Centre for
Water & Spatial Science

THE UNIVERSITY OF
WESTERN
AUSTRALIA

Urban Development over Shallow Groundwater in Perth

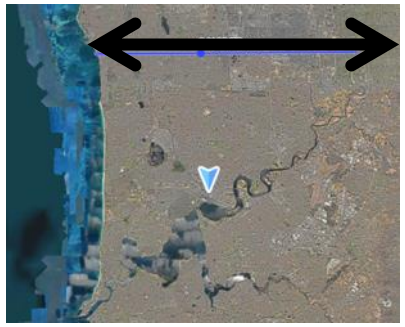
Whadjuk Noongar Boodja

My Boodja, My Turtle Dreaming by Joanne Parfitt (Bungaan)

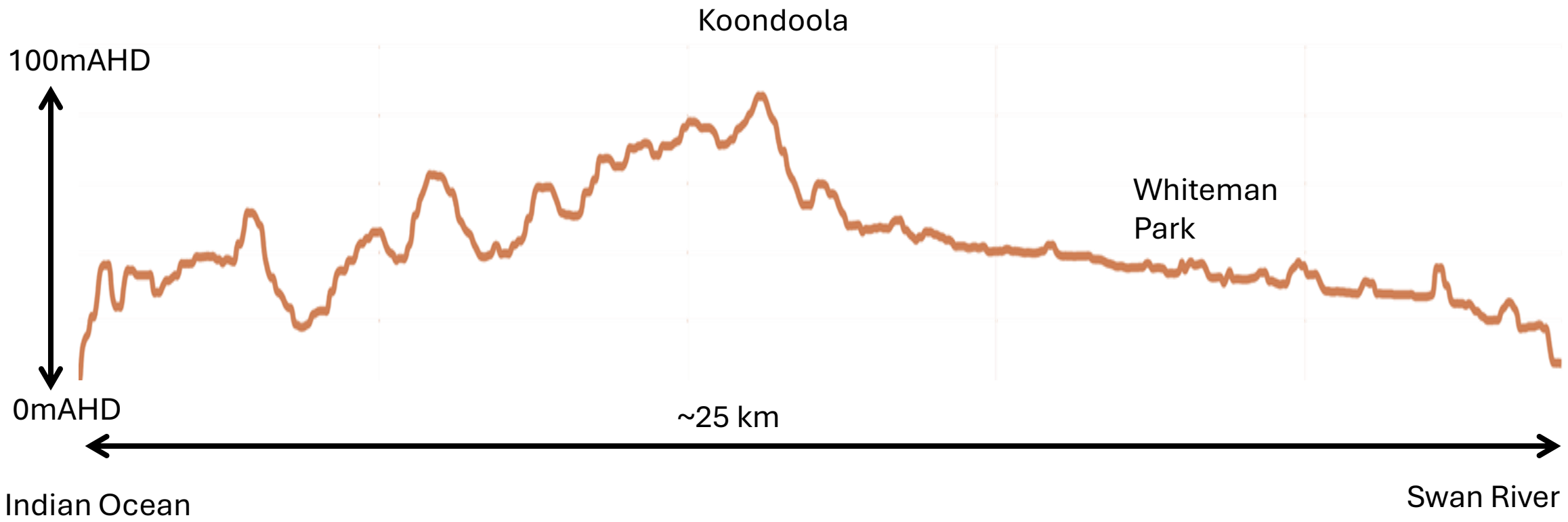
Thank you

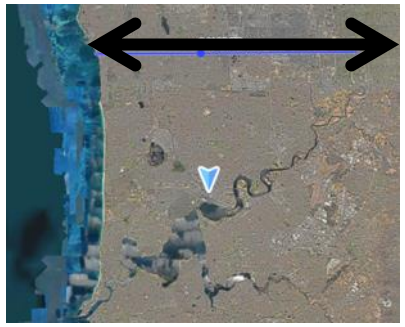
- Amirul Asraf Shah Nizamuddin
- Andrew van de Ven

- Harry Gratte and Cheryl Rogers
- Rod Henderson



Swan Coastal Plain





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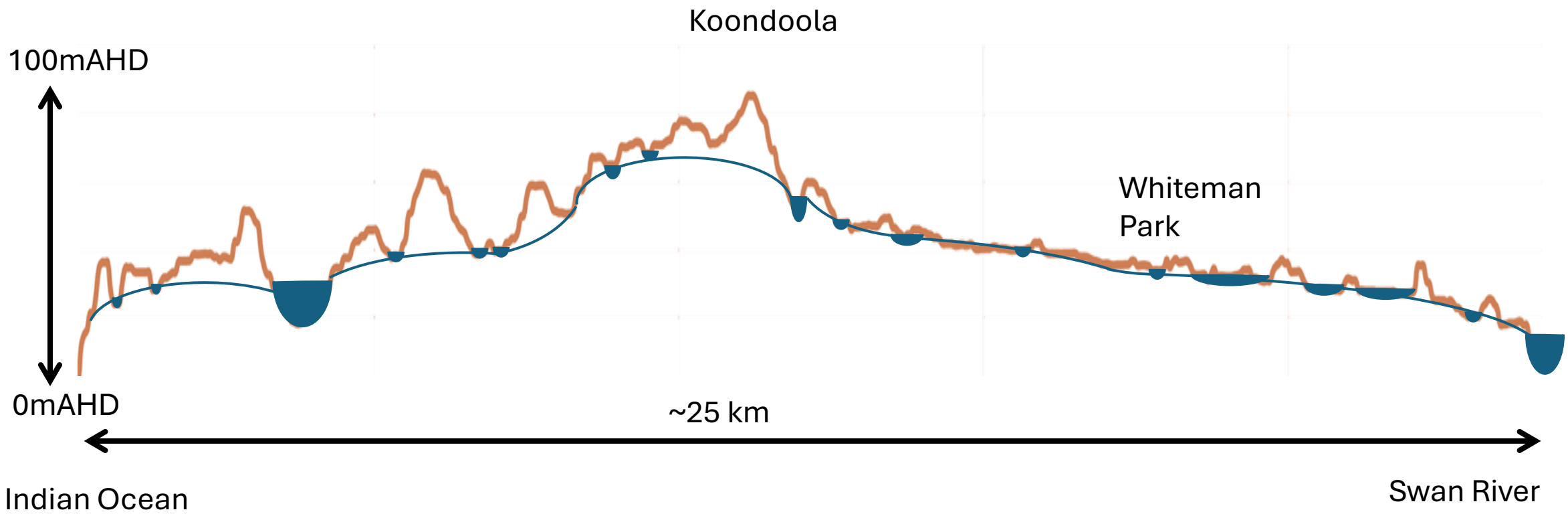
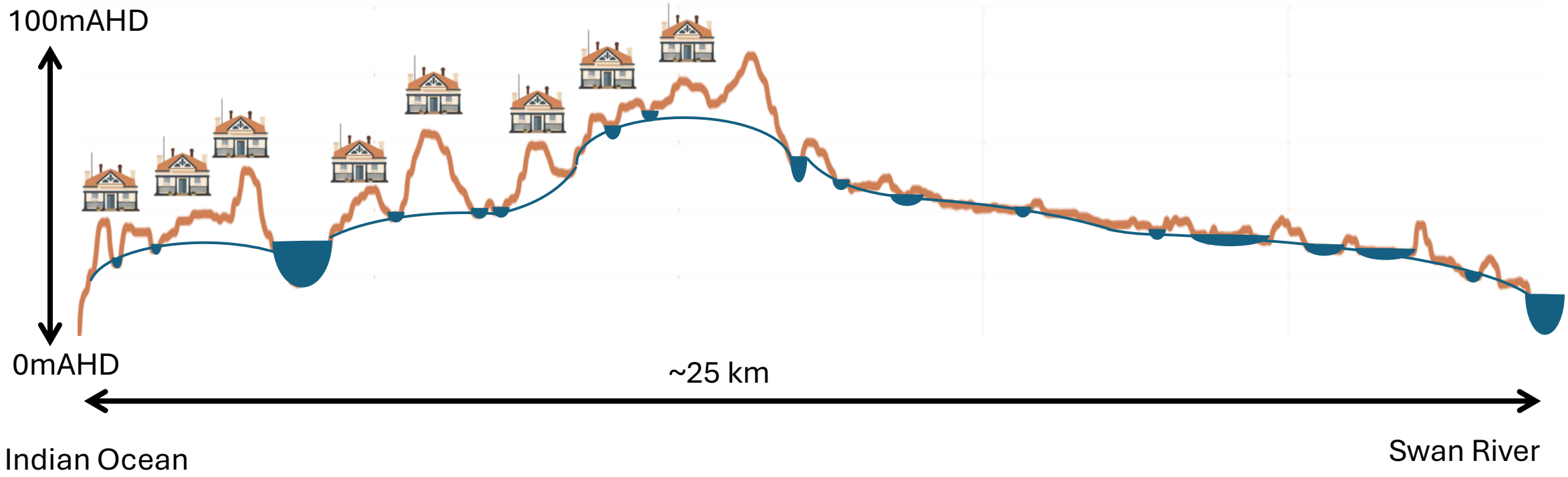
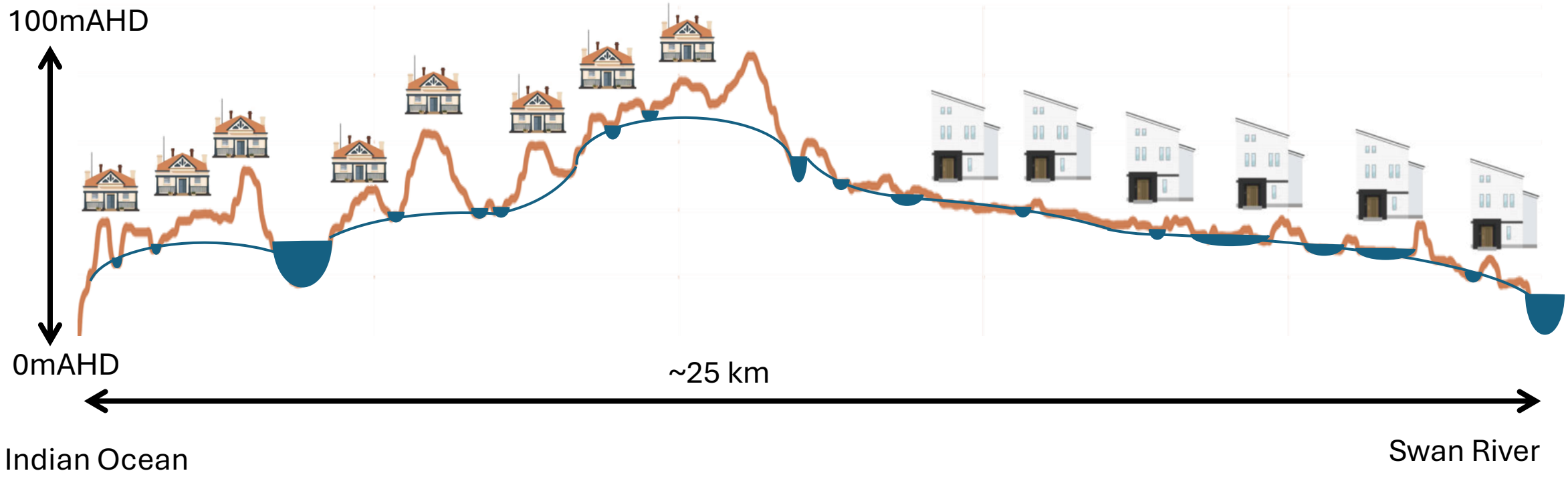


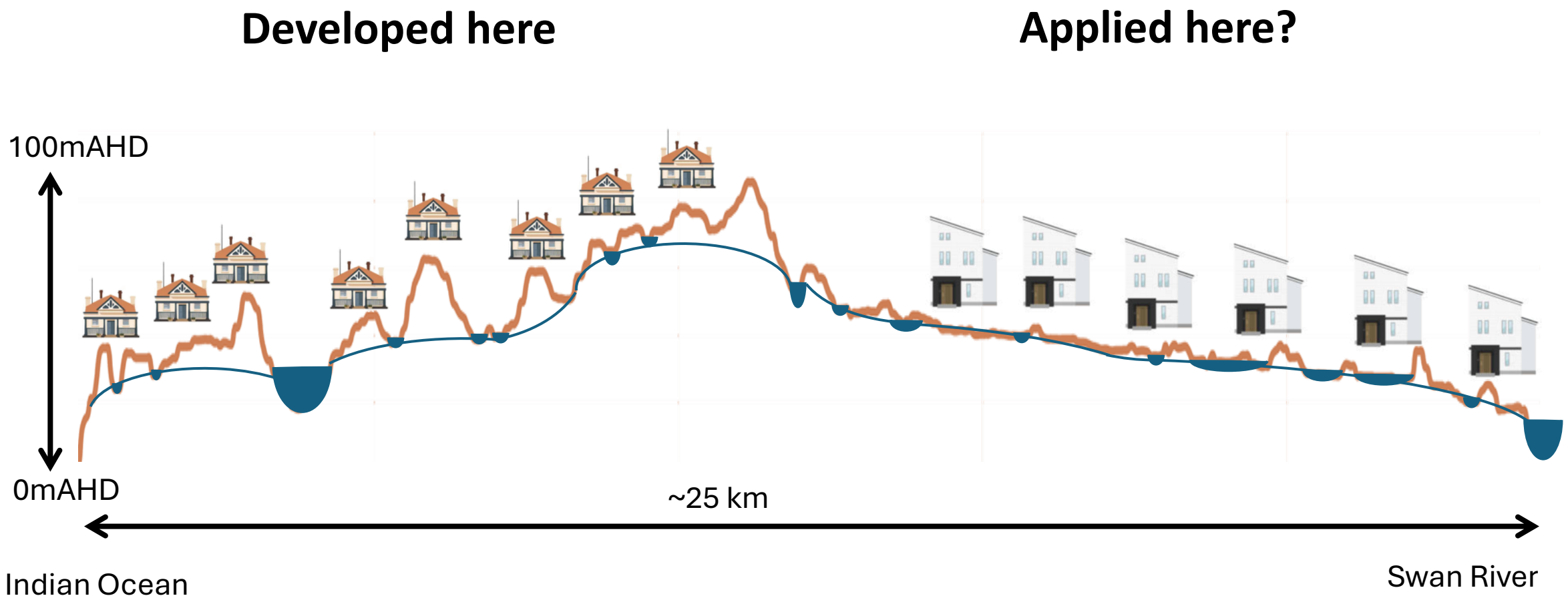
Initial Urban Development



North East Corridor (NEC) Development?



