

# Appendix B – Documentation of the Development of the Hybrid Approach: All Cross-Sections and Presentations



## Appendix B – Hybrid Street Section Development

This document summarises the development of the street cross-sections incorporating flood storage, and the overall case studies, as part of the *Water Sensitive Drainage and Flood Management Strategy for Fishermans Bend*, collaboratively developed by the Fishermans Bend Taskforce Drainage Working. This documents the evolution in thinking from September through to December 2018. This includes the iteration of the draft cross sections (summarised in Table 1) and documents from the various key meetings (summarised in Table 2). It excludes minutes from the various meetings and workshops and the various iterations of Council cross-sections, plans and strategy documents throughout the project.

**Table 1 Cross-Section Versions**

Phase	Attachment
<b>Council Reference Cross-Sections</b> provided 18 <sup>th</sup> – 25 <sup>th</sup> Sep	1
<b>GHD cross-sections v1</b> for Working Group workshop on 10 <sup>th</sup> Oct	2
<b>GHD cross-sections v2</b> for Steering Committee meeting on 24 <sup>th</sup> Oct	3
<b>GHD cross-sections v3</b> for Council meetings on 31 <sup>st</sup> Oct – 2 <sup>nd</sup> Nov	4
<b>GHD cross-sections v4</b> for Steering Committee meeting on 24 <sup>th</sup> Oct	5

**Table 2 Presentations from Key Meetings/Workshops**

Phase	Document	Attachment	
Initial scoping/alignment meetings (6 <sup>th</sup> Sep – 10 <sup>th</sup> Sep)	Proposal workflow diagram	6	
Opportunities/constraints workshop (11 <sup>th</sup> Sep)	Workshop presentation	7	
Case Study/ Cross-Section Development	26 <sup>th</sup> Sep workshop (GHD, CoPP, CoM, FB TF)	NA	
	10 <sup>th</sup> Oct workshop (GHD, CoPP, CoM, FB TF, MWC, CRCWSC)	Cross section & case study review memorandum Case study review workshop presentation	8 and 9
	24 <sup>th</sup> Oct steering group meeting	GHD input slides for meeting	10
	31 <sup>st</sup> Oct meeting (GHD, CoPP)	Case study assessment slides	11
	2 <sup>nd</sup> Nov meeting (GHD, CoM)	Case study assessment slides	12
	15 <sup>th</sup> Nov workshop (GHD, CoPP, CoM, FB TF, MWC, CRCWSC)	Progress meeting slides	13
	21 <sup>st</sup> Nov workshop (GHD, CoPP, CoM, FB TF, MWC, SEW, CRCWSC)	Progress meeting slides	14
Strategy:	6 <sup>th</sup> Dec steering group meeting	Final steering committee presentation	15

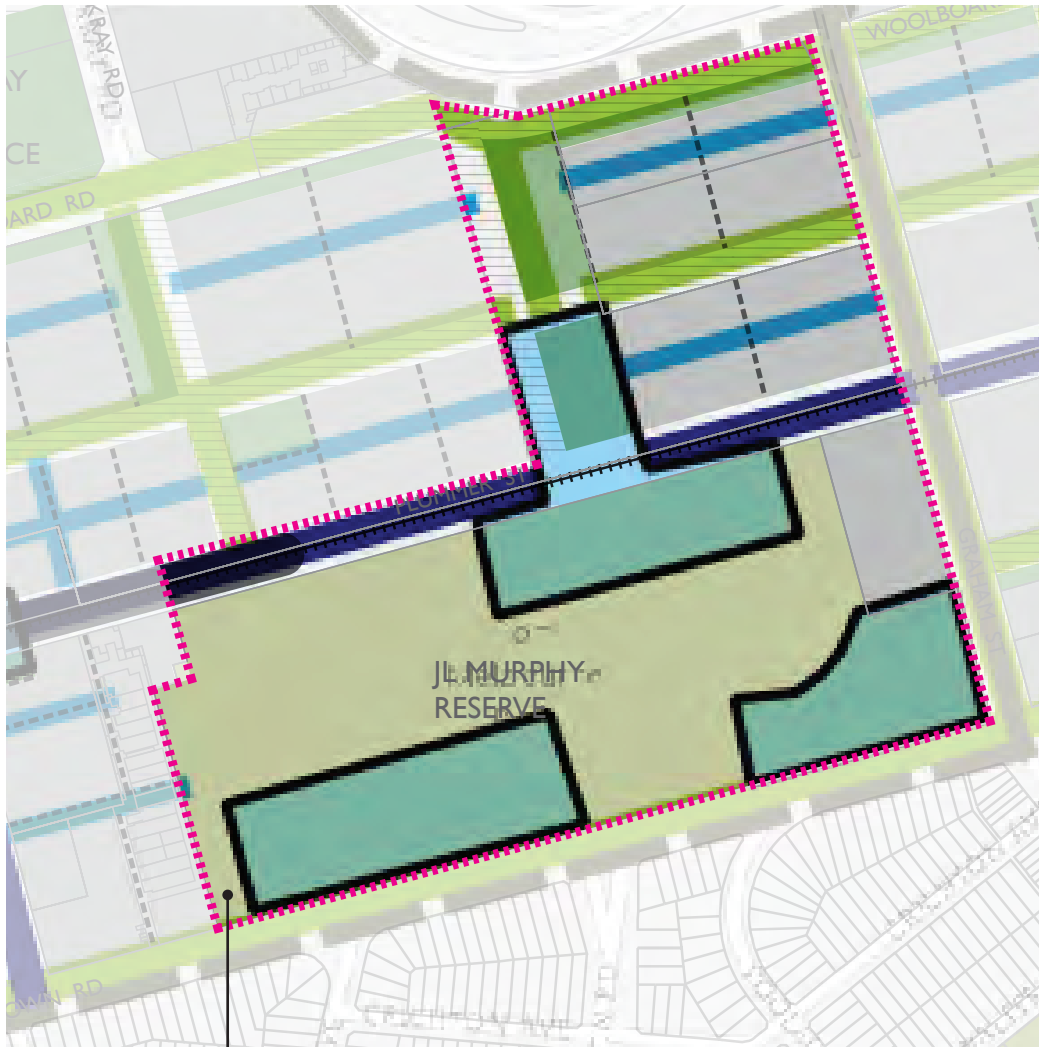
# Attachment 1

Council Reference Cross-Sections provided 18th – 25th Sep

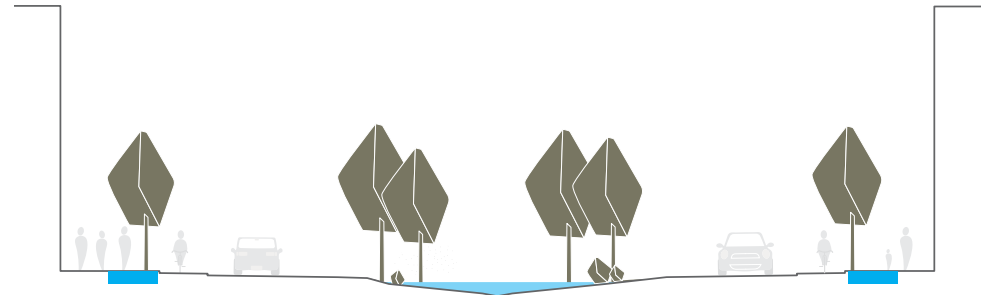
# City of Port Phillip Street and Laneway Cross Sections

