A TOOLBOX FOR DEVELOPMENT IN THE NORTHERN GROWTH CORRIDOR

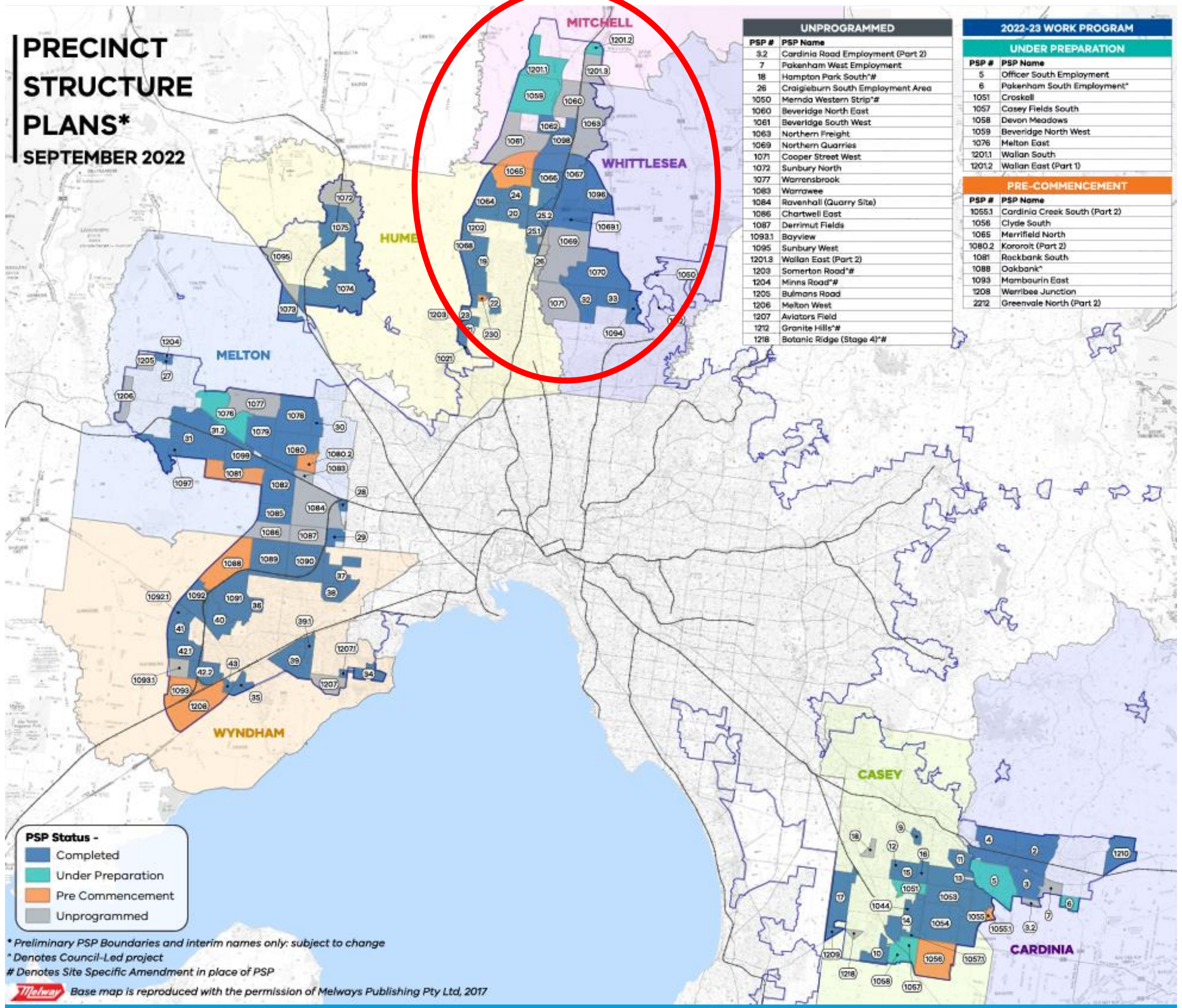
Take this with a grain of salt… or sodic dirt

13/06/2023

PROPOSED DEVELOPMENT

In the Northern Growth Corridor

- State has created a societal targets and corresponding plans to re zone this land
- Plan Melbourne outlines intention for 8mil people in metropolitan Melbourne 2050 and 10mil in Vic
- All of this growth requires the commercial, housing, transport, (etc.), to be interfacing with our stormwater assets
- Therefore, engineers, planners, authorities, and scientists must collaborate to balance those social needs with suitable assets
- What corridor specific capacities do we need to consider for our environmental assets within this new urban setting?



