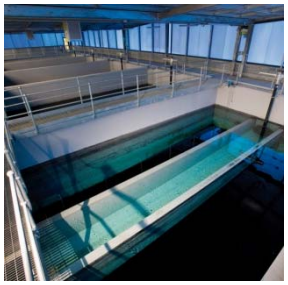
CoPP F&D Strategy Assessment



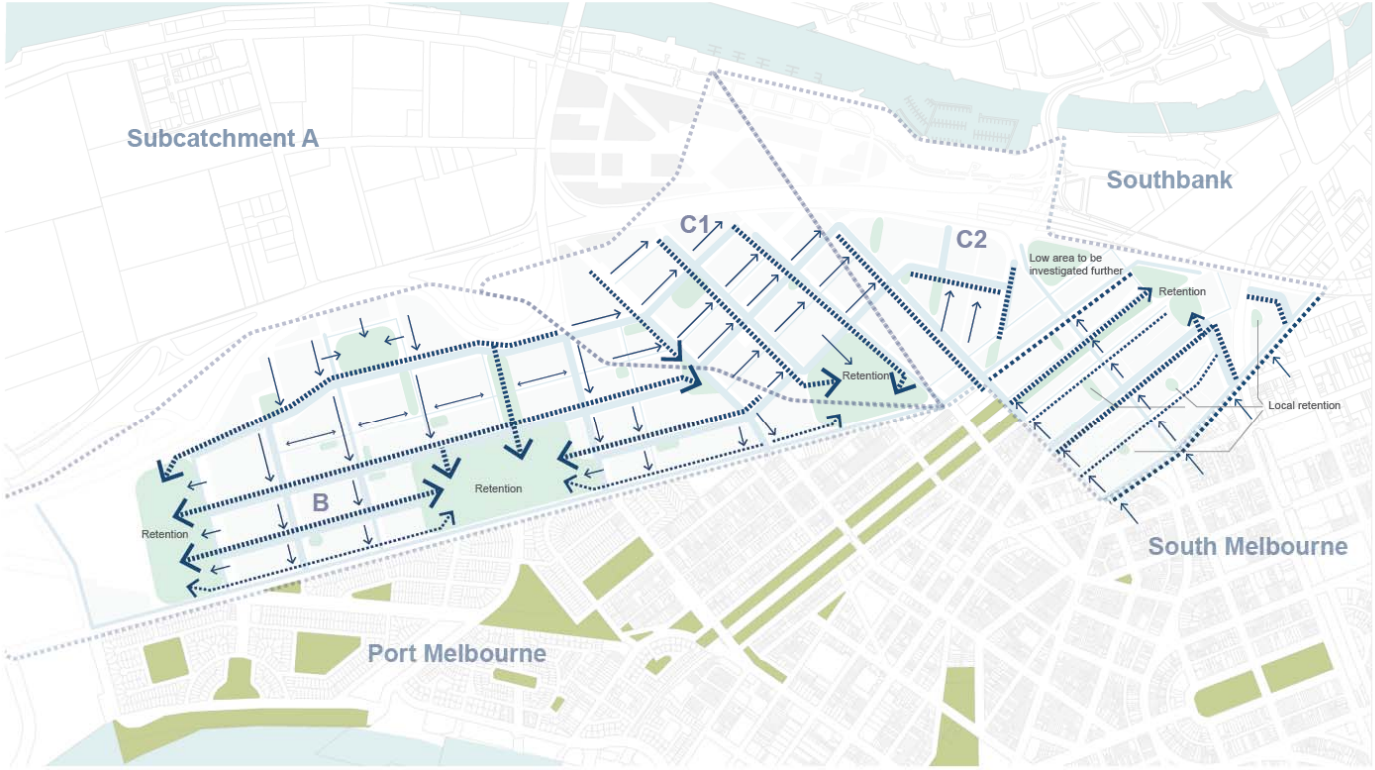


GHD Water

Presenter name
Role, sector/business line

Question: Is CoPP's F&D Strategy Feasible? – Overall Plan

Flooding Strategy
Main Catchments, conveyance and retention

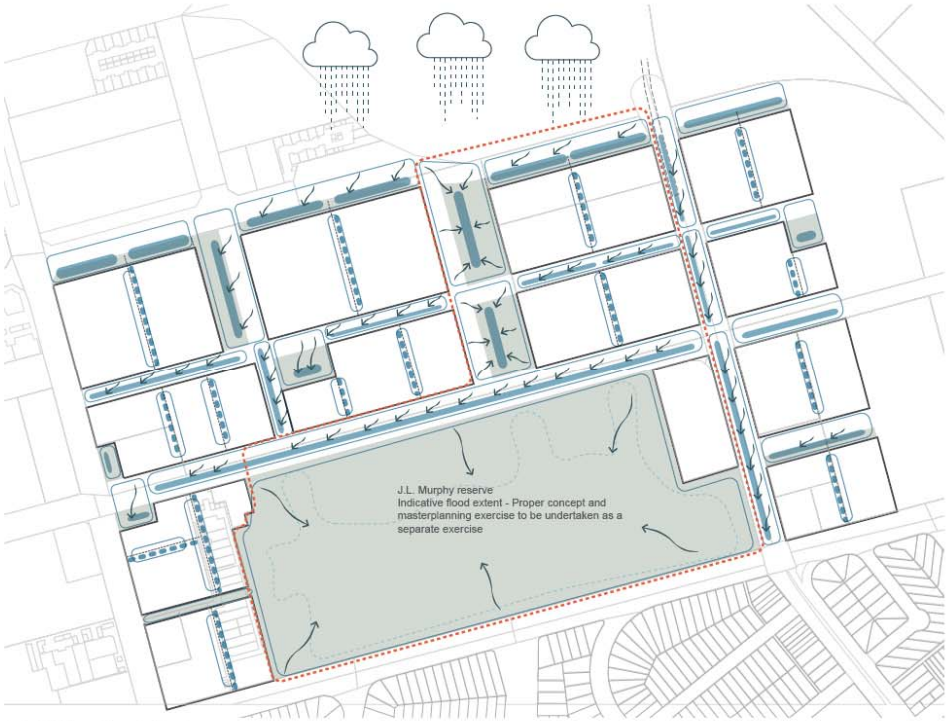


That map highlight the conveyance/ storage Strategy making use of the road network to enable local catchment areas and conveyance to the major paks and reserves. They would play the role of central retention area in the event of a 100 year ADI flood event. Smaller parks and plaza could support the strategy by enabling local retention discharge points through the network, particularly in Montague where the majors parks for potential central retention are very low. This has to be further investigated.

DRAFT

Question: Is CoPP's F&D Strategy Feasible? – 20y flood

Case Study Area
1/20 year flooding event

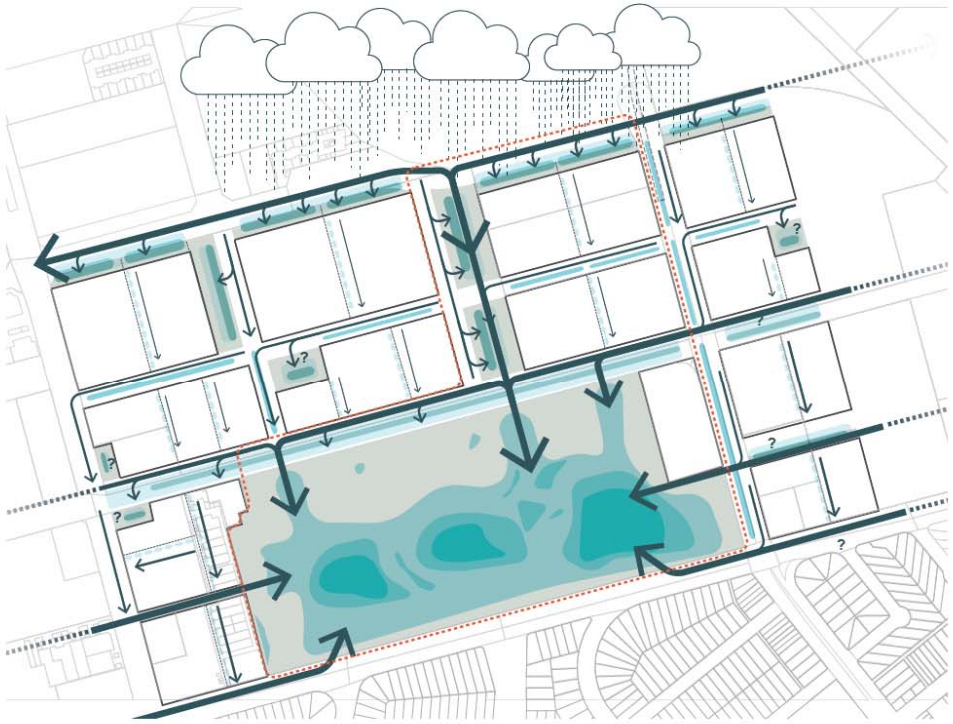


0 to 20 Year Flood situation
Roads, parcs and plaza define their own local catchment area.
The water is filtered through a system of bioswales and raingardens
Idealy, each area manages its own water, no conveyance required.
Water potentially harvested and stored in water tanks.

DRAFT

Question: Is CoPP's F&D Strategy Feasible? – 100y flood

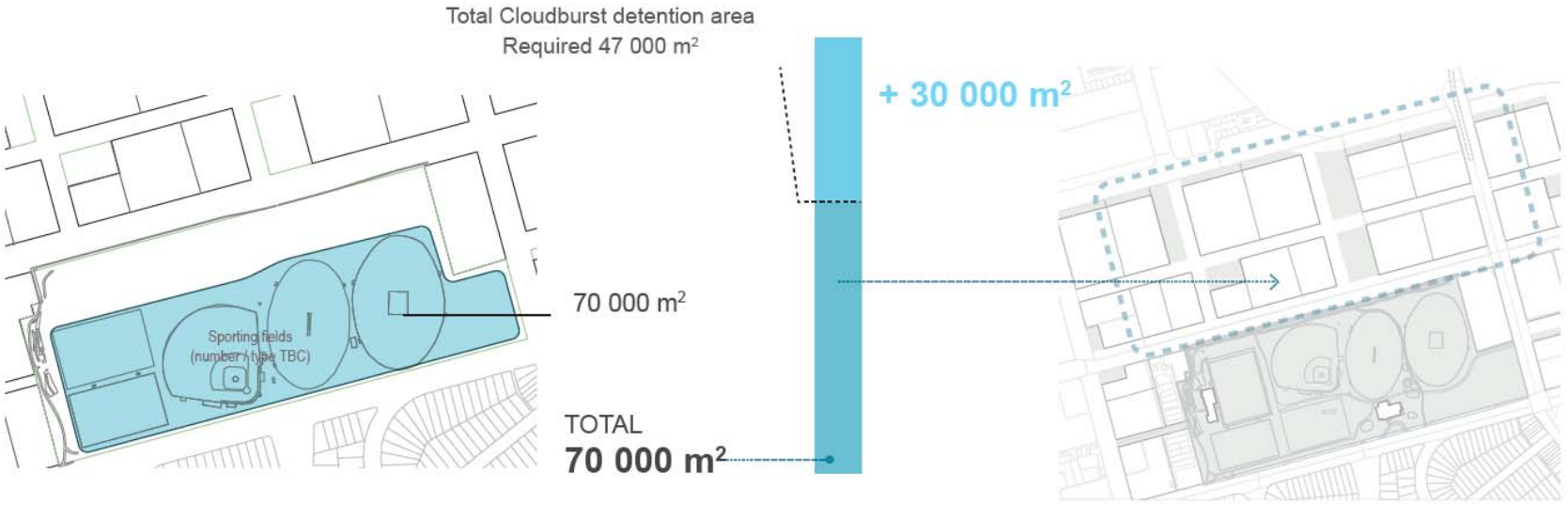
Case Study Area
1/100year flooding event



20 to 100 Year Flood situation *
The water fills up its local catchment storage capacity for a 0 to 20 years event first.The over flow is then conveyed through the main conveyance corridors to the cloudburst detention areas

DRAFT

Question: Is CoPP's F&D Strategy Feasible? – JL Murphy



Objectives

20 year event

- Estimate detention storage within each street
- Check which streets have deficient storage

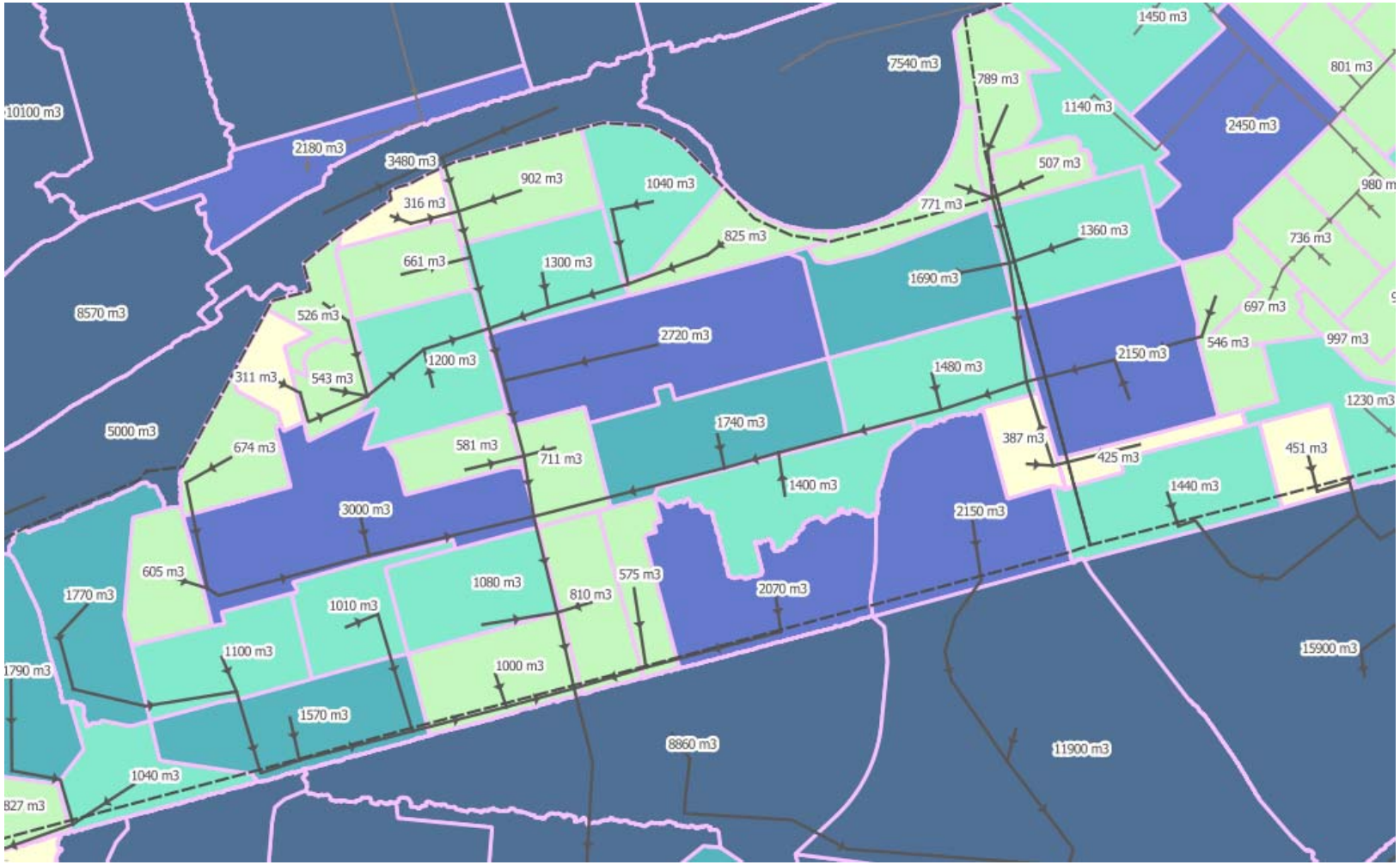
100 year event

- Estimate potential conveyance in the streets
- Check peak flows from catchment

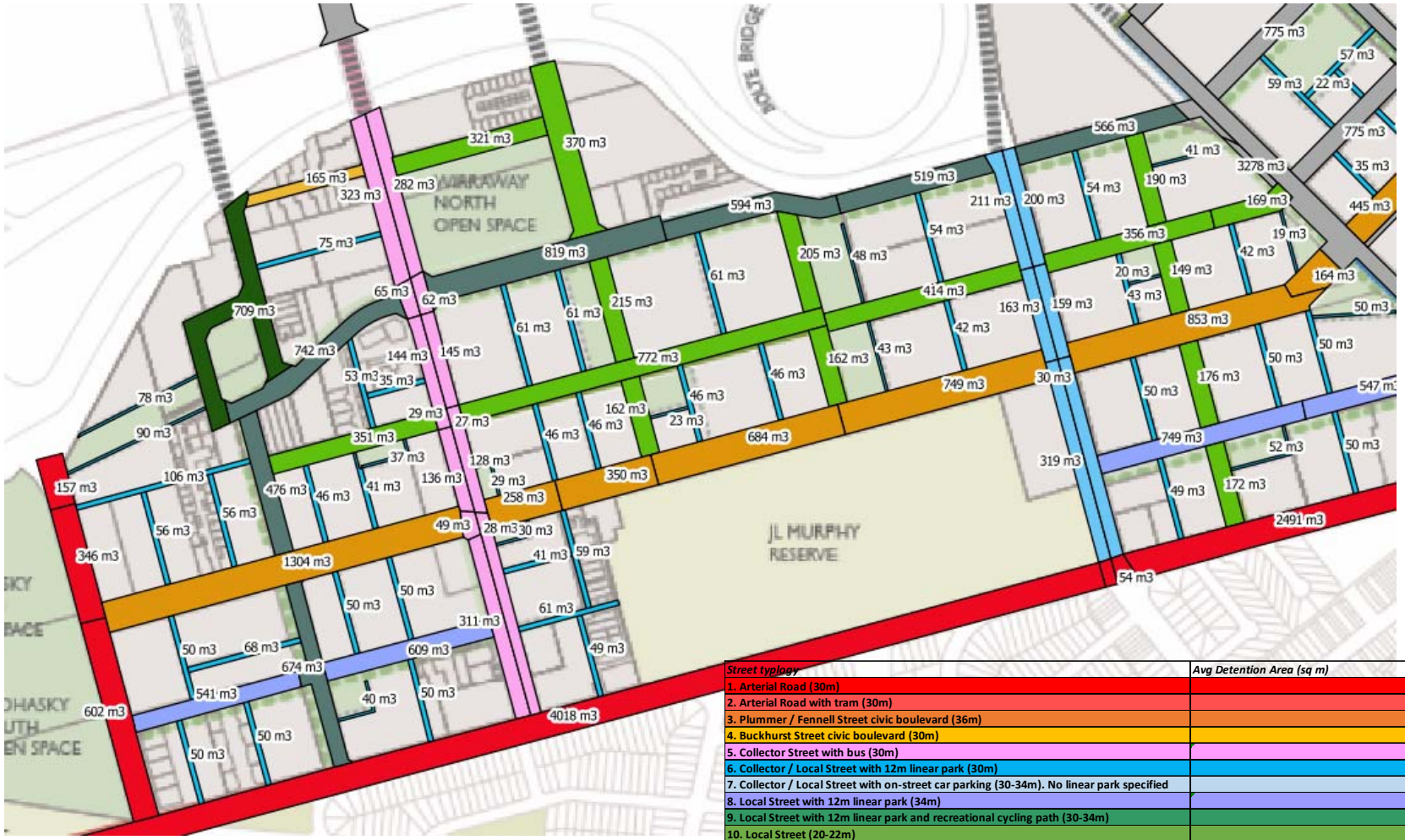
20 YEAR FLOOD EVENT

ASSESSMENT OF STREET DETENTION STORAGE

Step 1: Identify target volumes to be stored from each catchment



Step 2: Identify potential storage availability of proposed roads



Street typology	*Avg Detention Area (sq m)*
1. Arterial Road (30m)	2.50
2. Arterial Road with tram (30m)	2.50
3. Plummer / Fennell Street civic boulevard (36m)	3.00
4. Buckhurst Street civic boulevard (30m)	2.65
5. Collector Street with bus (30m)	2.50
6. Collector / Local Street with 12m linear park (30m)	2.65
7. Collector / Local Street with on-street car parking (30-34m). No linear park specified	2.83
8. Local Street with 12m linear park (34m)	3.01
9. Local Street with 12m linear park and recreational cycling path (30-34m)	2.83
10. Local Street (20-22m)	1.75
11. Local Street no separated cycle path (20m)	1.66
12. Local Street (13-15m)	1.16
13. Blue St (6 m)	0.50

Step 3: Match catchments to specific road storages

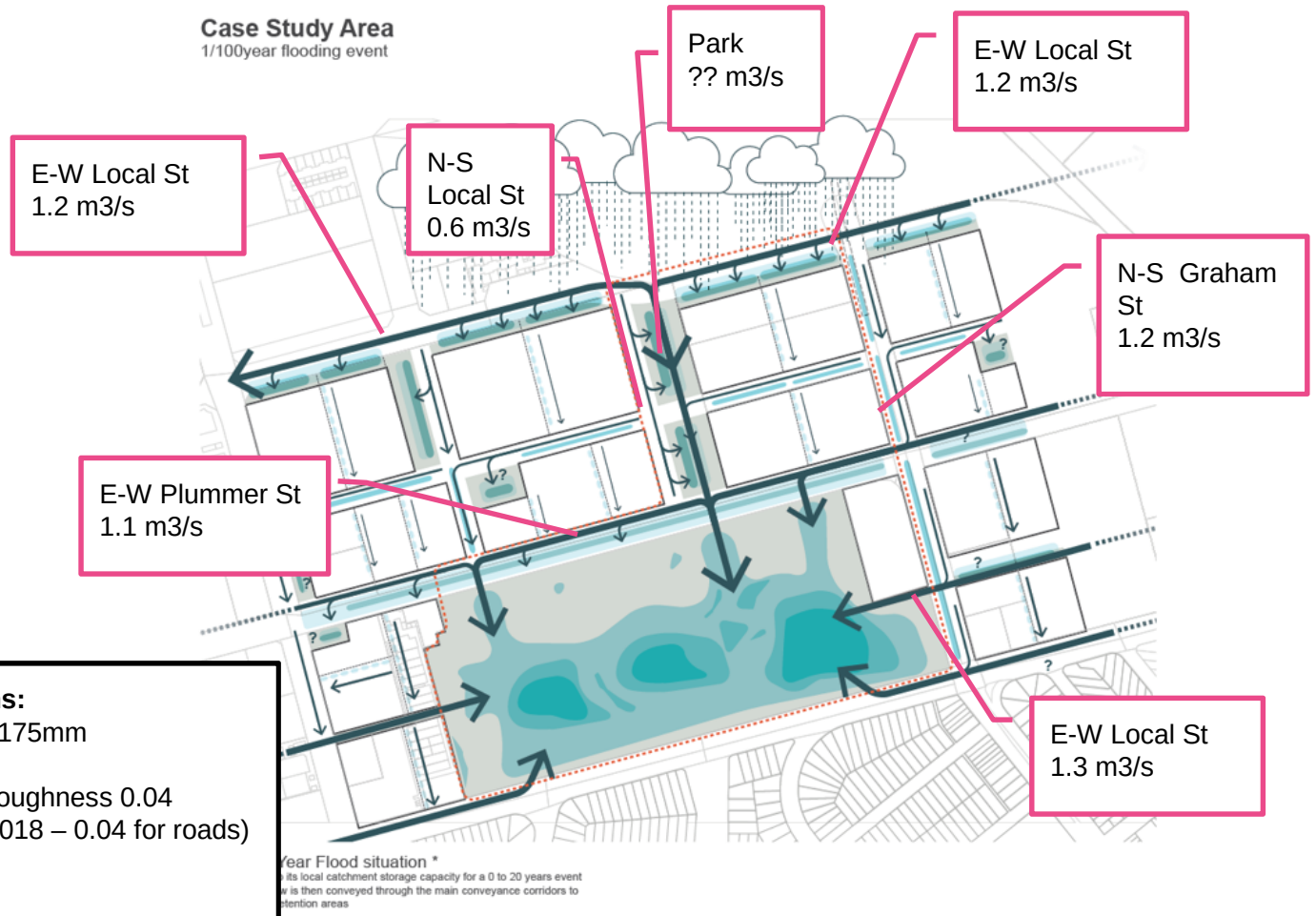
Step 3: Iterated over the study area....

Result: Streets without sufficient detention storage

100 YEAR FLOOD EVENT

ASSESSMENT OF STREET CONVEYANCE

Step 1: Estimate max conveyance per street

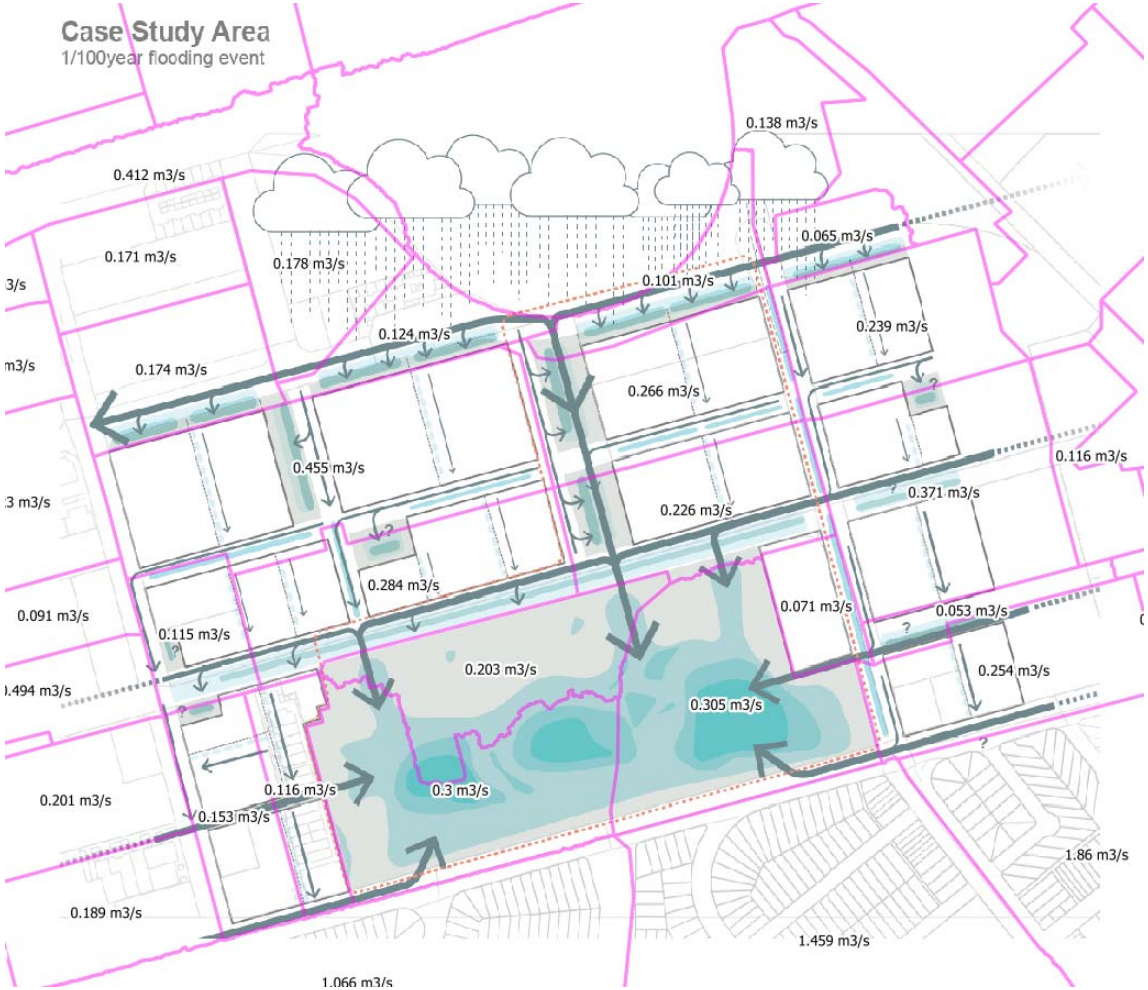


Assumptions:
- Ave. depth 175mm

- Mannings roughness 0.04
(MW guide0.018 – 0.04 for roads)

- Slope 0.1%

Step 2: Identify catchment peak flow



Result:...