# Cloudburst masterplan

Ramboll Final Report



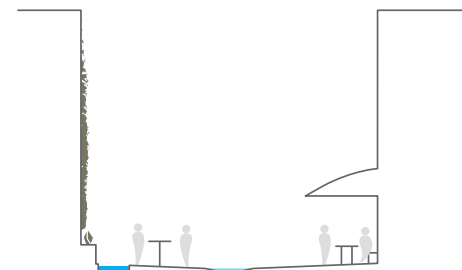
Case study area



**Cloudburst Boulevard**  
Potential detention: 10m width x 0.4m depth. Conveyance area?



**Green Streets**  
Potential detention: 8m width x 0.4m depth. Conveyance area?



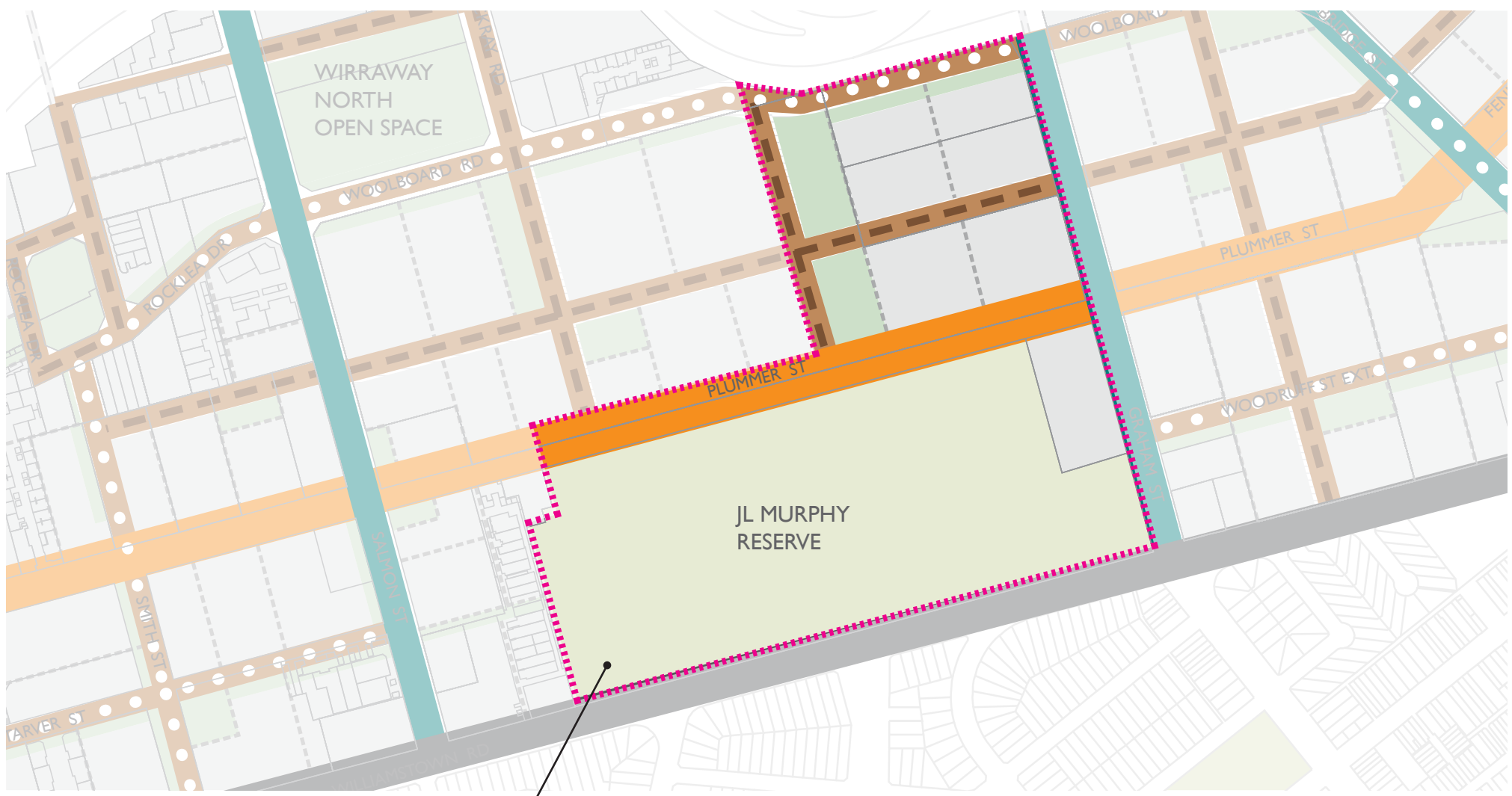
**Blue laneways**  
Potential detention: 2m width x 3m depth. Conveyance area?

**Key**









- Detention
- Conveyance

# Street hierarchy / types

CoPP

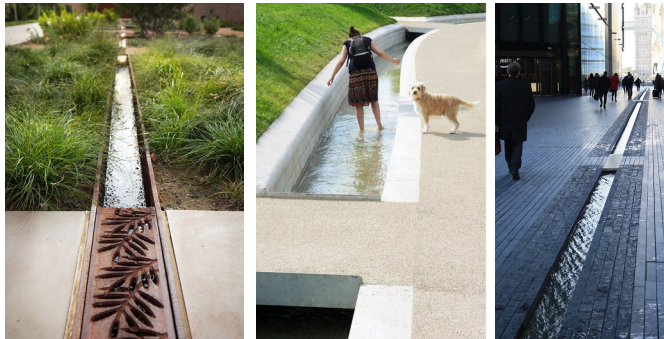


Case Study area boundary

- |   |                 |   |                           |
|---|-----------------|---|---------------------------|
|  | Arterial Road   |  | Local Street              |
|  | Collector Road  |  | 30m                       |
|  | Civic Boulevard |  | 30-34m (with linear park) |
|   |                 |  | 20-22m                    |
|   |                 |  | 13-15m                    |