UNPROGRAMMED

PSP #	PSP Name
3.2	Cardinia Road Employment (Part 2)
7	Pakenham West Employment
18	Hampton Park South^#
26	Craigieburn South Employment Area
1050	Mernda Western Strip^#
1060	Beveridge North East
1061	Beveridge South West
1063	Northern Freight
1069	Northern Quarries
1071	Cooper Street West
1072	Sunbury North
1077	Warrensbrook
1083	Warrawee
1084	Ravenhall (Quarry Site)
1086	Chartwell East
1087	Derrimut Fields
1093.1	Bayview
1095	Sunbury West
1201.3	Wallan East (Part 2)
1203	Somerton Road^#
1204	Minns Road^#
1205	Bulmans Road
1206	Melton West
1207	Aviators Field
1212	Granite Hills^#
1218	Botanic Ridge (Stage 4)^#

2022-23 WORK PROGRAM

UNDER PREPARATION

PSP #	PSP Name
5	Officer South Employment
6	Pakenham South Employment^
1051	Croskell
1057	Casey Fields South
1058	Devon Meadows
1059	Beveridge North West
1076	Melton East
1201.1	Wallan South
1201.2	Wallan East (Part 1)

PRE-COMMENCEMENT

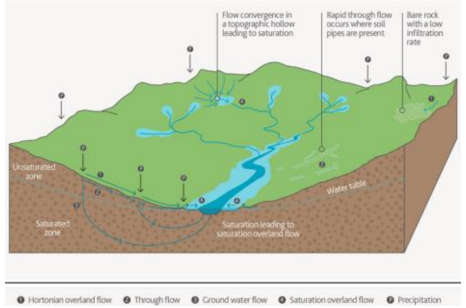
PSP #	PSP Name
1055.1	Cardinia Creek South (Part 2)
1056	Clyde South
1065	Merrifield North
1080.2	Kororoit (Part 2)
1081	Rockbank South
1088	Oakbank^
1093	Mambourin East
1208	Werribee Junction
2212	Greenvale North (Part 2)

https://planvic.maps.arcgis.com/apps/webappviewer/index.html?id=536f9e451be0496c89548ae04013d76b