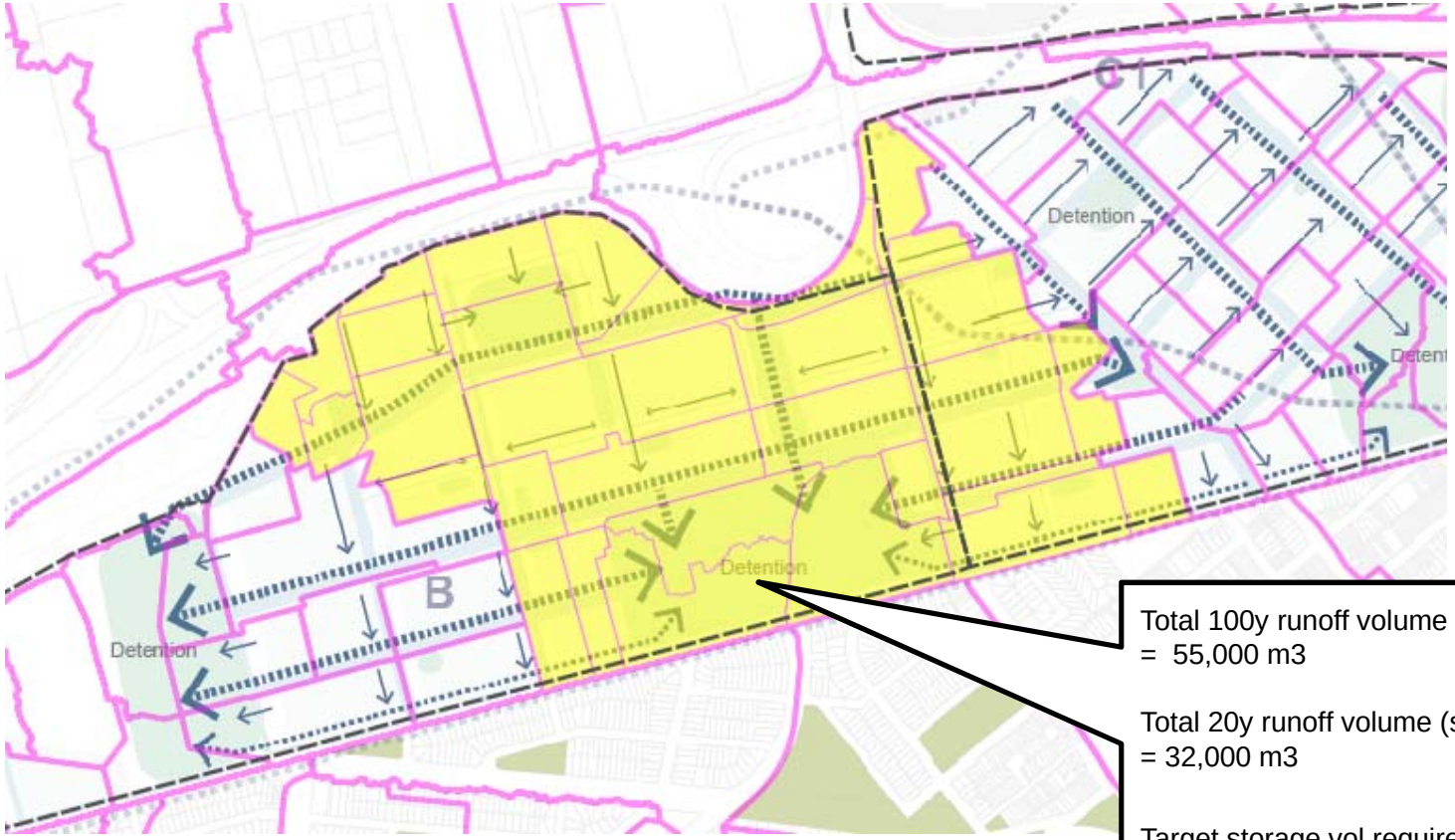
- Conveyance generally appears to be adequate
- There is flexibility to accommodate more detention at the expense of conveyance

100 YEAR FLOOD EVENT

ASSESSMENT OF STORAGE AT JL MURPHY RESERVE

GHD Environment

Assessment of Catchment Area to JL Murphy



Total 100y runoff volume
= 55,000 m3

Total 20y runoff volume (stored in streets)
= 32,000 m3

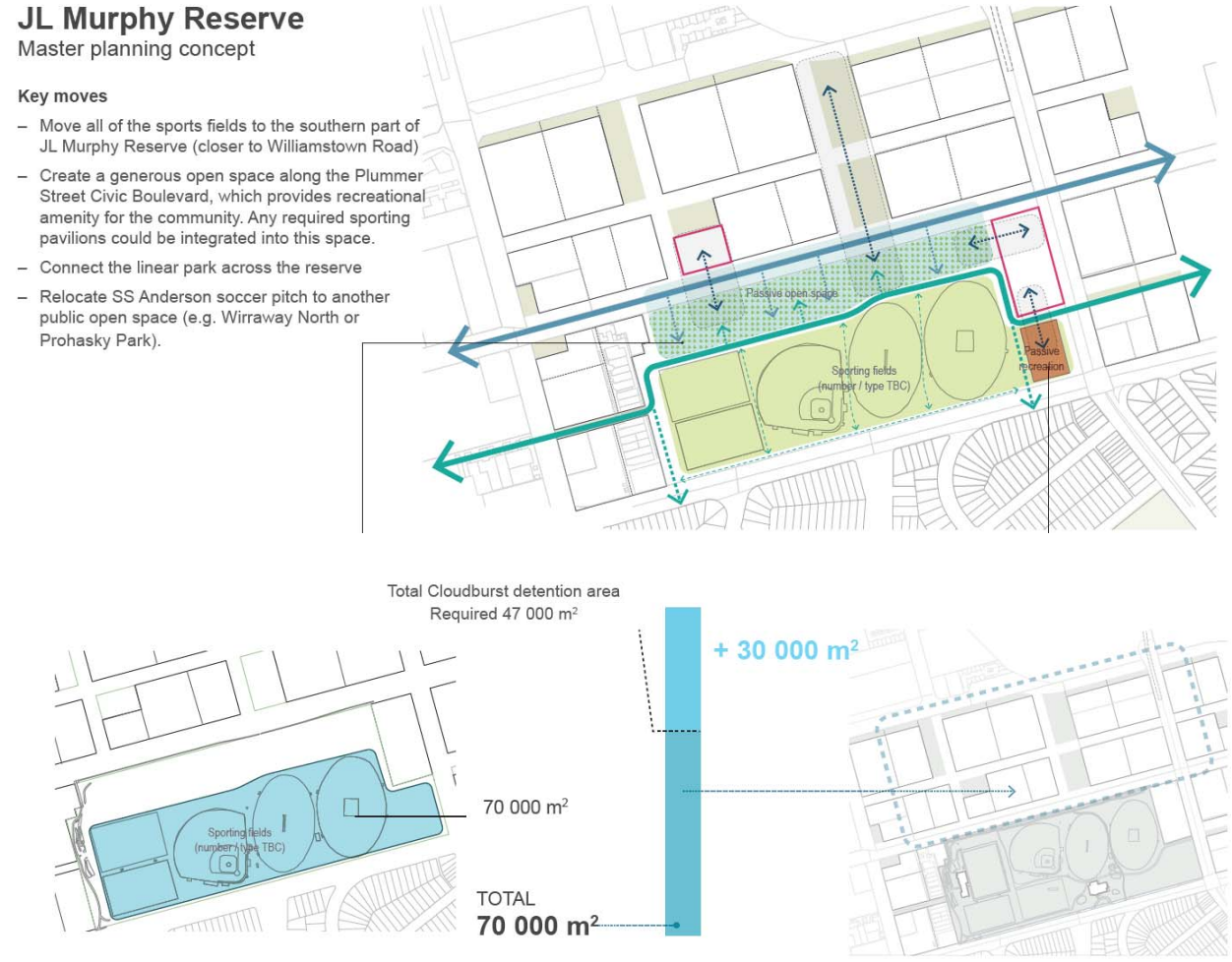
Target storage vol required at JL Murphy
= 55,000 - 32,000
= 23,000 m3

CoPP's Preferred Concept for JL Murphy Reserve

Target storage volume
= 23,000 m3

JL Murphy plan area
=70,000 m2

Depth required
= 0.33 m



CoPP's Preferred Concept for JL Murphy Reserve (scenario if all street storage is full)

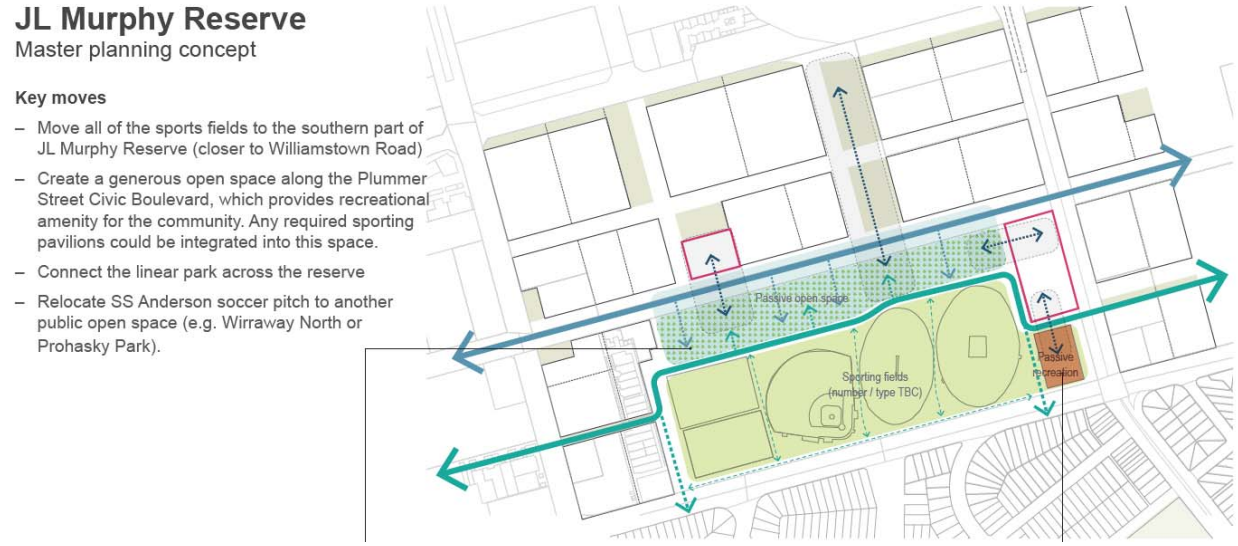
Scenario:

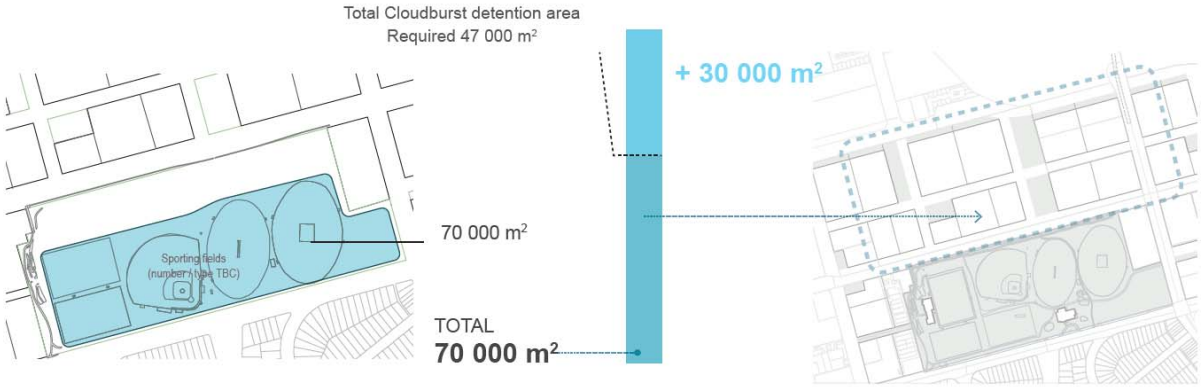
- What is there was a flood event just before the 100y flood event? This may take up the street storage.
- What if JL Murphy had to store all of the 100y flood event?

Target storage volume
= 55,000 m3

JL Murphy plan area
= 70,000 m2

Depth required
= 0.80 m

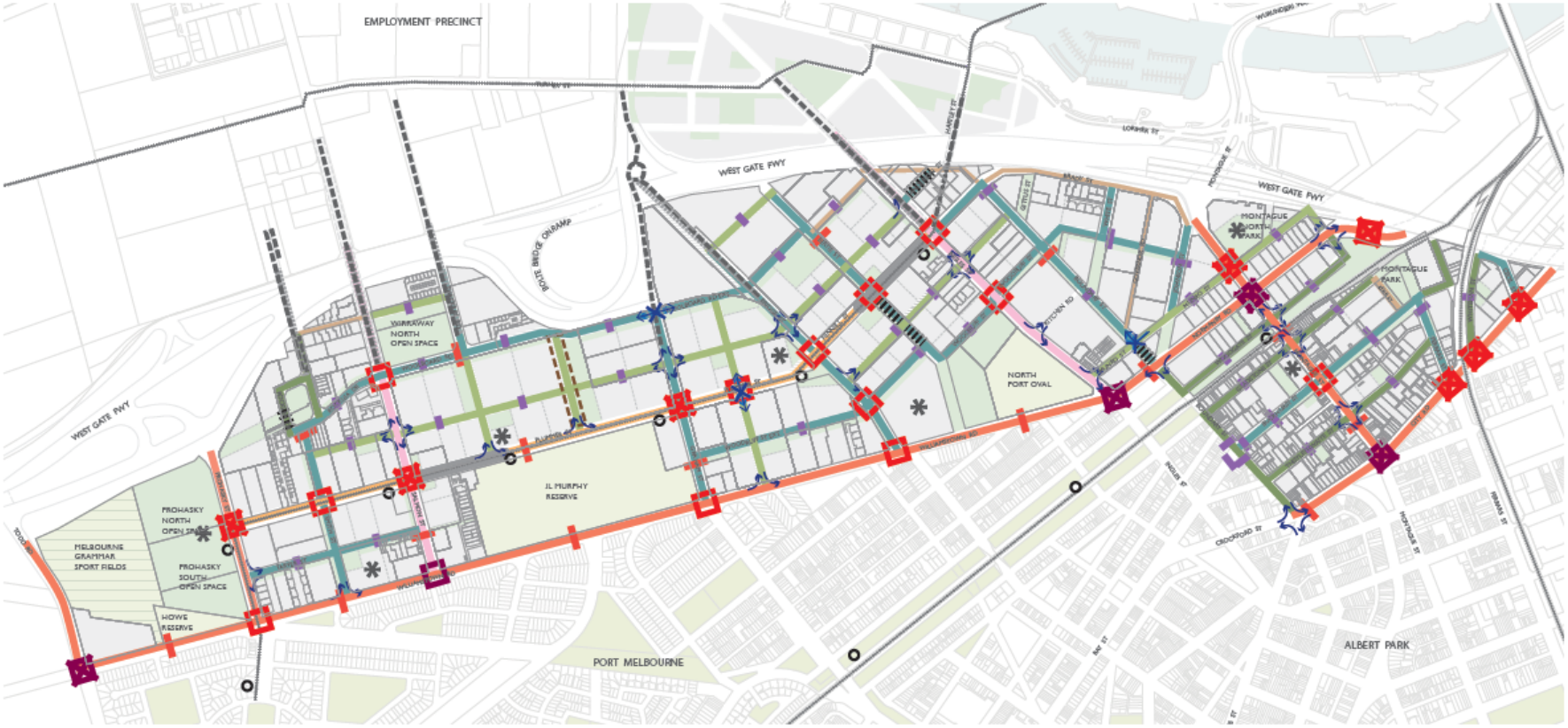




Raised Intersections

Movement and Access

Intersections (consolidated street cross sections)



Intersections:

- New signalised intersection (no turn lanes)
- Existing signalised intersection to be upgraded (no turn lanes)
- New signalised intersection (with turn lane)
- Existing signalised intersection to be upgraded (with turn lane)
- Left-in-left out vehicle traffic (cyclist full movements)
- Toucan crossing (signalised pedestrian & cyclist crossing)
- Wombat crossing (raised pedestrian crossing)
- No vehicle access (pedestrians and cyclists only)
- Restricted vehicle movement (no right turn / no through movement)
- Raised street (shared zone)

Other

- Tram stop
- Community Hub
- Bridge

Streets

1. Arterial Road (30m)
2. Arterial Road with tram (30m)
3. Plummer / Fennell Street civic boulevard (36m)
5. Collector Street with bus (30m)
4. Street with linear park (cross section #4, #6, #7, #8, #9)
10. Local Street (20-22m)
11. Local Street no separated cycle path (20m)
12. Local Street (13-15m)

NOTES:

Where an intersection treatment is not shown, it will be a full movement intersection.

All intersections are to be raised except for Arterial road intersections (the one exception being Ingles / Fennell Street)

All intersections to provide protection for bicycle paths (where provided)

It is expected that some additional signalised intersections will need to have controlled movements (not shown on plan).

FUNDAMENTAL STREETSCAPE ASSUMPTIONS

Basis for Detention & Conveyance Calculations

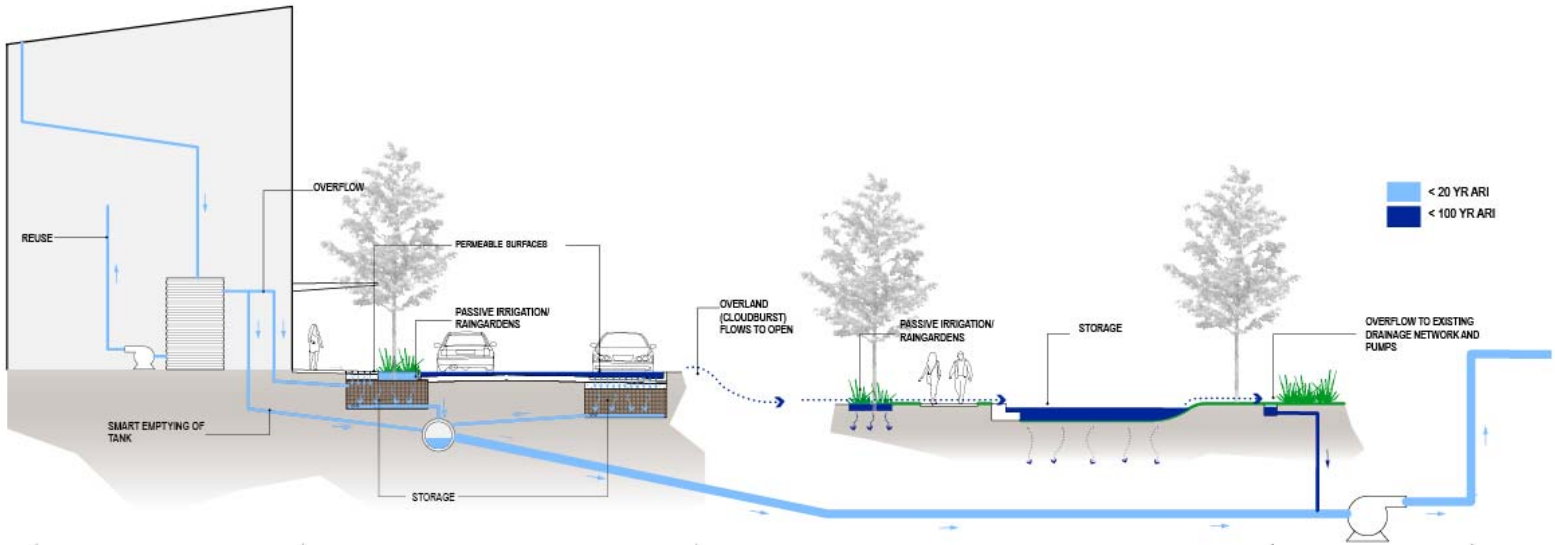
Detention Storage Assumptions:

- 300 mm of above ground detention in all trees pits
- No below ground detention around tree root ball accounted for (conservative measure noting concerns around depth assumptions and potential volume to reduce with time due to siltation) – ***refer sensitivity discussion***
- No drop in linear park to accommodate detention – ***refer sensitivity discussion***
- No changes to the COPP streetscape amenity considerations (i.e. no optimisation from a detention/conveyance perspective) – ***refer sensitivity discussion***

Conveyance Area Assumptions:

- Up to 20 yr ARI held in detention storages.
- 20 yr to 100 yr – streets and linear parks convey the flow (excluding tram and pedestrian paths) in accordance with Melbourne Water's Depth (<=0.4 m) and Velocity x Depth (<= 0.4 m2/s) criteria.
- ***Refer sensitivity discussion*** for the conveyance benefits associated with non-conforming depth criteria (i.e. > 0.4 m) in linear parks.

Functional Diagram



PRIVATE REALM

RAIN TANKS
REUSE
ONSITE PERMEATION

PUBLIC STREET

STORAGE
PERMEABLE PAVING
RAINGARDENS
PASSIVE IRRIGATION

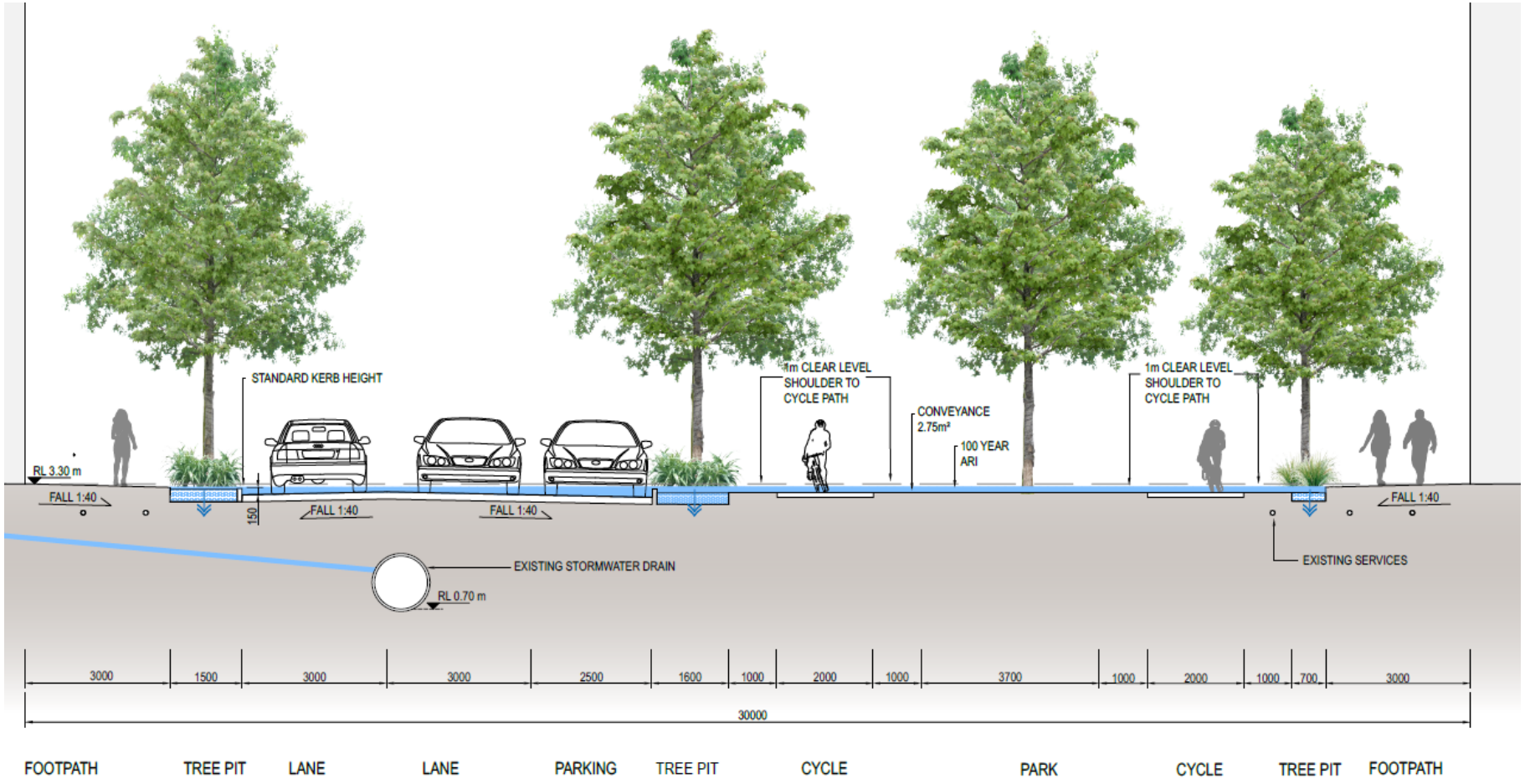
PUBLIC OPEN SPACE

STORAGE
PERMEABLE PAVING
RAINGARDENS
PASSIVE IRRIGATION

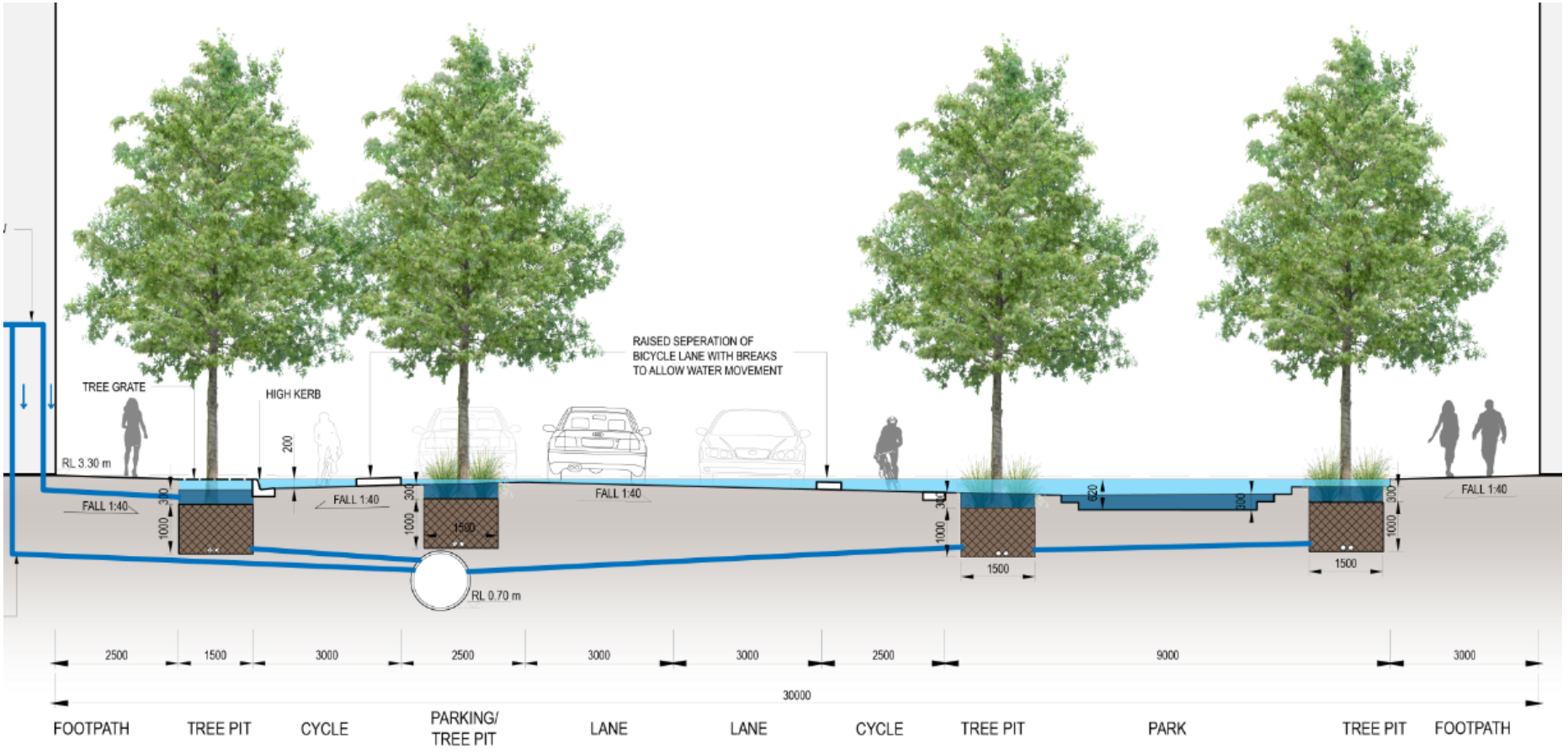
DRAINAGE INFRASTRUCTURE

PITS
PIPES
PUMPS

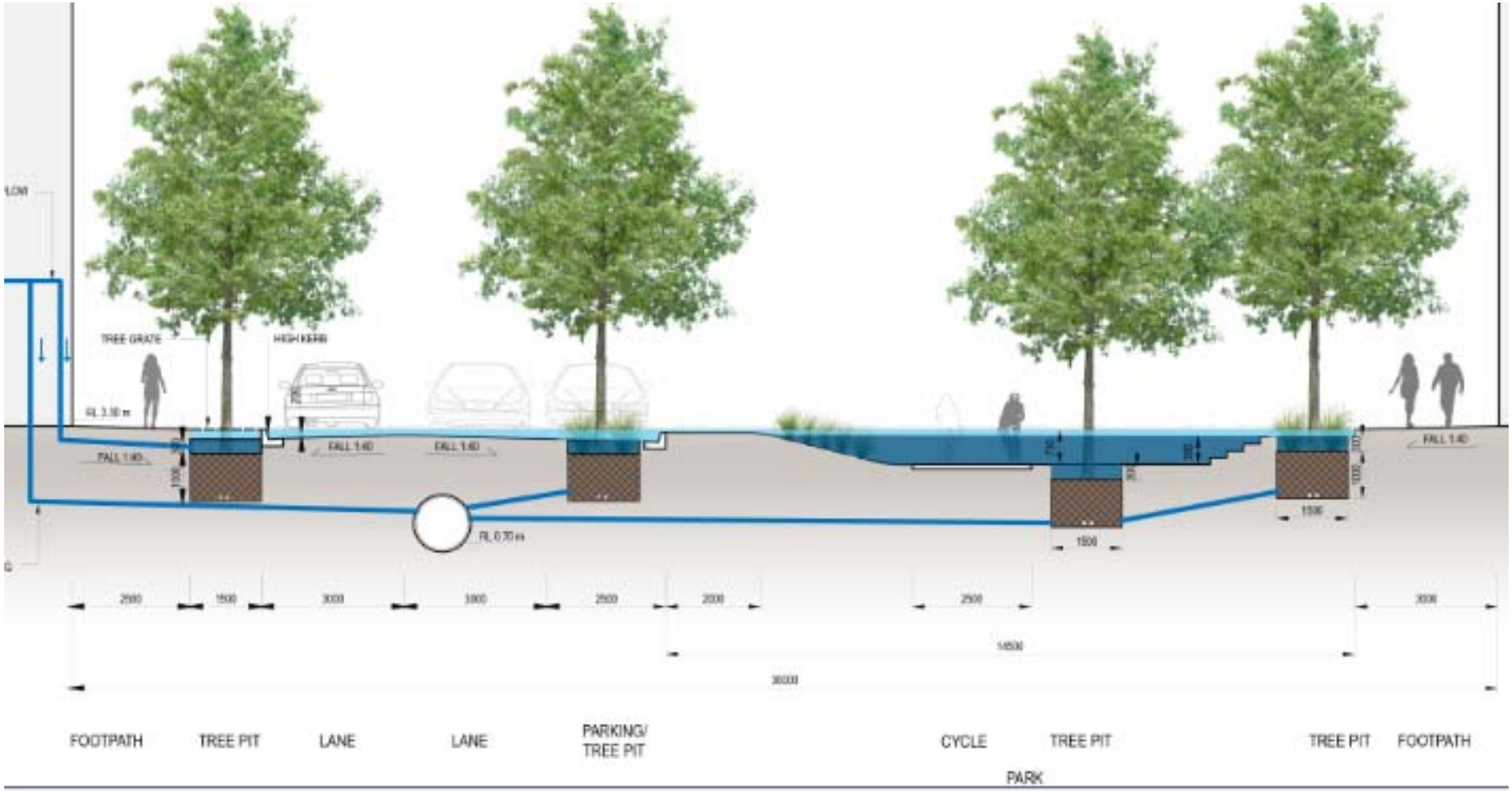
Initial 30 m Green St Section – Starting Point for Modelling