# Street interventions

Small-scale channels



Permeable paving + underground storage

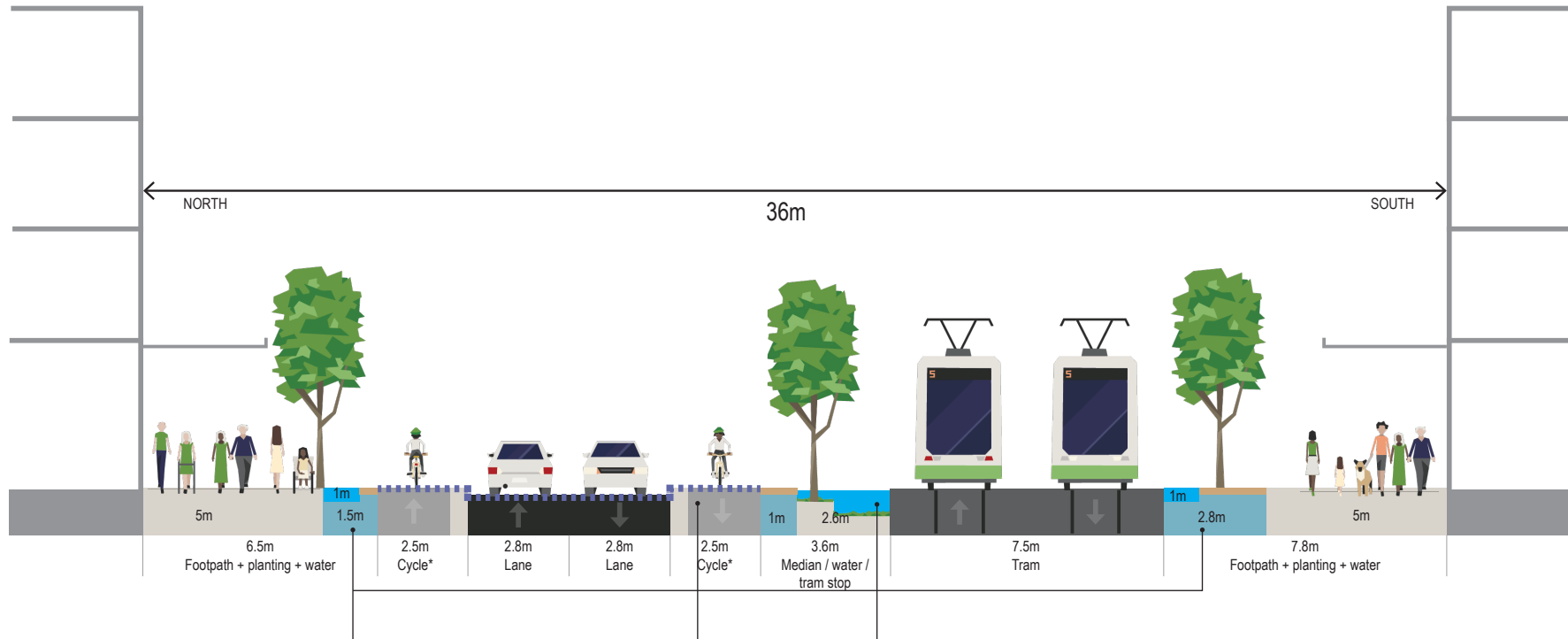


Stormwater planters



# Cloudburst Boulevard

## Plummer Street Civic Boulevard (36m)



- Conveyance
- Detention (surface)
- Permeable Paving
- Detention (underground)

NOTES:

- \* 2.5m separated cycle lane = 2m cycle lane, 0.5m buffer
- \* Tram stop - minimum 2.4m wide
- \* Option for 1-way traffic in some areas?
- \* Option to treat carriageway as a shared space (no kerbs)?
- \* Depth of underground storage TBC. Potential to extend storage under footpaths and/or cycle paths if needed.
- \* Services to be located underneath footpaths

Small-scale channel (1m) + permeable pavers with underground storage (hardstand areas at intersections)



Conveyance area (vehicle + cycle lanes) for Cloudburst events

\* Option for some stormwater planters (e.g. around trees)

Stormwater planters + permeable paving buffer (hardstand areas at tram stops / intersections)



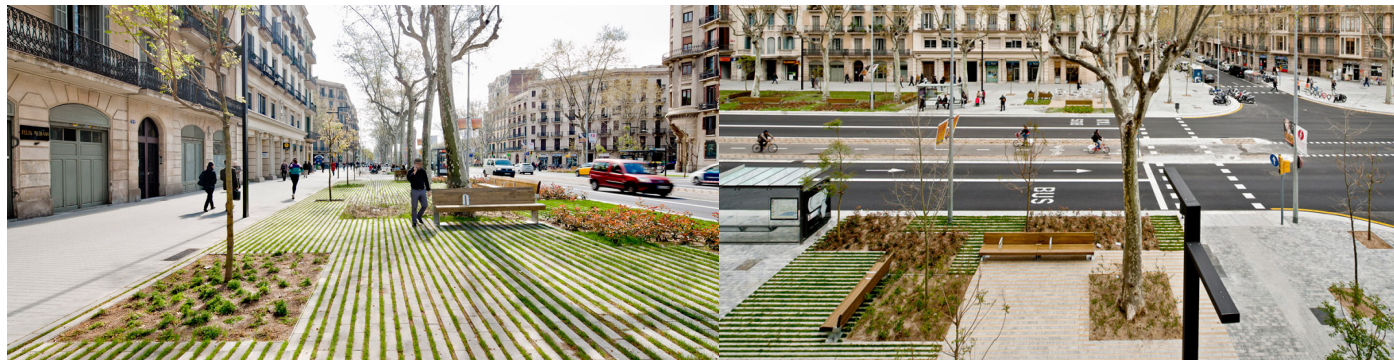
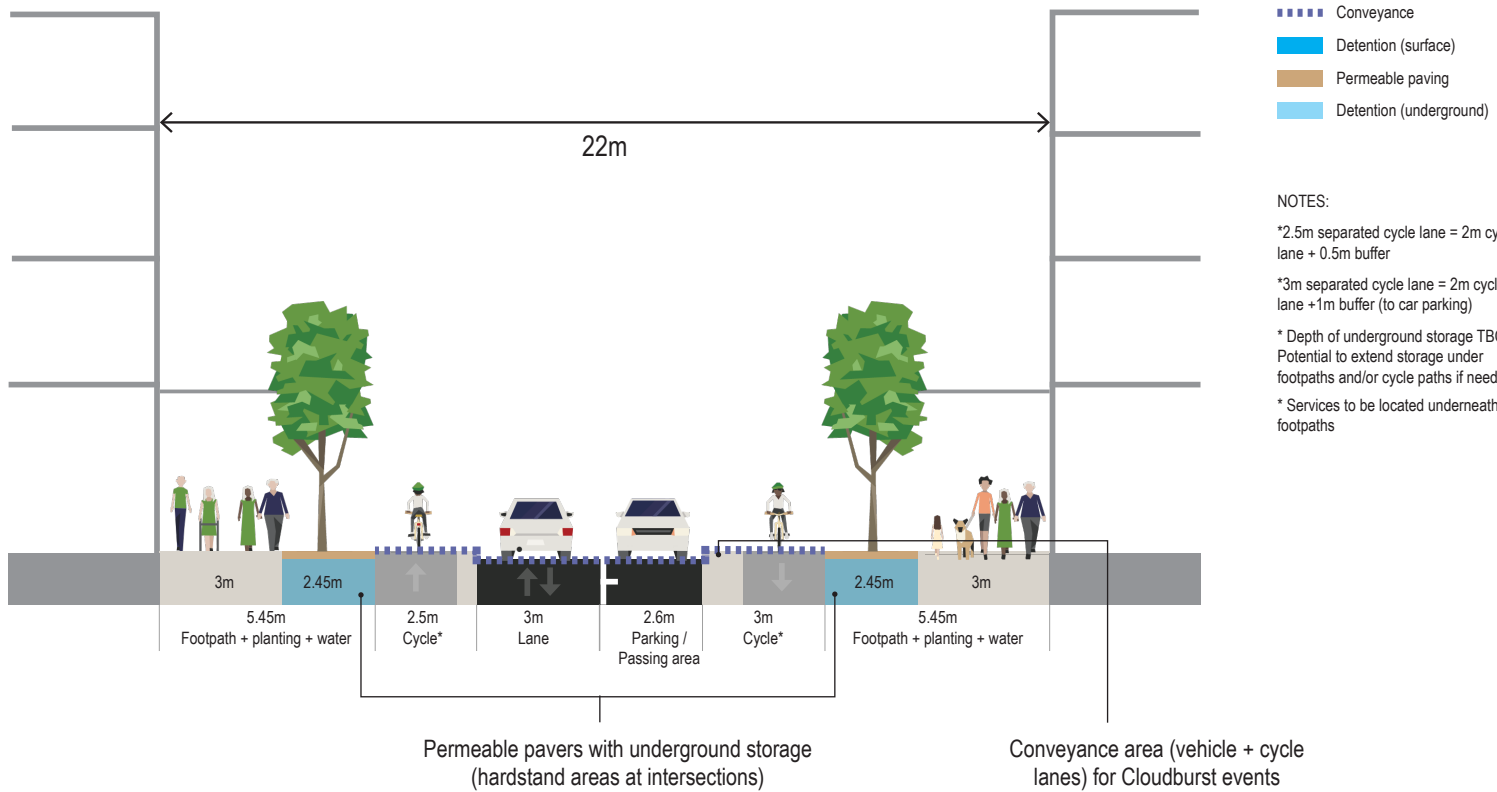
All intersections / tram stops / pedestrian crossings will be paved.