Urban water management approaches

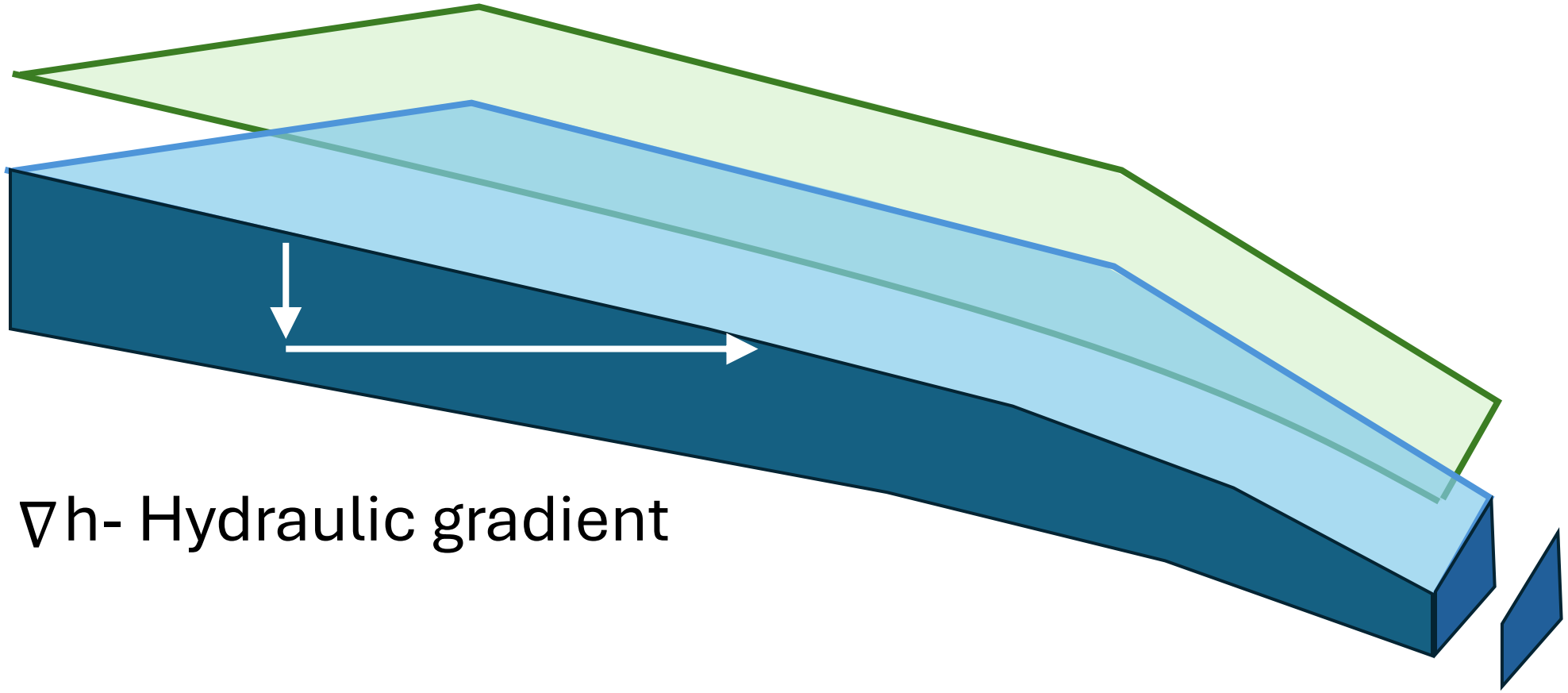


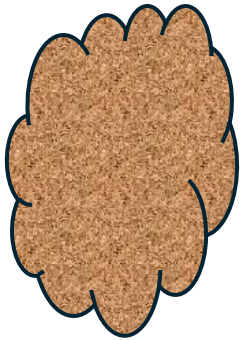

What is groundwater?