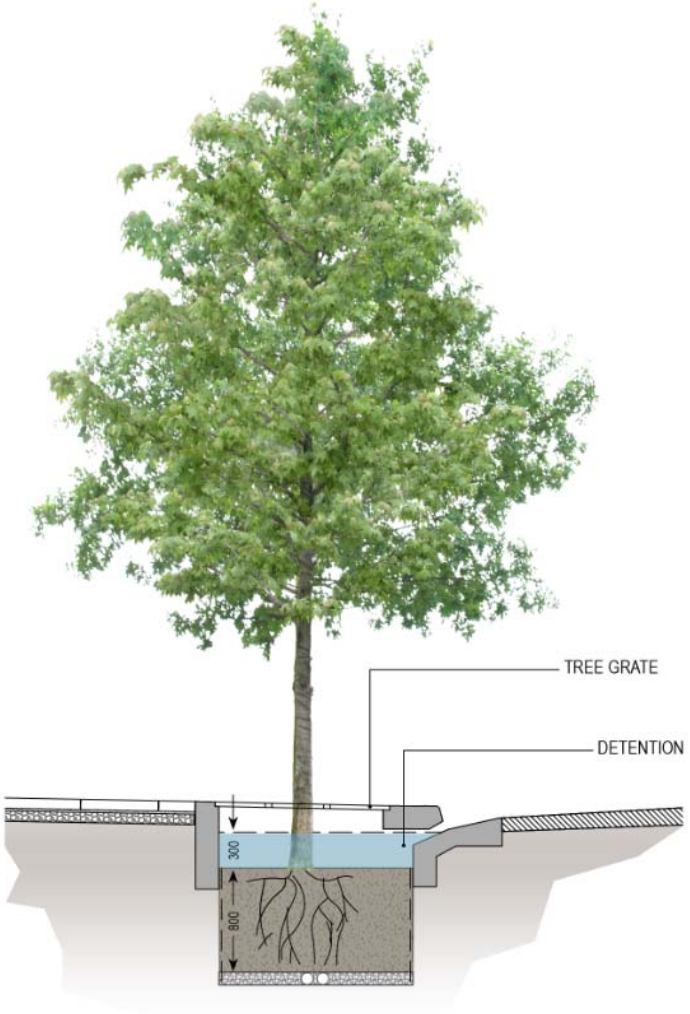
Alternative 30 m Green St Section 1 – Dropped Linear Park



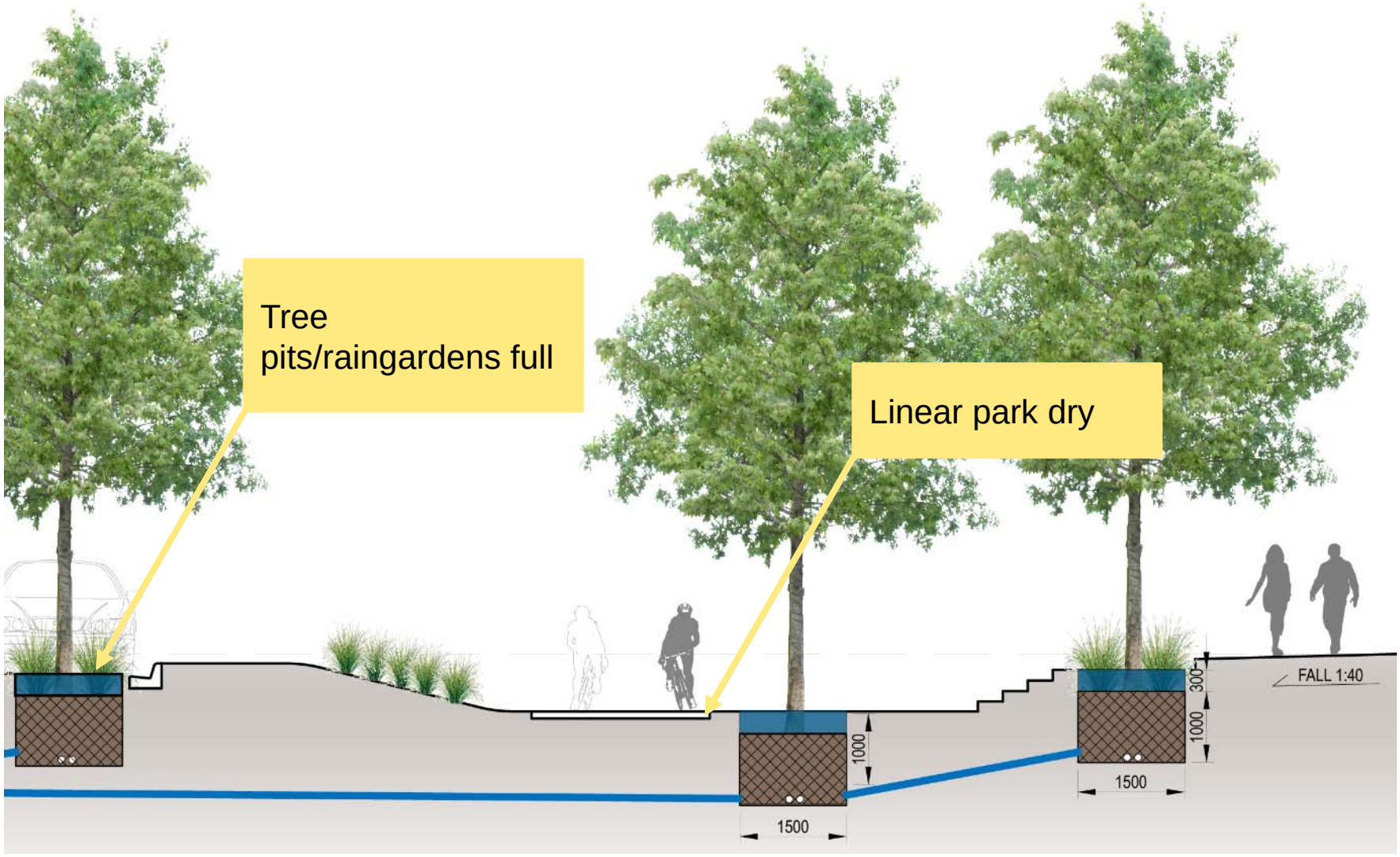
Alternative 30 m Green St Section 2 – Dropped Linear Park & Relocated Cycle Path



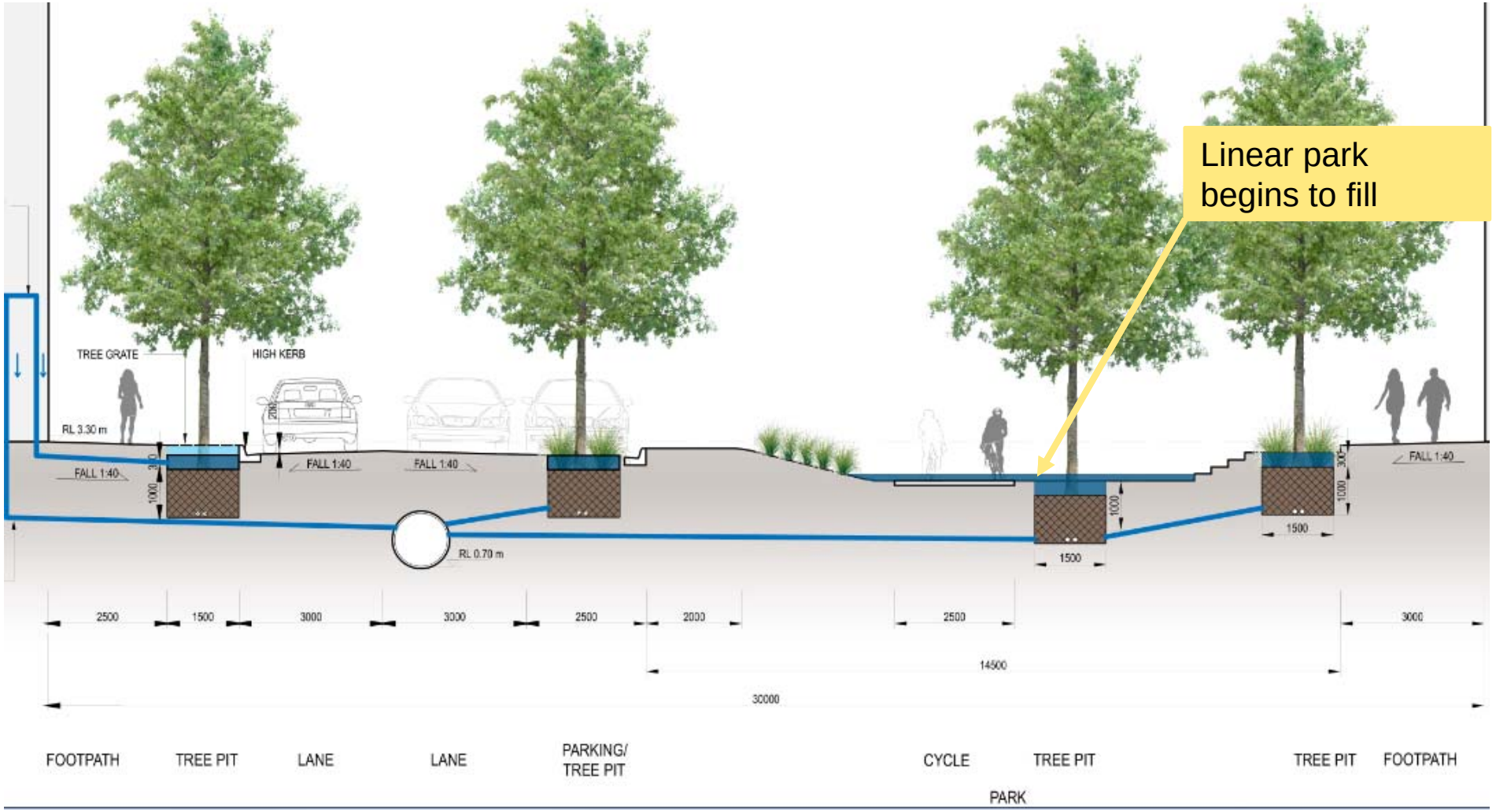
Role of Tree Pits & Raingardens



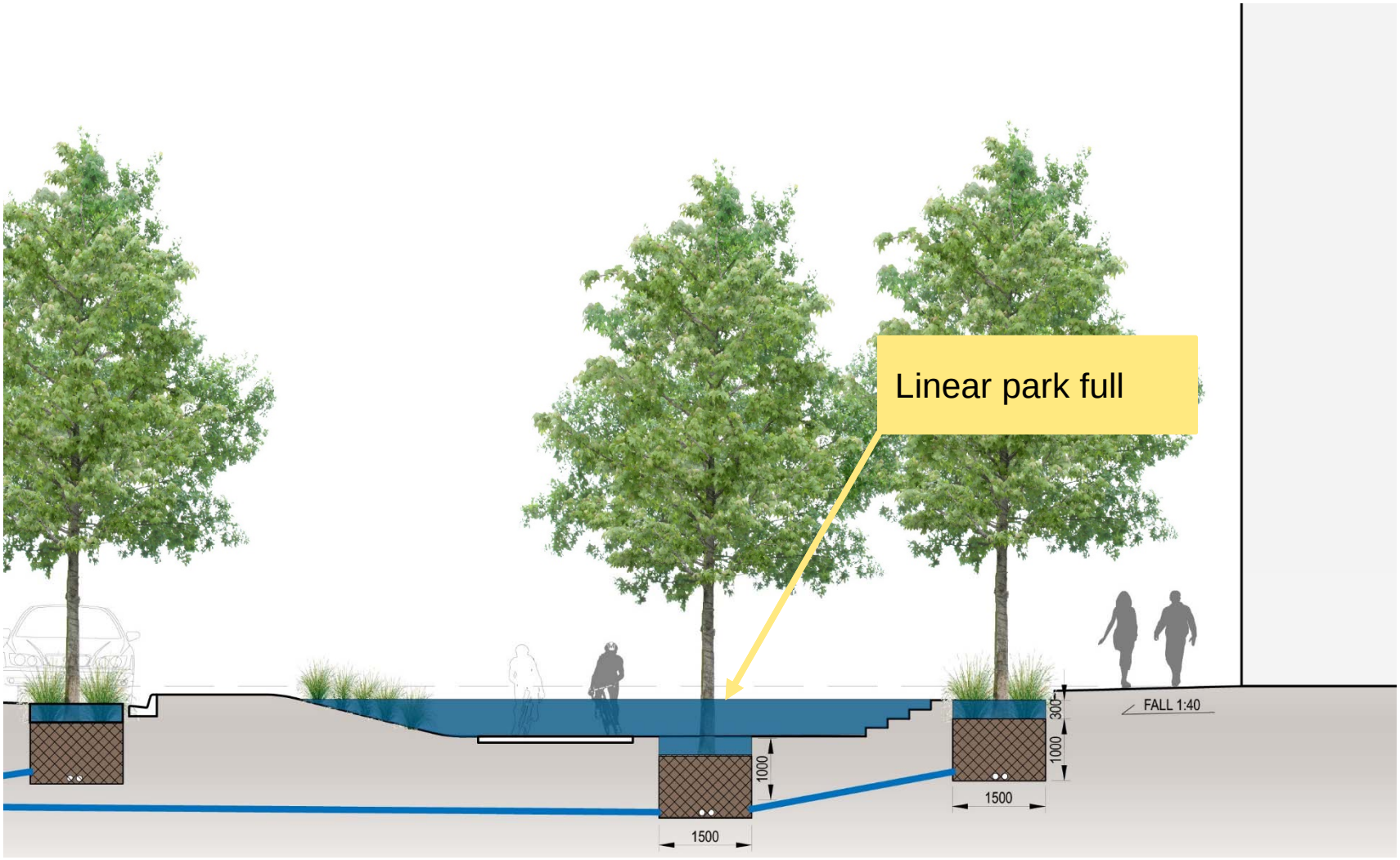
What fills in 1 in 3 month ARI?



What fills in 1 in 1 yr ARI?



What fills in 1 in 20 yr ARI?



Sensitivity Discussion

Optimisation of Street Cross Sections for Drainage Benefit

- Optimising the existing street cross section by dropping the linear park and/or relocating cycle paths into the linear park *increases* the conveyance and detention areas available in 5 of the 12 streetscape typologies with linear parks.

  As an example in the 30 m Green St with this results in:

  - 4.94 sq m or **72%** of additional detention with dropped park and relocated cycle paths
  - 1.17 sq m or **38%** of additional detention with dropped park

Accounting for Below Ground Detention in Street Trees/Raingardens

- Accounting for below ground detention around the tree root ball (up to a depth of 1 m below ground) increases the detention volumes by **57%** (accounting for a porosity of 40%).

Sensitivity Discussion

Scenario	Additional Detention from starting point (sq m)	Total Resultant Detention (sq m)	Total Conveyance (sq m)	20 yr ARI depth of water (mm) in base of park	100 yr ARI depth of water (mm) in base of park
Dropped Park	1.17	2.97	4.76	300	617
Dropped Park with Relocated Cycle Path	4.94	6.74	3.74	580	734

Key Questions

- Can we send legal point of discharge away from laneways?
- When can we start to flood linear parks (i.e. 1 in 3 month ARI event)?
- Can we accommodate cycle paths in linear parks?
- How deep can we make linear parks?
- What proportion of streetscape has tree pits/raingardens (current sections show approx. 80% of streetscape)?
- Can we compromise on raised intersections?
- Can we assume all roads will be renewed for the purposes of scaling up?
- Next steps for Council and how can we work together?

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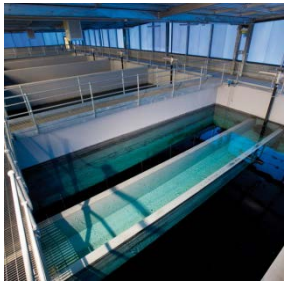
Attachment 12

Case Study Assessment Slides (CoM)

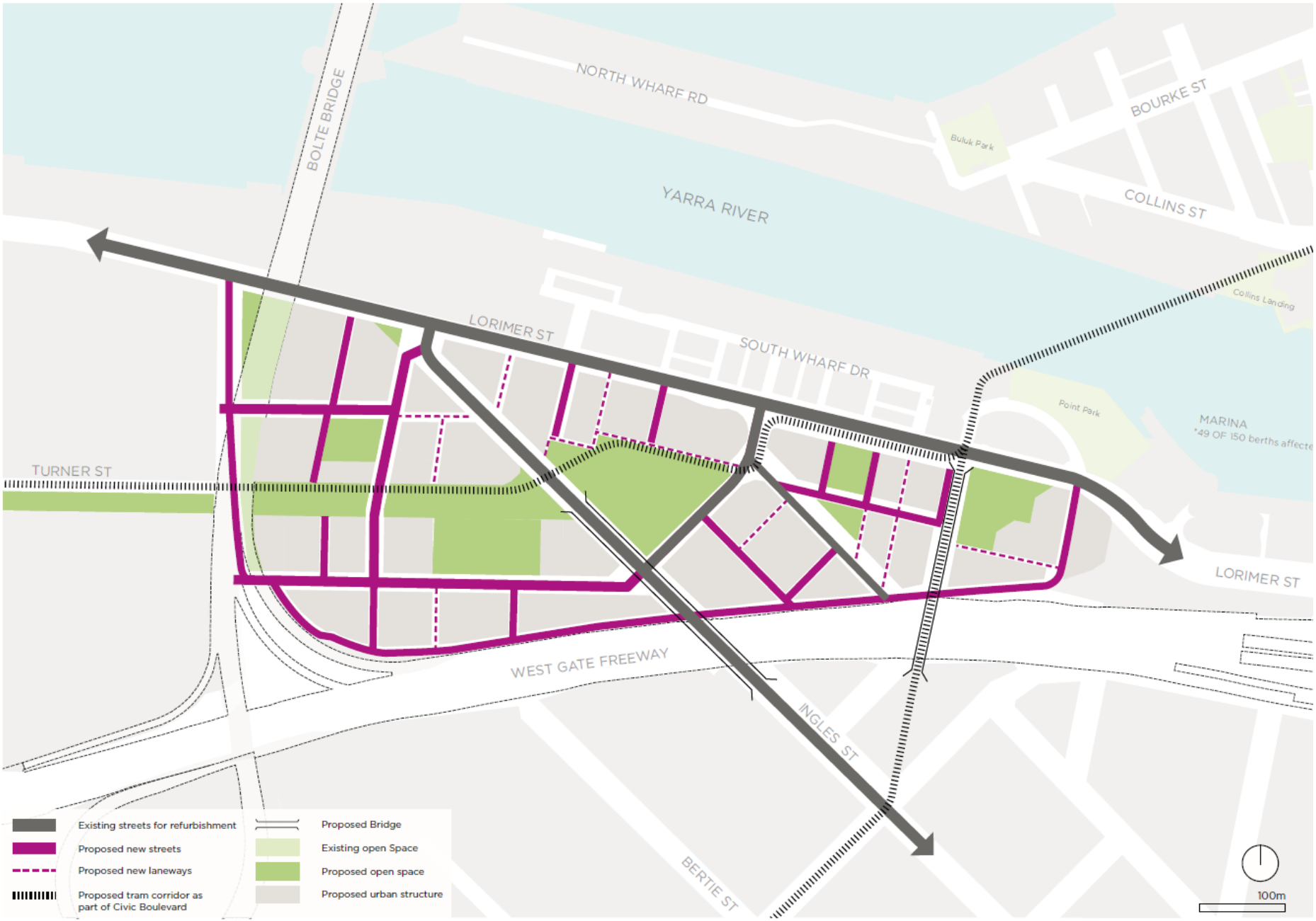
Progress update
CoM case study area



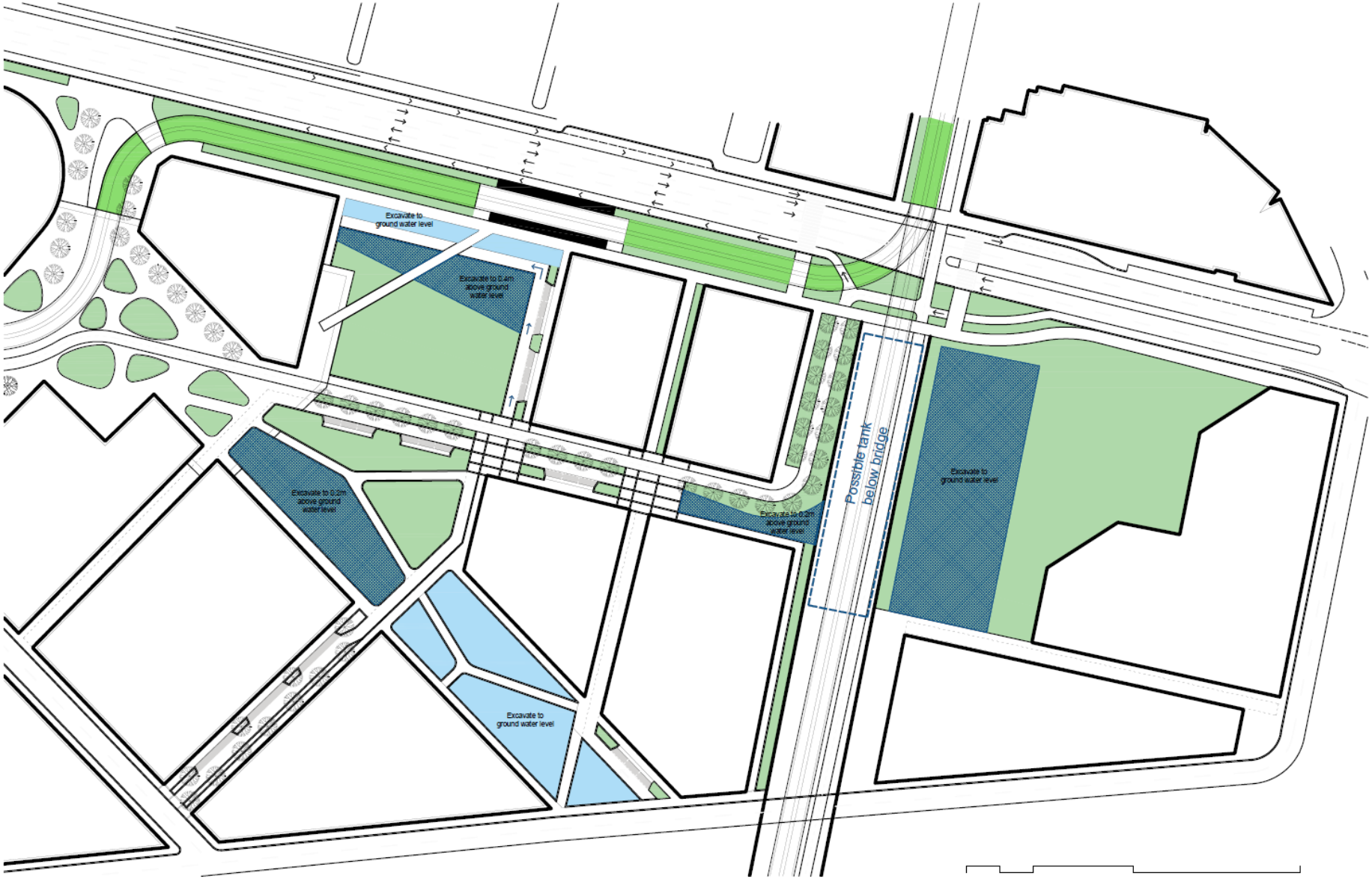


Philip Joyce

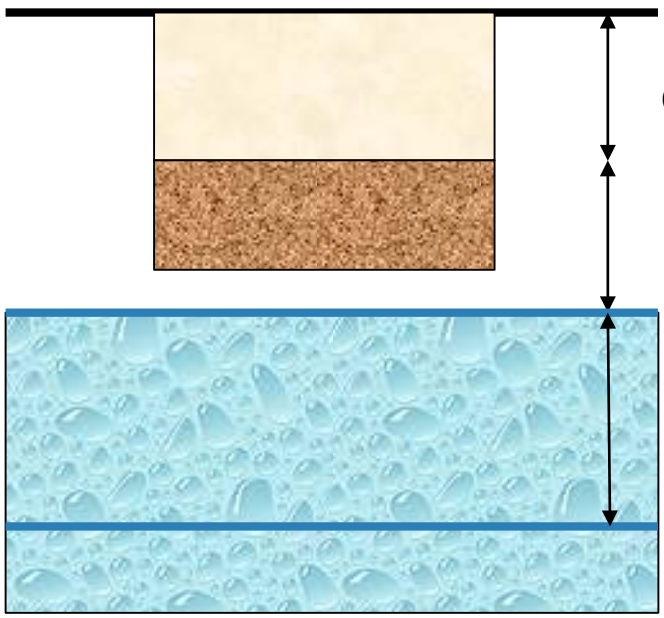
GHD Water



NEW & REFURBISHED STREETS


Excavate to ground water level
Excavate to 0.4m above ground water level
Excavate to 0.2m above ground water level
Excavate to 0.2m above ground water level
Excavate to ground water level
Excavate to ground water level
Possible tank below bridge

Suggested minimum ground level for excavated storages



1.8mAHD – Minimum ground level for excavated storages

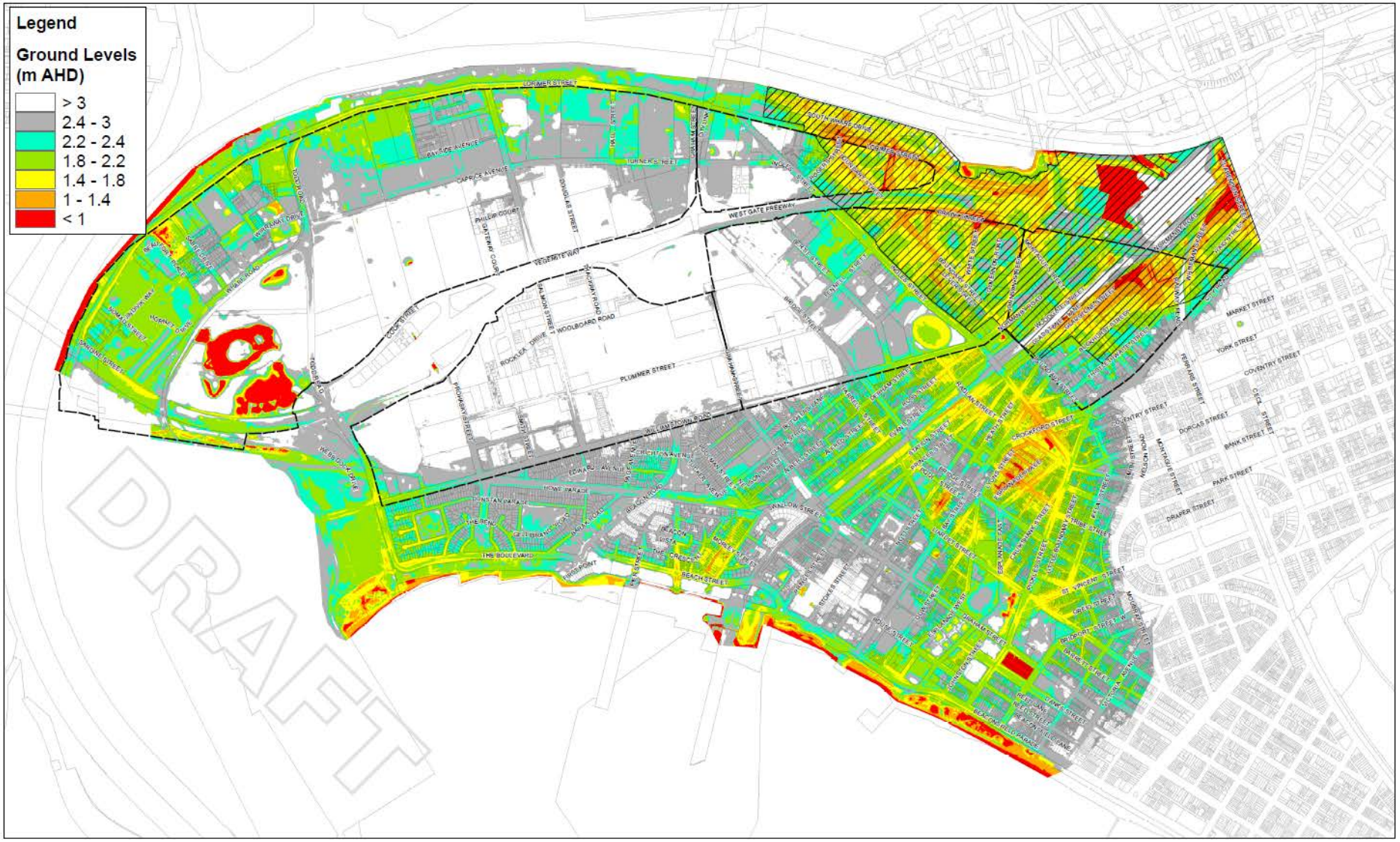
0.5m – Maximum depth of excavated storage

0.5m – Allowace for a suitable formal invert to be established

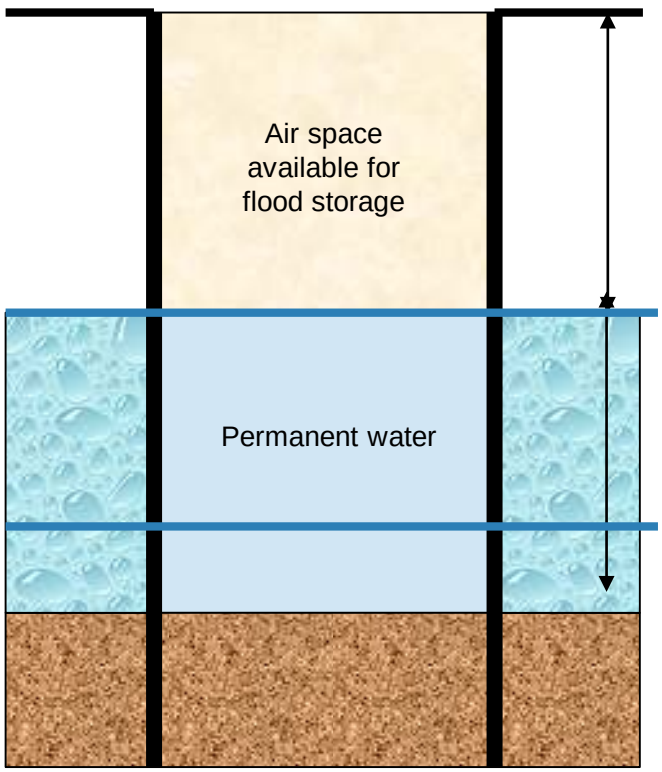
0.8mAHD - General groundwater level in 2100