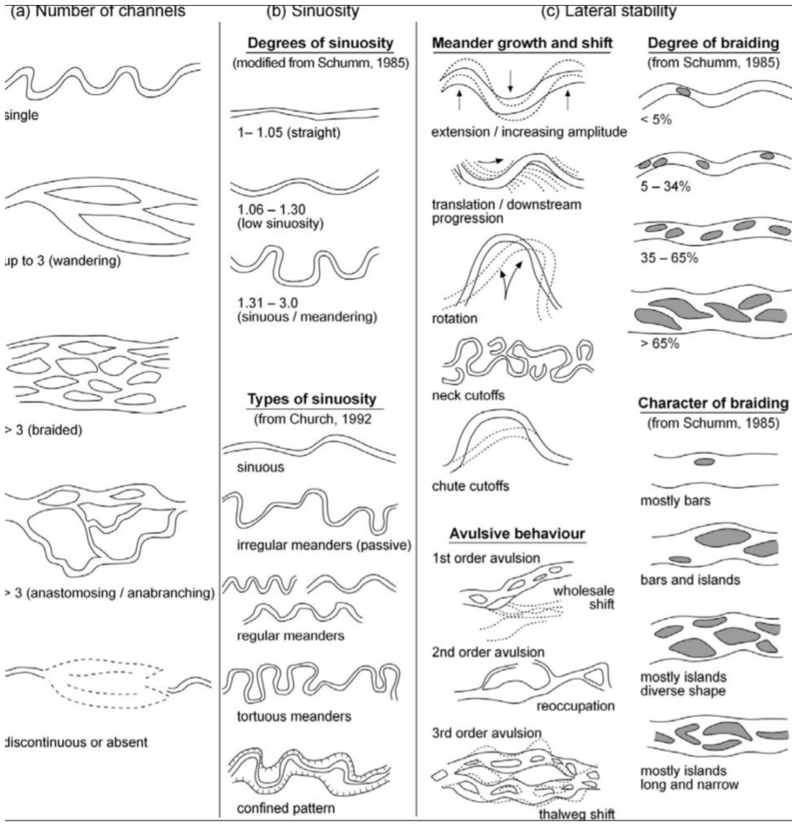
ENVIRONMENTAL CAPACITIES

Some contributors to stormwater asset morphology

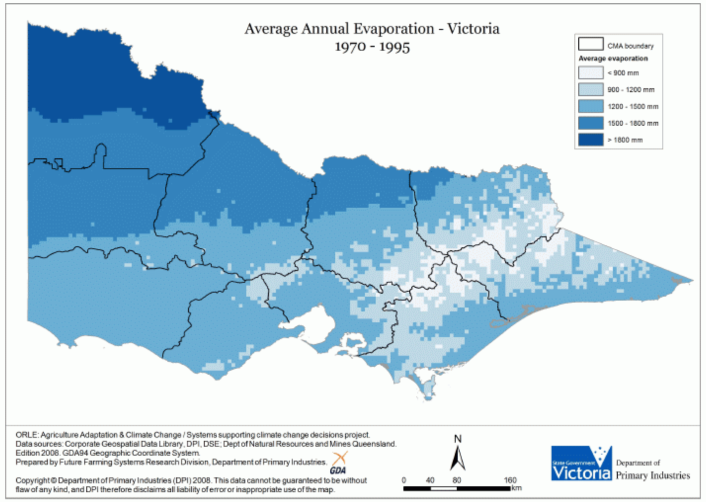
- Topography
- Soil type
- Catchment
- Land use
- Rainfall
- Evaporation
- Ecology
- Groundwater, etc.

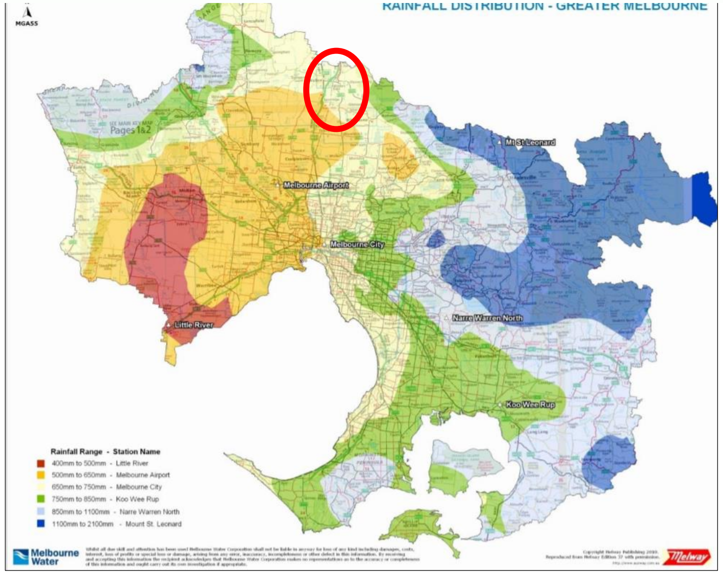


Hydrologic pathways generating flow in an undeveloped catchment, Melbourne Water, 2019



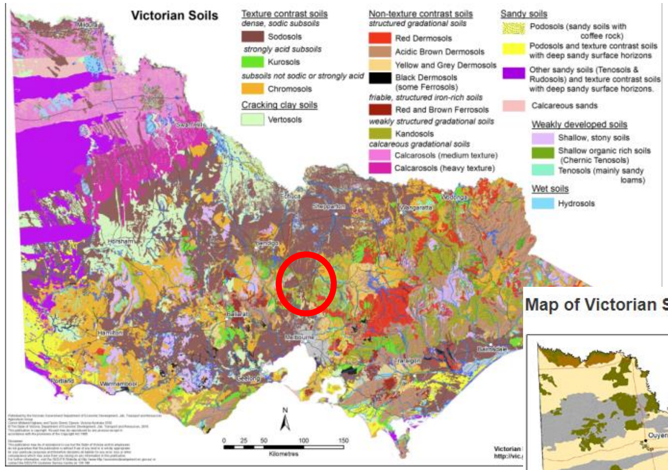
Measure of planform: Brierley & Fryirs, 2005