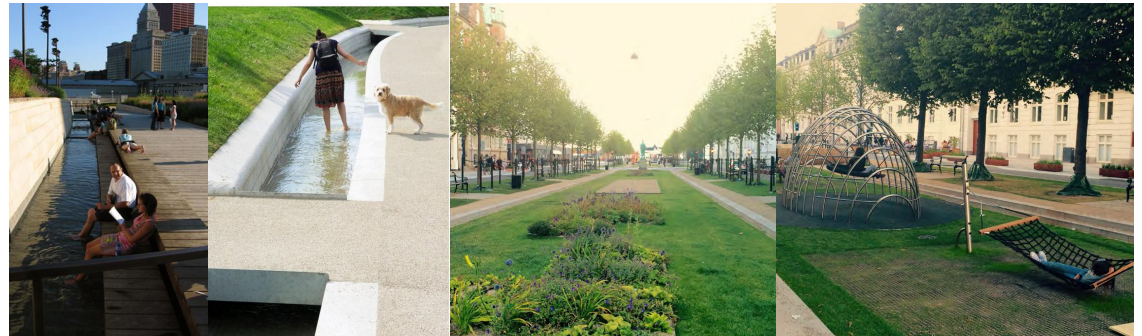
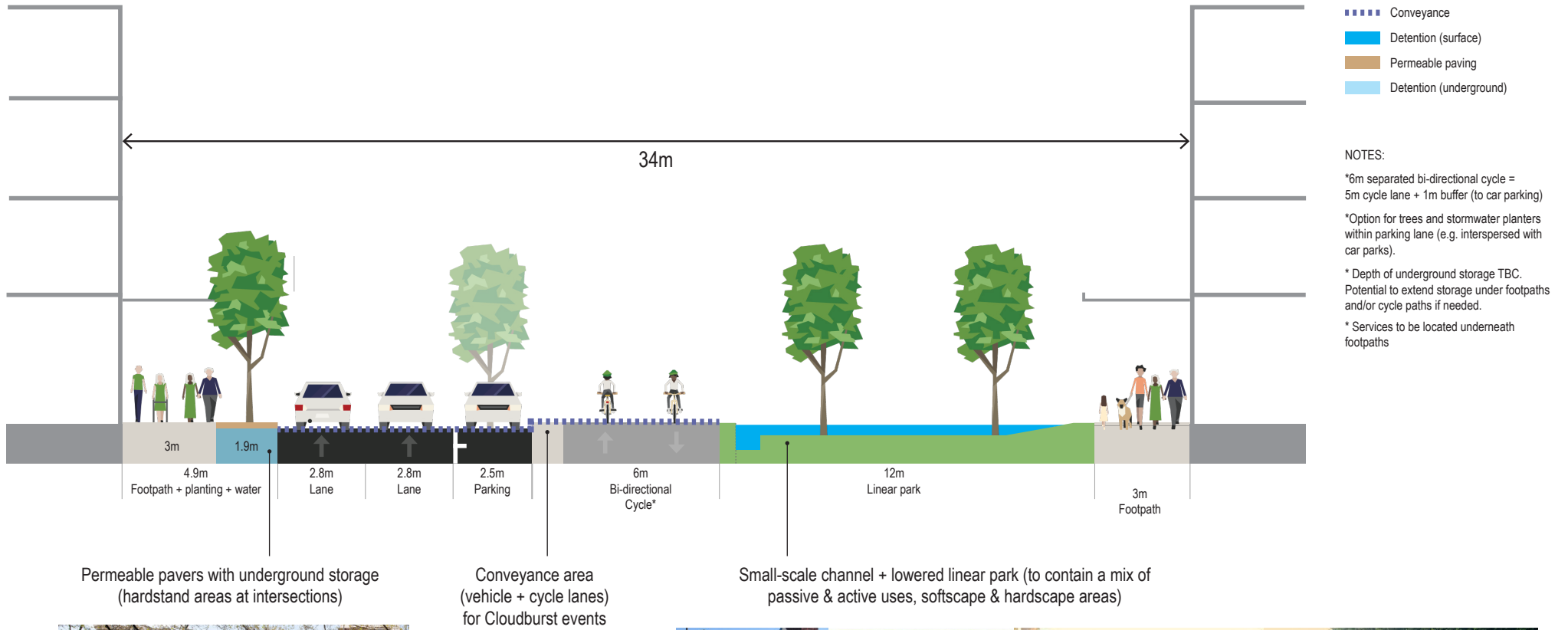
# Green Street

## New street (22m)



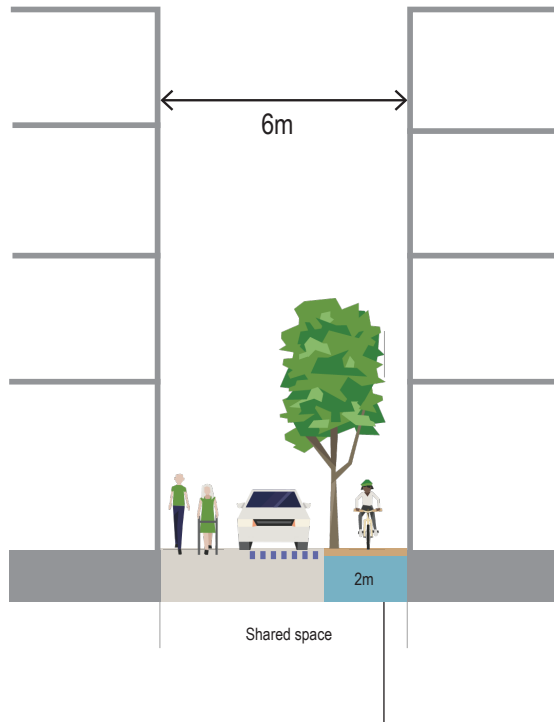
# Green Street

New street (34m with linear park)

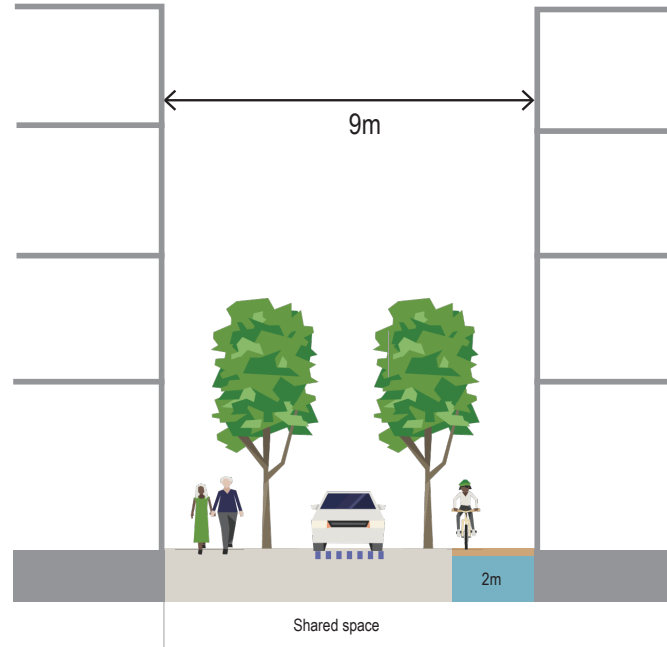


# Blue Laneway

New laneway (6m)



Permeable pavers with underground storage  
(hardstand areas at intersections)



- Conveyance
- Detention (surface)
- Permeable paving
- Detention (underground)

NOTES:

\*Taskforce preference for 6m wide laneways. CoPP requested 9-12m wide laneways through panel process.  
 \*Laneways assumed to be shared spaces.  
 \* Depth of underground storage TBC. Potential to extend storage under footpaths or bike paths if needed.