Water stored in pores of soils / rocks

Groundwater flows

$$Flow = k_{sat}\,\nabla h\,A$$



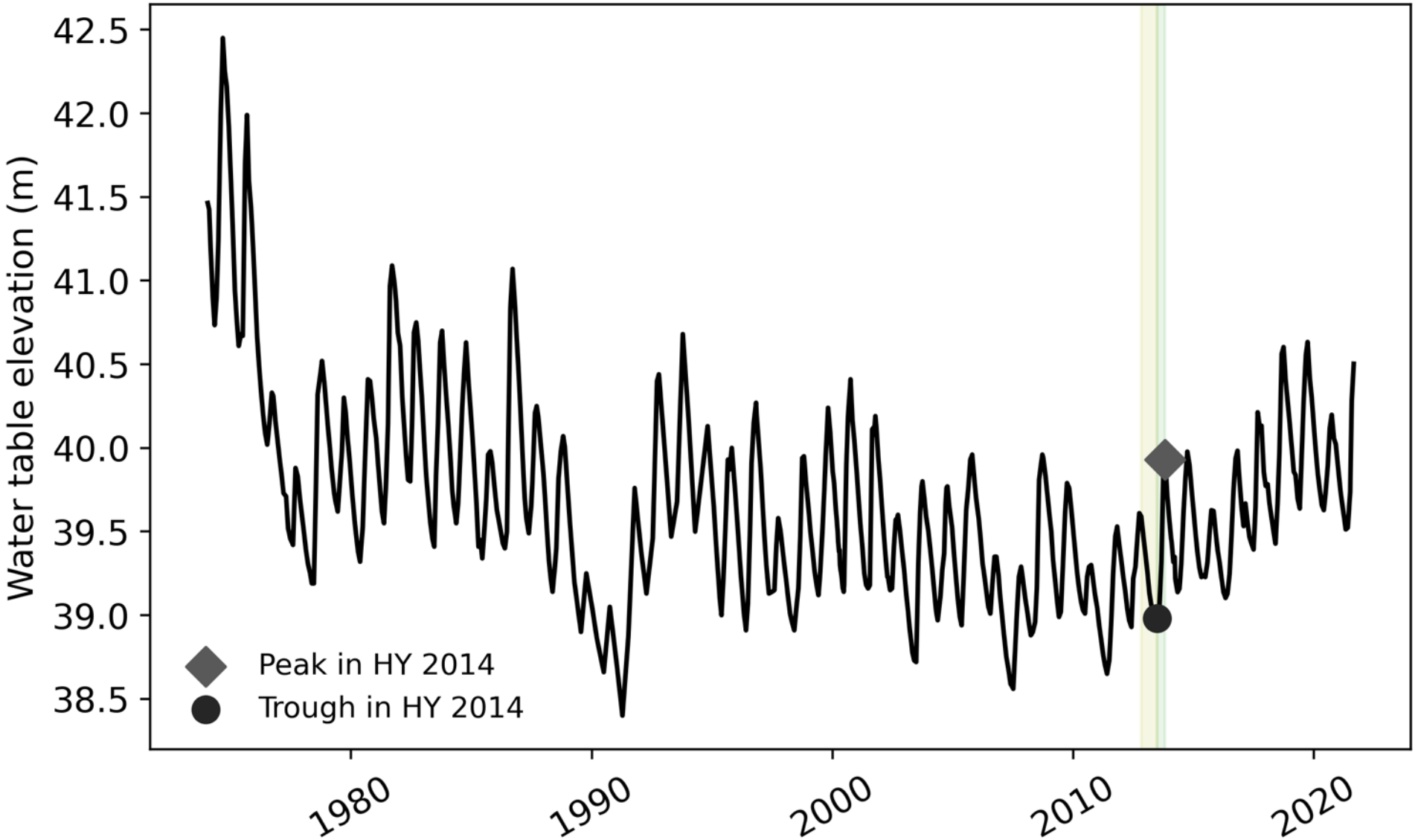


k_{sat} – Hydraulic conductivity

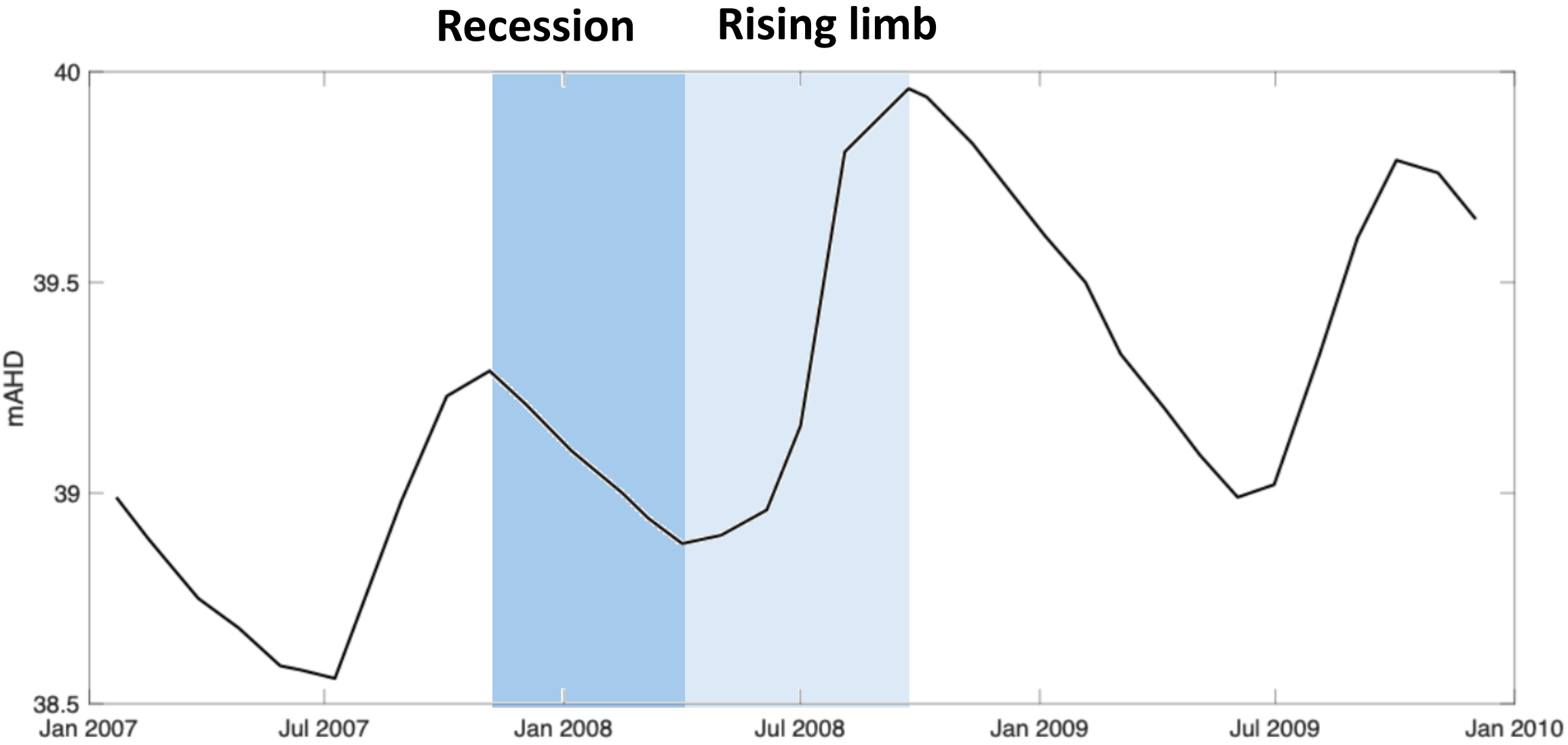
∇h- Hydraulic gradient

A - Saturated area

Measure in one place – a bore/well

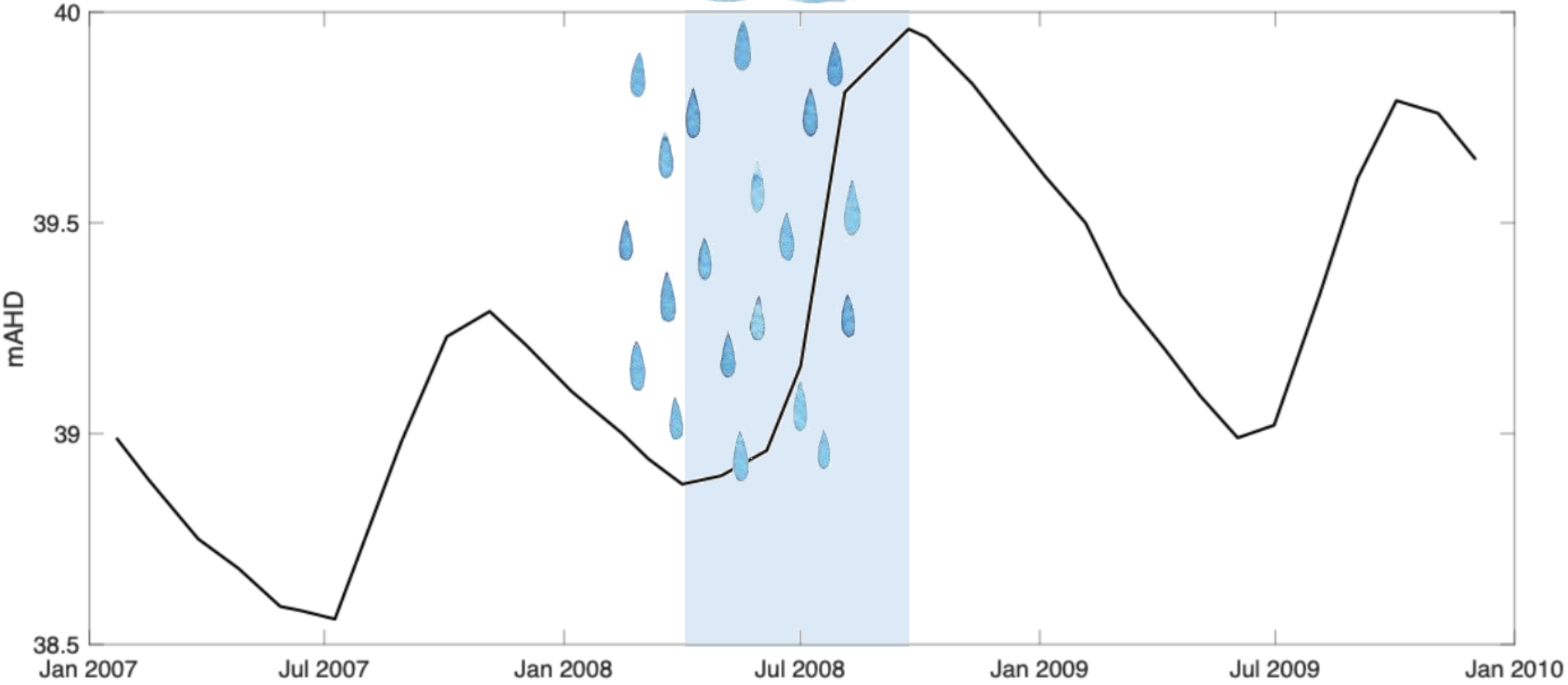


Terminology



Terminology

Rainfall → Recharge



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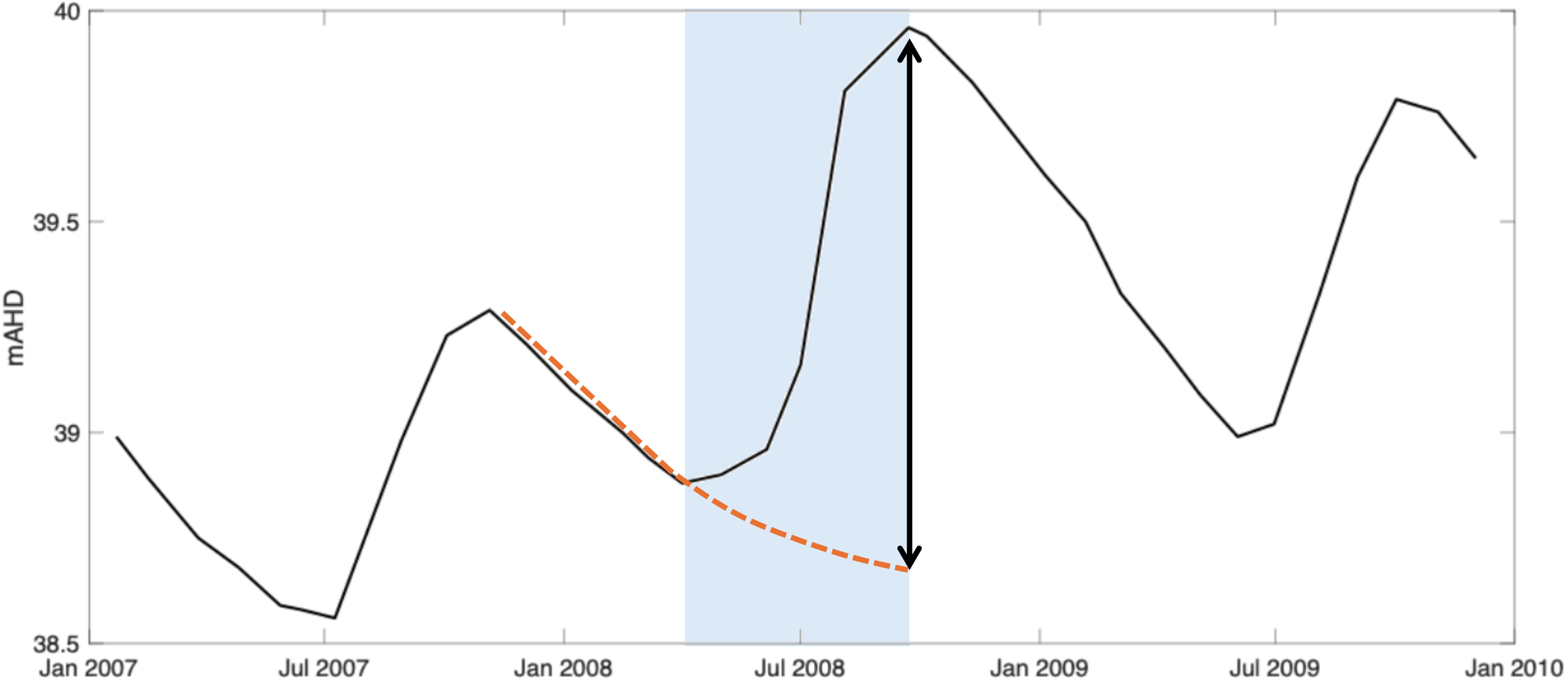
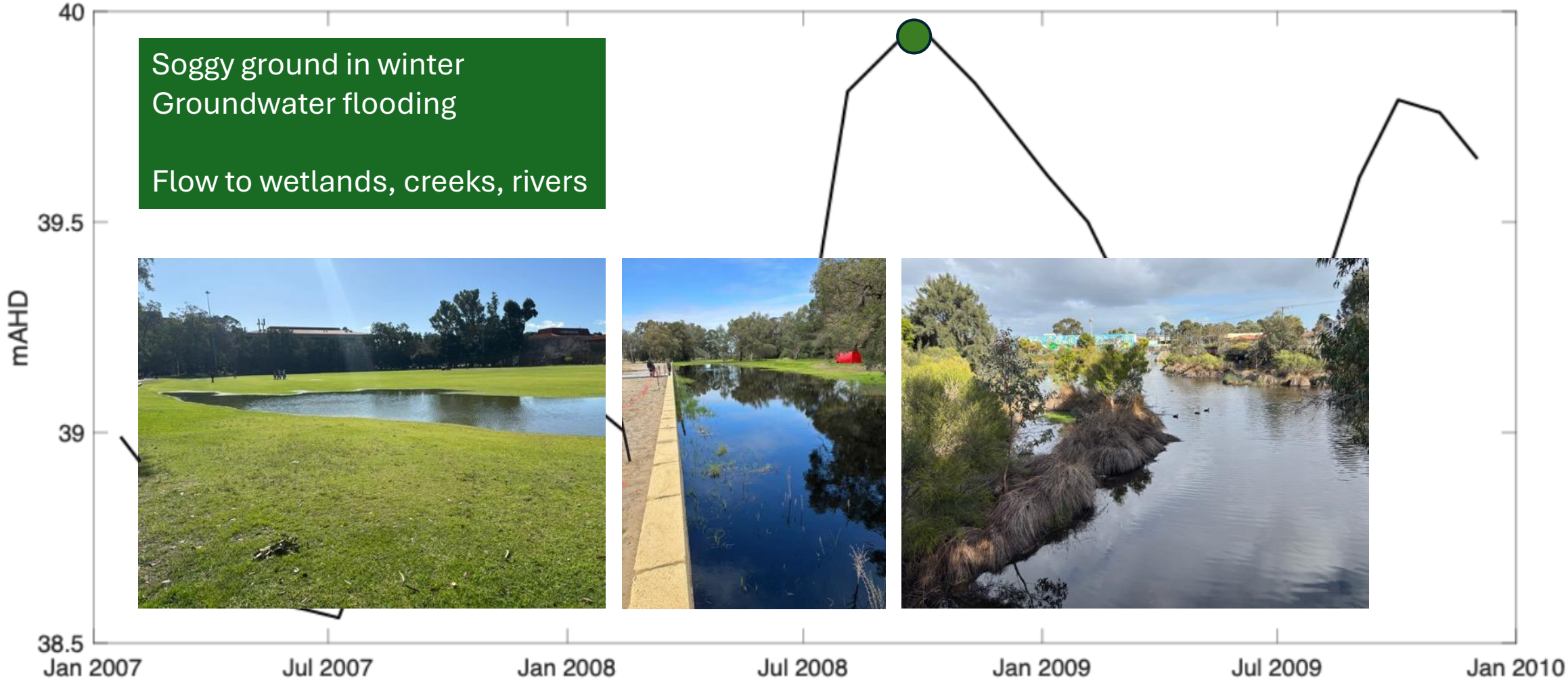


What do these water levels mean?



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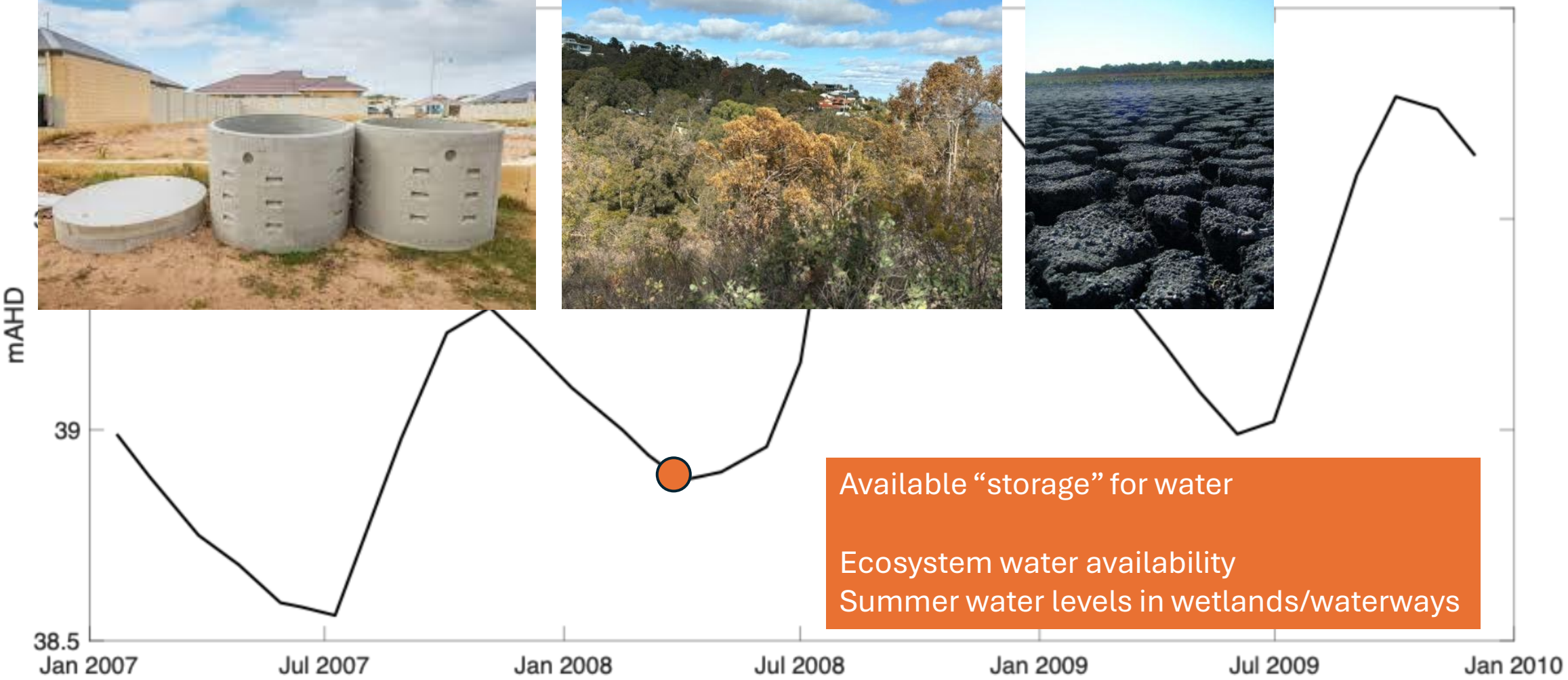
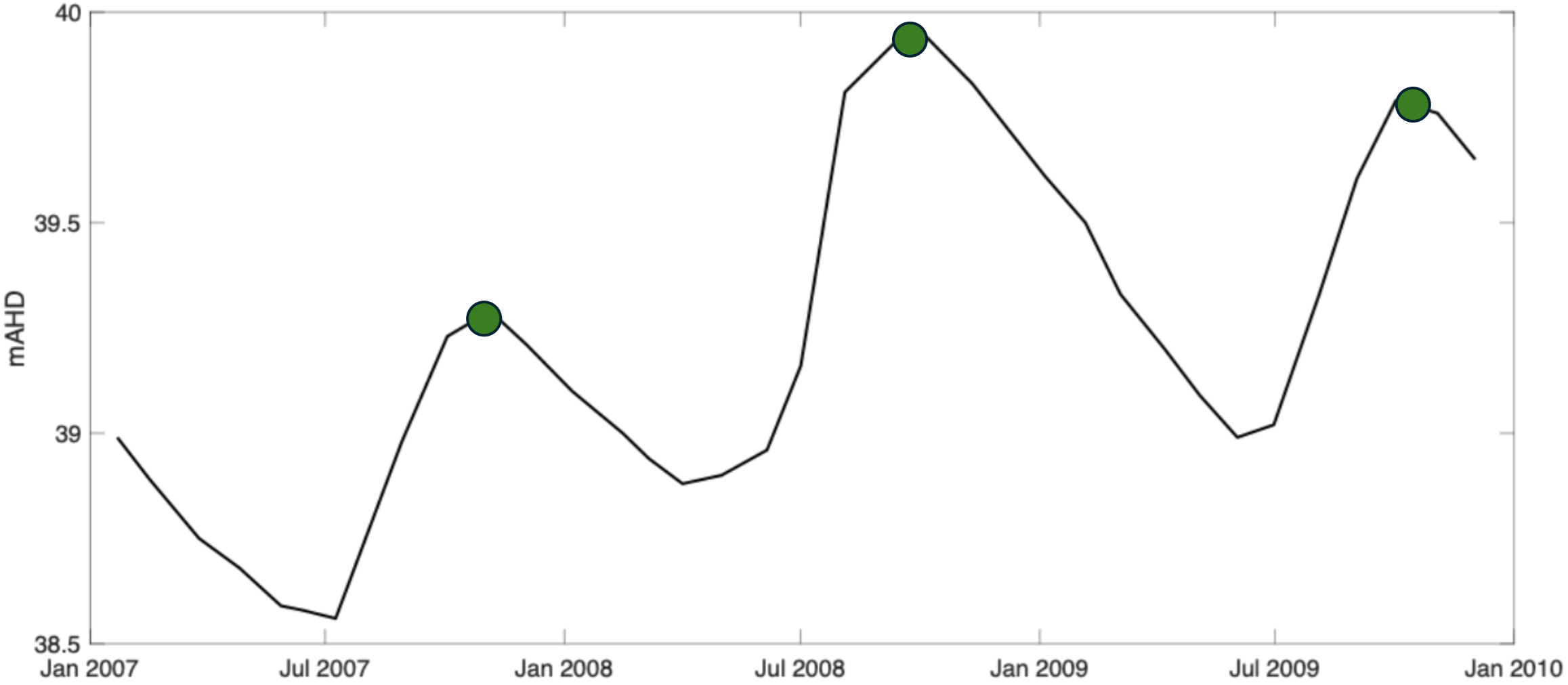