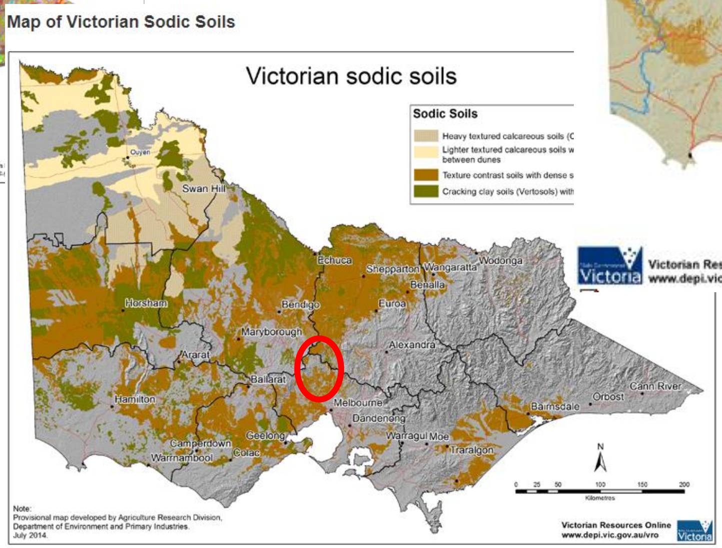


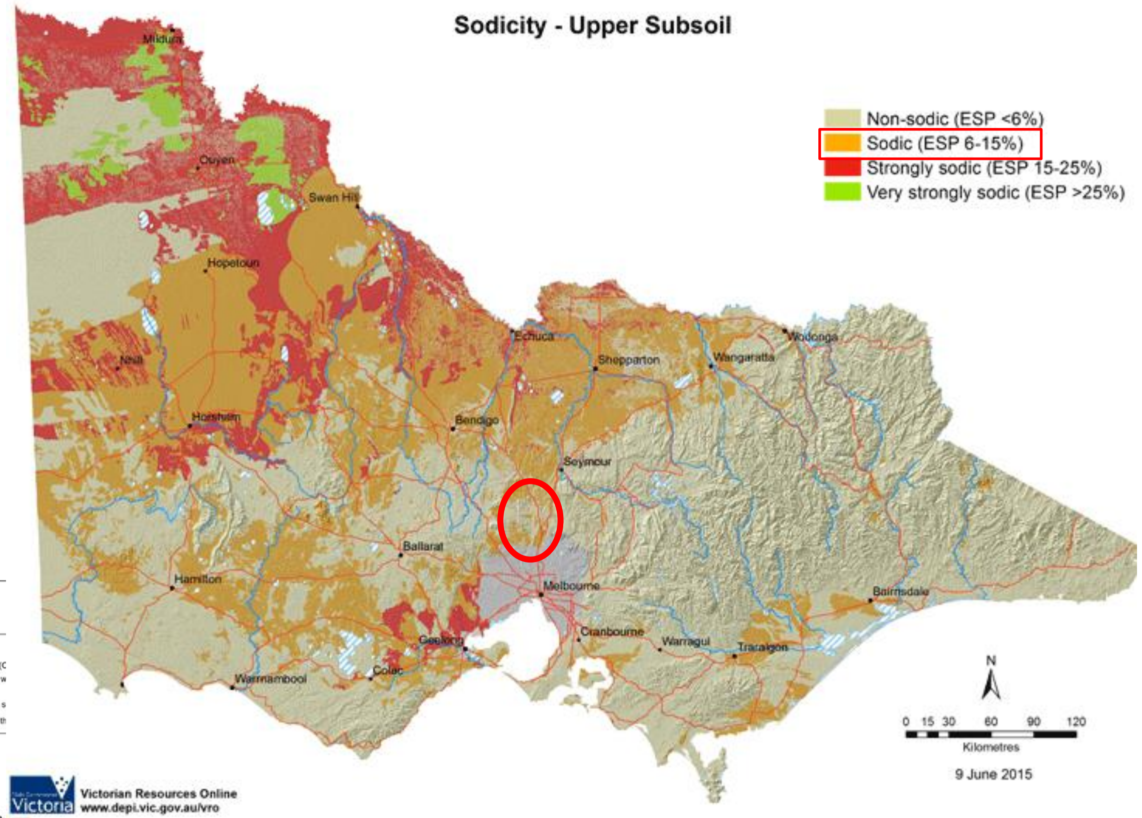


SOIL TYPE/CAPABILITIES

Important consideration for (urban) stormwater assets in this corridor







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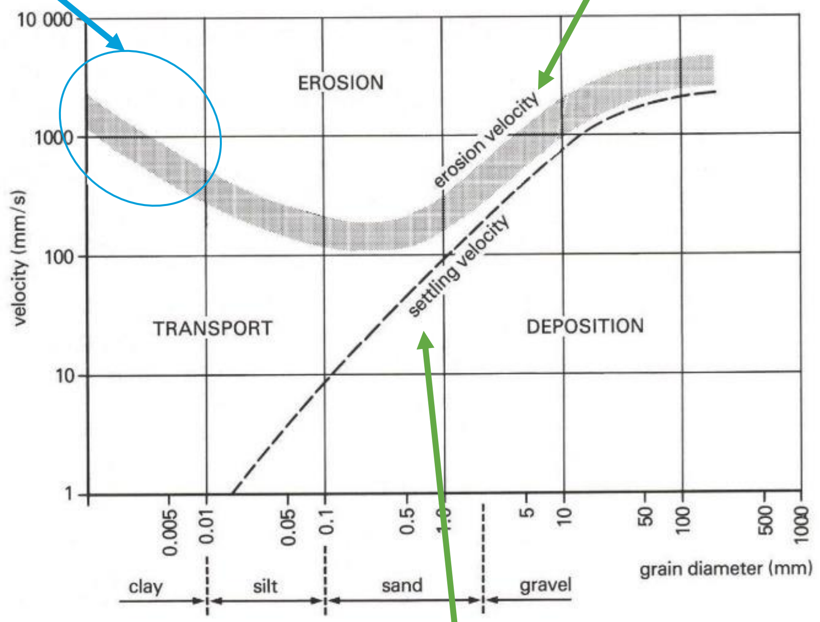
SOIL VARIATION