0.8m – Allowance for sea level rise by 2100

0.0mAHD - Current general groundwater level


Legend
Ground Levels (m AHD)
> 3
2.4 - 3
2.2 - 2.4
1.8 - 2.2
1.4 - 1.8
1 - 1.4
< 1
DRAFT
FORMER STREET
BAYSIDE AVENUE
CAPRICE AVENUE
TURNER STREET
WEST GATE FREEWAY
VEGEMITE WAY
ROCKLEA DRIVE
WOOLBOARD ROAD
PLUMMER STREET
TODD ROAD
HORNET DRIVE
COOK STREET
PROMARY STREET
SALMON STREET
ROCKAMPTON ROAD
WILLIAM ENGLAND AVENUE
EDWARD AVENUE
HOWE PARADE
DUNSTAN PARADE
THE BEND
THE BOULEVARD
BEACH STREET
MARKET STREET
BRIDGE STREET
GRAY STREET
MARKET STREET
YORK STREET
COVENTRY STREET
DORCAS STREET
PARK STREET
DRAPER STREET
MONTAGUE STREET
BANK STREET
CECIL STREET
FERRARS STREET
CROCKFORD STREET
ST VINCENT STREET
MOUNT PLEASANT ROAD
GHD

A storage design for low lying areas



1.8mAHD – Minimum ground level for excavated storages

1.0m

0.8mAHD - General groundwater level in 2100

0.8m

0.0mAHD - Current general groundwater level


Legend
Ground Levels (mAHD)
> 3
2.01 - 3
1.76 - 2
1.51 - 1.75
1.26 - 1.5
1.01 - 1.25
0.01 - 1
<= 0
552 Lorimer St
Under City Link North
Under City Link Middle
Under City Link South
Point Park Crescent
Hartley St
Cnr Rogers Ingles St
Gittus St
Westgate Freeway Detention
Cnr Ferrars & Douglas St
Cnr Ingles and Woodruff St
Cnr Bertie & Woodruff St
Munro St
Westgate Park North
Westgate Park East
Westgate Park South
J Murphy Reserve North
Cnr Plummer & Bridge St
Cnr Ingles St and Williamstown Rd
Rocklea Dr
Cnr Plummer & Salmon St
J Murphy Reserve West
J Murphy Reserve East
83 Prohasky St
DRAFT

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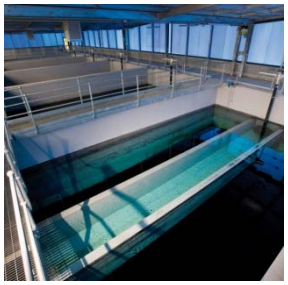
Attachment 13

Progress Meeting Slides 15th Nov

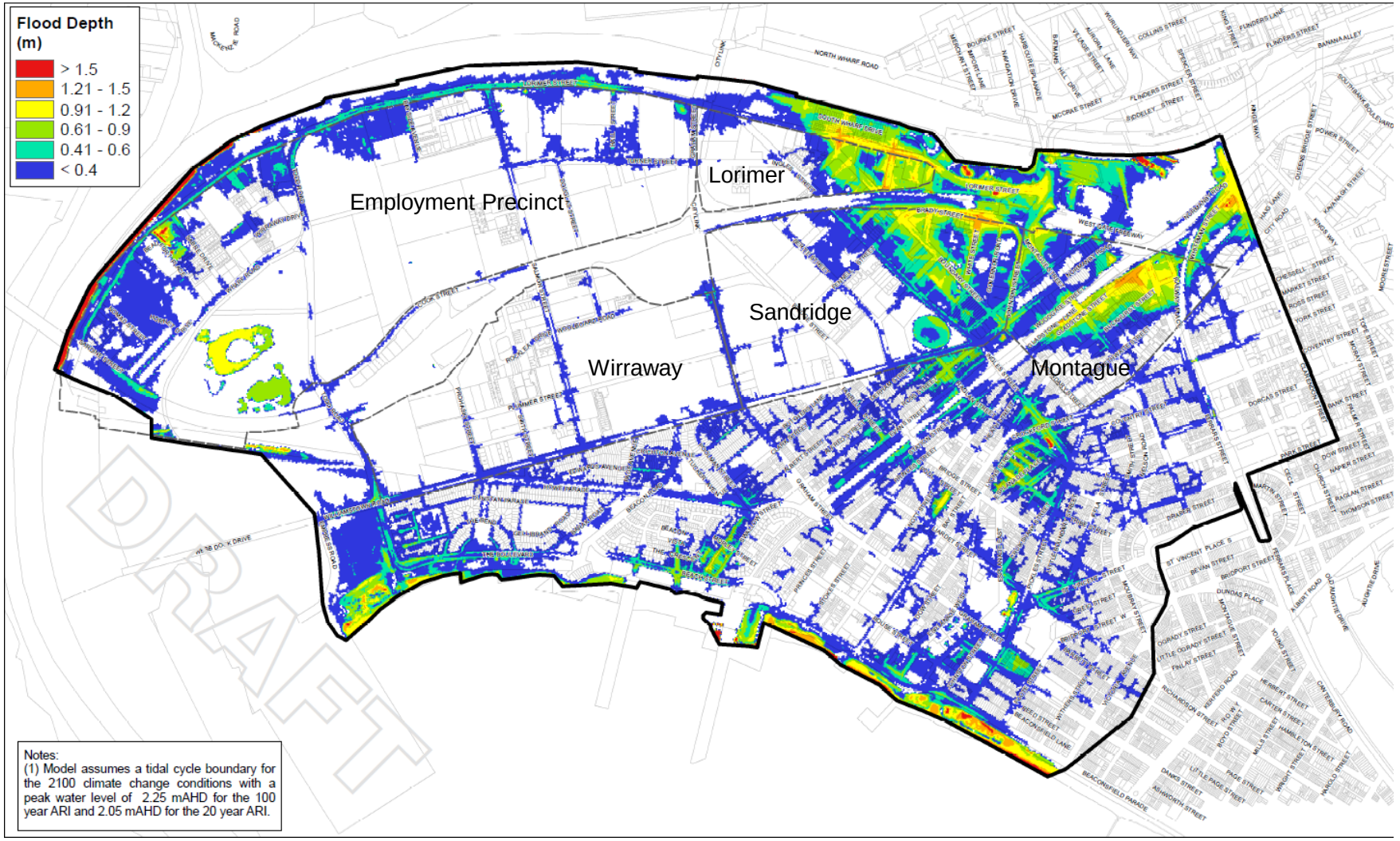
Fishermans Bend
Progress update 15 Nov



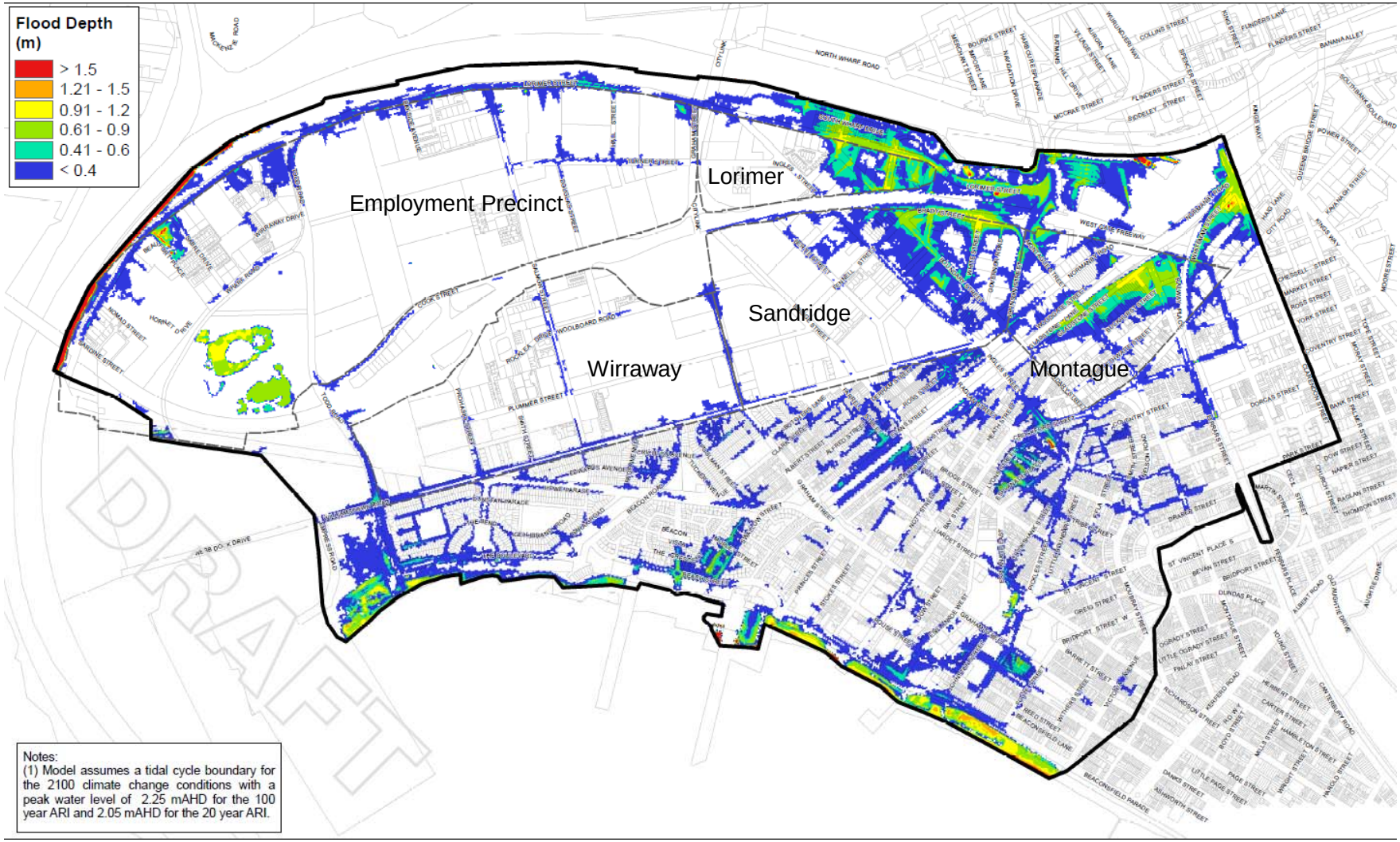


GHD Water

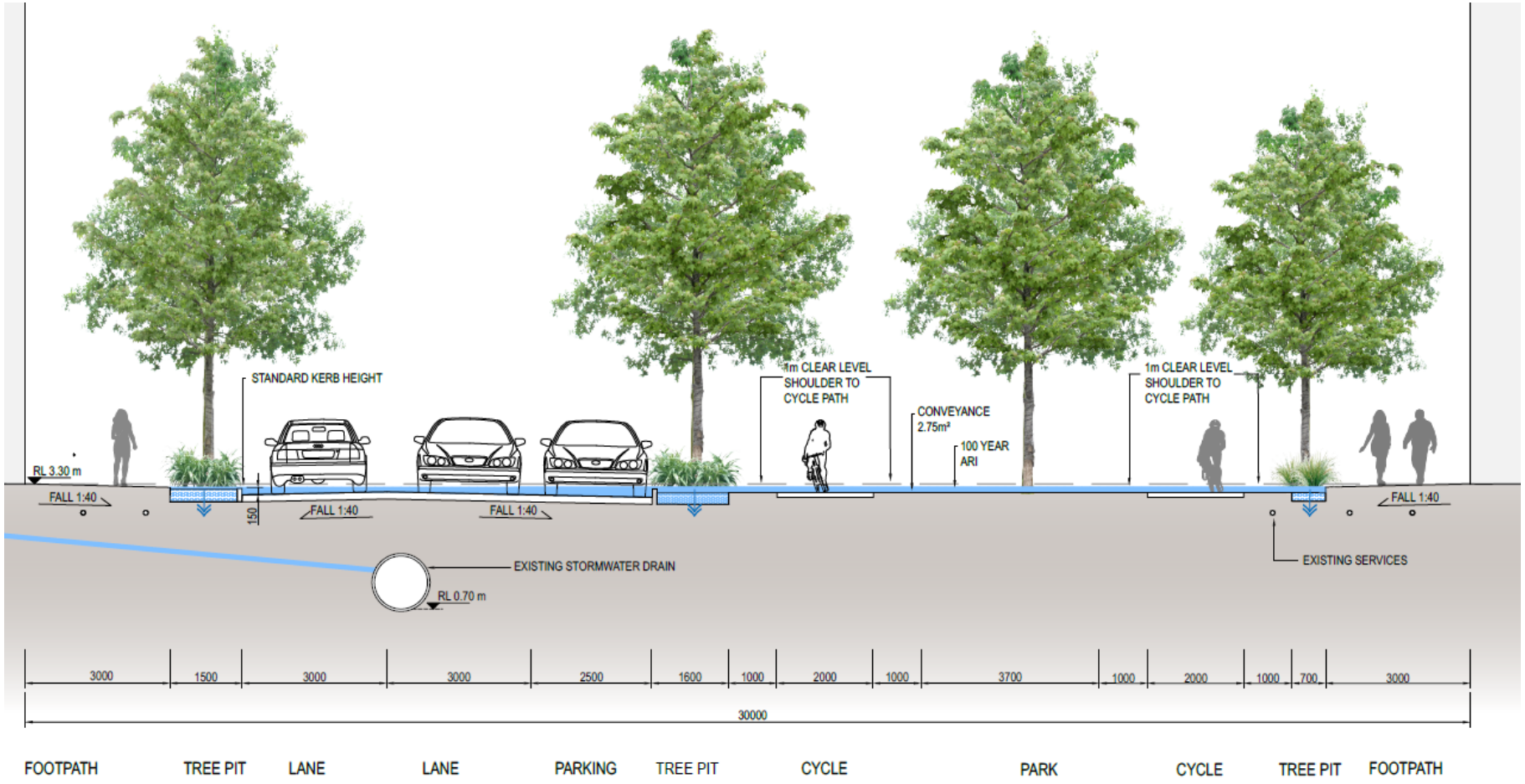
100-yr ARI flooding in 2100 with no mitigation



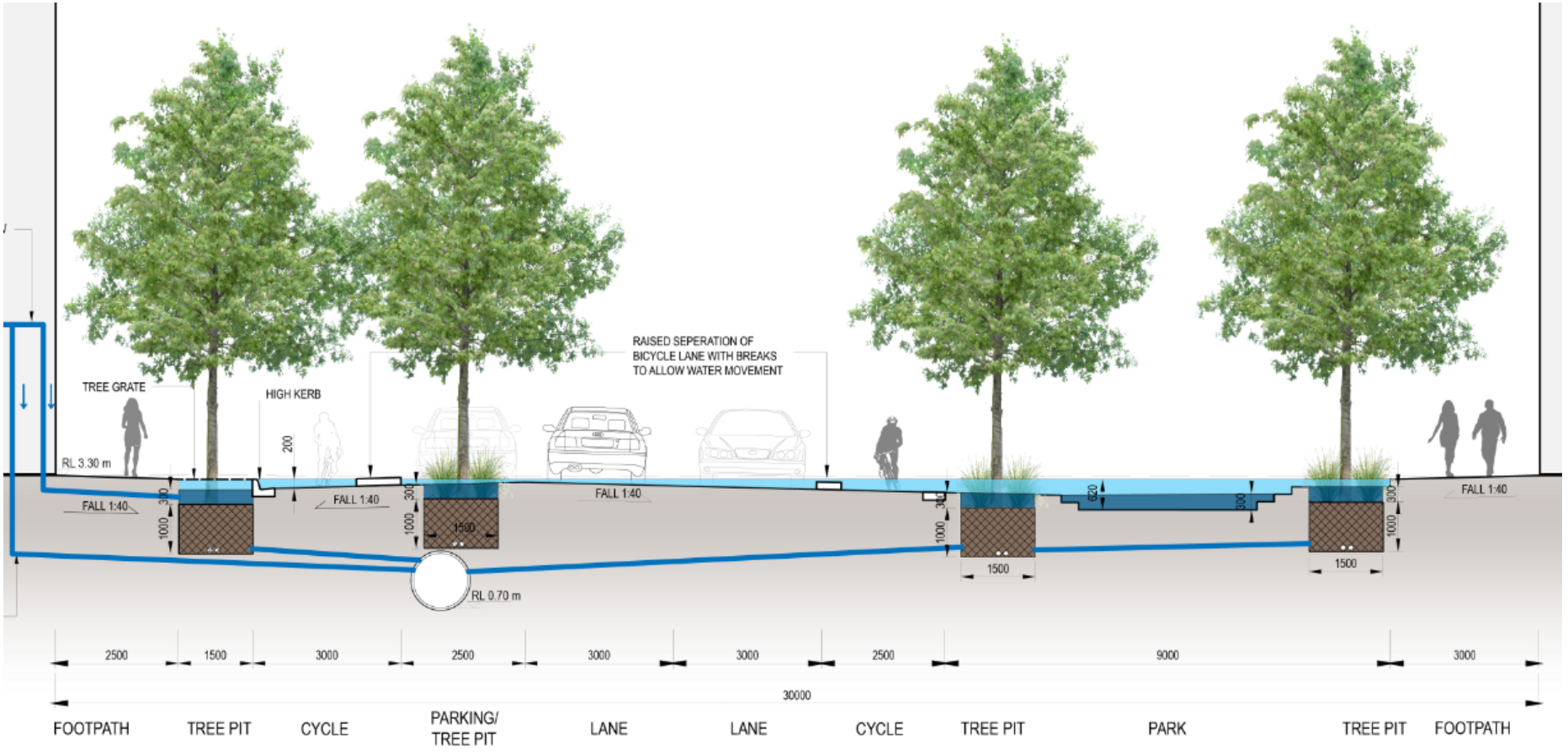
20-yr ARI flooding in 2100 with no mitigation



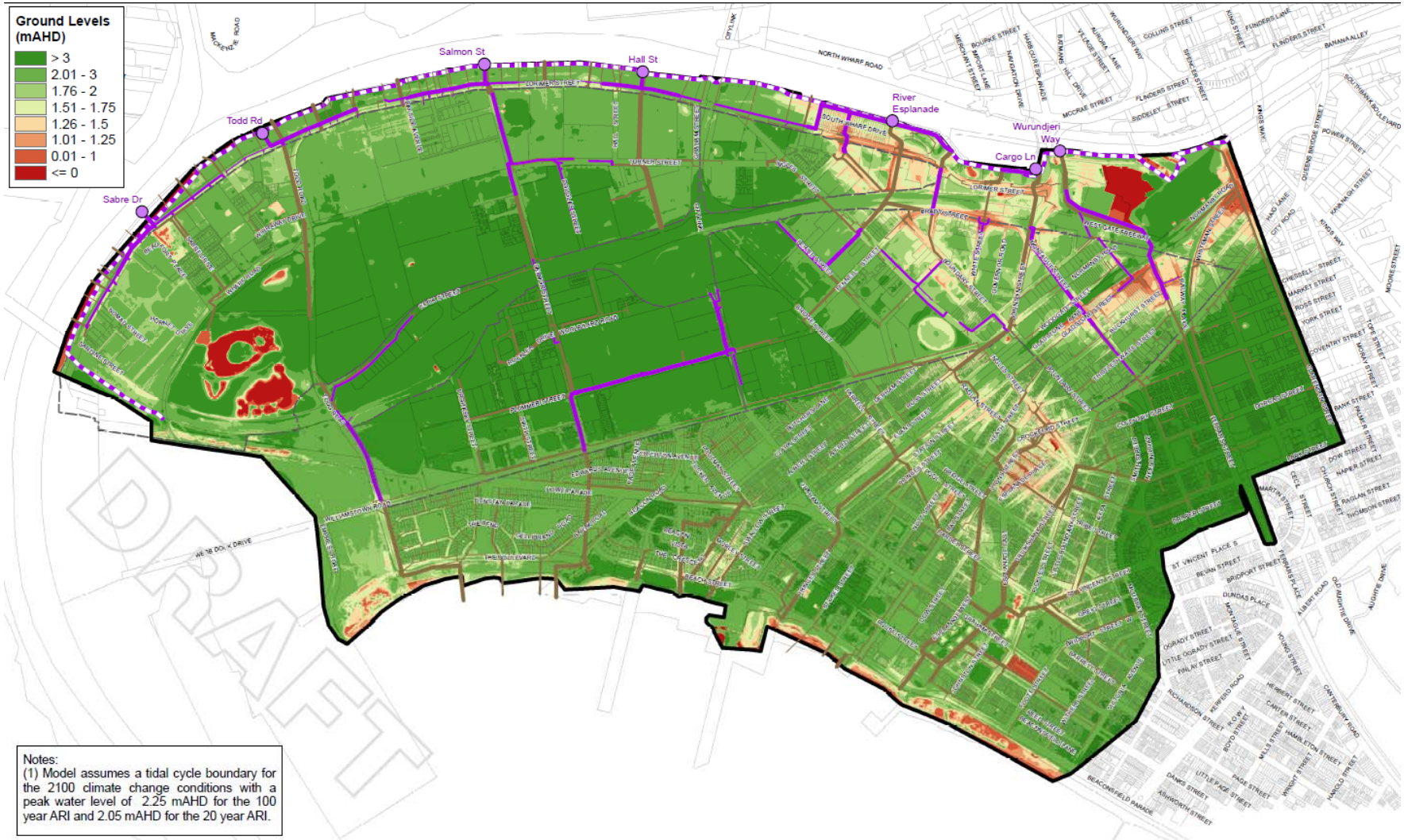
Initial 30 m Green St Section – Starting Point for Modelling



Alternative 30 m Green St Section 1 – Dropped Linear Park

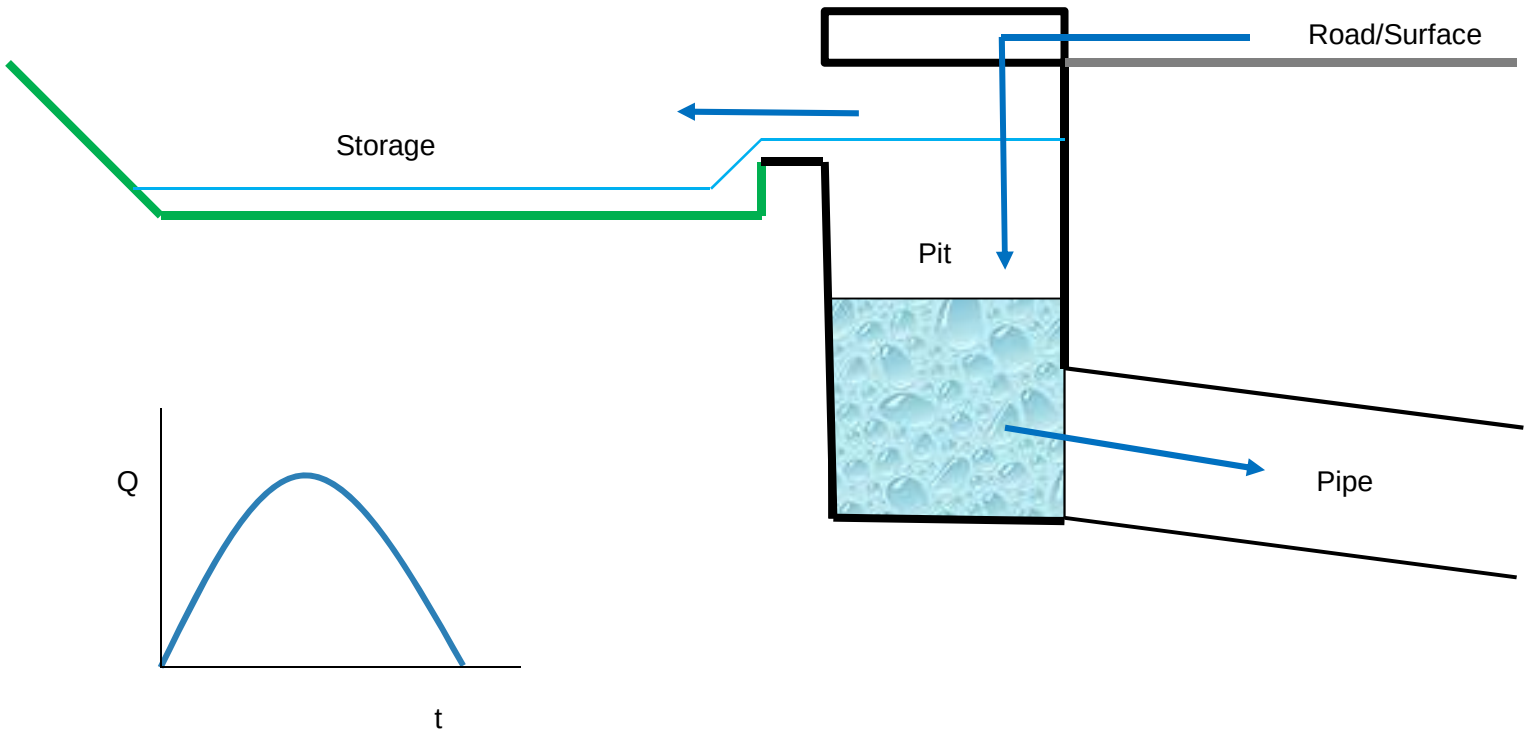


Baseline drainage plan

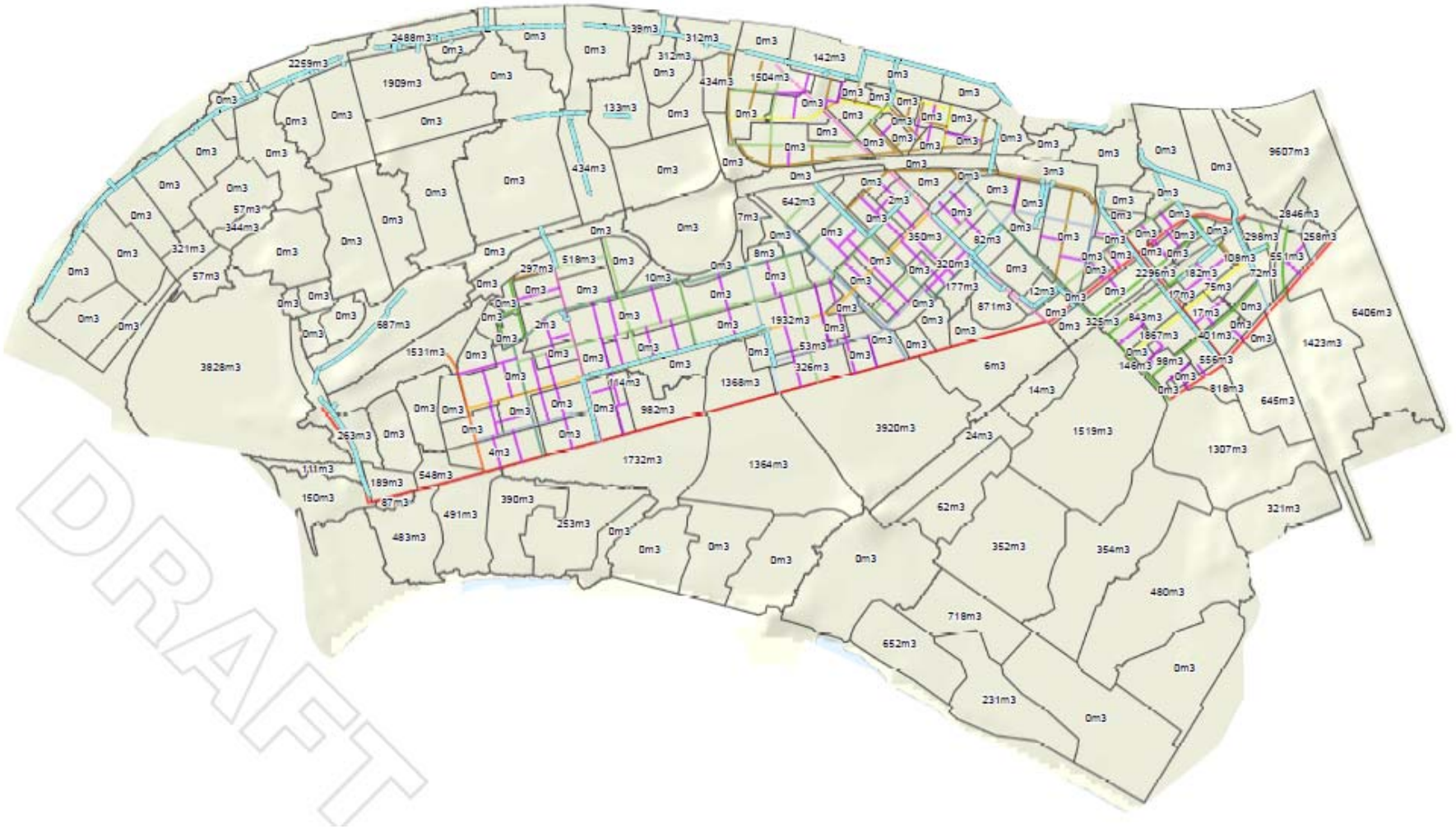


Notes:
(1) Model assumes a tidal cycle boundary for the 2100 climate change conditions with a peak water level of 2.25 mAHD for the 100 year ARI and 2.05 mAHD for the 20 year ARI.