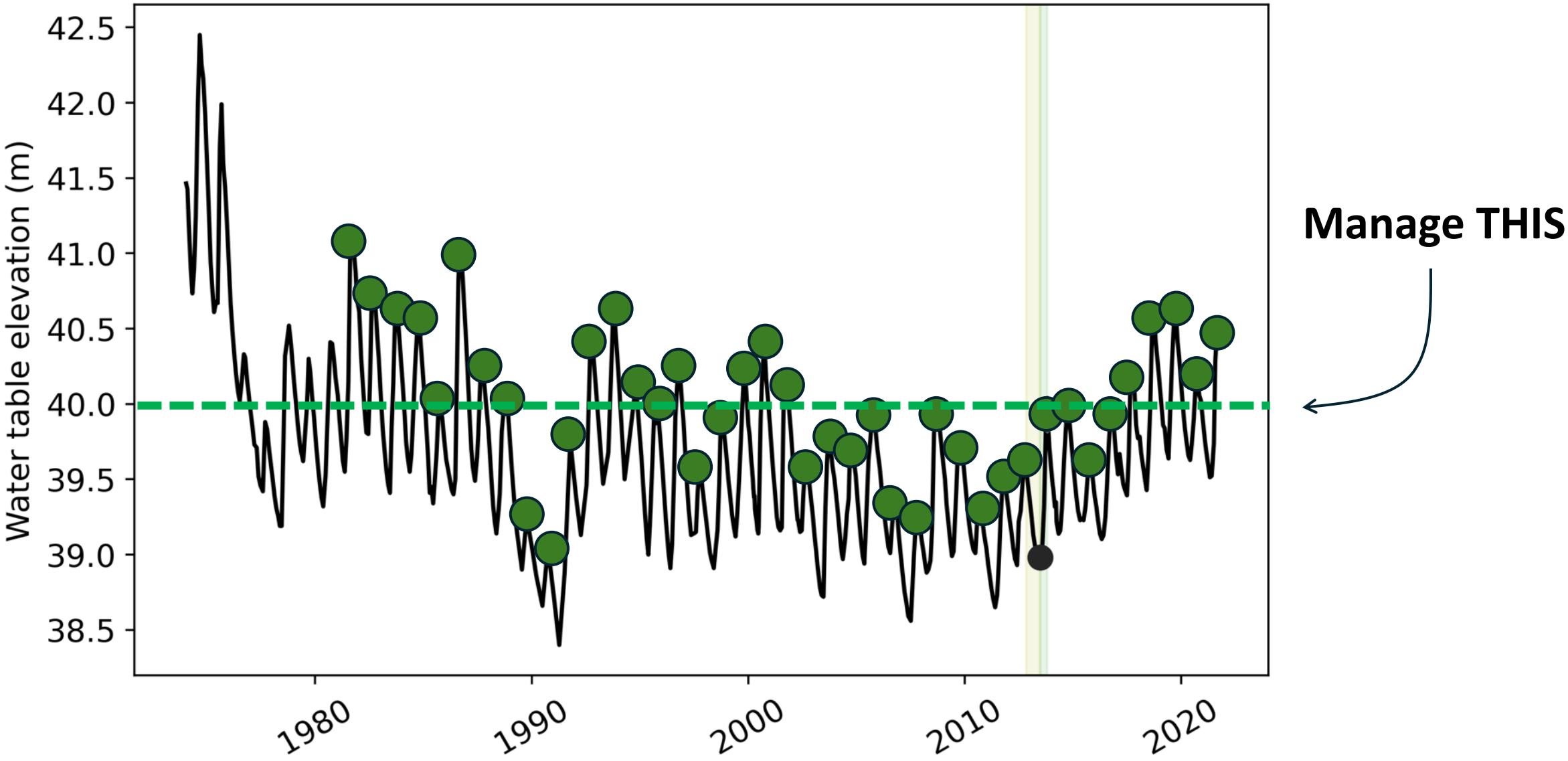
Available “storage” for water

Ecosystem water availability
Summer water levels in wetlands/waterways

Urban water management: AAMGL

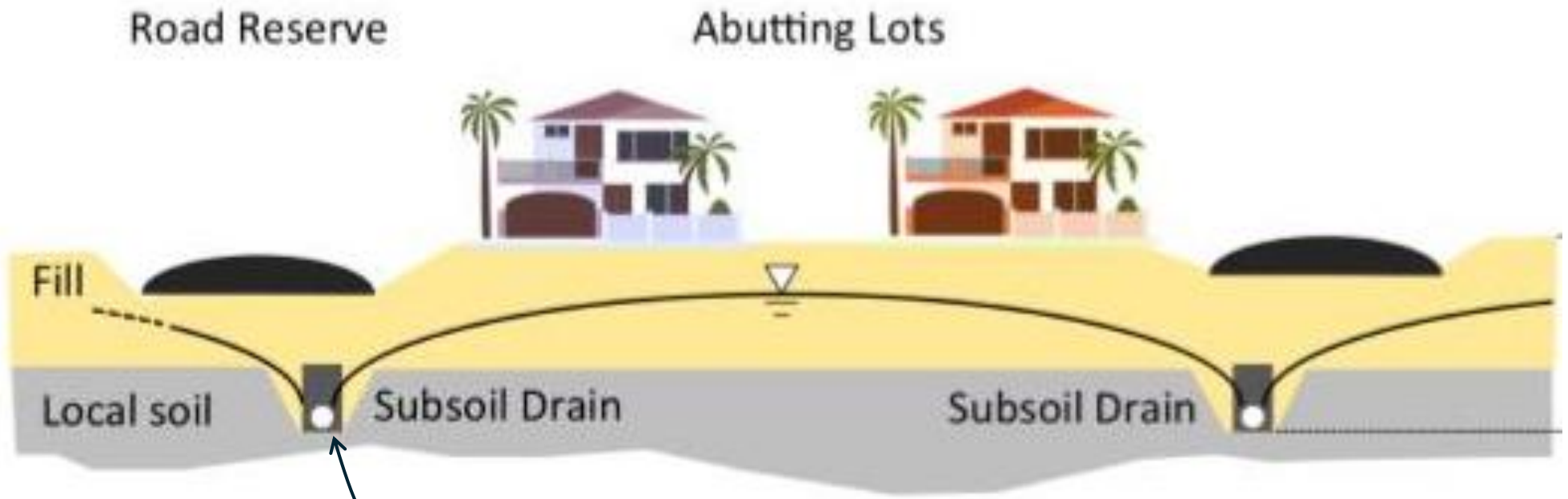


Urban water management: AAMGL



How do we manage an AAMGL?

Subsoil drains control the GW height



Controlled Groundwater Level - CGL

What are the rules for CGL?

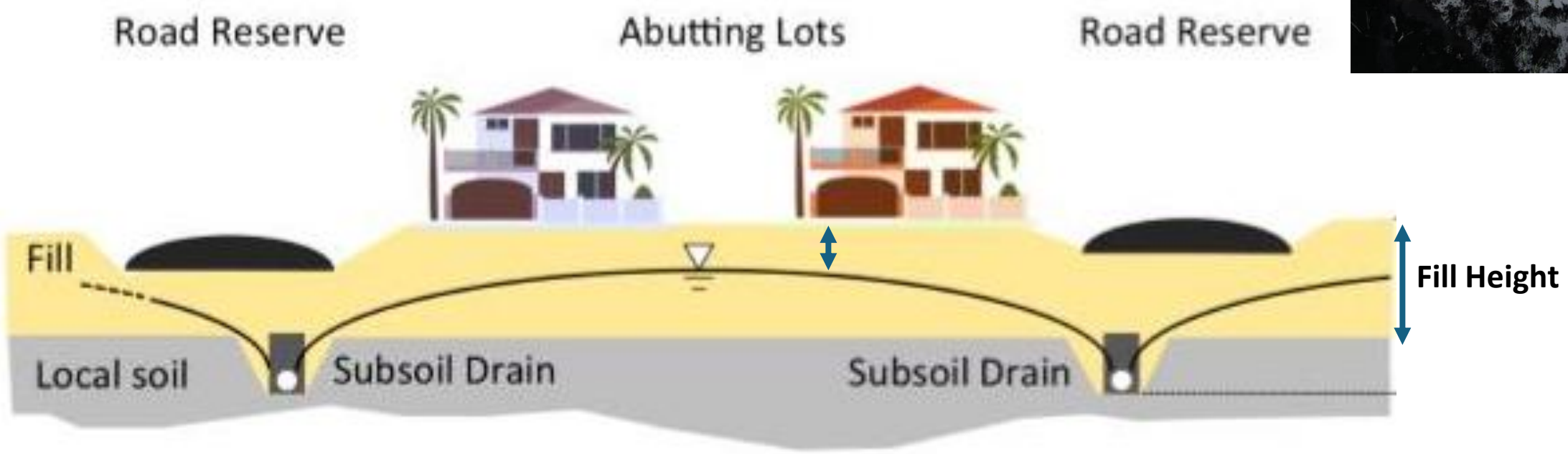
Must be at or above AAMGL

Protect GDEs from drying

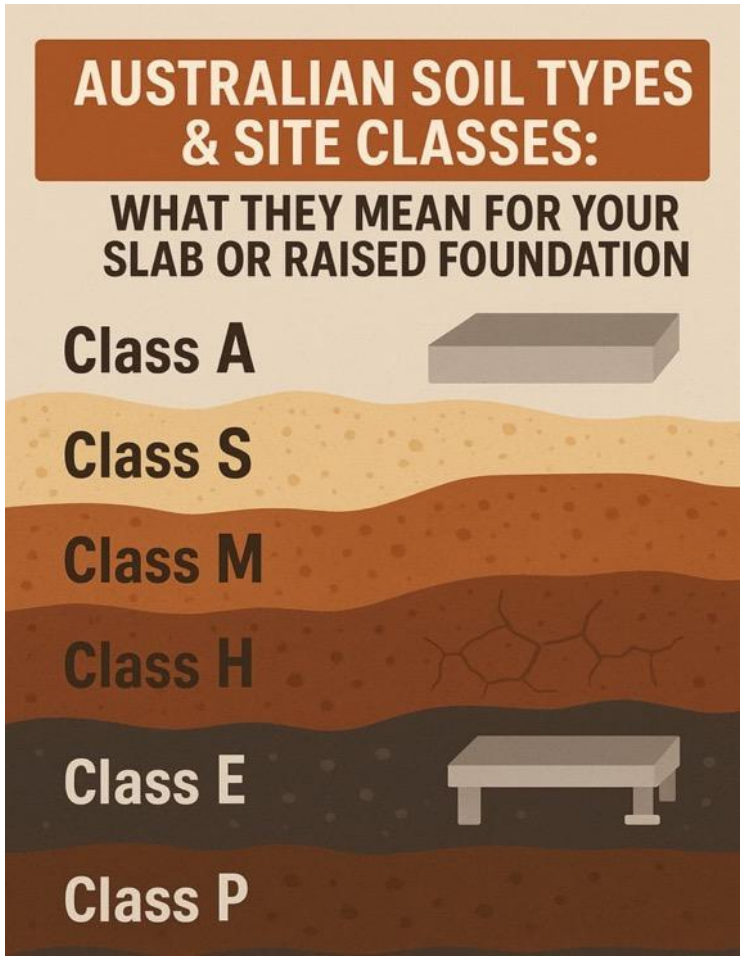
What protects from gw flooding?