A consideration for all disciplines

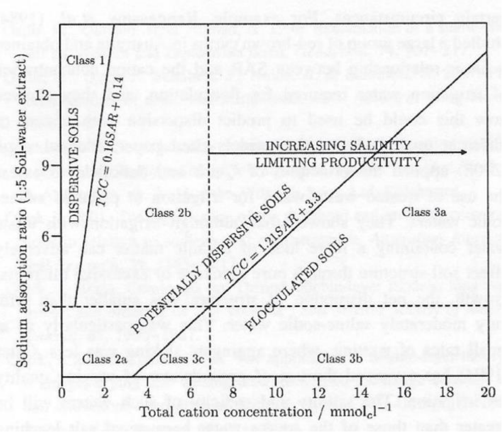
SOIL BEHAVIOUR

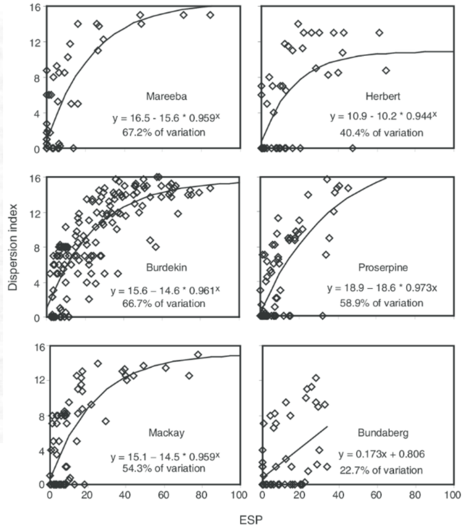
Generally clayey material is cohesive

Minimum velocity required to lift a certain particle size



Max velocity before particle size deposited





Relationship between dispersion index and exchangeable Na percentage (ESP).

- Exception to the Hjulstrom curve
- Type of soils mapped in this area are clay-fine soils with an Exchangable Sodium Percentage (ESP) >6%
- ESP >6% is regarded as being a sodic soil
- Even though they are small the high ESP “breaks” cohesion bonds and they become repulsive
- >6% is where you start having a detrimental impact on agricultural productivity, inhibited plant growth, soil structure, failures, turbidity, and you can see visible effects dispersion/repulsive forces

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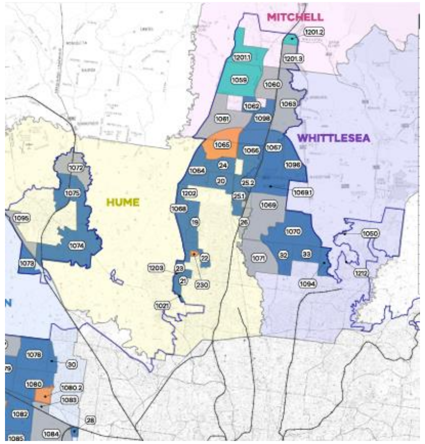
JUST ADD WATER?

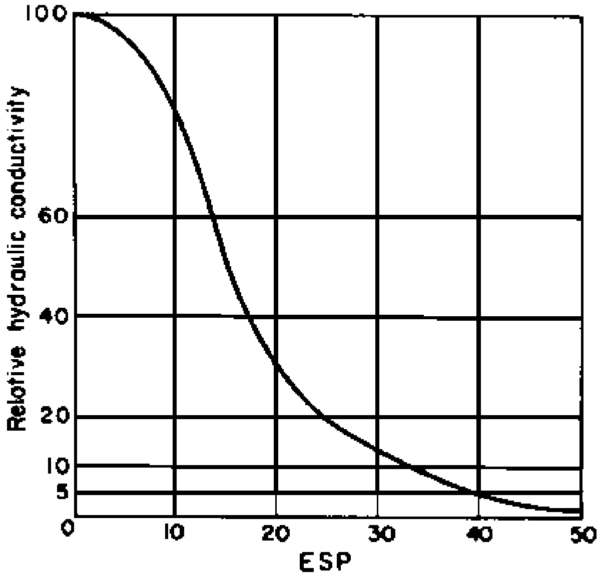
Impacts on infiltration (+ contaminant transport)

