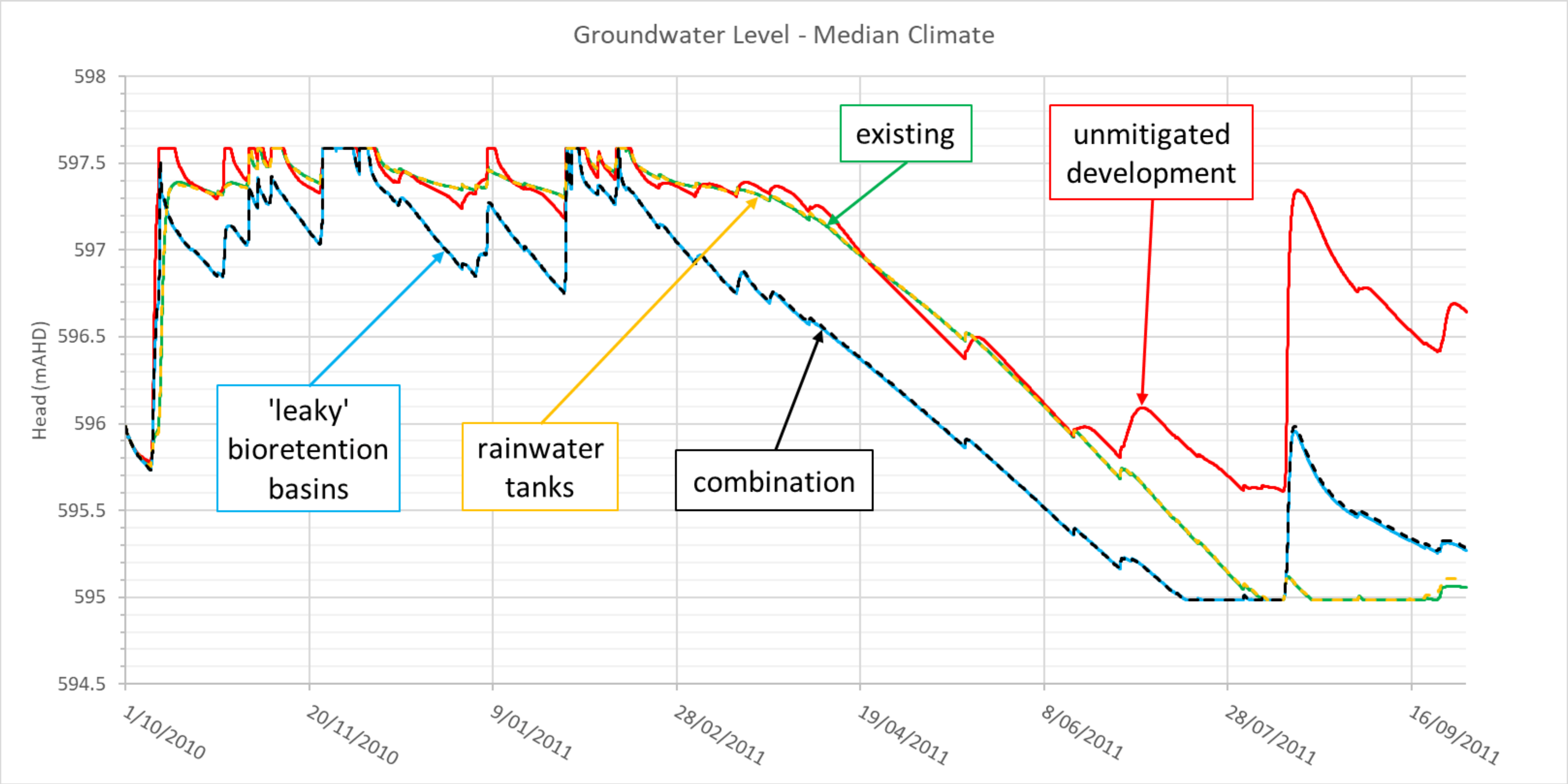

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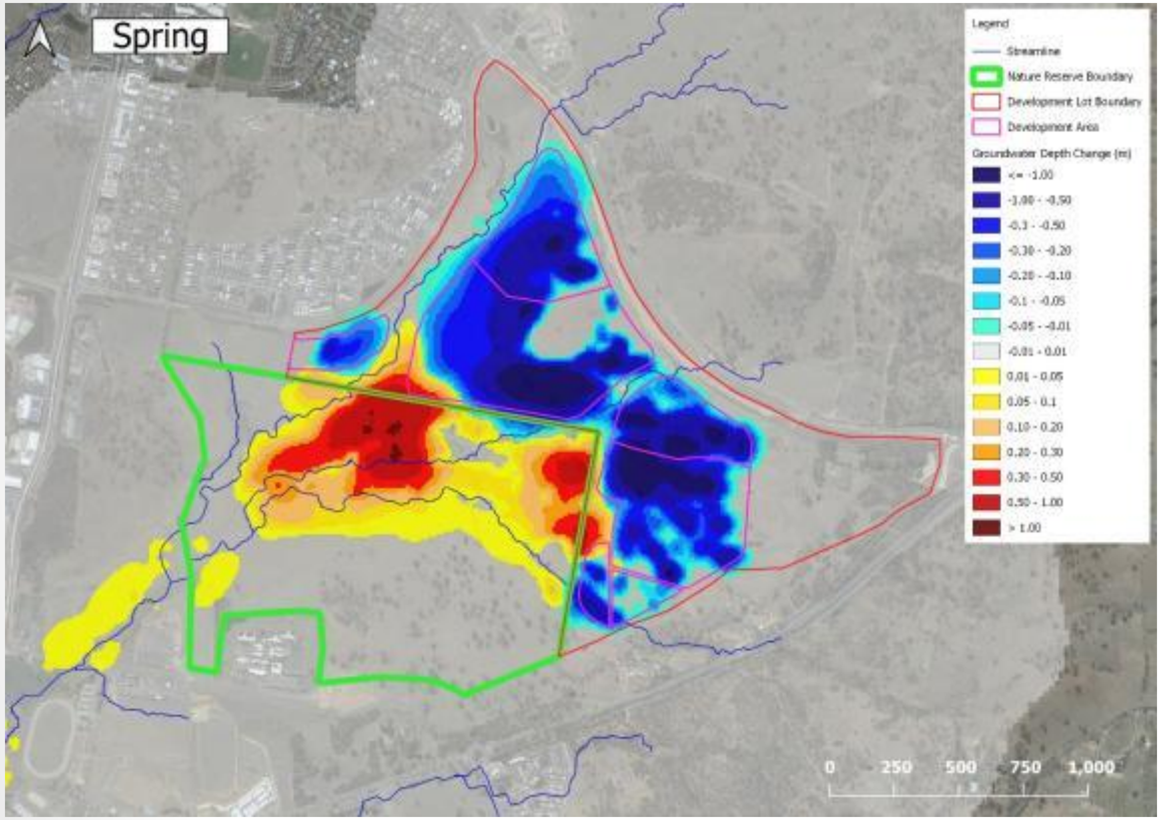
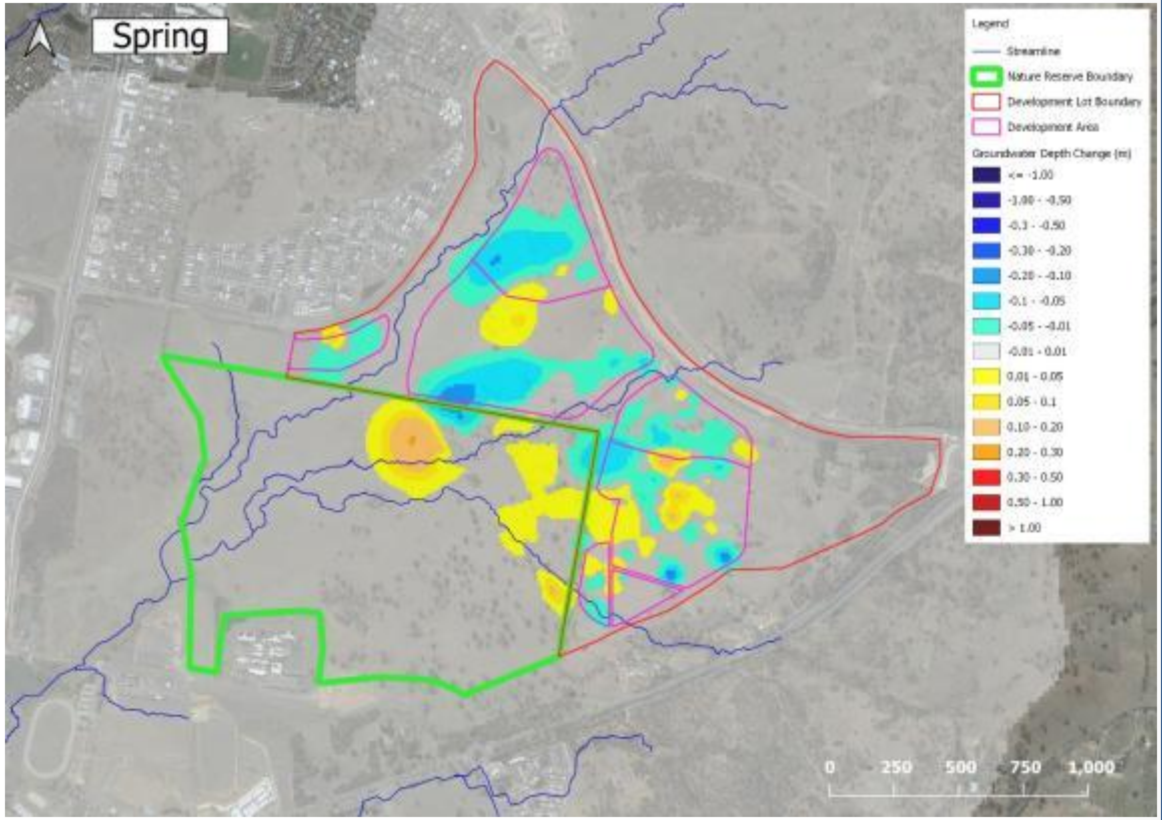
Impacts



Unmitigated development - groundwater impacts



Mitigated development - groundwater impacts

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Conclusions

- Adopting a holistic, appropriate hydrological model has multiple benefits
- Combined with detailed data, systems can be understood and impacts quantified
- Required mitigation measures to protect sensitive environments can be determined
- Call to action for developers, engineers, scientists and policymakers to collaborate and innovate