Separation distance – groundwater peak to “finished surface”
CGL too high?

Import fill

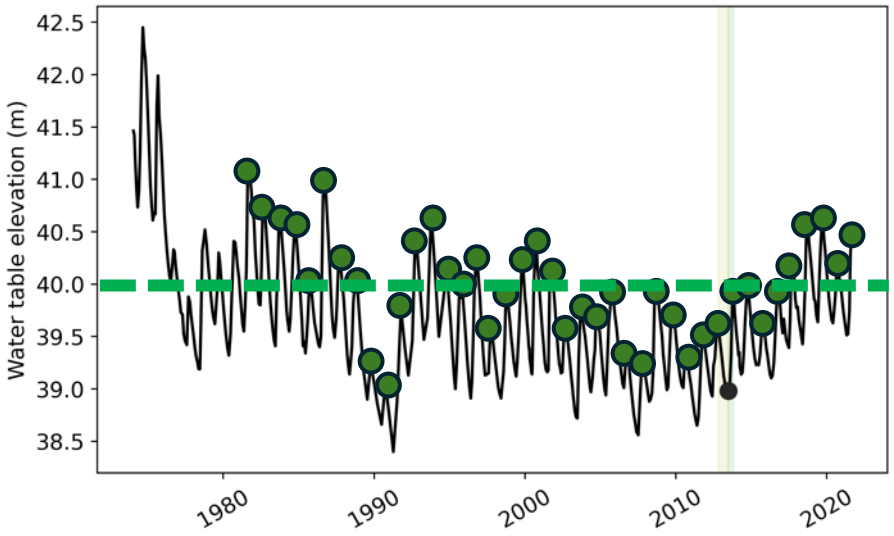


High groundwater increases costs



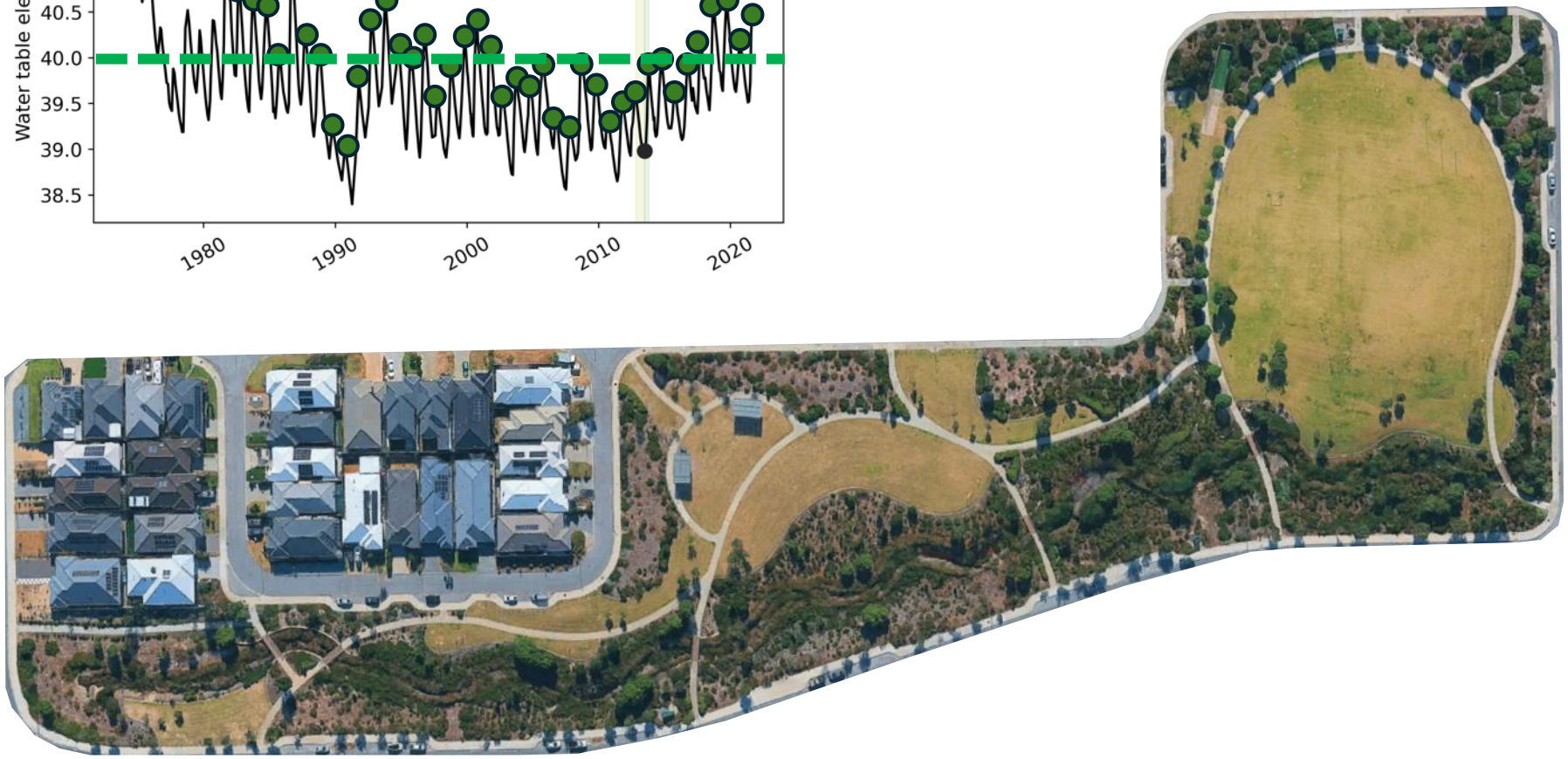
https://www.newwaterways.org.au/key-initiatives/case-studies-fact-sheets/wsud-case-studies/

But implementation is imperfect



Whiteman Edge Living Stream

Flows all year



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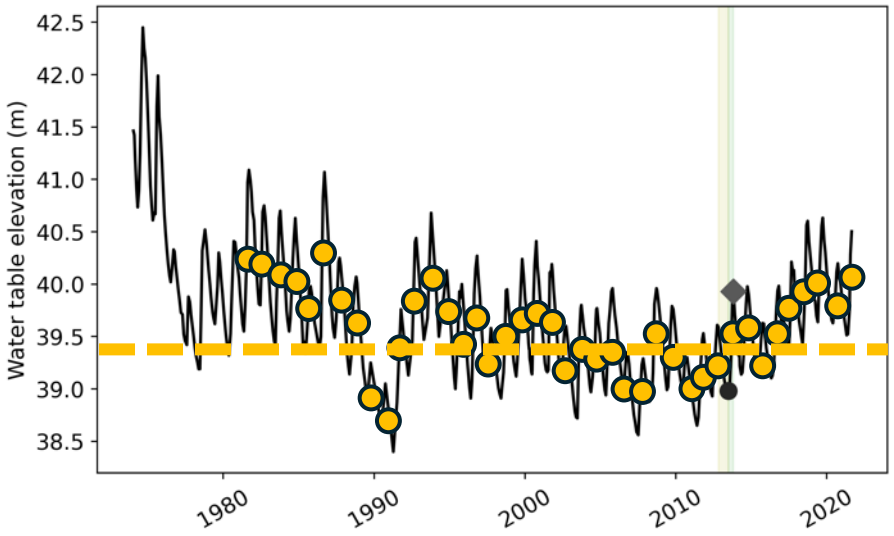
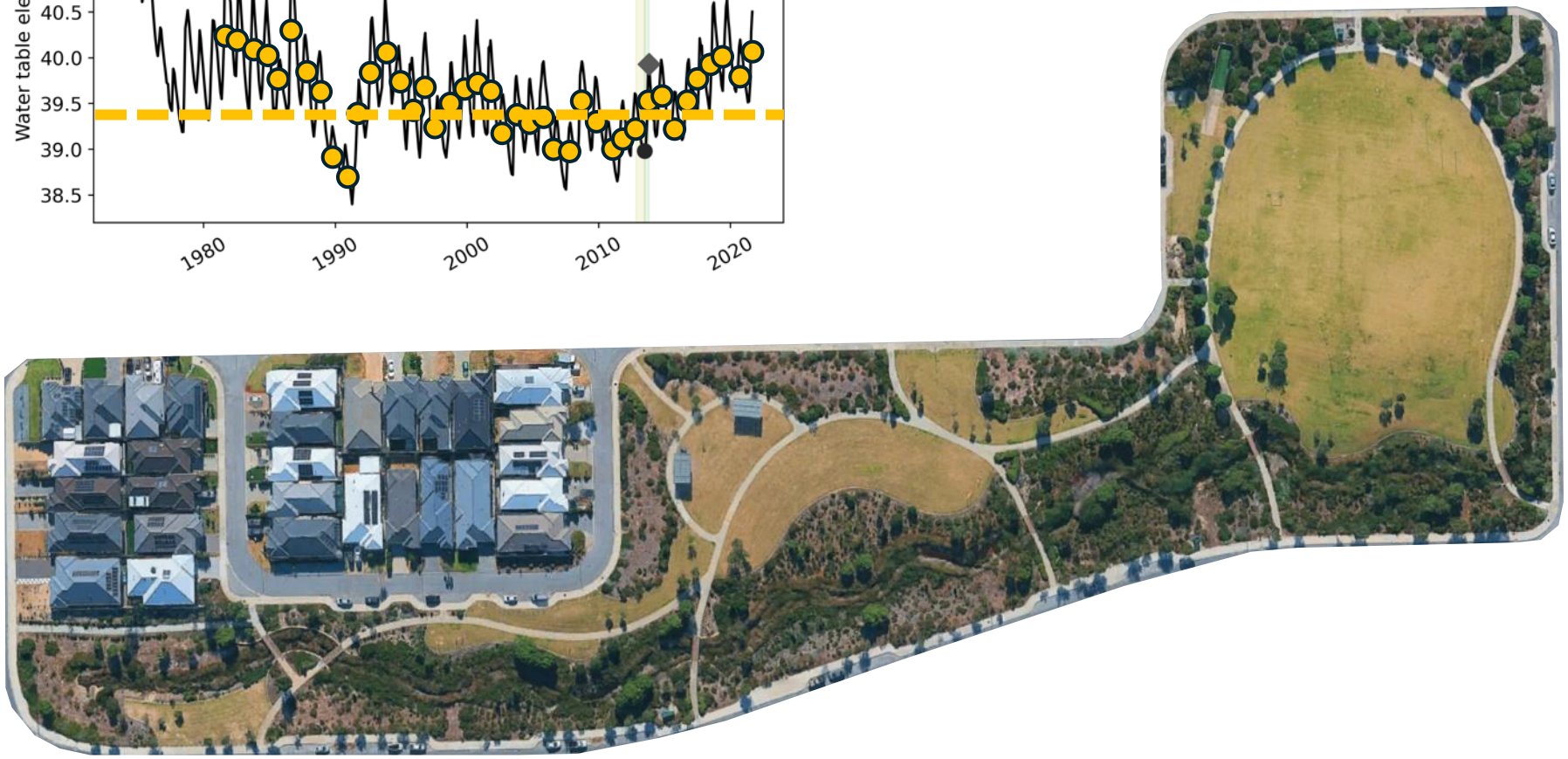
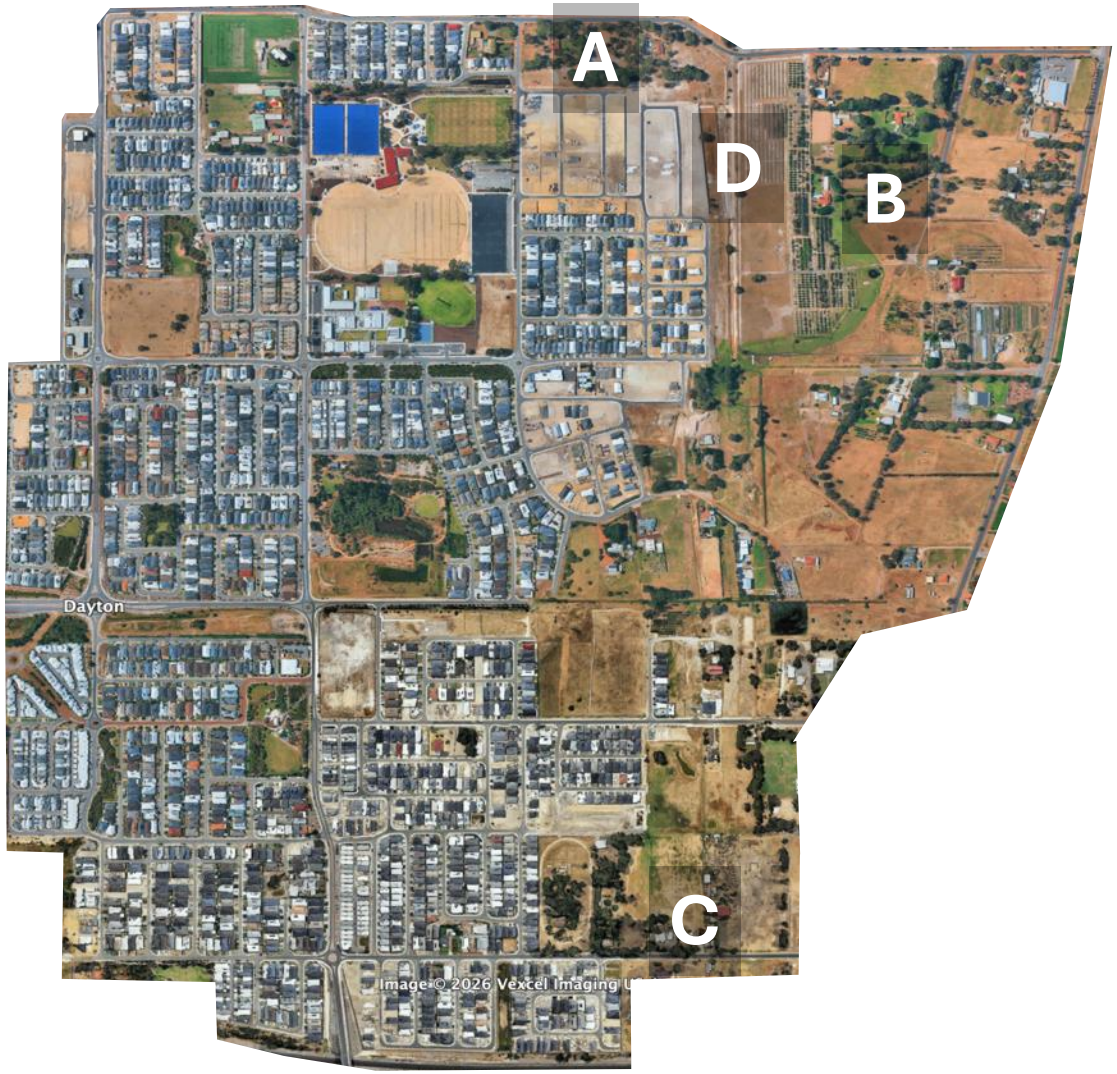