# City of Melbourne and Laneway Cross Sections

# SECTION A

## LOCAL STREET ADJACENT TO OPEN SPACE

### Function

Provides local experience, connection to destination and creates pedestrian-friendly block intervals.

### Vehicle Movement + Access

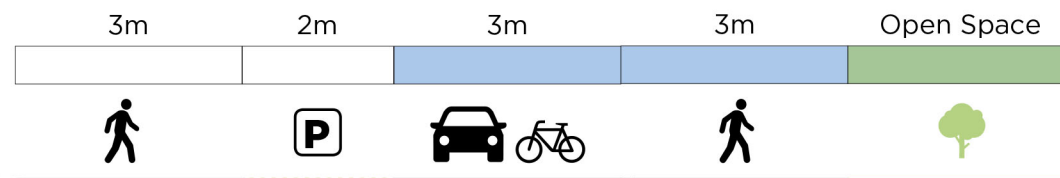
Low-volume street without transit routes. 3m width for one way traffic, focusing on place making over vehicle movement.

### Water management

Working as a Cloudburst Street to convey waters to nearby detention areas. Conveyance area defined to vehicular lane and secondary pedestrian footpath.

### Parking

Restricted on street parking, with parking spaces limited to car share and delivery/service vehicles.



## SECTION B

### LOCAL STREET WITH LINEAR PARK

#### Function

Provides local experience, connection to destination and creates pedestrian-friendly block intervals.

#### Vehicle Movement + Access

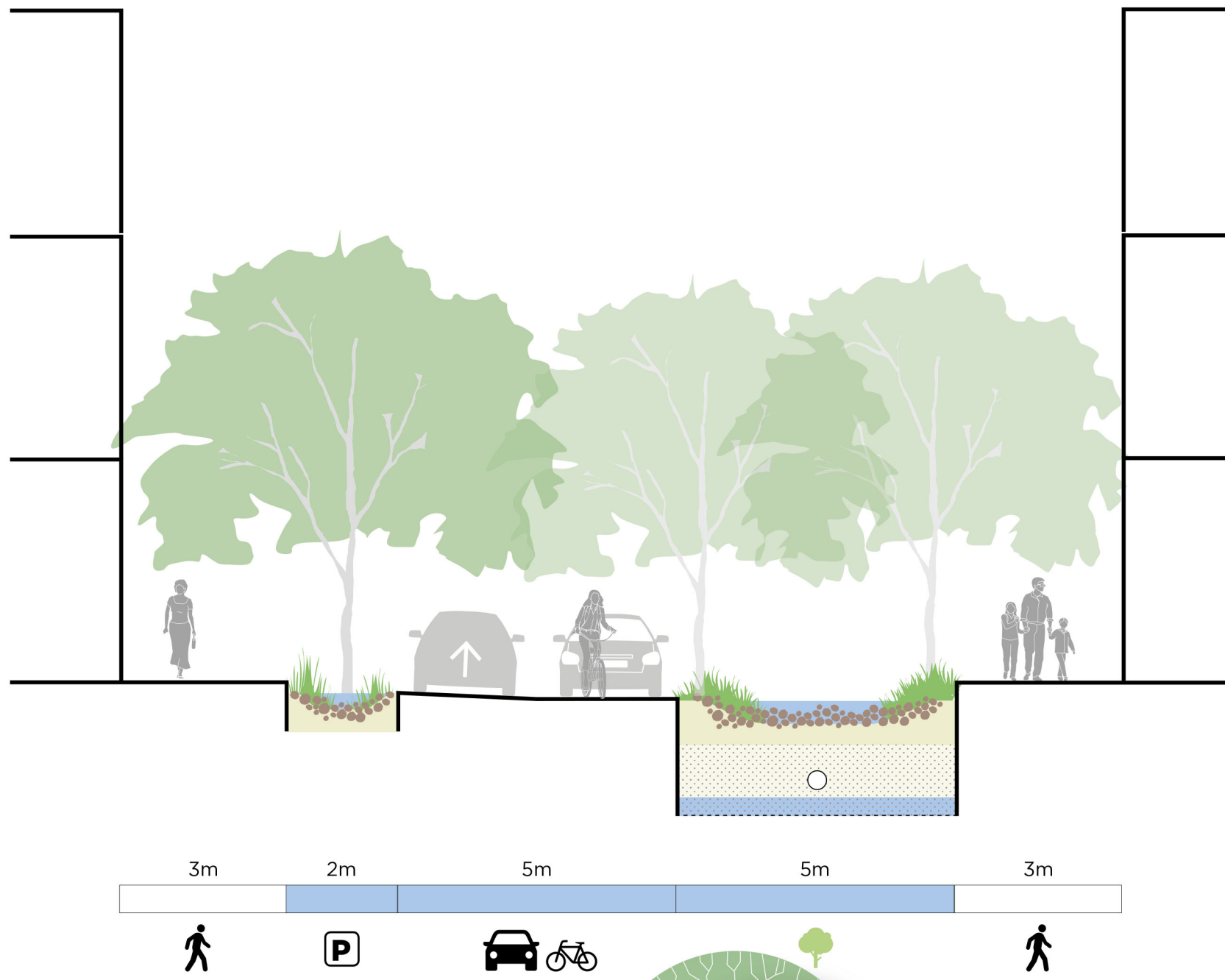
5 m width for bidirectional lanes, also known as yield lanes. On low-volume streets without transit routes, vehicles moving in opposite directions can yield to one another as they pass.

#### Water management

Working as a Cloudburst Street to convey waters to on street detention areas. Detention areas to operate during regular flood events, while the conveyance areas to work during greater than 1 in 20 year flood event (5 per cent AEP). Conveyance area defined to vehicular lane and linear park.

#### Parking

Restricted on street parking, with parking spaces limited to car share and delivery/service vehicles.



# SECTION C

## LOCAL STREET ADJACENT TO PROPOSED TRAM BRIDGE

### Function

Provides local experience, connection to destination and creates pedestrian-friendly block intervals.