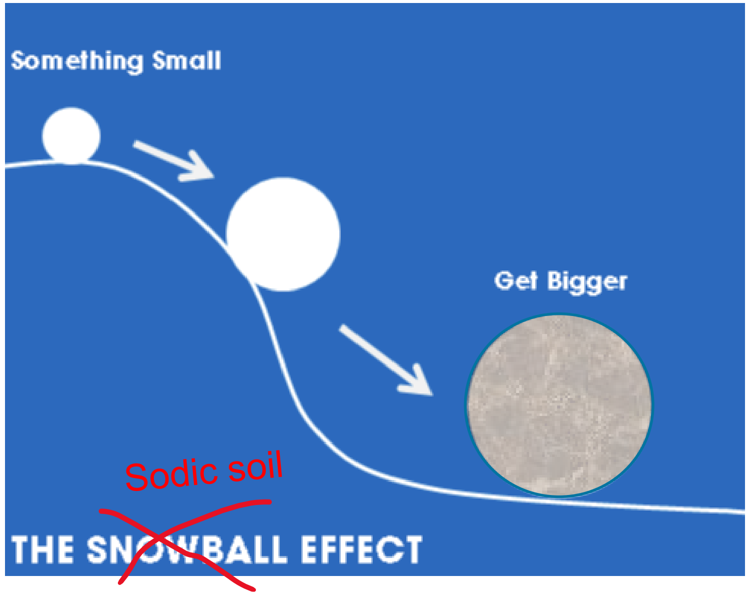
- High ESP reduces relative hydraulic conductivity
- Relative hydraulic conductivity is a measure of how easily water can pass through soil or rock
- Low hydraulic conductivity = less permeable
- Less permeable = more runoff

Don't forget:

- Development = less permeable
- Less permeable = more runoff







Result

- Soil with dispersive forces that is also less permeable
- Met with increased developed runoff
- Magnifying the runoff and impact of erodibility
- Exposing more sodic subsoils

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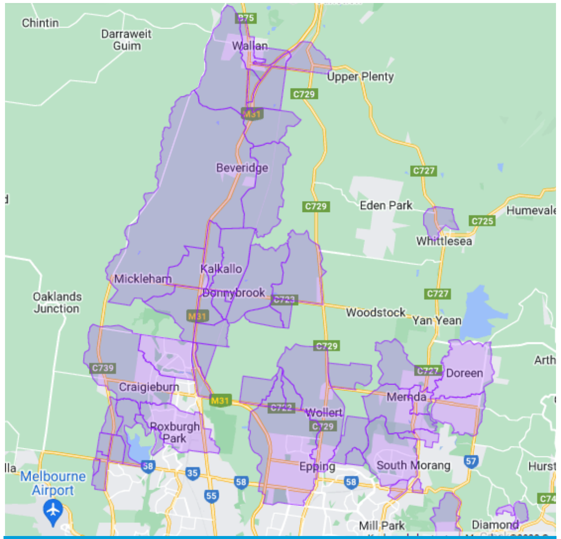
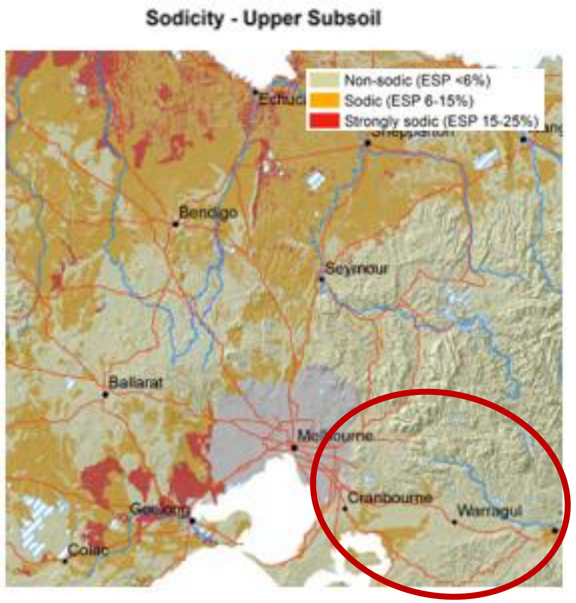
WHY DO WE NEED THIS KNOWLEDGE?