AAMGL replaced by AAGL

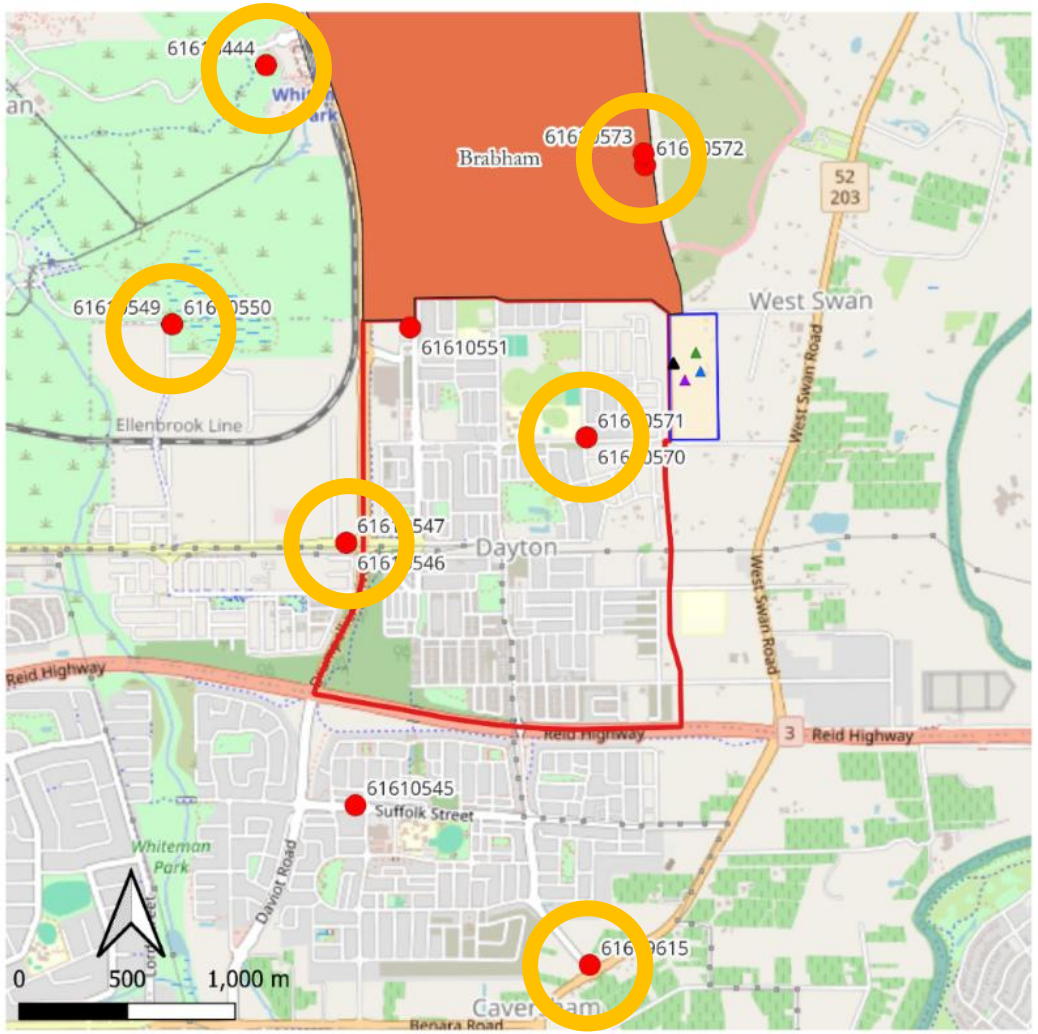
Subsoils IN the groundwater

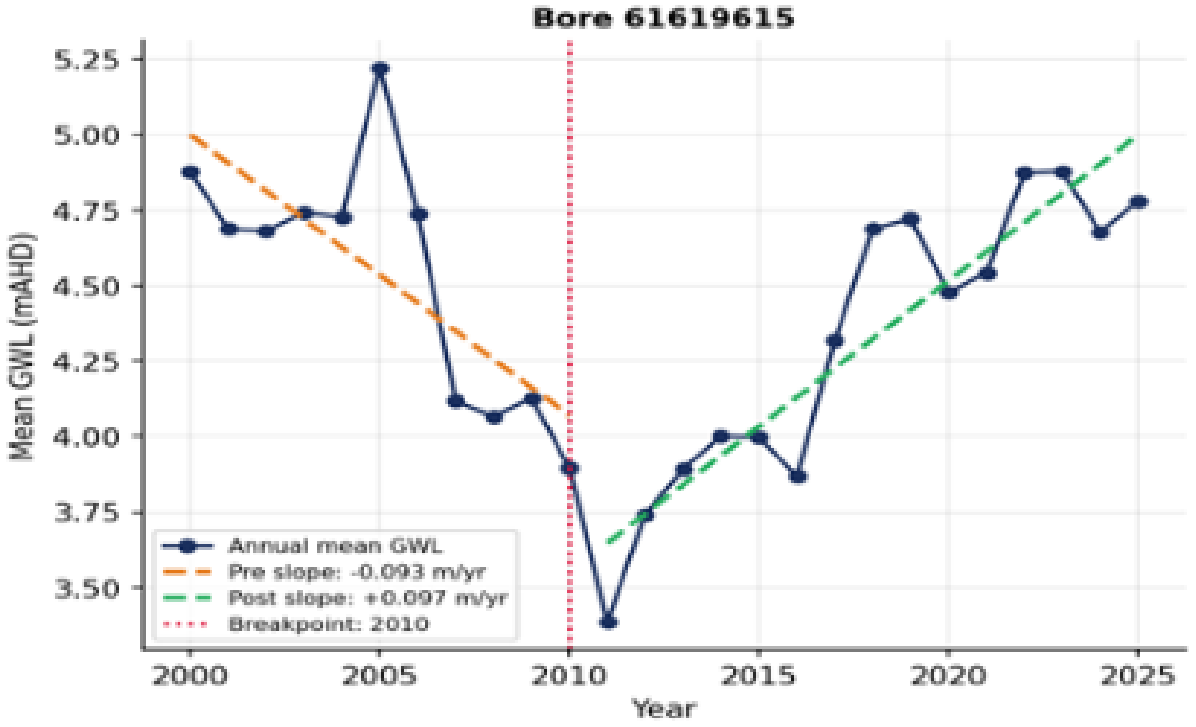


And it doesn’t protect neighboring areas



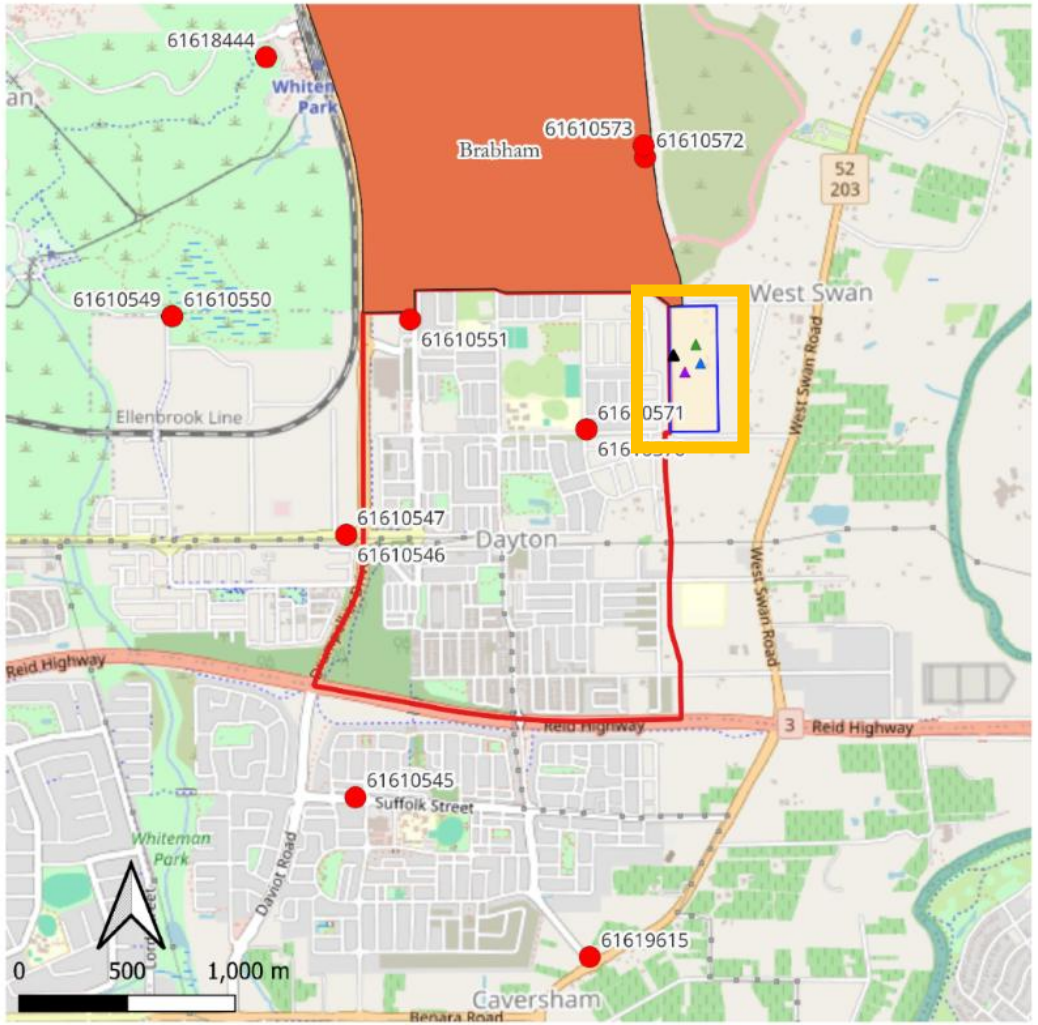
Impacts v. monitoring network?