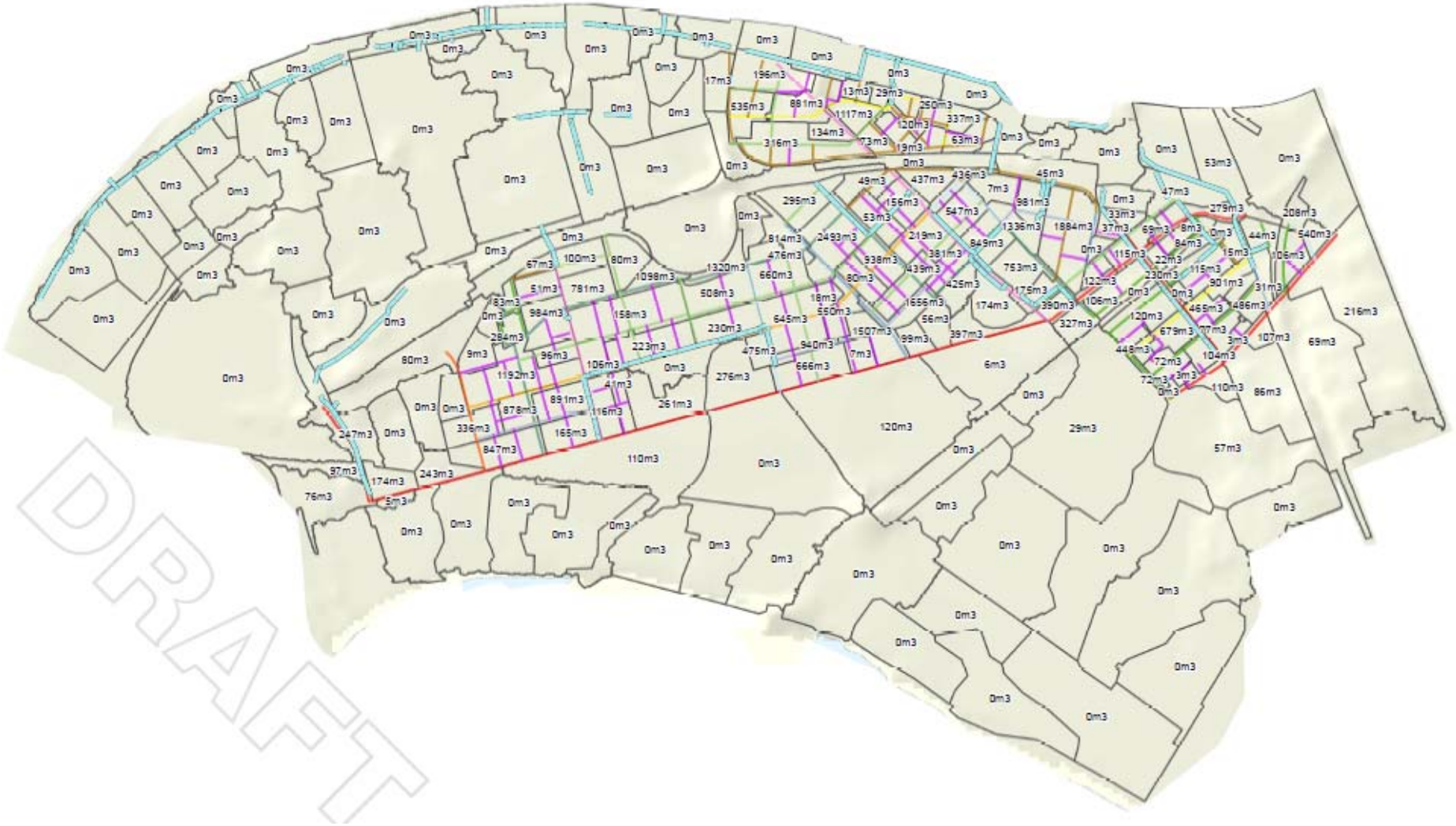
Storage design to avoid pipe upgrades (pumps still used)



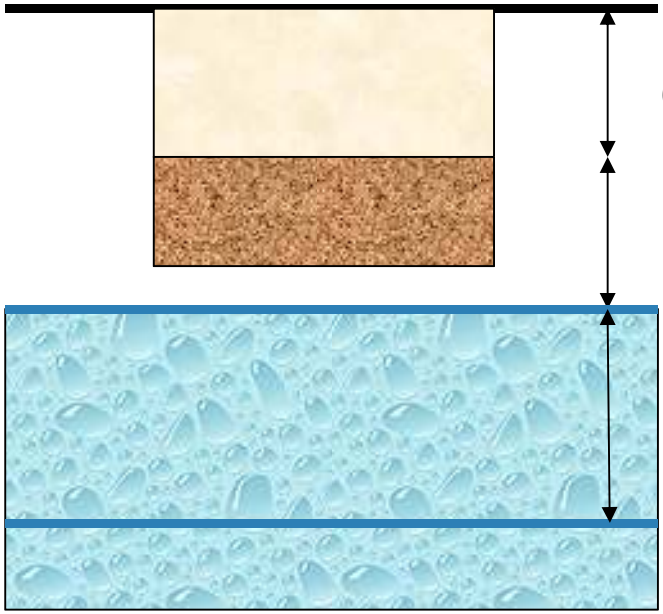
Required storage volumes to avoid pipe upgrades



Available distributed street storage volumes



Suggested minimum ground level for excavated storages



1.8mAHD – Minimum ground level for excavated storages

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0.5m – Allowace for a suitable formal invert to be established

0.8mAHD - General groundwater level in 2100

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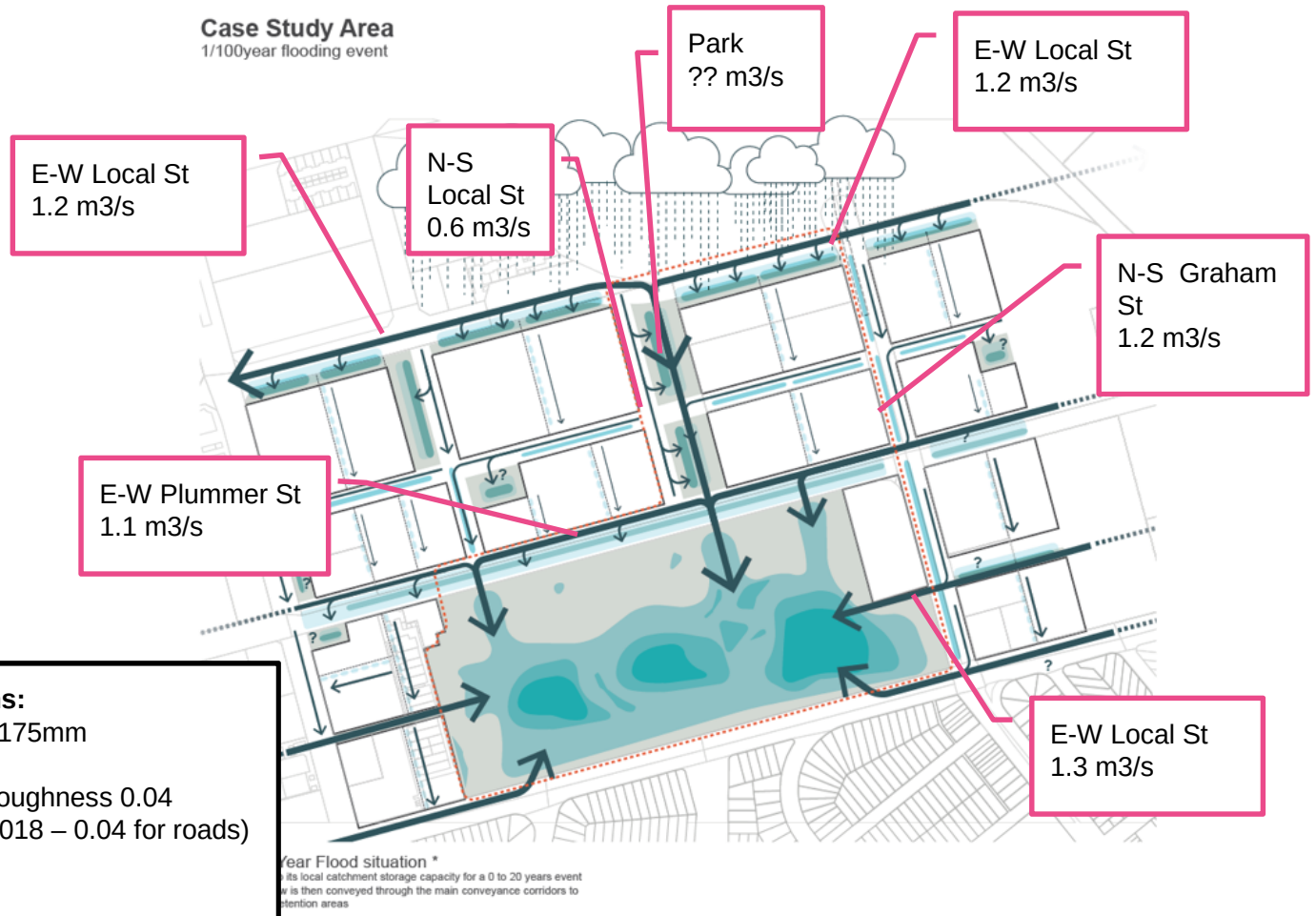
0.0mAHD - Current general groundwater level

Groundwater level assumption

Estimate max conveyance per street – CoPP case study



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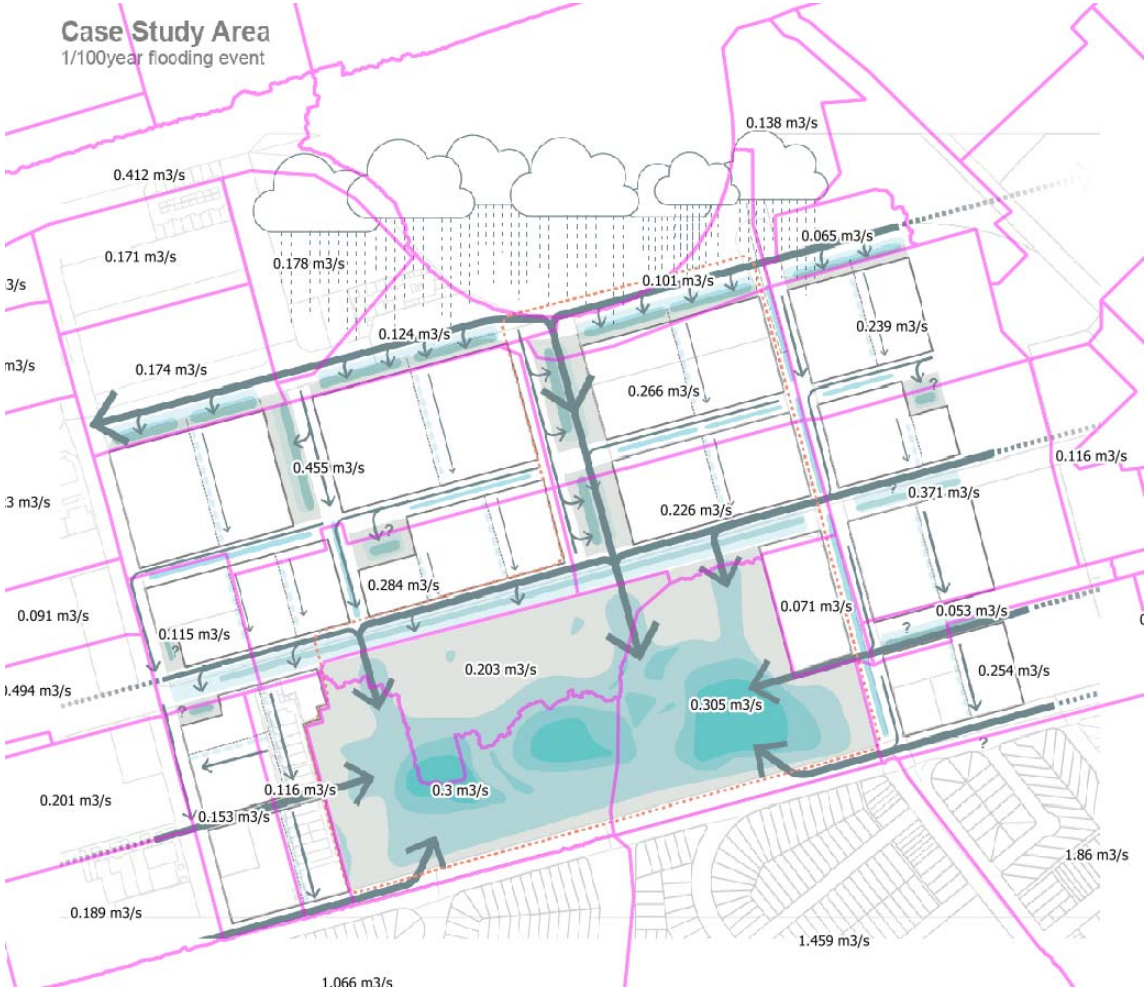
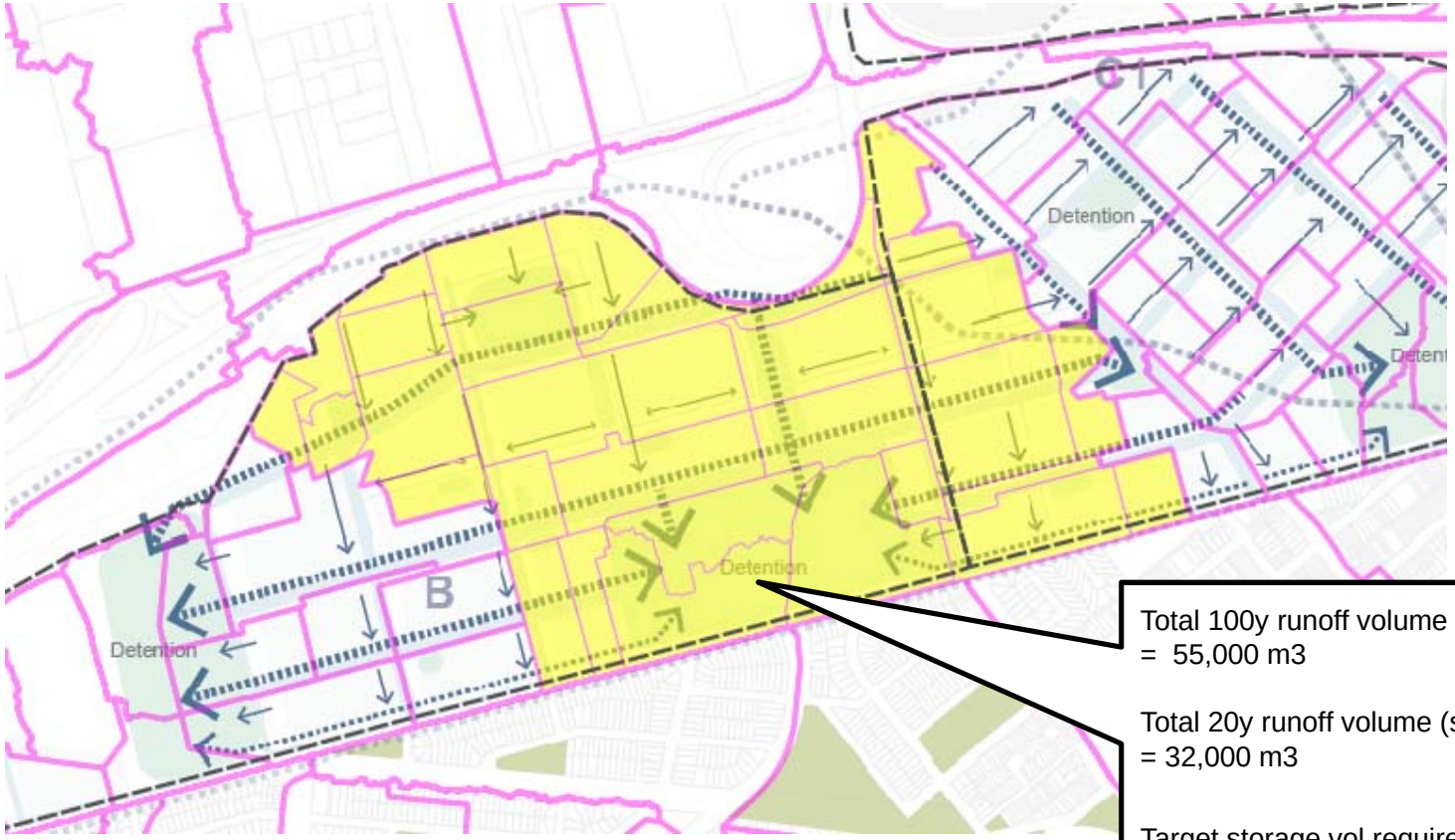
Catchment peak flows – CoPP case study



100-yr ARI flood flows to JL Murphy



Total 100y runoff volume
= 55,000 m3

Total 20y runoff volume (stored in streets)
= 32,000 m3

Target storage vol required at JL Murphy
= 55,000 - 32,000
= 23,000 m3

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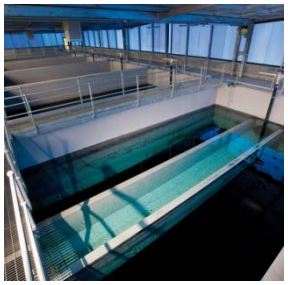
Attachment 14

Progress Meeting Slides 21st Nov

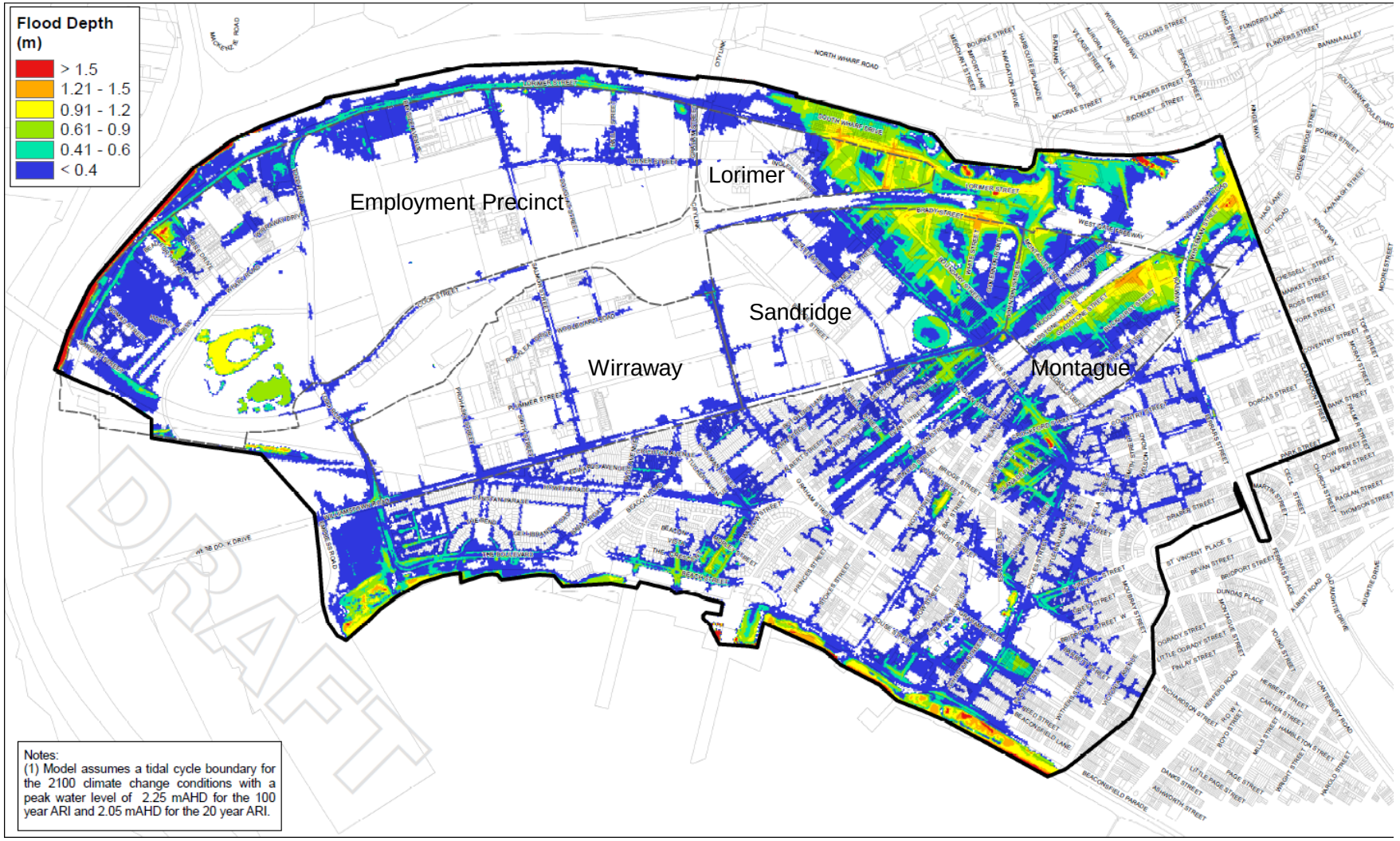
Fishermans Bend
Flooding and drainage update
21 Nov



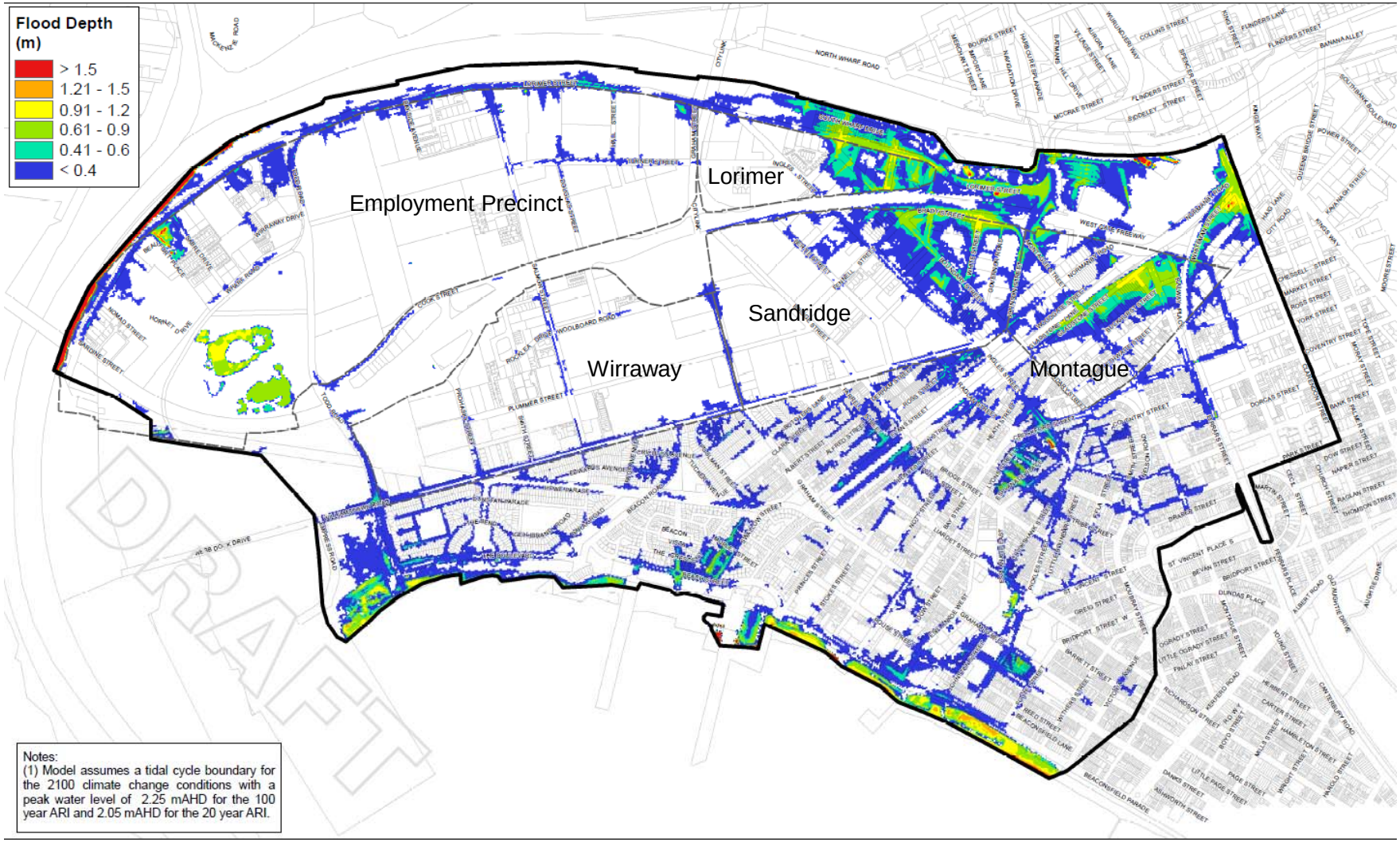


GHD Water

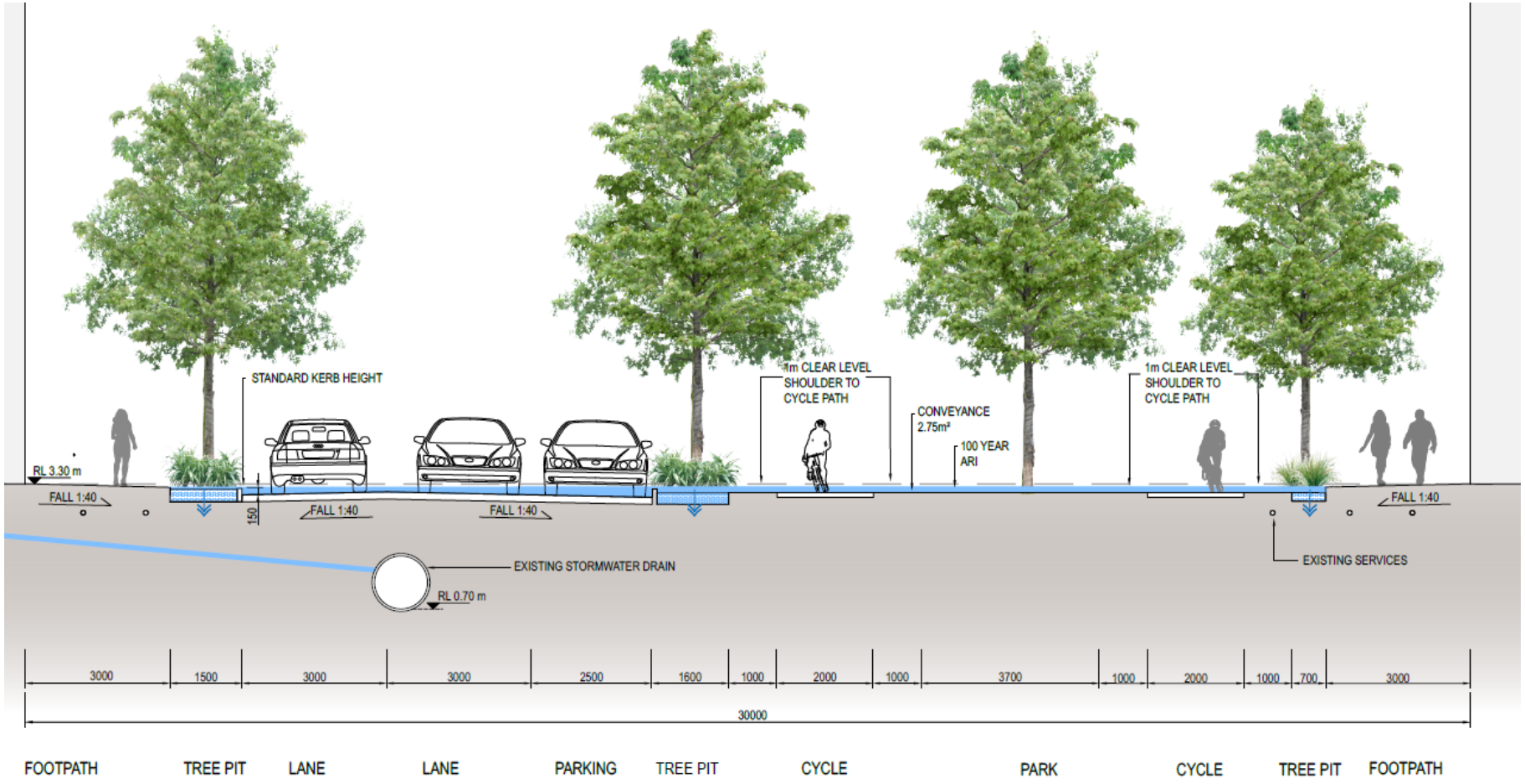
100-yr ARI flooding in 2100 with no mitigation



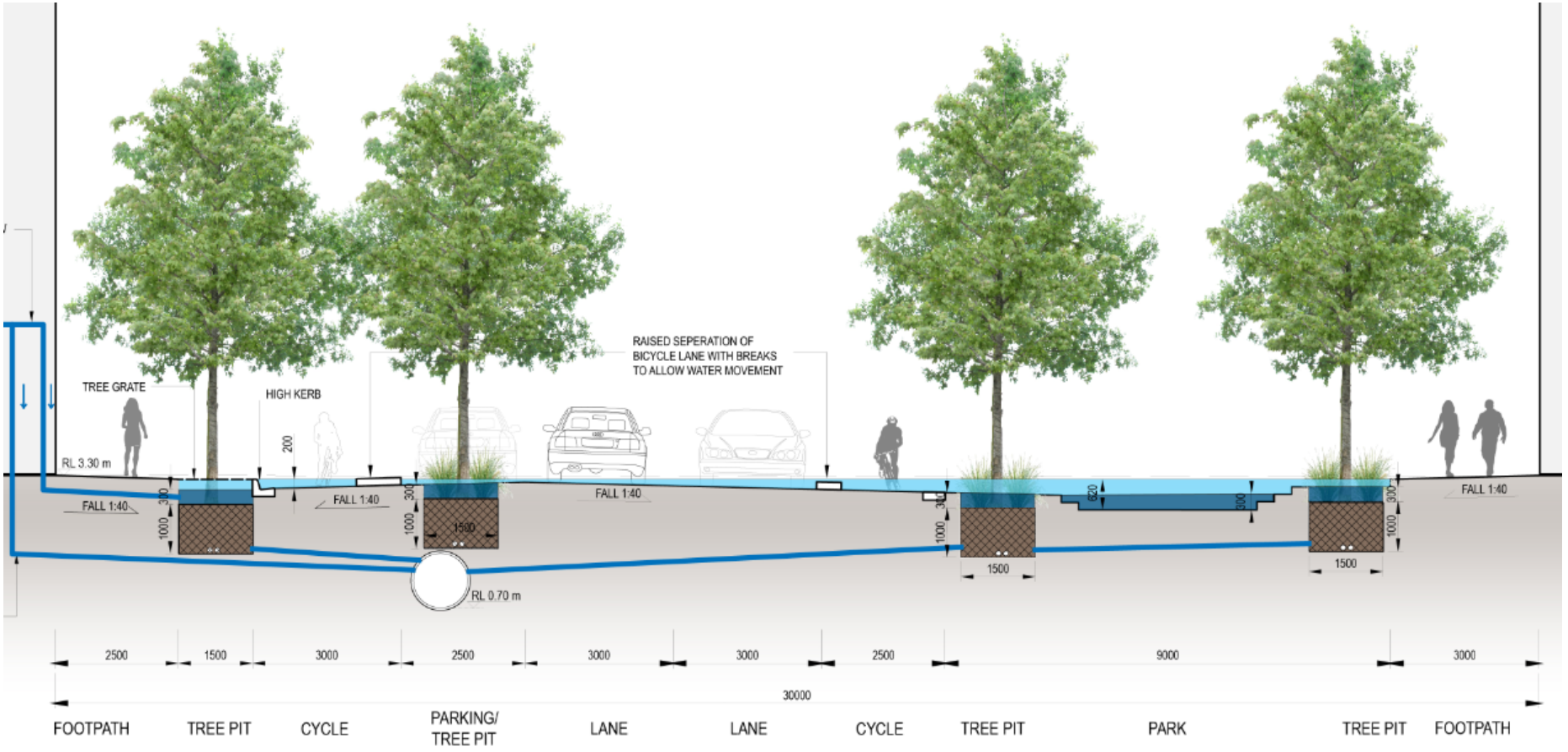
20-yr ARI flooding in 2100 with no mitigation