Current drainage planning

- We have been provided with design and construction standards with conditions for new urban development
- Standards outline acceptable asset types and construction requirements
- A lot of these identify the same proposed assets across the north/south



Drainage planning



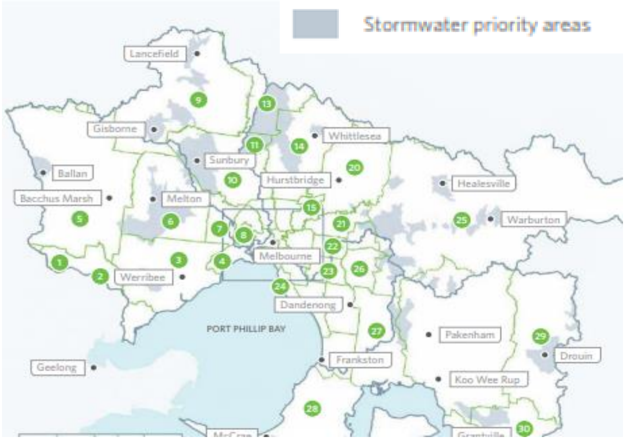
- The current toolbox is often missing a final link to soil capacity
- This link would facilitate practical, constructable, successful and environmentally beneficial assets in this growth corridor

TOOLBOX ORIGIN STORY

TOOLBOX

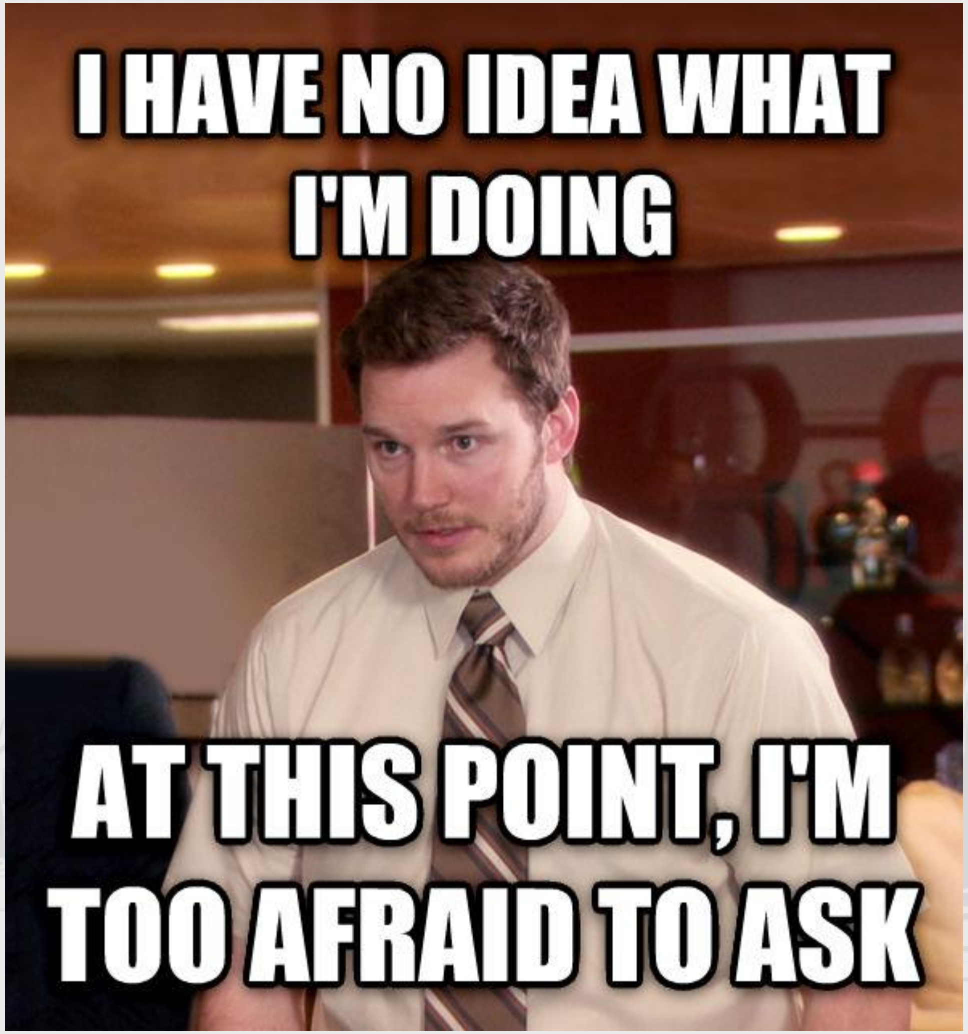
Why else do we need this knowledge?

- These areas contain defined stormwater priority areas



VS

WHAT DO WE DO?