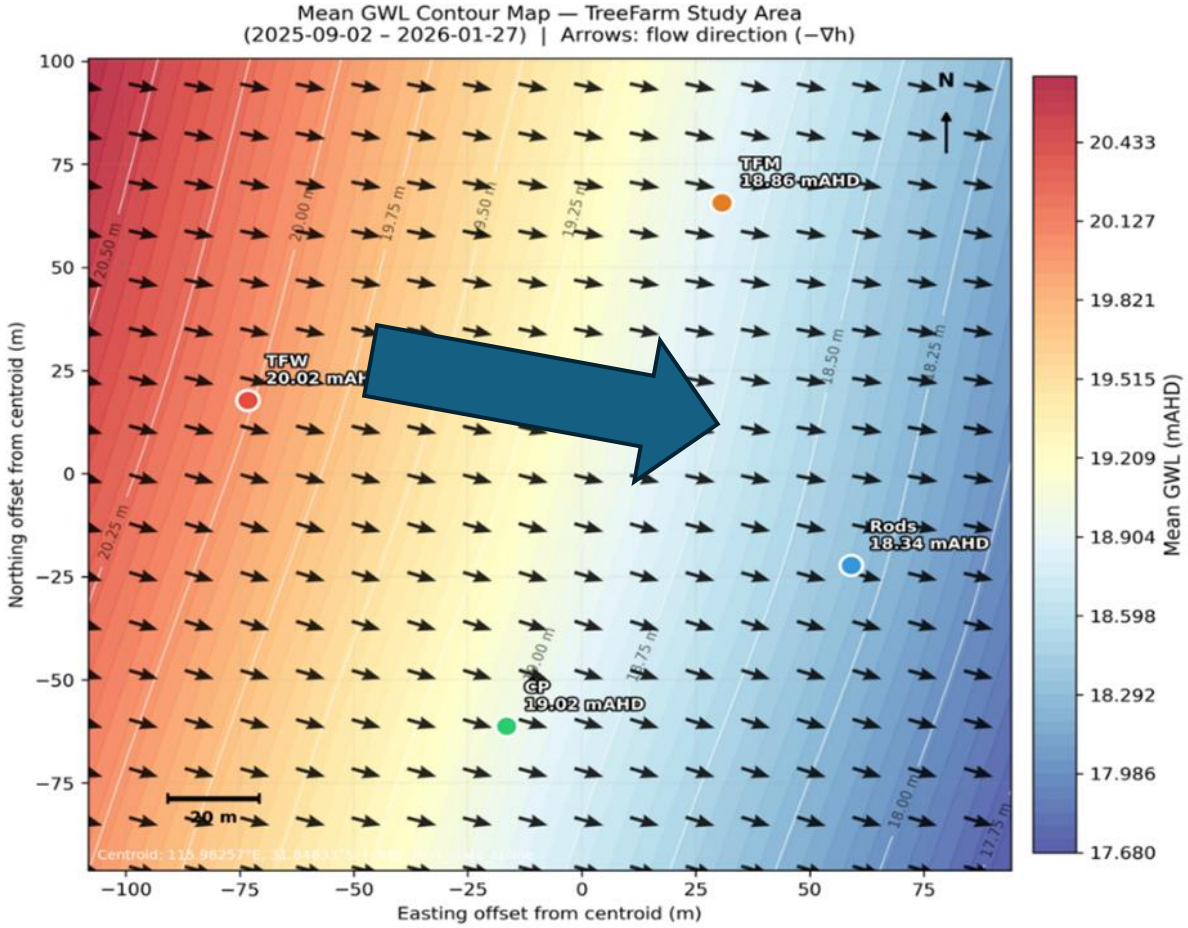




Groundwater levels trending up after 2010

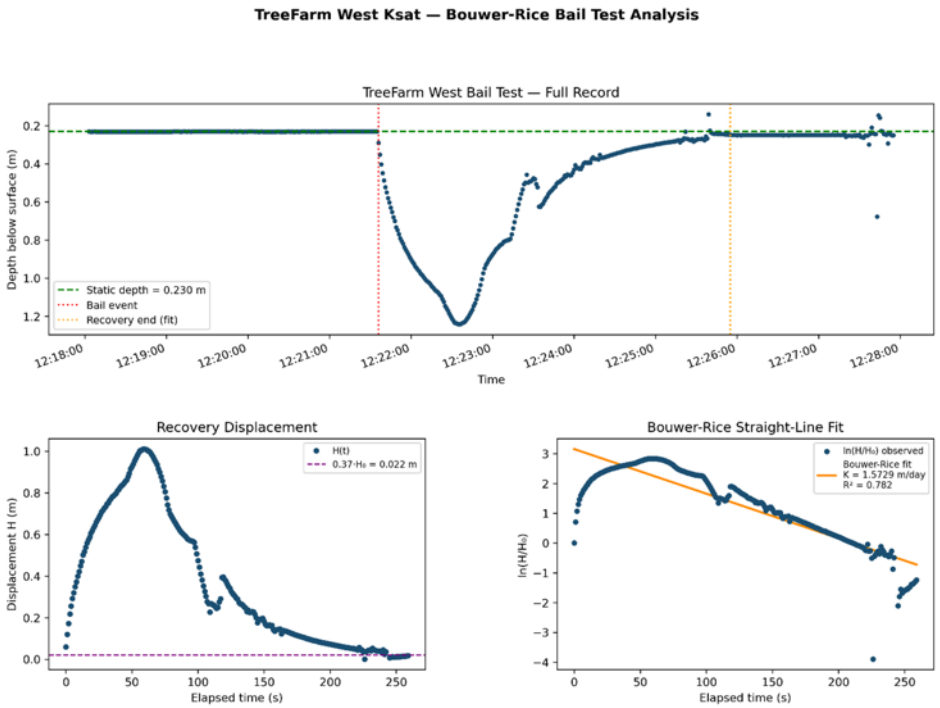
Impacts v. monitoring network?





Groundwater flow almost due east
Winter – Spring 2025

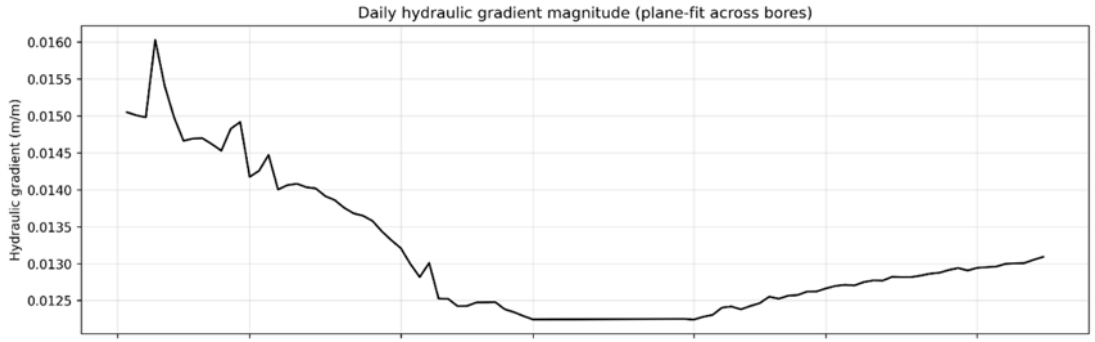
Measuring soil permeability



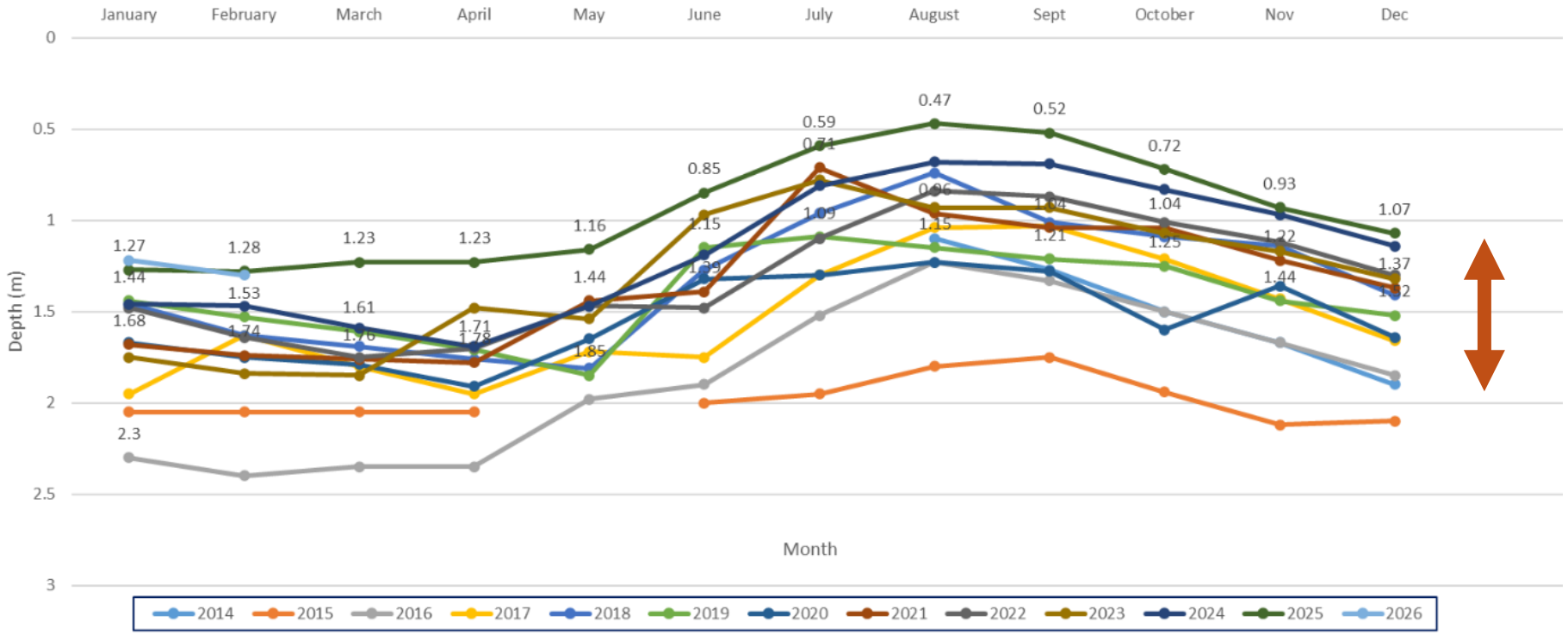
K_{sat} ~ 1.57 m/day

What groundwater input associated with development?

K_{sat} ~ 1.57 m/day



Water Table slope – ~15 mm / m



Extra water ~1m

What groundwater input associated with development?

- Flow per 1 m boundary
- ~ 1.57 m/day x 0.015 m/m x 1 m

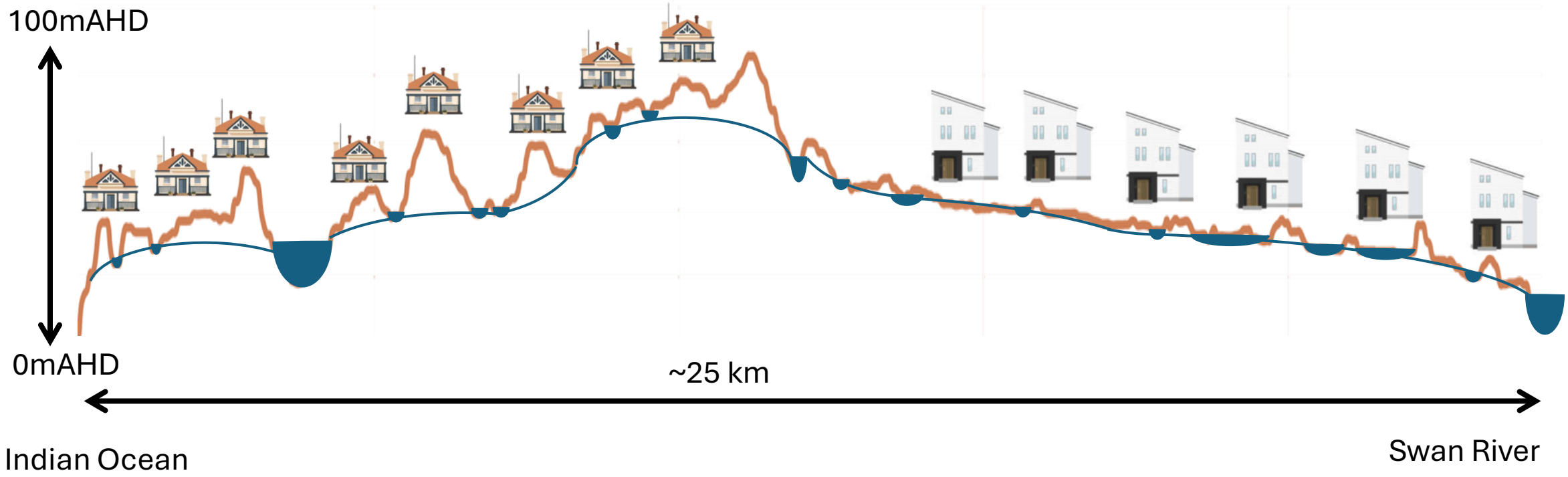
- ~0.0225 m^3/m/day


What went wrong?