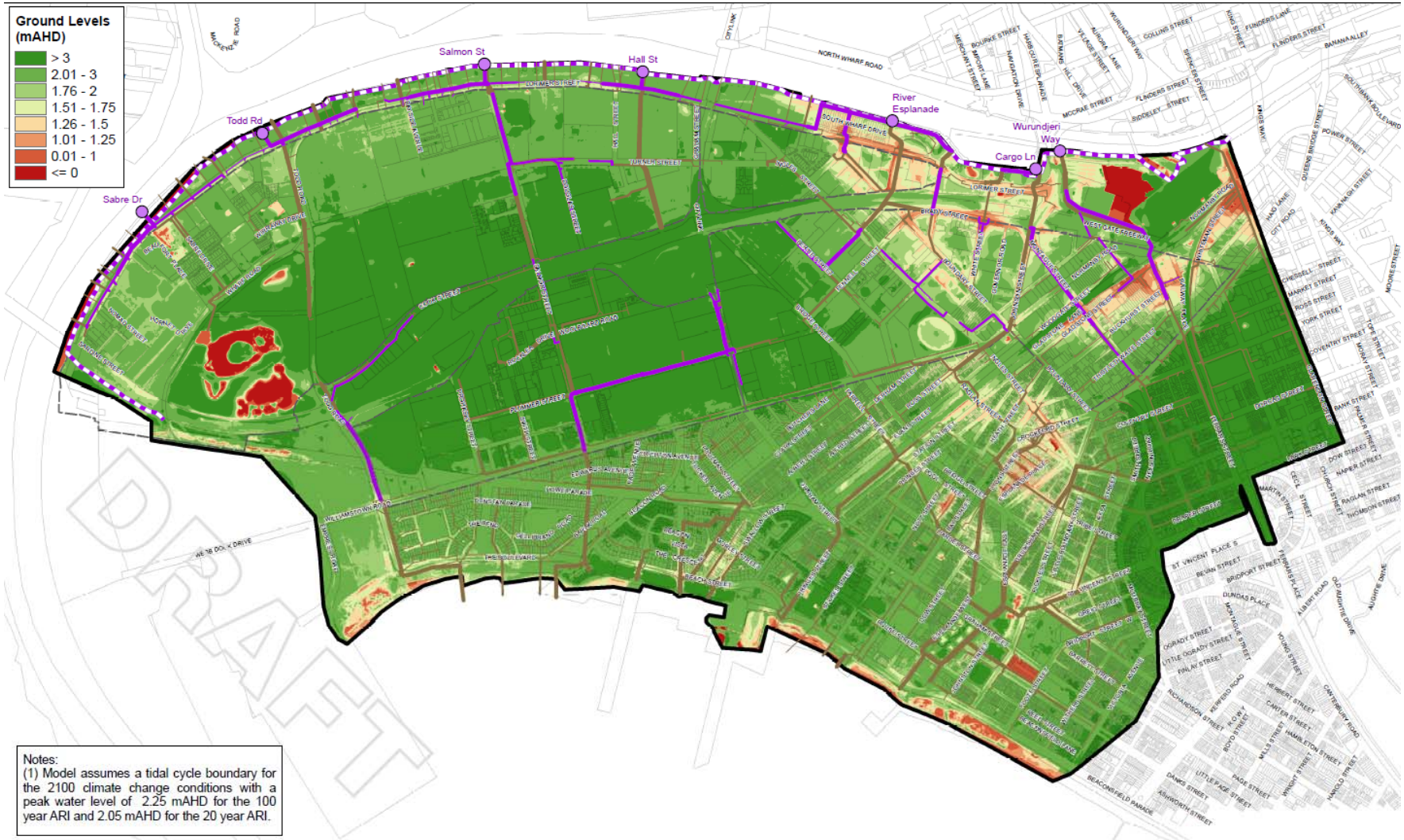
A 30m st section – no storage for flood mitigation



A 30m st section – with storage for flood mitigation



Traditional approach drainage plan



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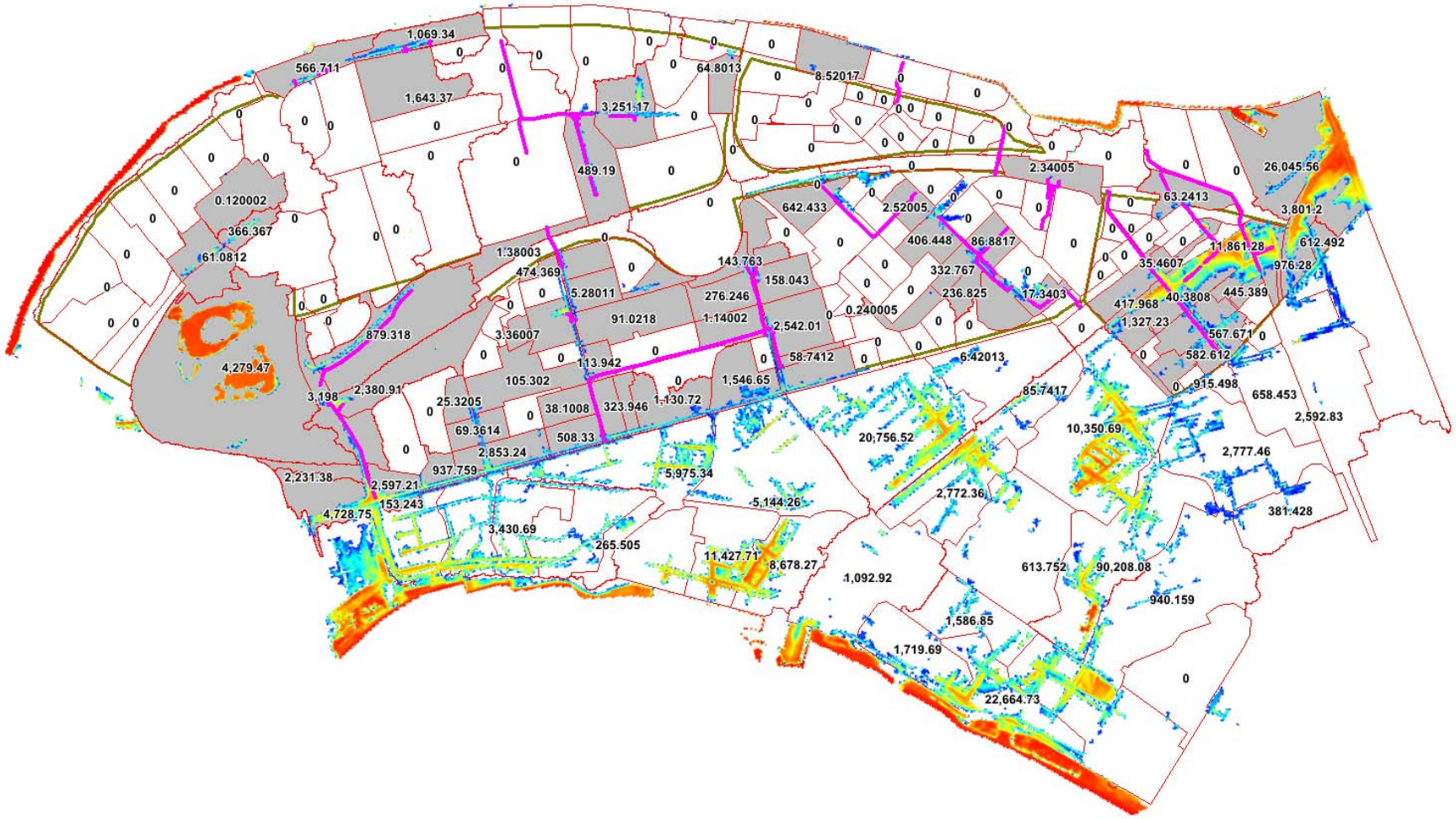

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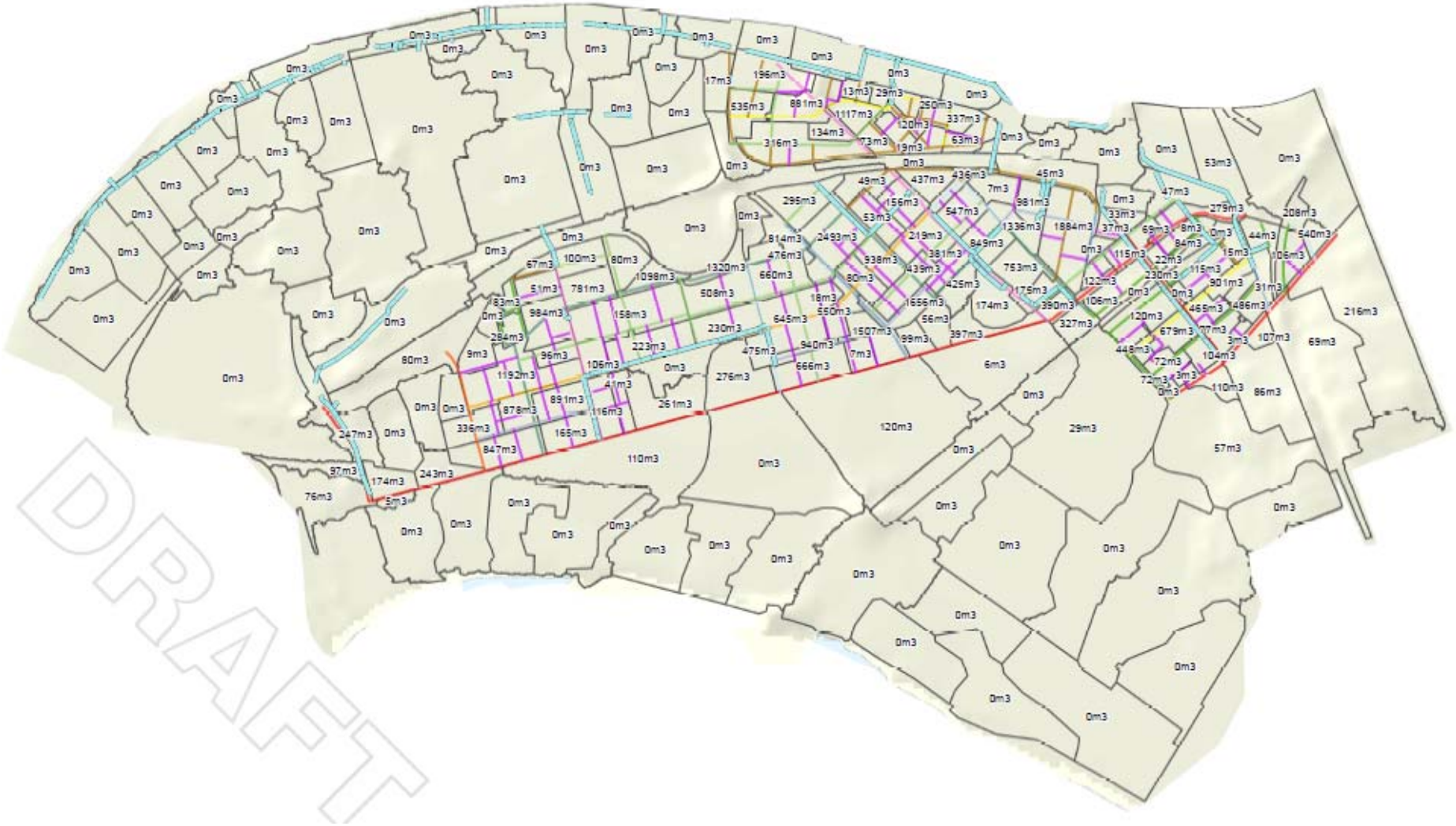
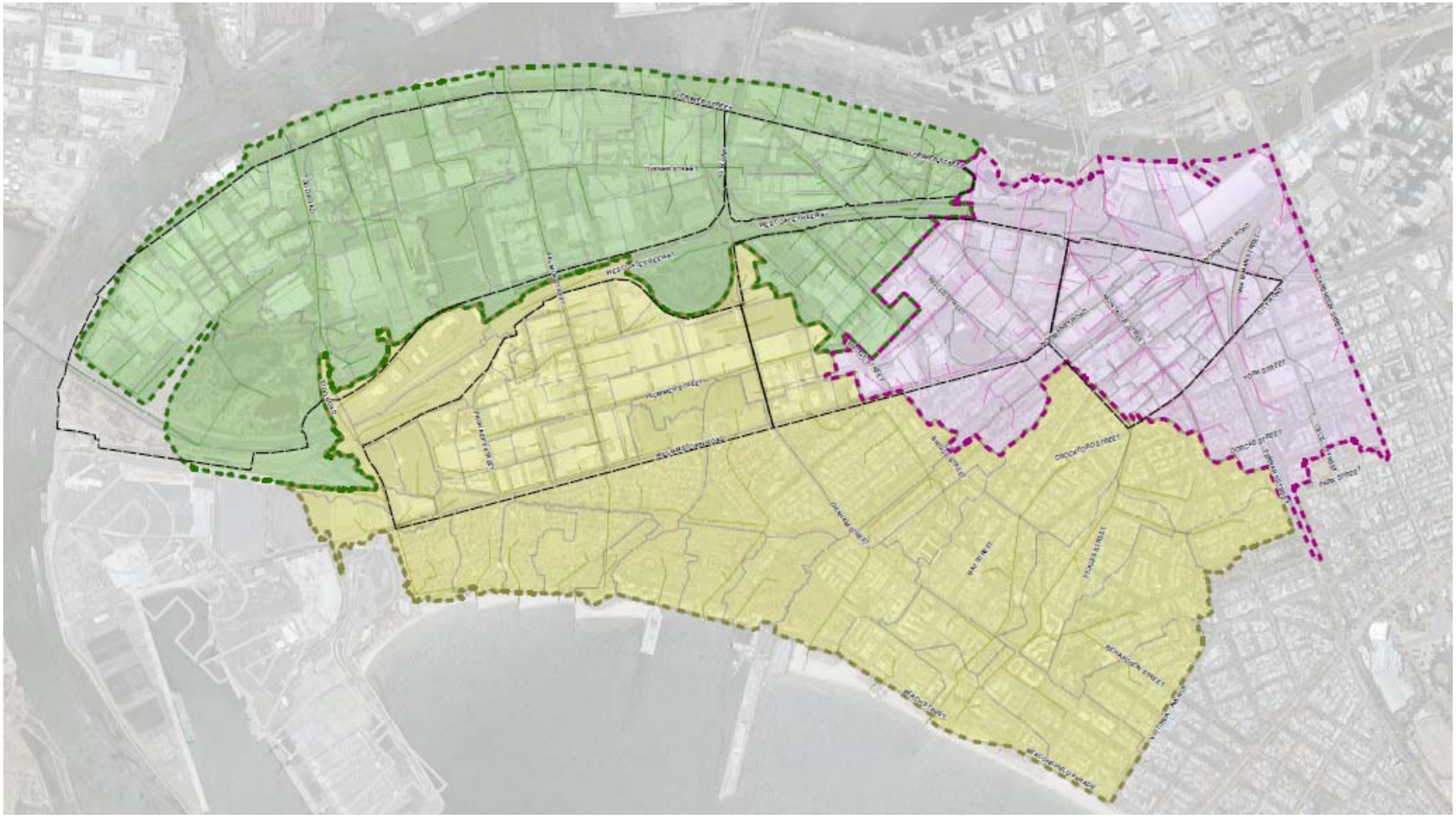


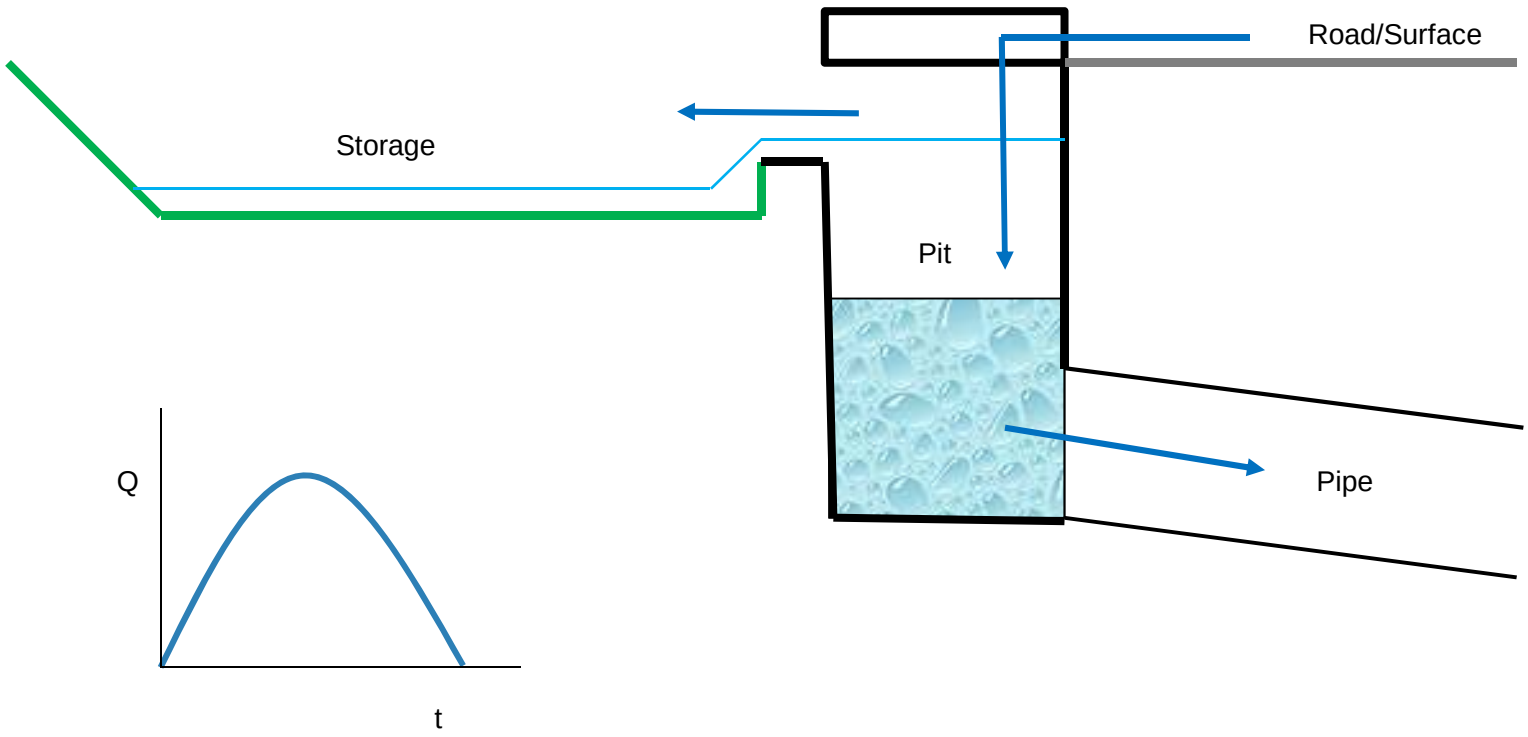
Groundwater level assumption

Open space storages

Drainage areas



Storage design to avoid pipe upgrades (pumps still used)



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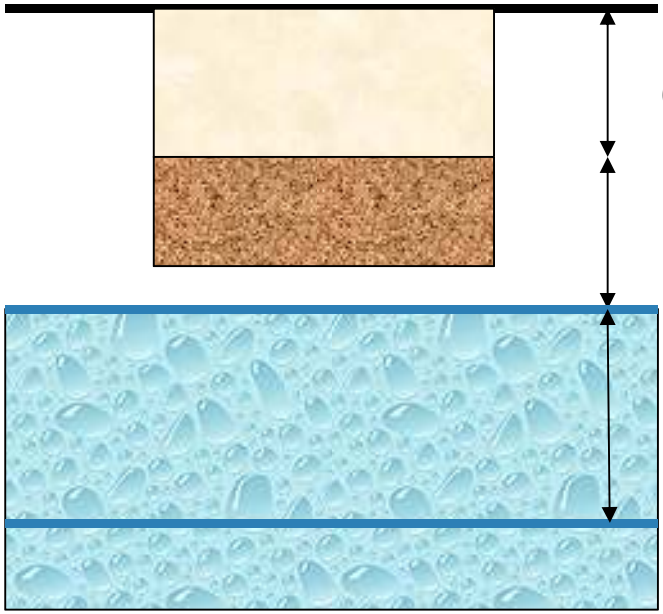

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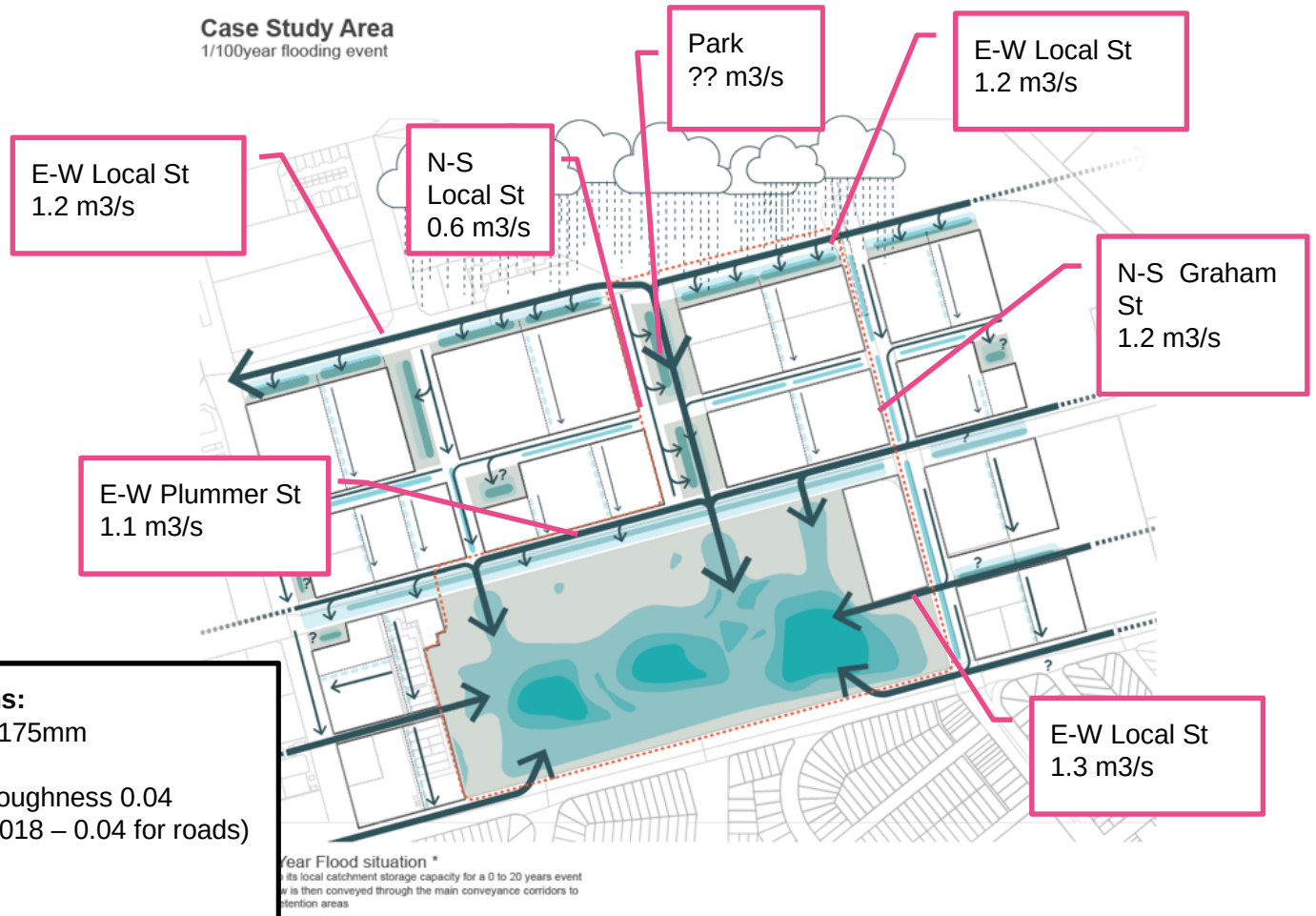
Estimate max conveyance per street – CoPP case study



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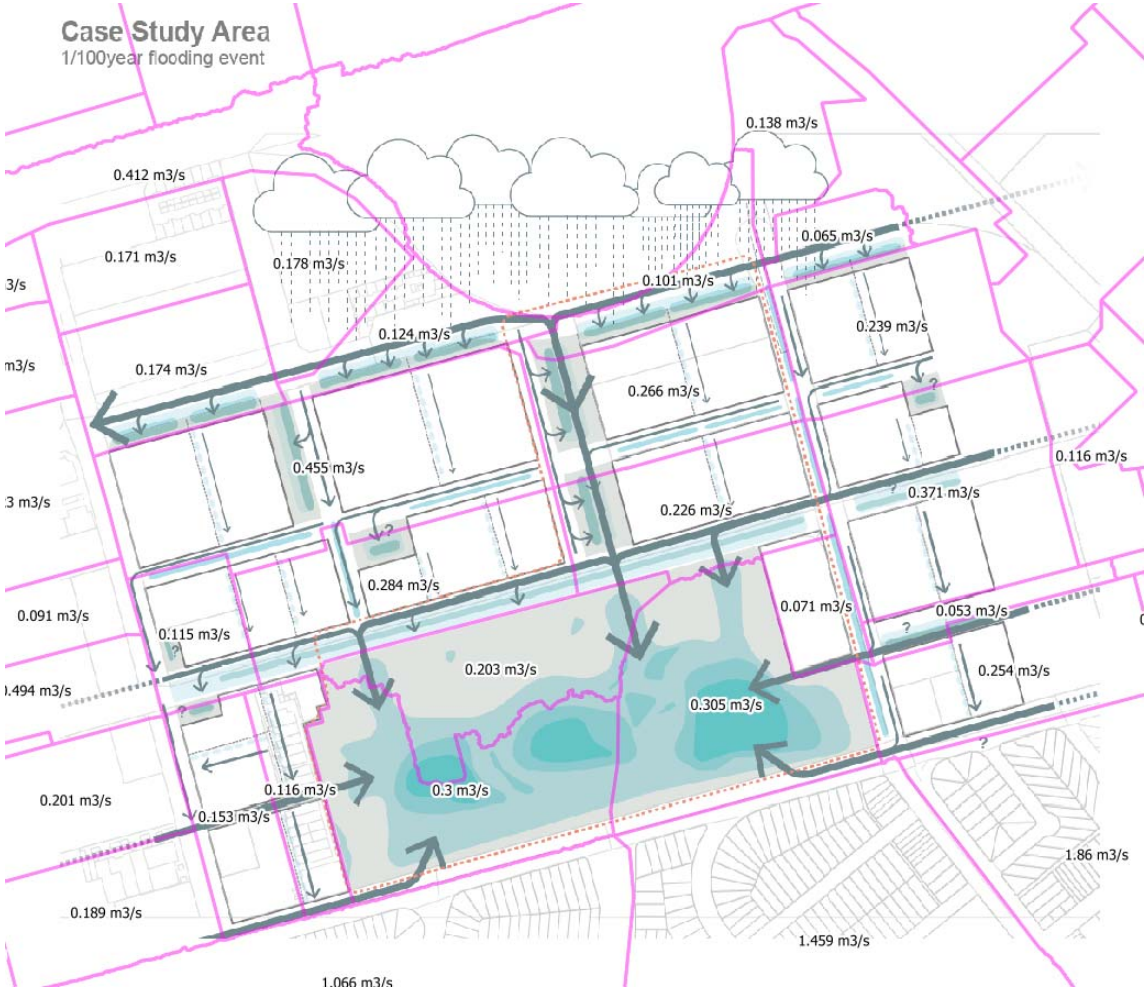

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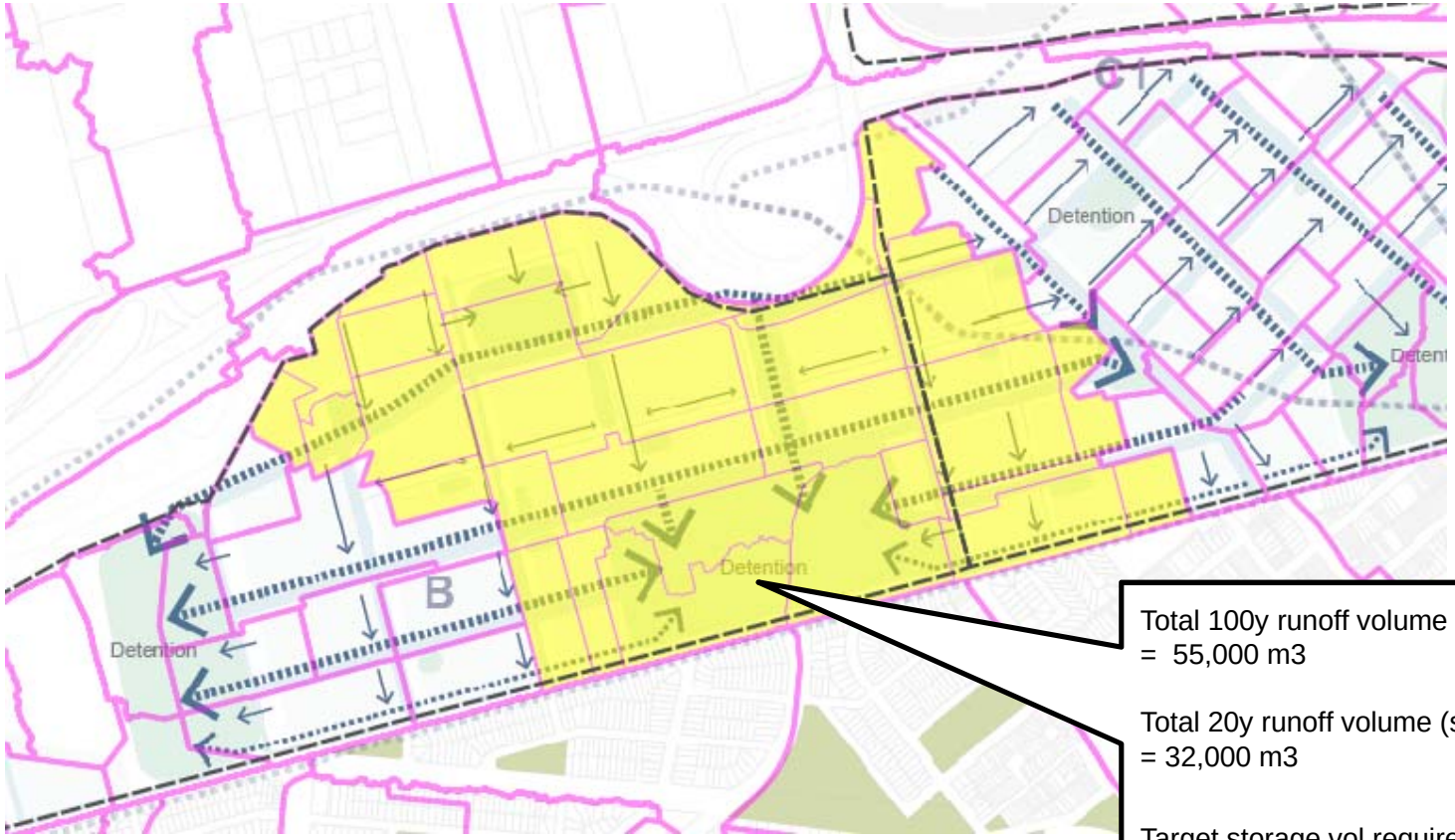

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Total 20y runoff volume (stored in streets)
= 32,000 m3

Target storage vol required at JL Murphy
= 55,000 - 32,000
= 23,000 m3

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Attachment 15

Final Steering Committee Meeting Presentation

Fishermans Bend Water Sensitive City Strategy

Hybrid Approach

Water Sensitive Design Strategy

Why are we here today?