### Vehicle Movement + Access

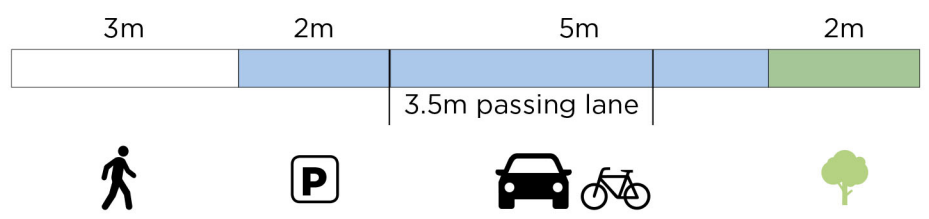
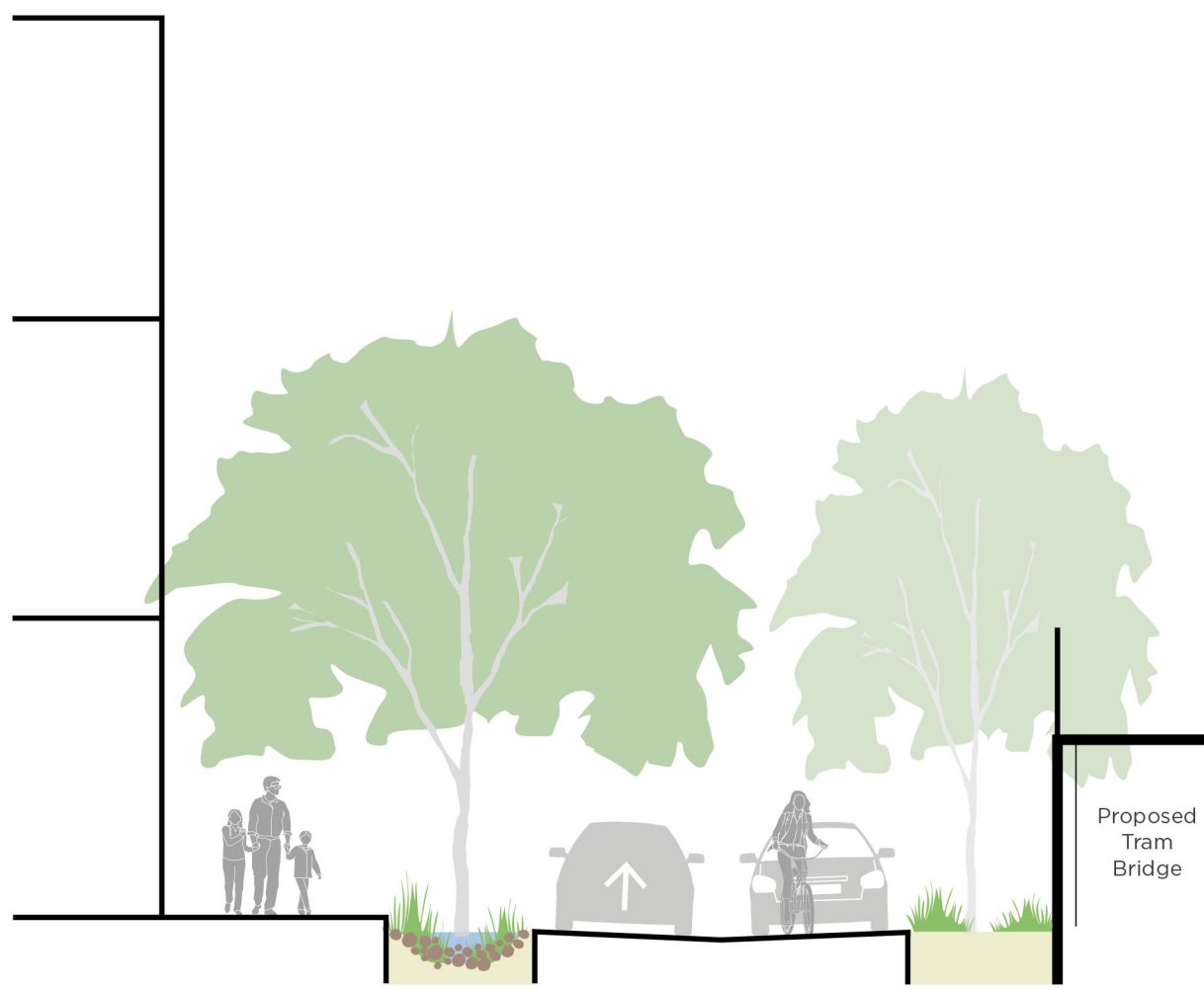
5 m width for bidirectional lanes, also known as yield lanes. On low-volume streets without transit routes, vehicles moving in opposite directions can yield to one another as they pass. 3.5 m passing lanes are introduced for further traffic calming.

### Water management

Working as a Cloudburst Street to convey waters to on street detention areas. Detention areas to operate during regular flood events, while the conveyance areas to work during greater than 1 in 20 year flood event (5 per cent AEP). Conveyance area defined to vehicular lane.

### Parking

Restricted on street parking, with parking spaces limited to car share and delivery/service vehicles.



# SECTION D

## ONEWAY LANEWAY

### Function

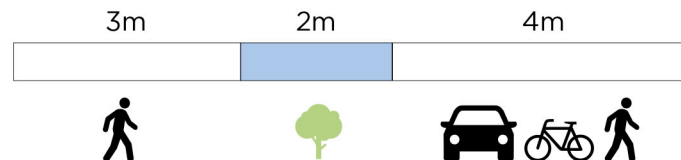
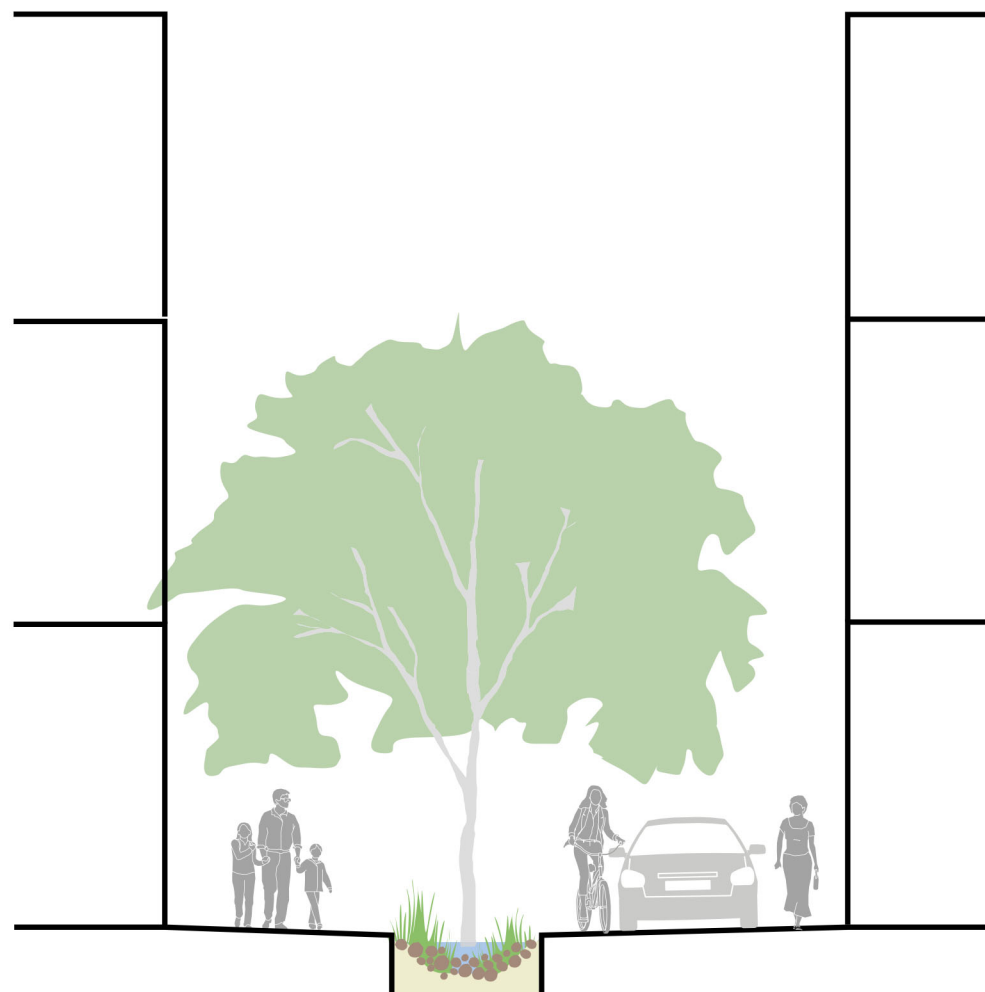
Provides local experience, connection to destination and creates pedestrian-friendly block intervals.

### Vehicle Movement + Access

Low-volume street without transit routes. 4m width for one way traffic as part of a shared surface, focusing on place making over vehicle movement.

### Water management

Working as a Cloudburst Street to convey waters to nearby detention areas. Conveyance area defined to central rain gardens.