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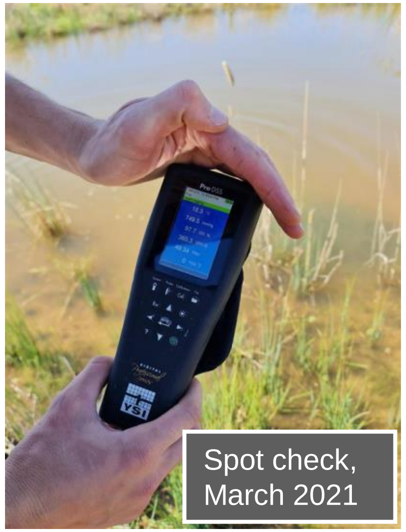
CASE STUDY

Visual water quality through time

- Trialed a variety of solutions in this area
- Built in consultation with drainage authority
- Suited to this site and the existing grasslands
- This is not the only alternative and not suited to every site



Spot check, March 2021

- On site: ~49 FNU/TNU
- Nearby creeks: ~ 200-300
- Nearby dam with exposed bank: ~500

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FRAMEWORK THAT AFFLUX USE

Context based approach: look at the current landscape

Physical
- Asset types
- Asset shapes
- Model assumptions
- Targets/limits
- Armouring
- Asset location (avoid exposure)

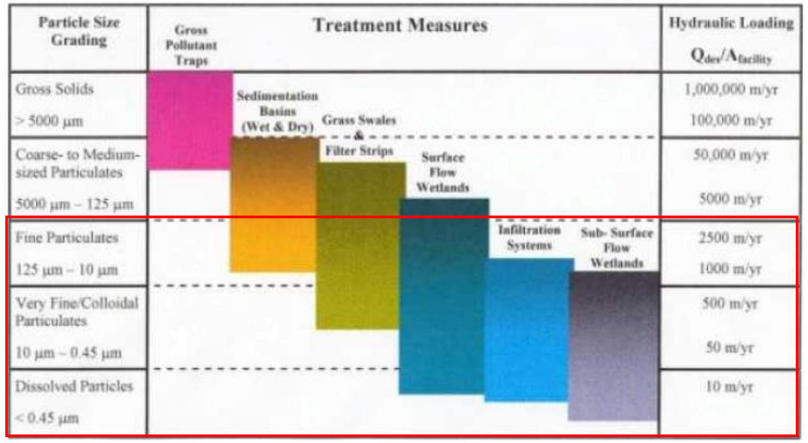
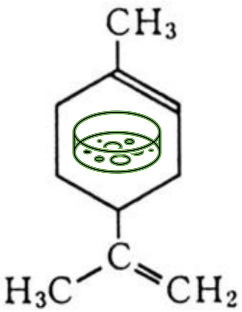


Figure 3 Operating hydraulic loading and target particle size of stormwater treatment measures (Wong, 2000).

Biological
- Increase organic matter
- Facilitate long-term vegetation success



Chemical
- Treatment until vegetation establishment

Educational
- Assess and communicate risk
- Accept turbidity
- Consider appropriateness of standards
- Resource management requirements (cost/maintenance)

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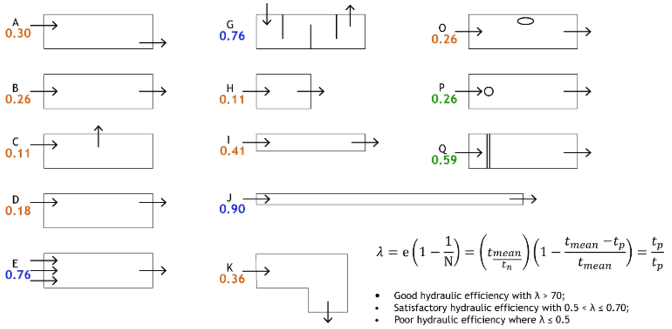
PRINCIPLES

All should be specific to site

- Seal the catchment as quickly as possible - leaving sodic soils exposed increases risks.
- Design may require smaller stages and WSUD in pieces
- Avoid temporary channels, or if required high establishment needs (i.e. vegetation, gypsum treatment)
- RRJ pipes everywhere
- Constructed channels should be avoided
- Wider corridors are a simplistic solution
- Converting a headwater stream to an open channel with urban hydrology is not the same as “preserving” a headwater stream
- “Relief” pipes along existing corridors
- Channel widths and stability criteria (including erosion thresholds) need to be revised
- Channel hydraulic thresholds (i.e. when to place a channel) need to be higher (there aren't many natural channels in these soils for a reason)
- Sedimentation basin considerations - may need longer lambda (λ) basins
- Need more integration with the landscaping treatments and experts. Specifically, regarding the use of gypsum and other pre-soil treatments.
- Staging of vegetation across time
- Need more informed catchment managers and drainage engineers.
- Need more soil scientists
- IWM needs to be facilitated in this corridor (actual IWM)



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CONCLUSIONS

- SE toolbox decisions are riskier in these catchments
- Look at the landscape/site for catchment appropriate solution
- Wholistic considerations and IWM implementation will be crucial for safe and healthy waterways
- We need to do better