– Brief the Steering Committee on the results of the Hybrid solution investigations.

– To seek endorsement (subject to future government consideration) to use the Hybrid solution as the 1:20 year ARI level of service option in the Funding & Finance Strategy, Water Sensitive Cities Strategy and Precinct Plans.

– To seek endorsement from the Steering Committee on the benefits of distributed storage.

– To have a discussion around the service level for Fishermans Bend (subject to future work).

Water Sensitive Design Strategy

Executive Summary

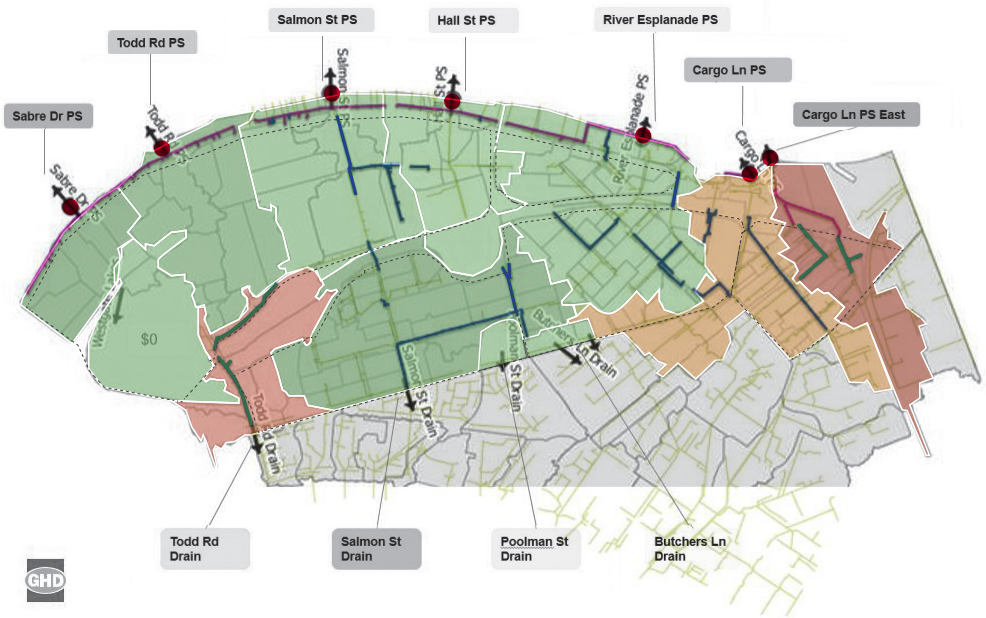
– Based on the work to date, the Hybrid solution comprising a combination of above ground storage and conventional drainage infrastructure is viable in the majority of Fishermans Bend.

– There are many benefits from pursuing the Hybrid solution.

– The hybrid solution is cost competitive when compared to the baseline option.

– Further direction is required on the service level for Fishermans Bend.

– Further work is needed to progress an implementation strategy that covers roles, responsibilities and staging.



Water Sensitive Design Strategy

Benefits of distributed storage over pipes

– Improved social resilience to flooding (i.e. visible water raises awareness of flooding and how to respond to it)

– Sets a precedent for urban renewal – local, national and global (natural solution to a natural problem)

– Helping to define the character of the place through water being visible

– Where drainage is a driver it will ensure that greening happens and more quickly

– Reduced reliance on operation of pumps in a storm event through the slow release of flood water from storage (increased resilience to pump failure)

– Easier to monitor the performance and risk of failure of above ground storage

– Reduced cost of pipes

– Reduced flooding impacts south of Williamstown Rd

– Storages provide multiples lines of defence reducing local flooding impacts

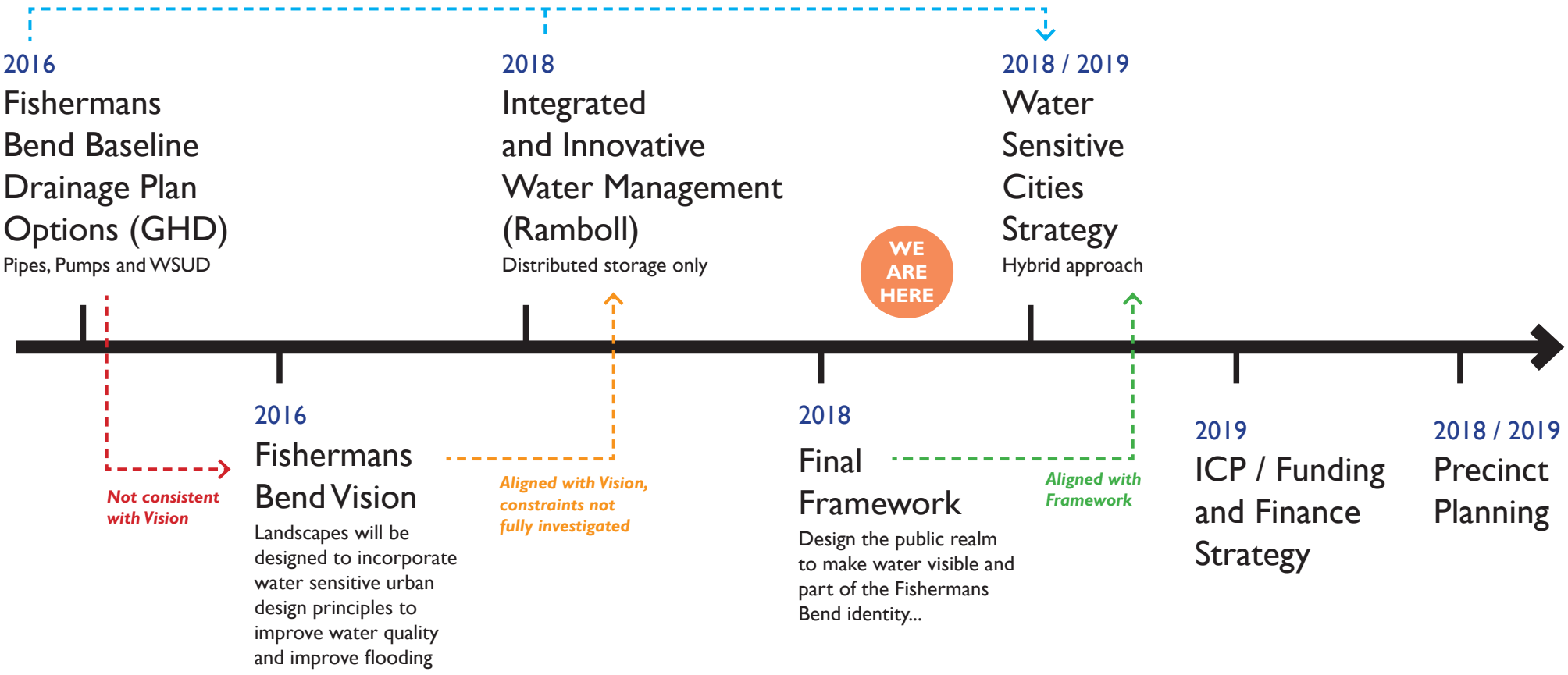
South Jamaica Houses in its current state

Future concept for South Jamaica Houses (dry day)

Future concept for South Jamaica Houses (very wet day)

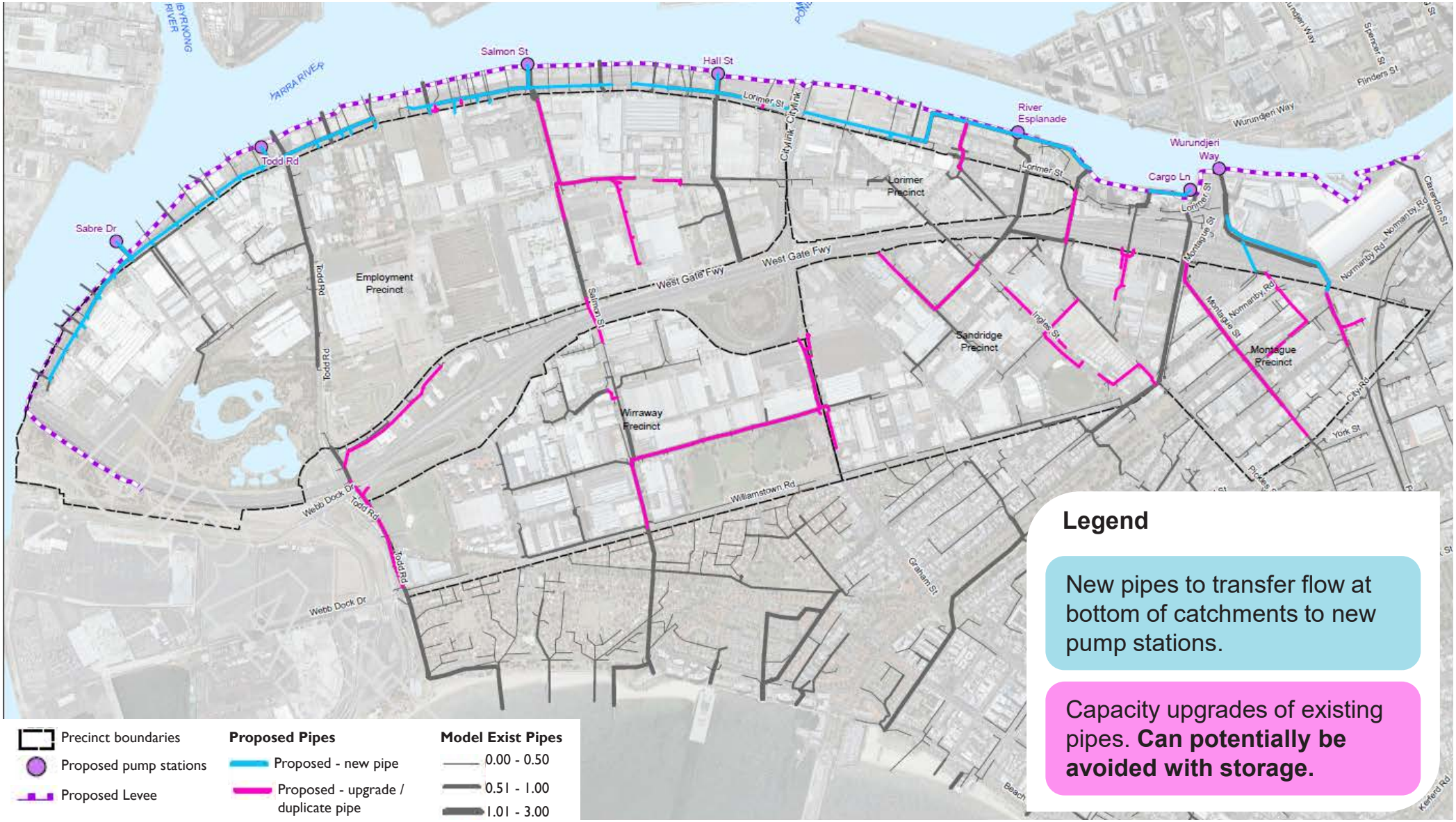
Water Sensitive Design Strategy

Timeline - how did we get here?



Water Sensitive Design Strategy

Baseline Drainage Plan Infrastructure



Legend

New pipes to transfer flow at bottom of catchments to new pump stations.

Capacity upgrades of existing pipes. **Can potentially be avoided with storage.**

Water Sensitive Design Strategy
GHD scope

– Establish agreed benefits

– Investigate challenges

– Test where distributed storage is feasible

– Estimate Costs

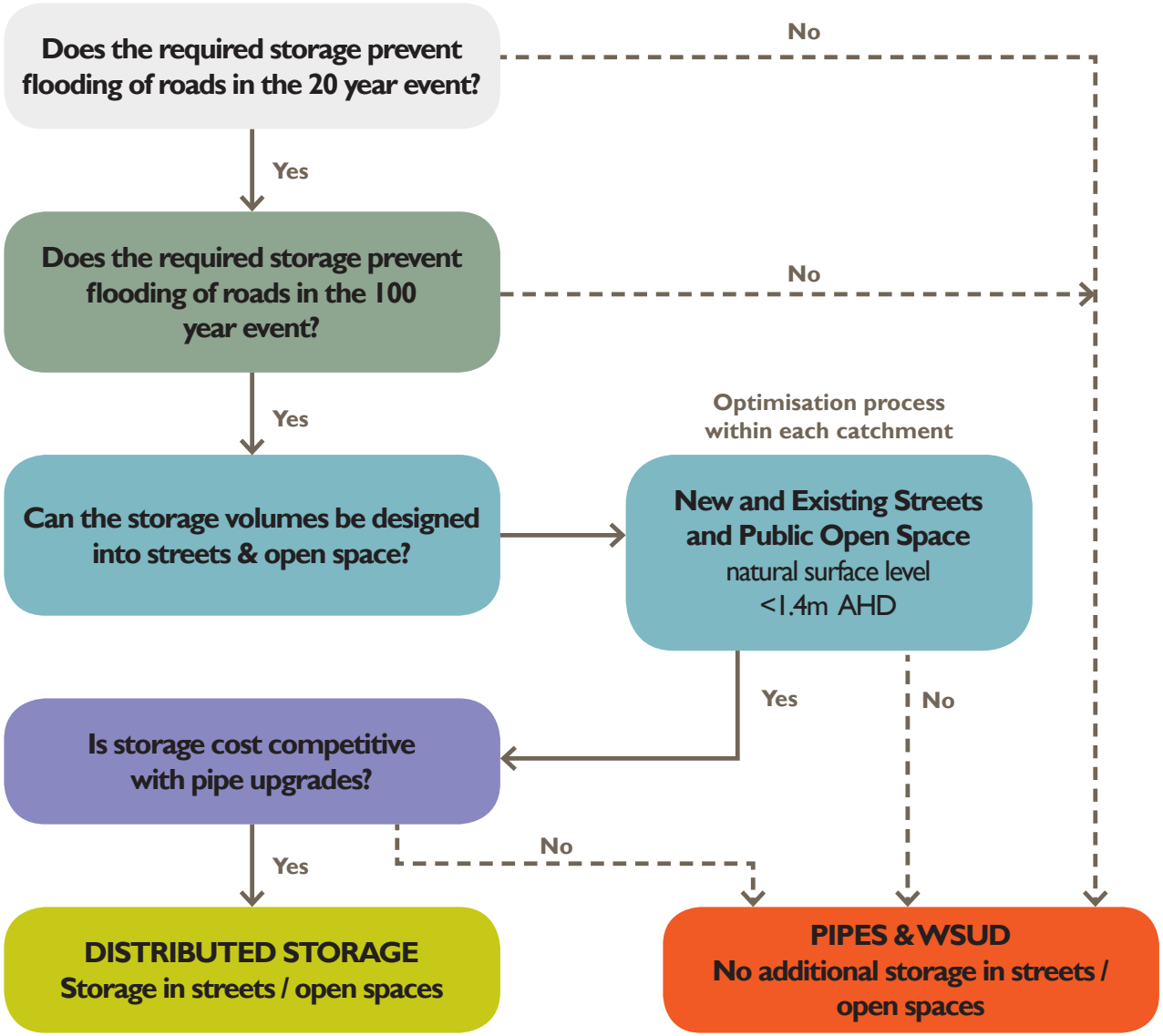
Water Sensitive Design Strategy

Challenges with the Hybrid Solution

Risk	Potential Mitigations
Inadequate storage achieved (rainwater tanks and/or streets) *Note: rainwater tank risk applies to both options*	• Careful wording of planning controls and ability to update • Audit of rain tank / street storage volumes actually installed • Undertake a pilot distributed storage project to test this risk.
Timing of implementation of new streets / renewals (multiple asset solution)	• Living with unacceptable flooding (1:5 or 1:20 year) until augmentation. • Use of piped solution where flood mitigation is critical to development • Staged delivery of streets to align with likely drainage needs • Site planning controls (e.g. on-site detention, temporary works or works-in-kind).
Costs of additional excavation to achieve road & open space storage are greater than assumed *Note: that this issue will apply to all construction works in the precinct and therefore is a shared risk*	• Further on-site investigation • Allow for a process to recover additional costs if they arise • Undertake a pilot distributed storage project to test this risk.
Reliance on ongoing management and maintenance of multiple assets *Note: because the storage area is required to serve a drainage function it is more likely that it will be properly maintained.*	• Maintenance requirements outlined, costed and agreed by asset owner.
Future flooding is worse than assumed *Note: this risk applies to both options*	• Monitor and review Water Sensitive City Strategy with 5-year review of Precinct Plans and ICP (already programmed).

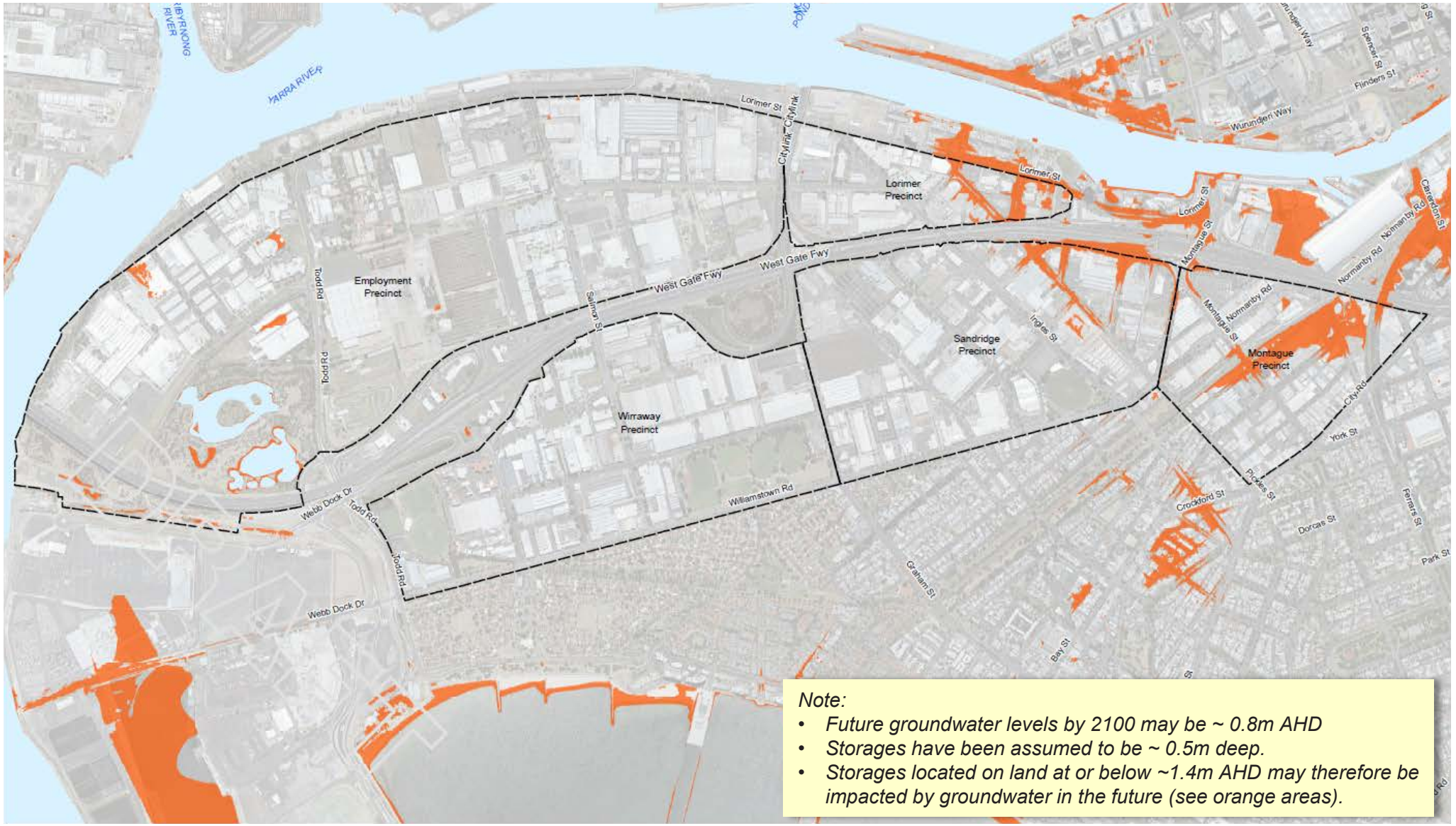
Water Sensitive Design Strategy

Decision Framework - storages in streets and public spaces



Water Sensitive Design Strategy

Ground levels - lower than 1.4m AHD



Note:

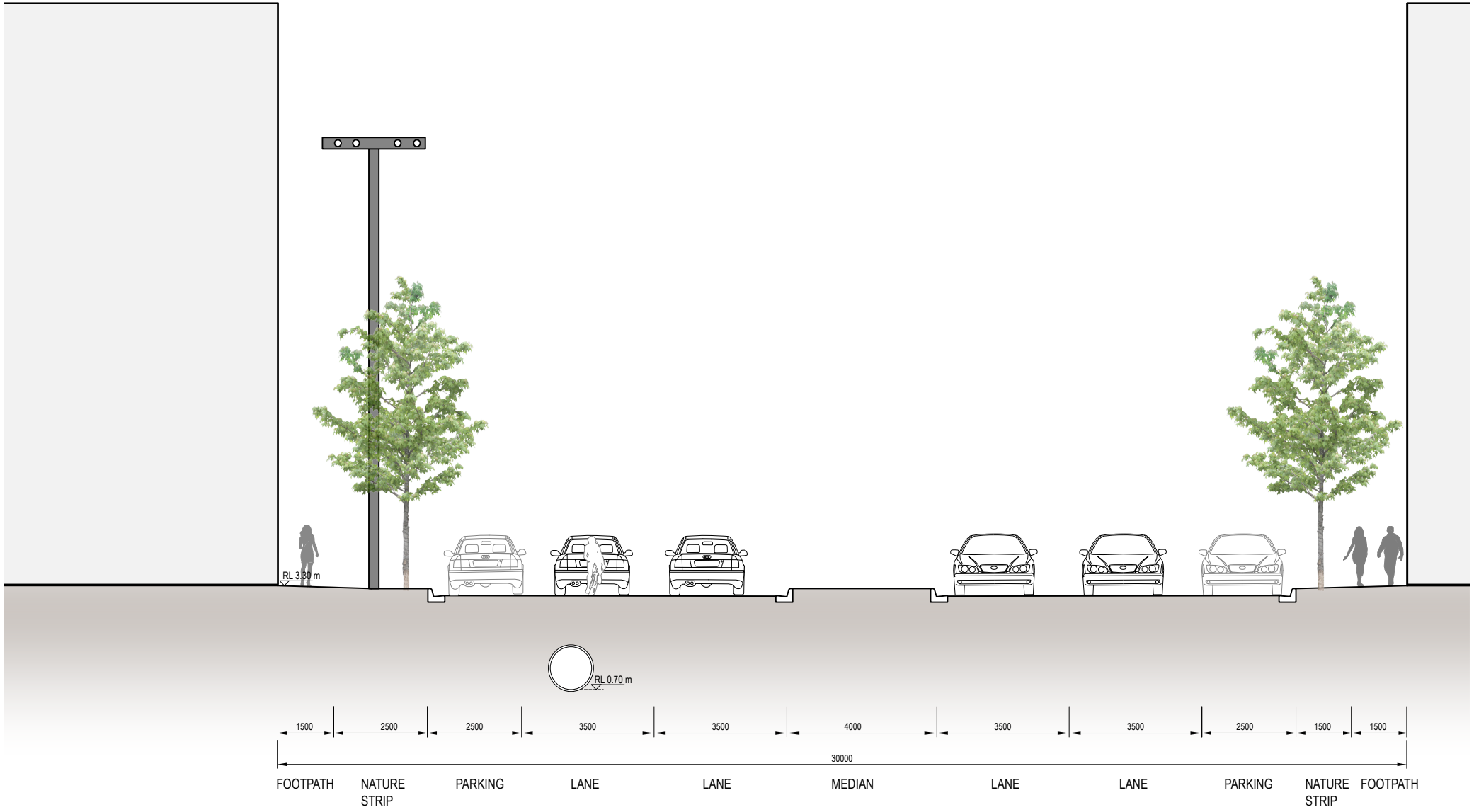
- *Future groundwater levels by 2100 may be ~ 0.8m AHD*
- *Storages have been assumed to be ~ 0.5m deep.*
- *Storages located on land at or below ~1.4m AHD may therefore be impacted by groundwater in the future (see orange areas).*

Surface Elevation

- > 1.4m AHD
- < 1.4m AHD
- Precinct boundaries

Water Sensitive Design Strategy

Existing Street (30m) - Graham Street (south of Plummer St)

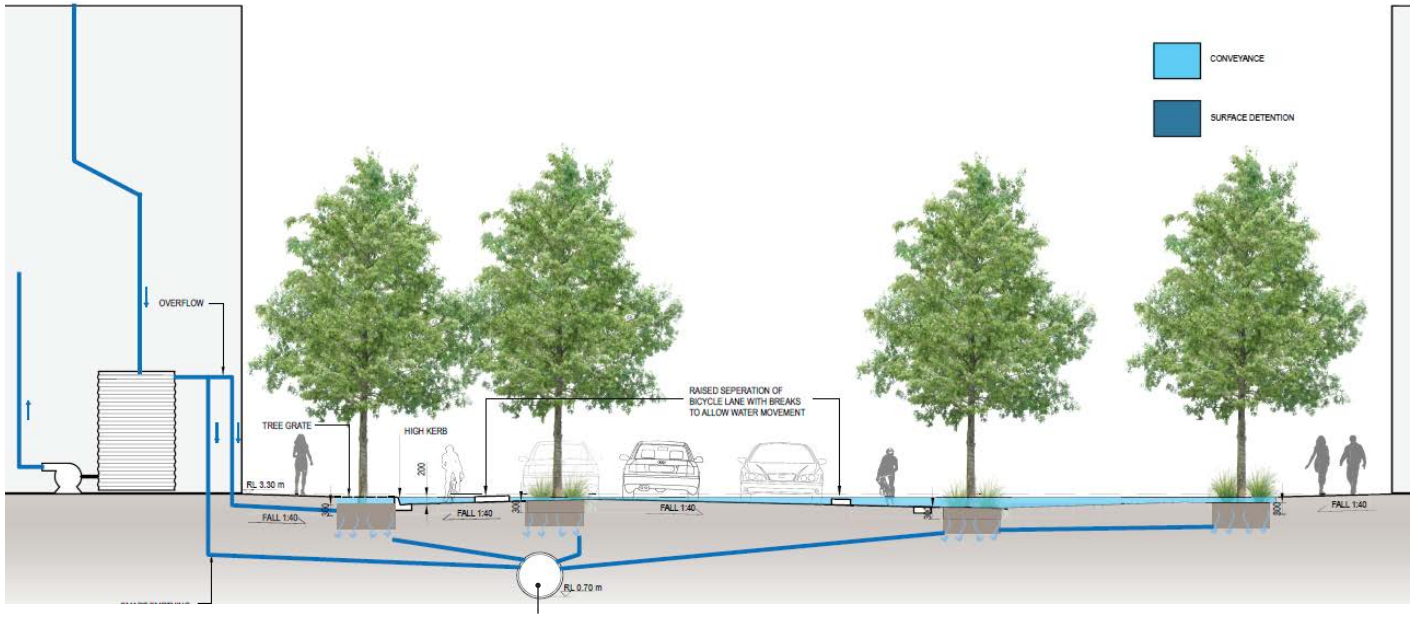


Water Sensitive Design Strategy

Sample cross section - Graham Street (30m)