# SECTION E

## PEDESTRIAN LANEWAY

### Function

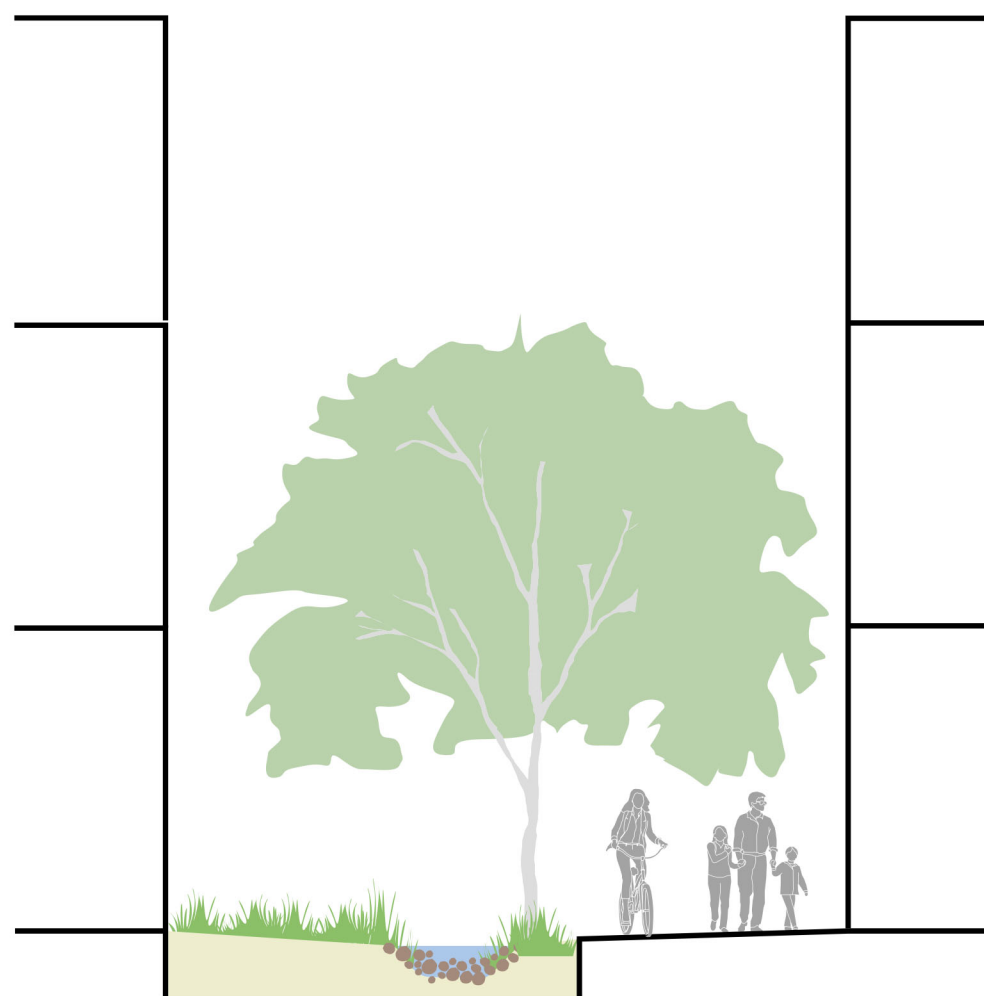
Provides local experience, connection to destination and creates pedestrian-friendly block intervals.

### Vehicle Movement + Access

Off limits to private vehicles, however do allow emergency vehicular access.

### Water management

Working as a Cloudburst Street to convey waters to nearby detention areas. Conveyance area defined to green space.



5.5m

3.5m



# SECTION F

## SERVICE ROAD

### Function

Dedicated service access, concentrating larger vehicles (local freight, waste collection, parking access and servicing) to the perimeter of the precinct.

### Vehicle Movement + Access

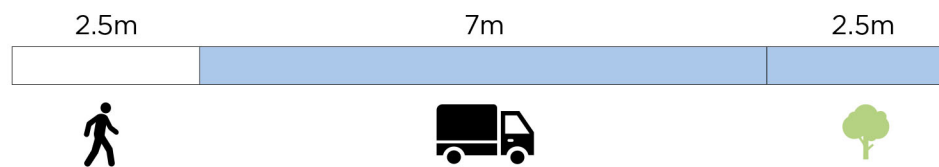
7 m width for two lane traffic. Tree planting introduced for further traffic calming.

### Water management

Working as a Green Street to store flood waters at the source.

### Parking

No on street parking.



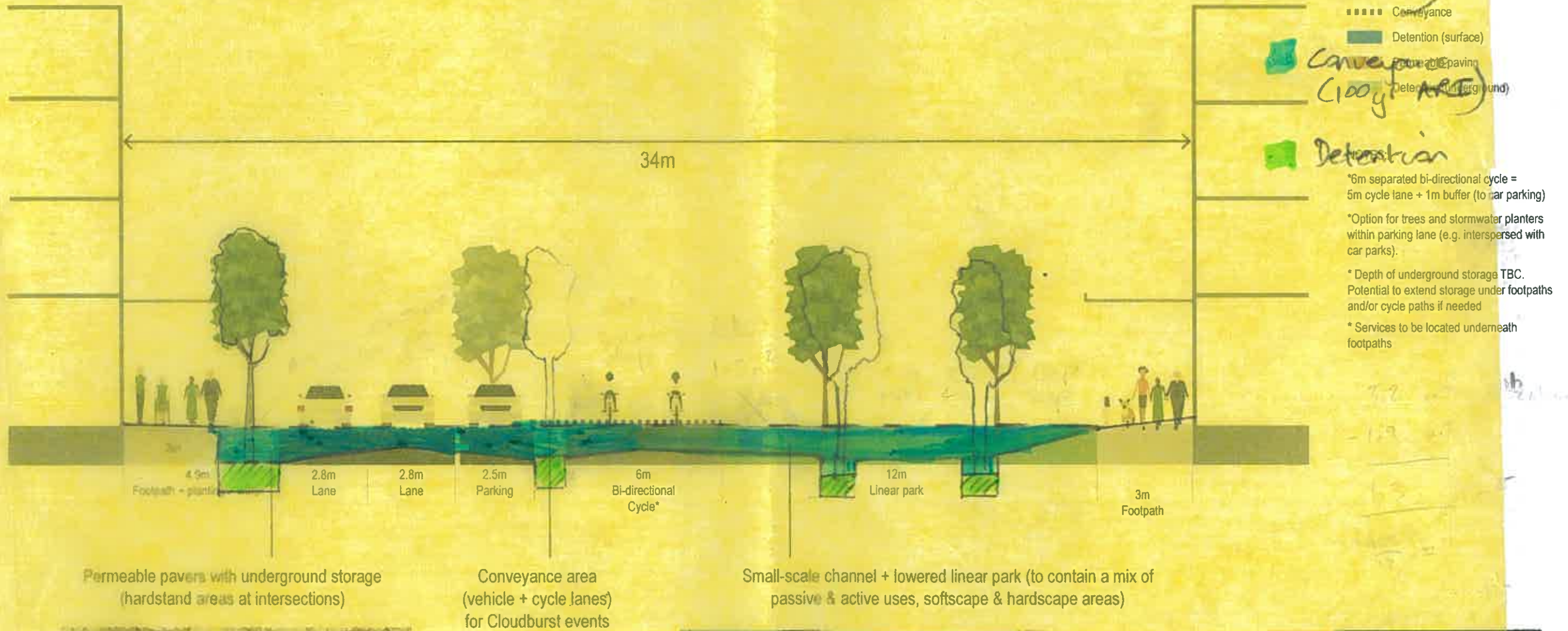
## Attachment 2

GHD cross-sections v1 for Working Group workshop on 10th Oct

# Green Street

New street (34m with linear park)

Graham St - Green St (34m with Linear Park)



Permeable pavers with underground storage (hardstand areas at intersections)

Conveyance area (vehicle + cycle lanes) for Cloudburst events

Small-scale channel + lowered linear park (to contain a mix of passive & active uses, softscape & hardscape areas)