Offsite groundwater impacts not managed

Installing drains > AAMGL with fill does not protect from offsite flooding due to groundwater rise within development area

Planning system

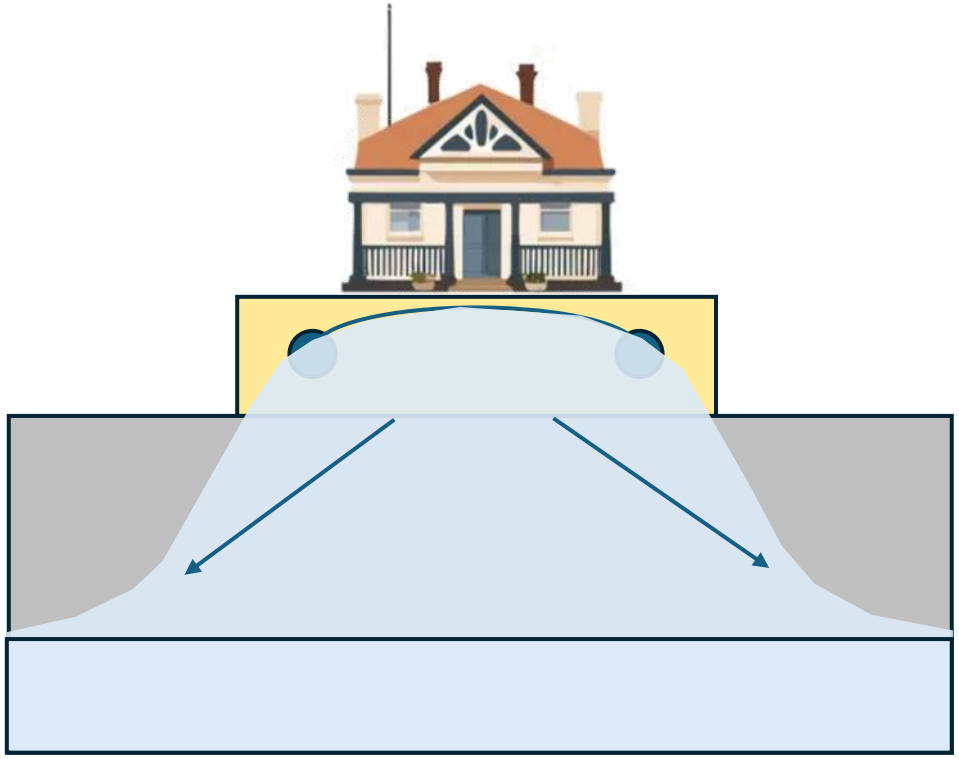


Sandy Soils

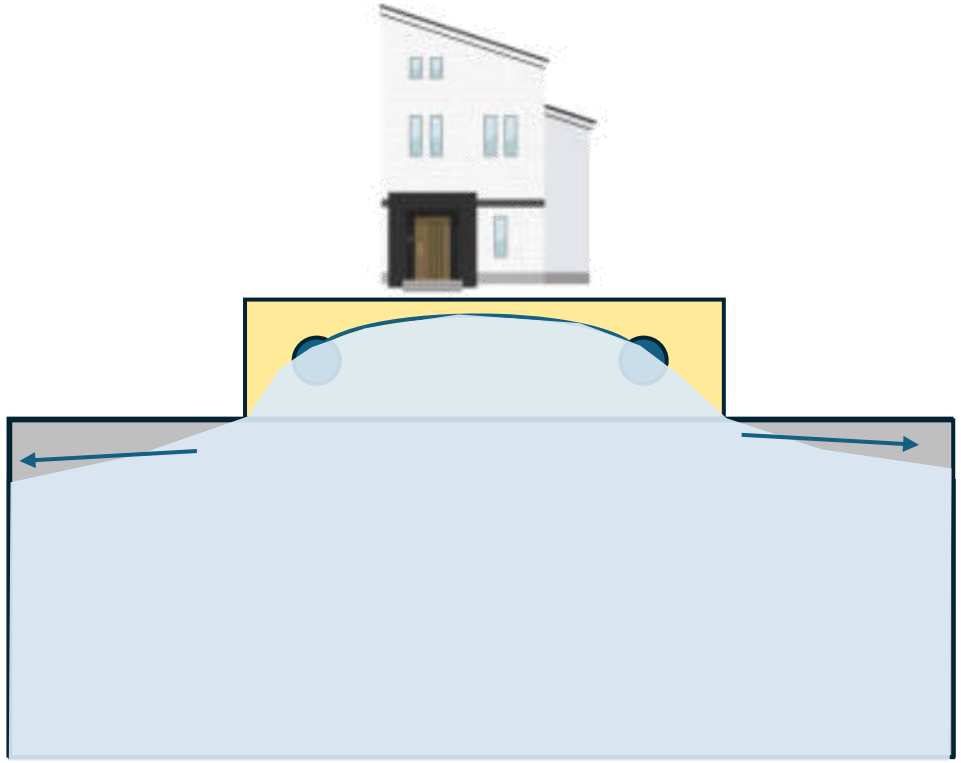
Sands with Clay

Planning system

Sands and deep groundwater absorb offsite flows



Shallow groundwater and clays send offsite flows laterally



Piecemeal planning

St Leonards Estate Pty Ltd

St Leonards Estate, Dayton: Stages 1U, 1V, 1W and 1X

Urban Water Management Plan

WAPC No. 157006

September, 2019

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JDA Consultant Hydrologists

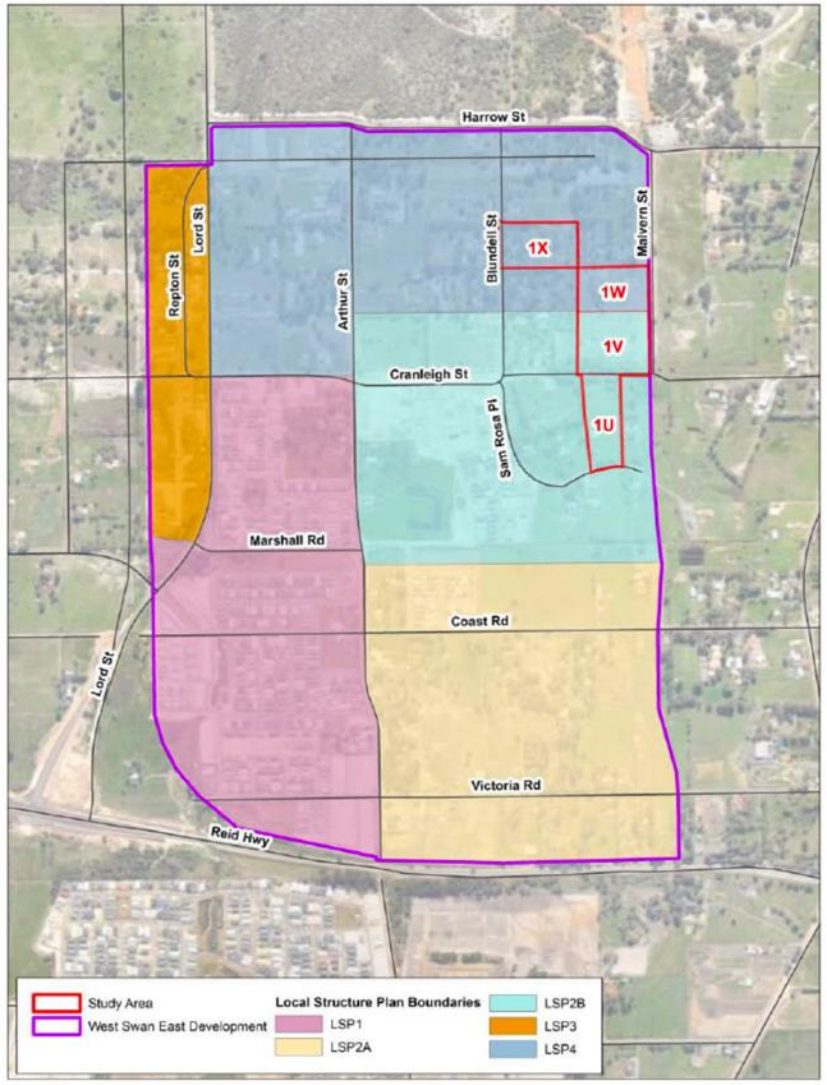


Figure 2

Subdivision Approval

Estimated 40% increase in recharge

Estimated 1.5 m/year groundwater table rise

Showed finished gw levels +1.5m only (multi-year outcomes?)

Piecemeal planning

Argued for no CGL in 2024
No citation of 2019 report

URBAN WATER MANAGEMENT PLAN

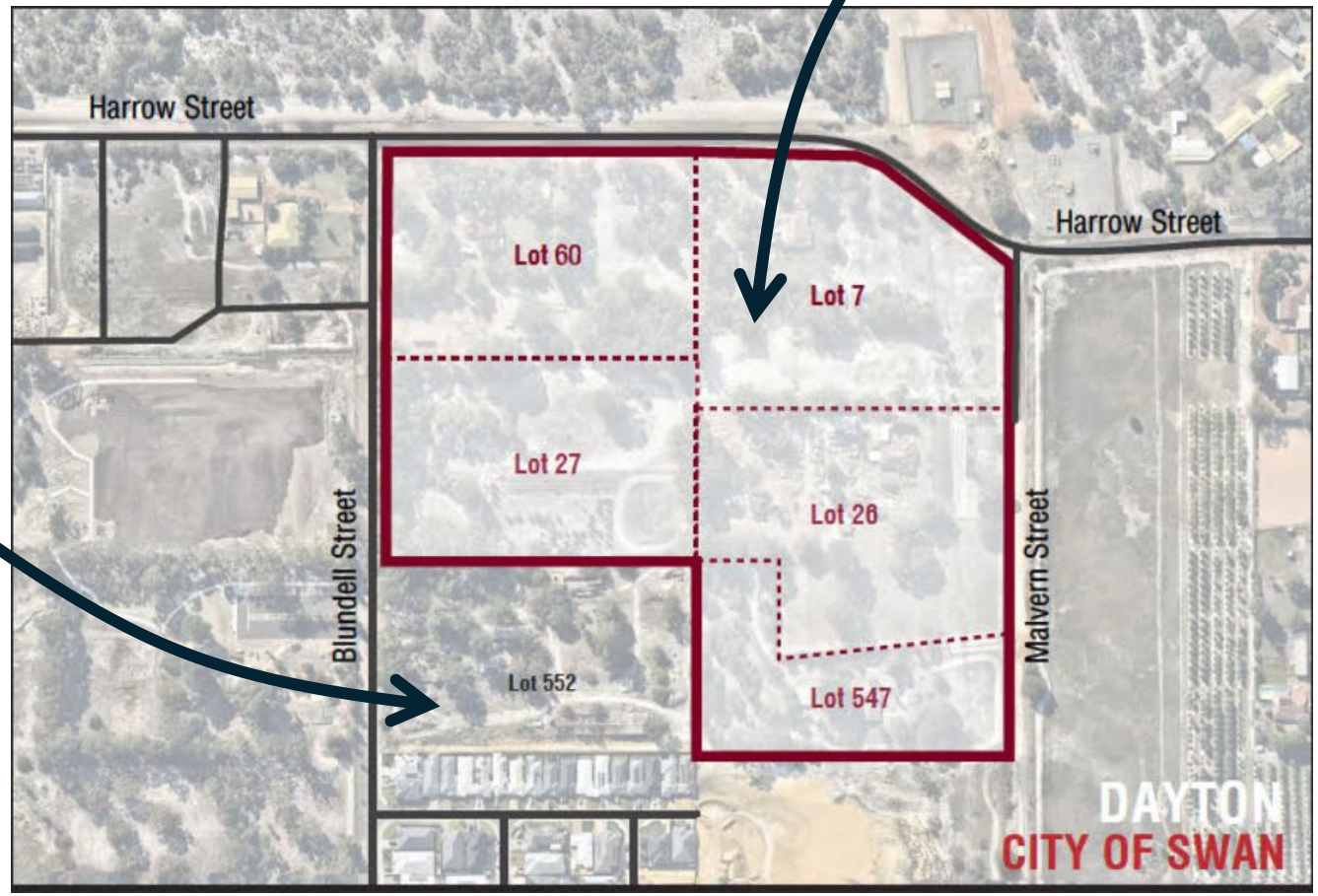
Lot 27 Blundell Street, Lot 26 and 547
Malvern Street, Lot 7, 16, 60 and 8284
Harrow Street, Dayton, WA

August 2024

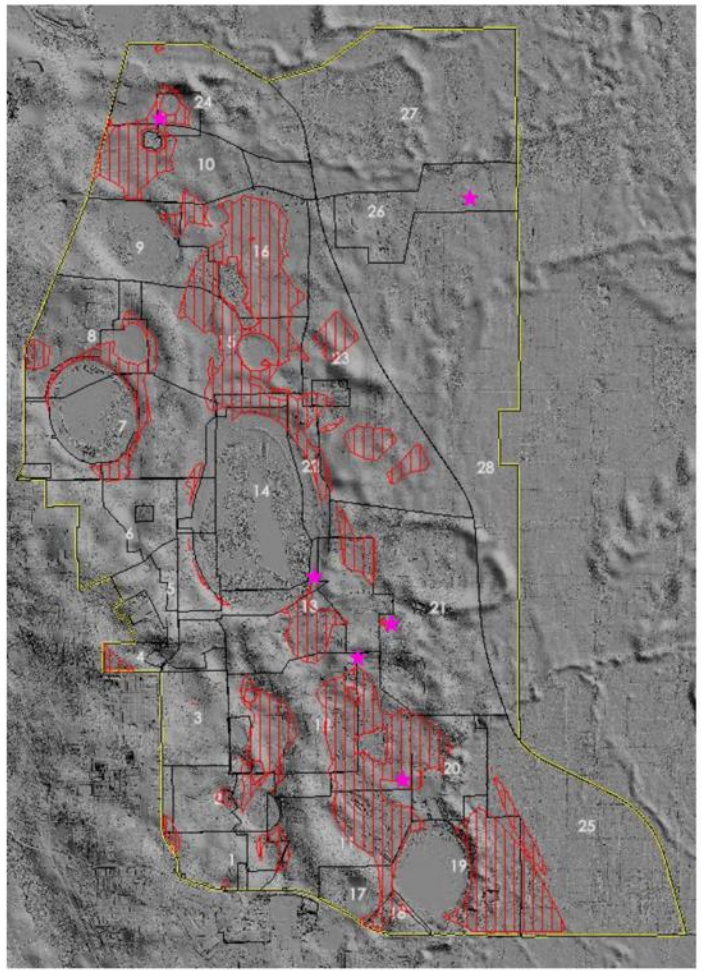
Revision D

kctt
Part of Premise

Estimated 1.5 m/yr
GW rise in 2019



New planning takes groundwater rise seriously



Areas at risk of rising groundwater, East Wanneroo UWMP, Urbaqua

"... key risks to development ... **associated with predicted groundwater level rise** .. **waterlogging** and loss of amenity ... **damage** to infrastructure ... **loss of capacity** in stormwater systems... prevalence of mosquitoes and other **nuisance** insects."


Is it reasonable to expect equivalently serious treatment in the NEC?