Baseline drainage option

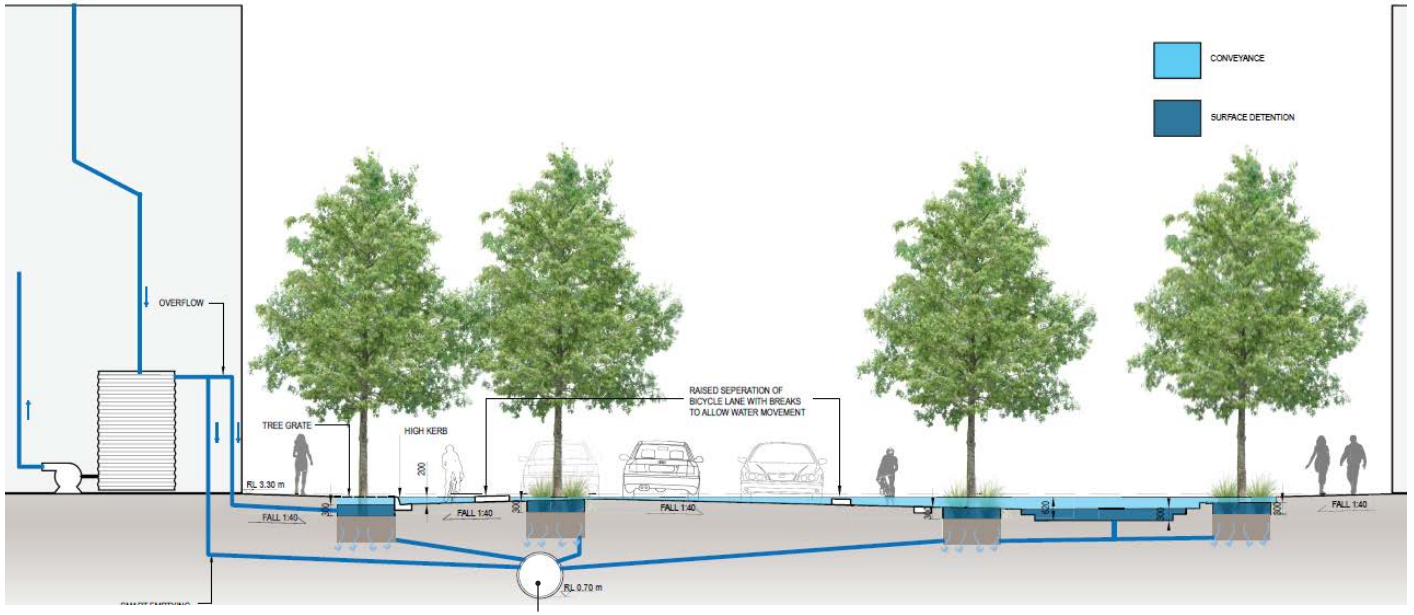
- Large underground pipe
- Water Sensitive Urban Design (WSUD)



Existing drainage pipe

Hybrid drainage option

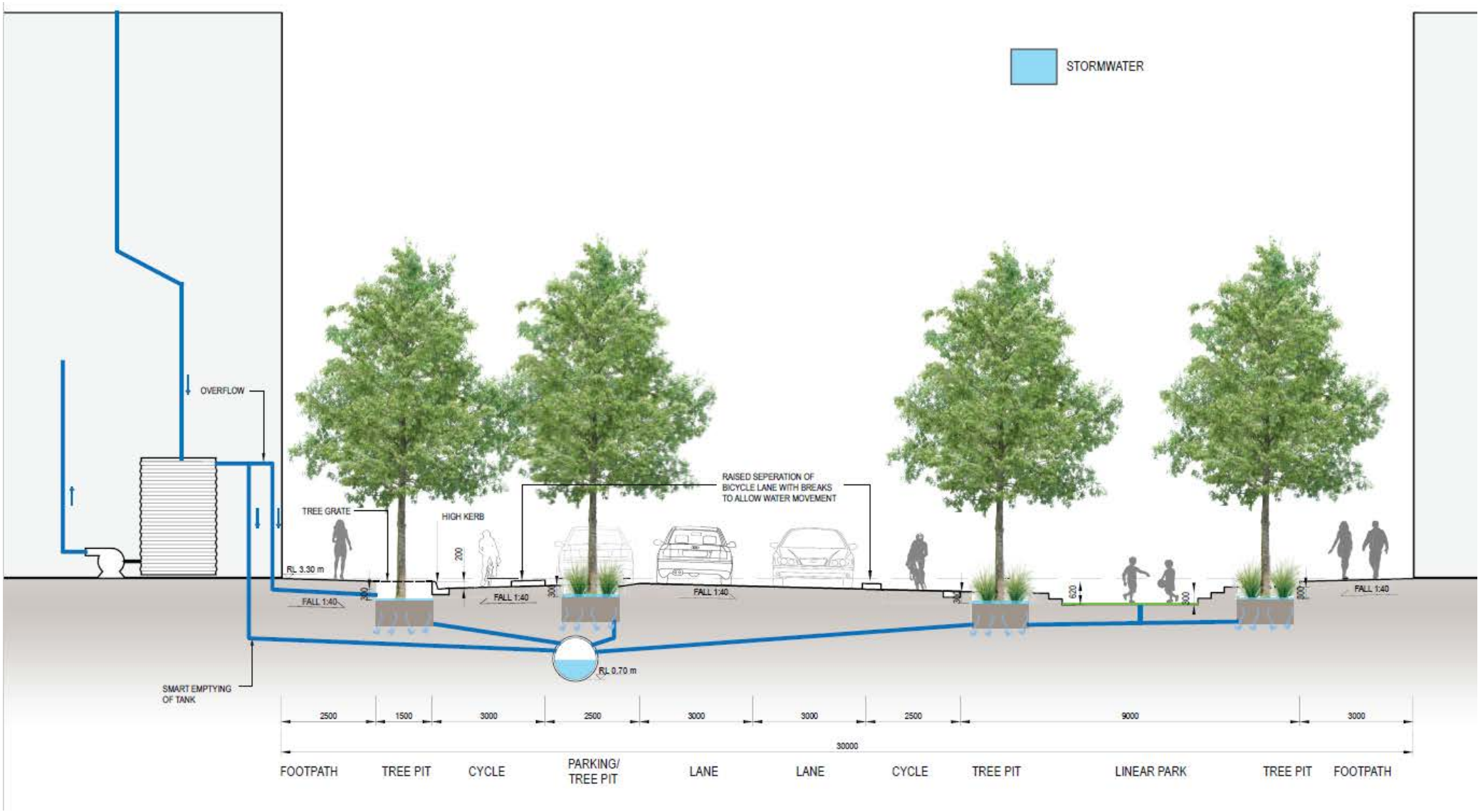
- Above ground storage
- Smaller underground pipe
- Water Sensitive Urban Design (WSUD)



Existing drainage pipe

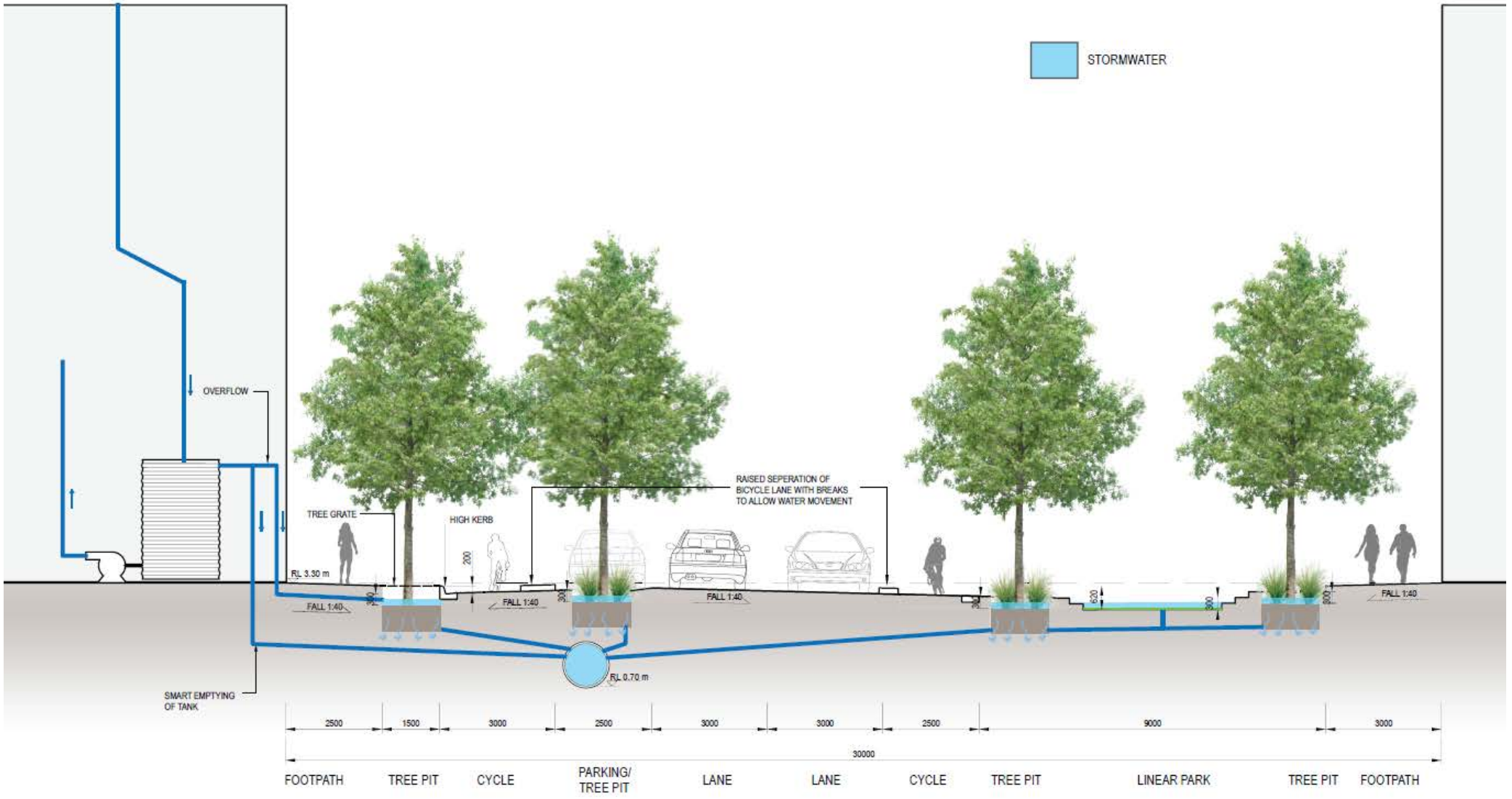
Water Sensitive Design Strategy

Graham Street (30m) - 1 in 5 year ARI event



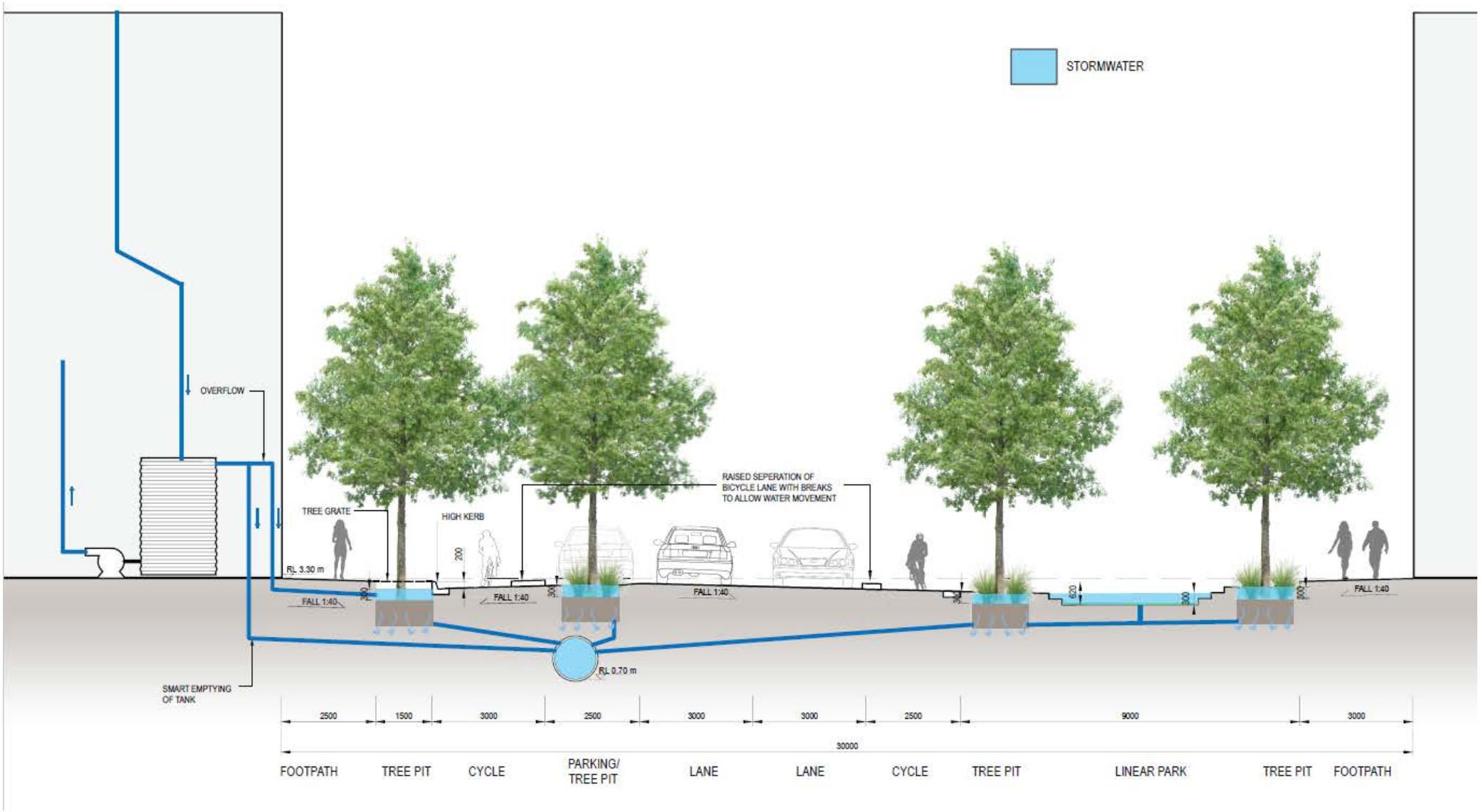
Water Sensitive Design Strategy

Graham Street (30m) - 1 in 10 year ARI event



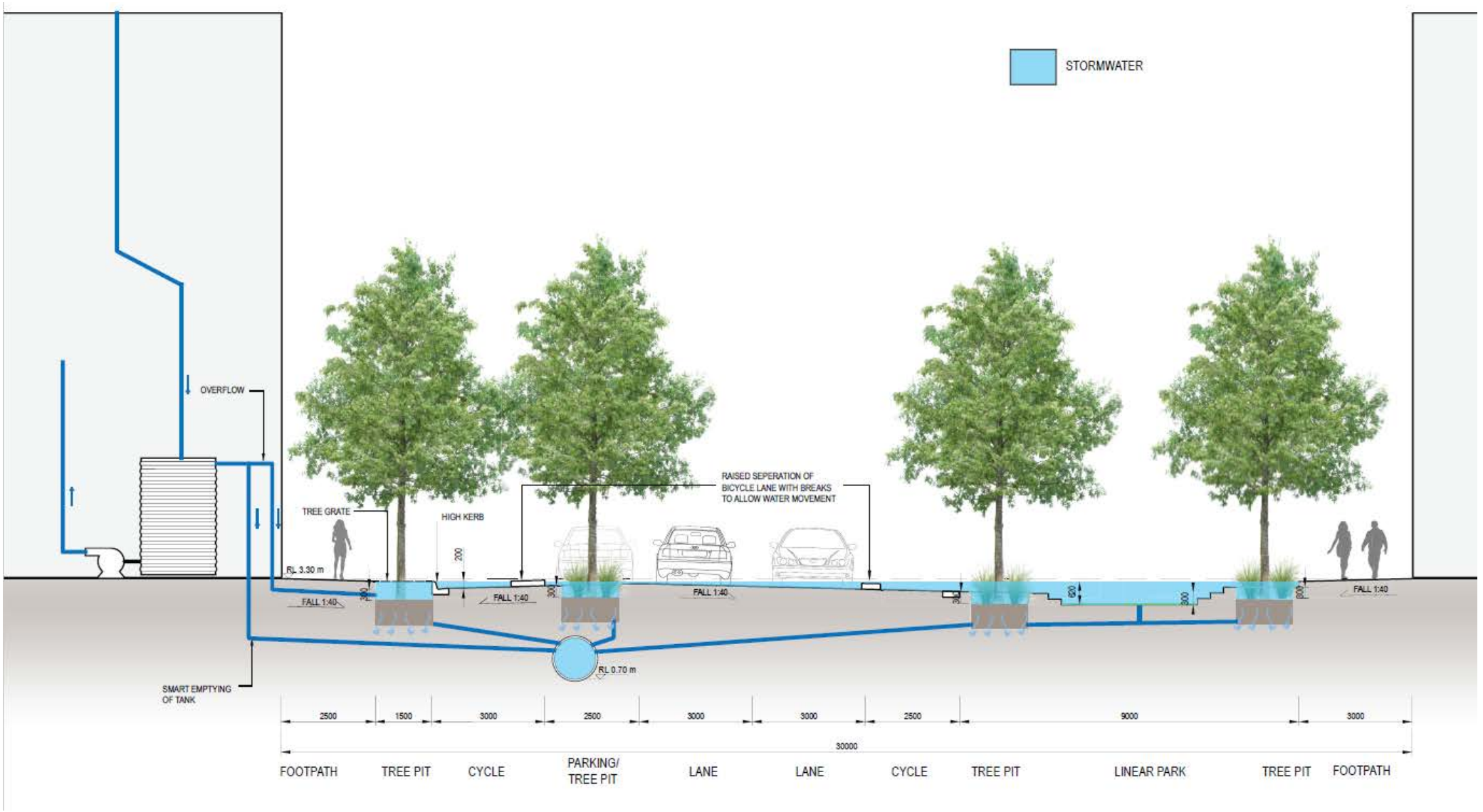
Water Sensitive Design Strategy

Graham Street (30m) - 1 in 20 year ARI event

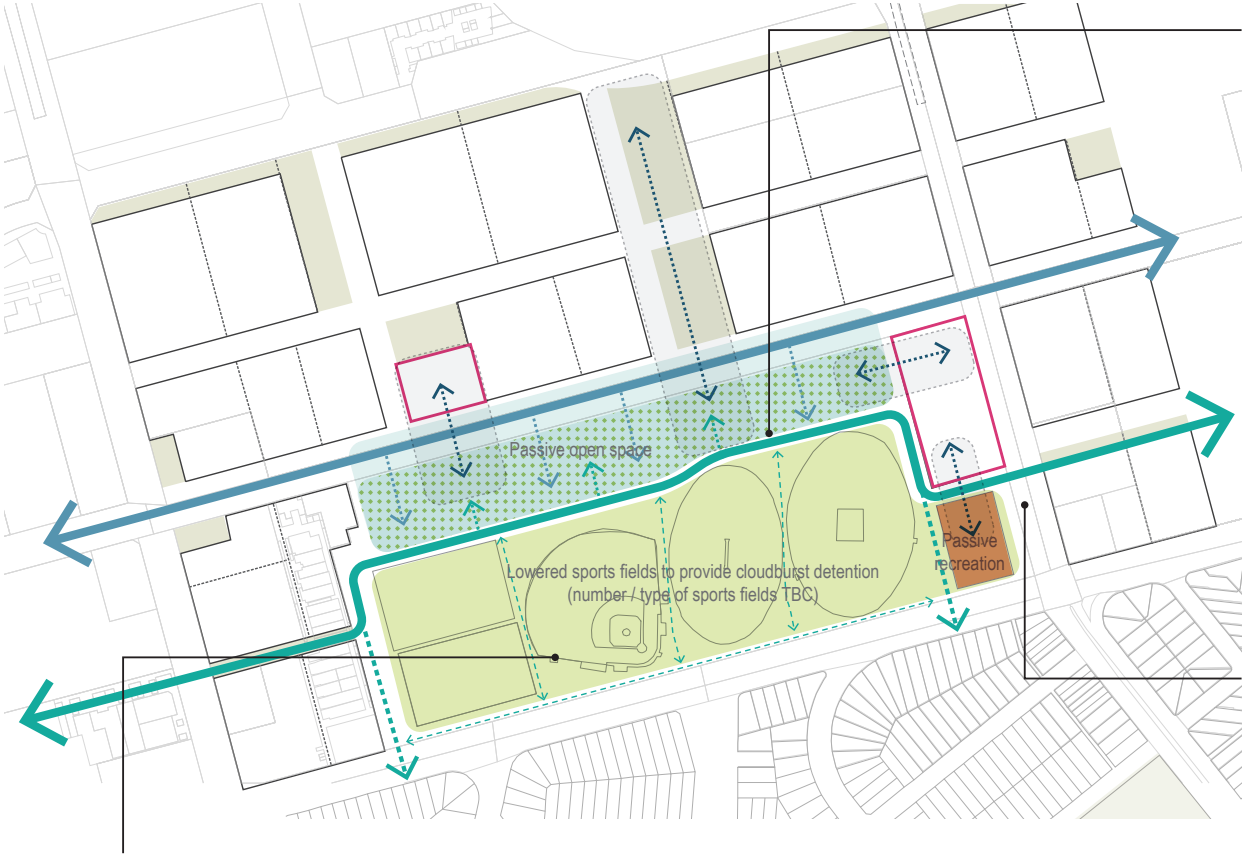


Water Sensitive Design Strategy

Graham Street (30m) - 1 in 100 year ARI event



Water Sensitive Design Strategy
Sample public open space plan - JL Murphy Reserve



Passive open space along Plummer Street

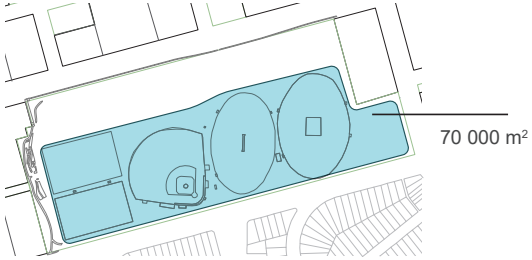
Create a generous open space along the Plummer Street Civic Boulevard, which provides recreational amenity for the community. Any required sporting pavilions could be integrated into this space.

Example of passive recreation facilities

Connect the linear park across JL Murphy reserve

Lowered sporting fields / detention area

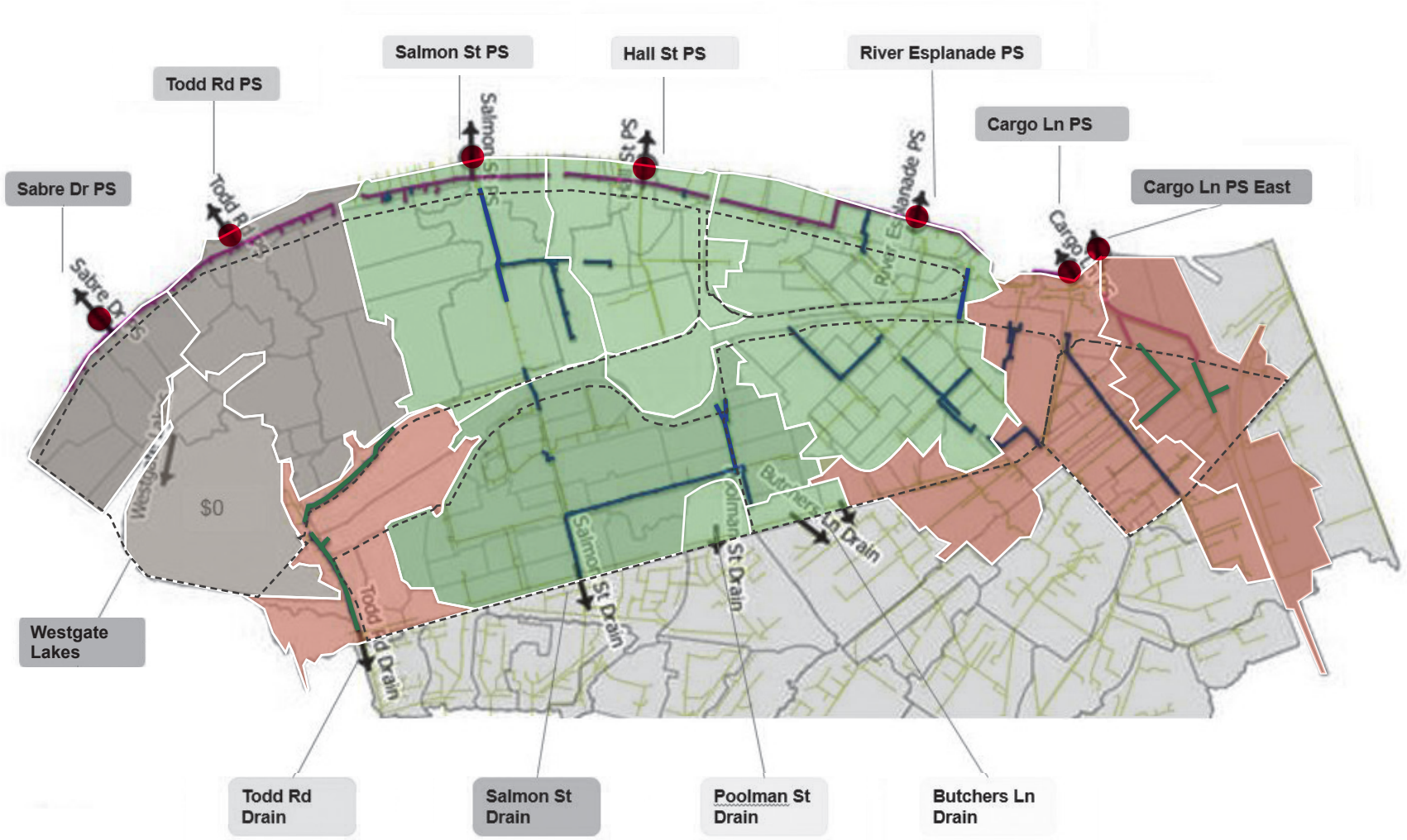
Move the sports fields to the southern part of JL Murphy Reserve and lower them to create a large detentionarea (up to 70,000m3). Relocate one of the existing soccer pitches to another public open space (e.g. Wirraway North or Prohasky Park).



Examples of lowered sporting fields

Example of passive recreation facilities

Water Sensitive Design Strategy
Hybrid Option



Distributed storage (above ground storage + WSUD)
Enough storage available in 1:5 and 1:20 year events in streets / open spaces & cost competitive

Traditional approach (pipes + WSUD)
Not enough storage available in 1:5 (or 1:20) year events and/or not cost competitive

No pipe upgrades or storage required

New pipe (required in both baseline and hybrid)

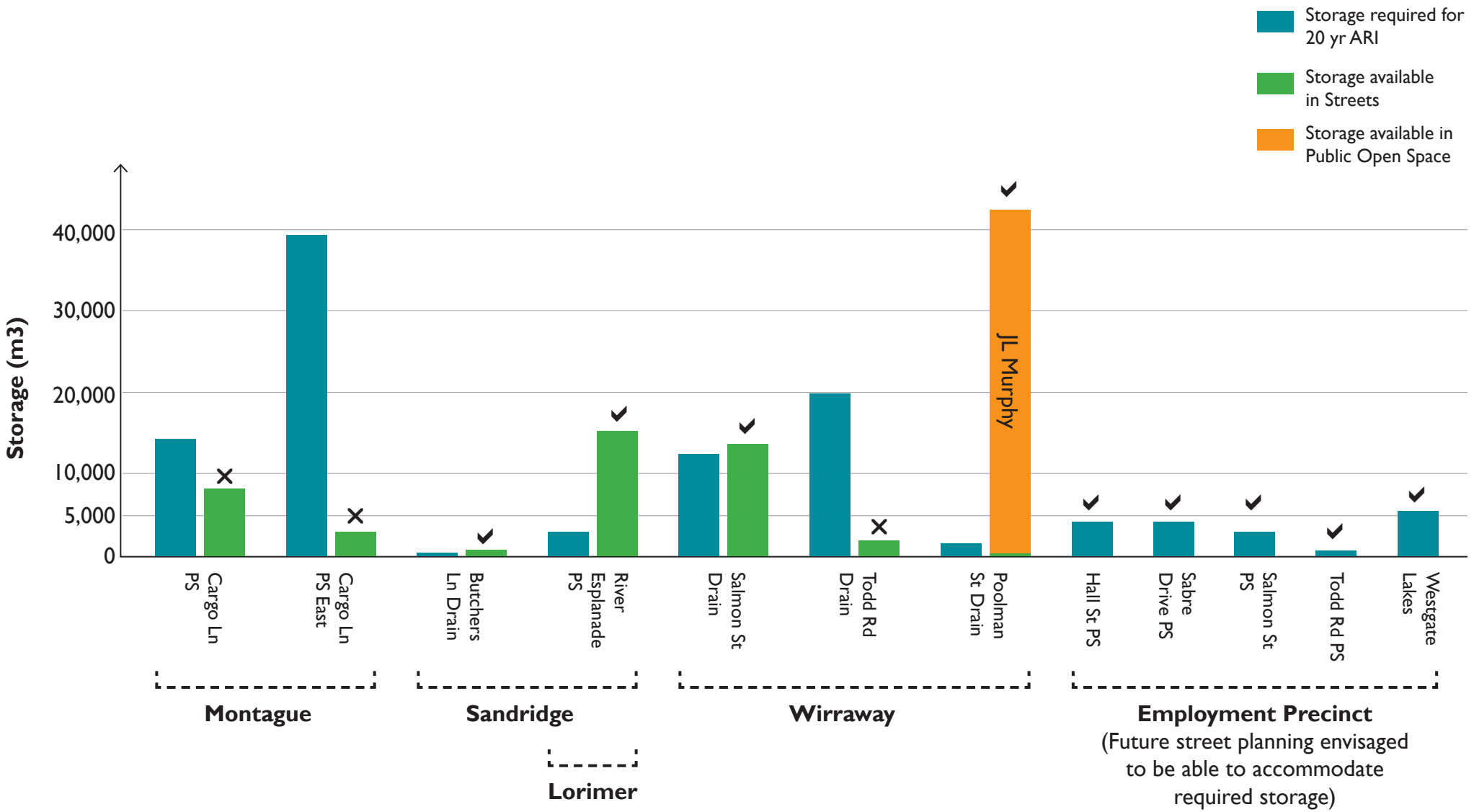
Pipe upgrade / duplication

Pipe upgrade / duplication which can be avoided with storage

Pump Station (required in both baseline and hybrid)

Water Sensitive Design Strategy

Storage volumes - 20 year ARI event



Water Sensitive Design Strategy

Conclusions, recommendations and next steps

Conclusions:

– Based on the work to date, the Hybrid solution is a viable alternative to the baseline approach as it is a beneficial outcome and cost competitive.

Working Group recommendations:

– The Hybrid solution is used as the 1:20 year ARI level of service option for in the Funding & Finance Strategy, Water Sensitive Cities Strategy and Precinct Plans.

– Further work is undertaken to progress the Hybrid Solution. This should consider formalising a level of service and preparing an implementation strategy that includes roles, responsibilities and staging.

Next steps:

– GHD to finalise report this year.

– Working group to scope further work required to complete Water Sensitive City Strategy.

– Future consideration by Melbourne Water Board, Councils and Government.