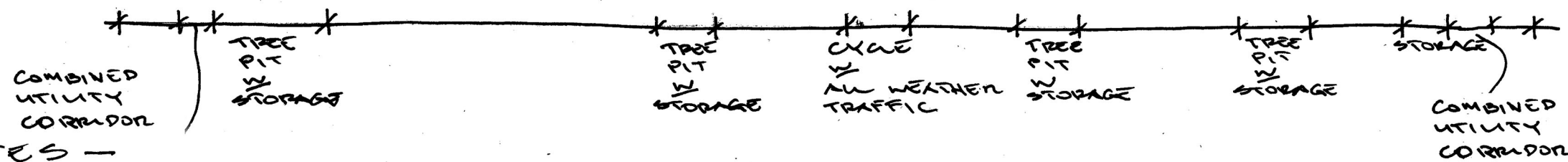
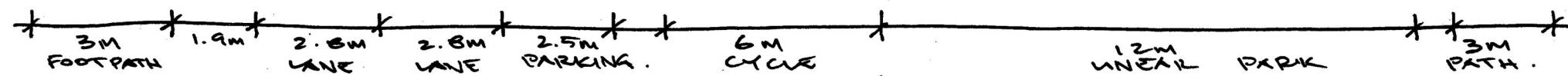
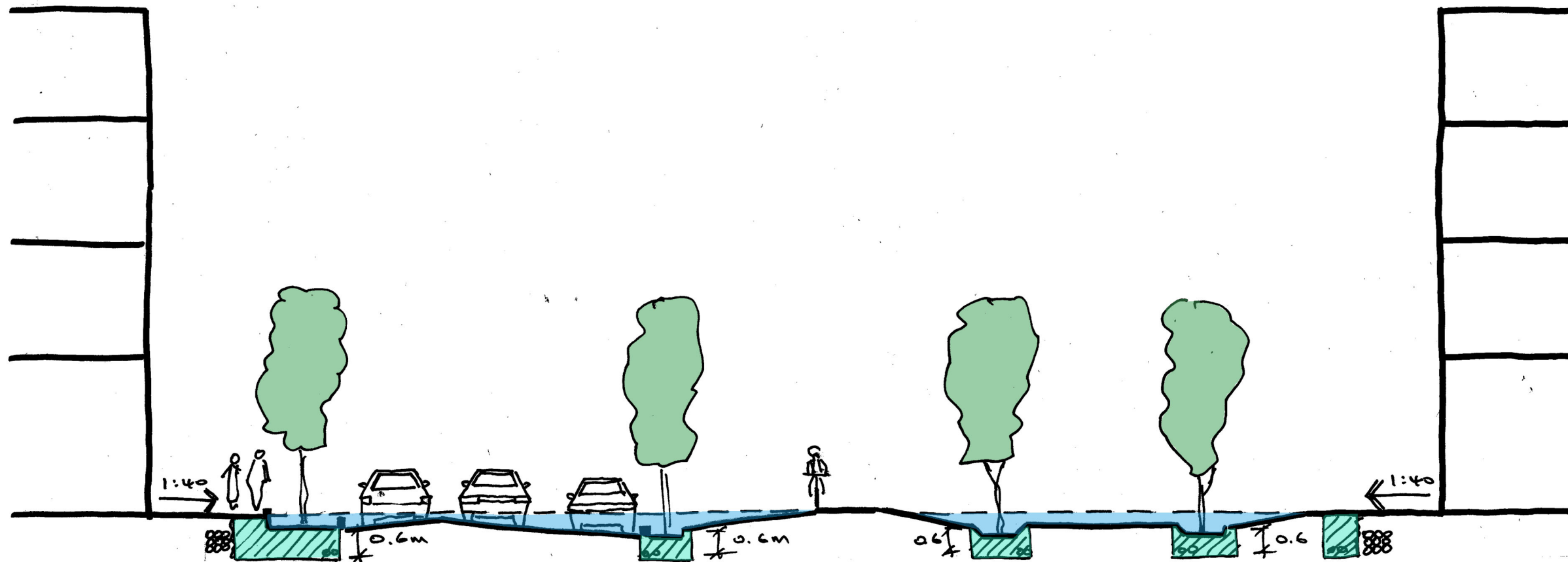
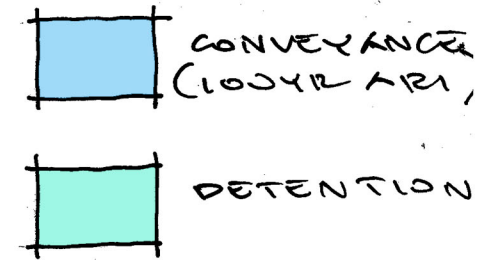


Detention ~ 3.6 m<sup>2</sup>  
 Conveyance ~ 10 m<sup>2</sup>



(target 3.2 m<sup>2</sup> based on Port Phillip Council) based on (a) tree pits / rain gardens avg. 300mm / 1.66 m<sup>2</sup>  
 (b) road avg. 350mm / 2.84 m<sup>2</sup>  
 (c) cycle path avg. 325mm / 1.95 m<sup>2</sup>  
 (d) linear park avg. 350mm / 3.40 m<sup>2</sup>

GREEN STREET  
 GRAHAM ST - GREEN ST  
 (34M W LINEAR PARK)

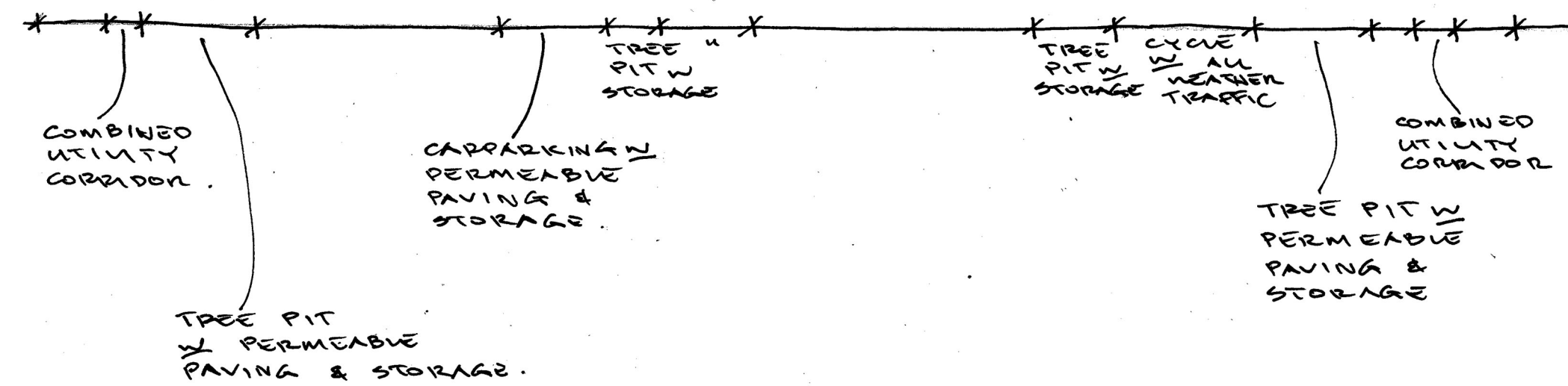
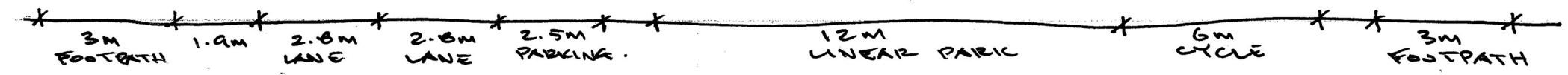
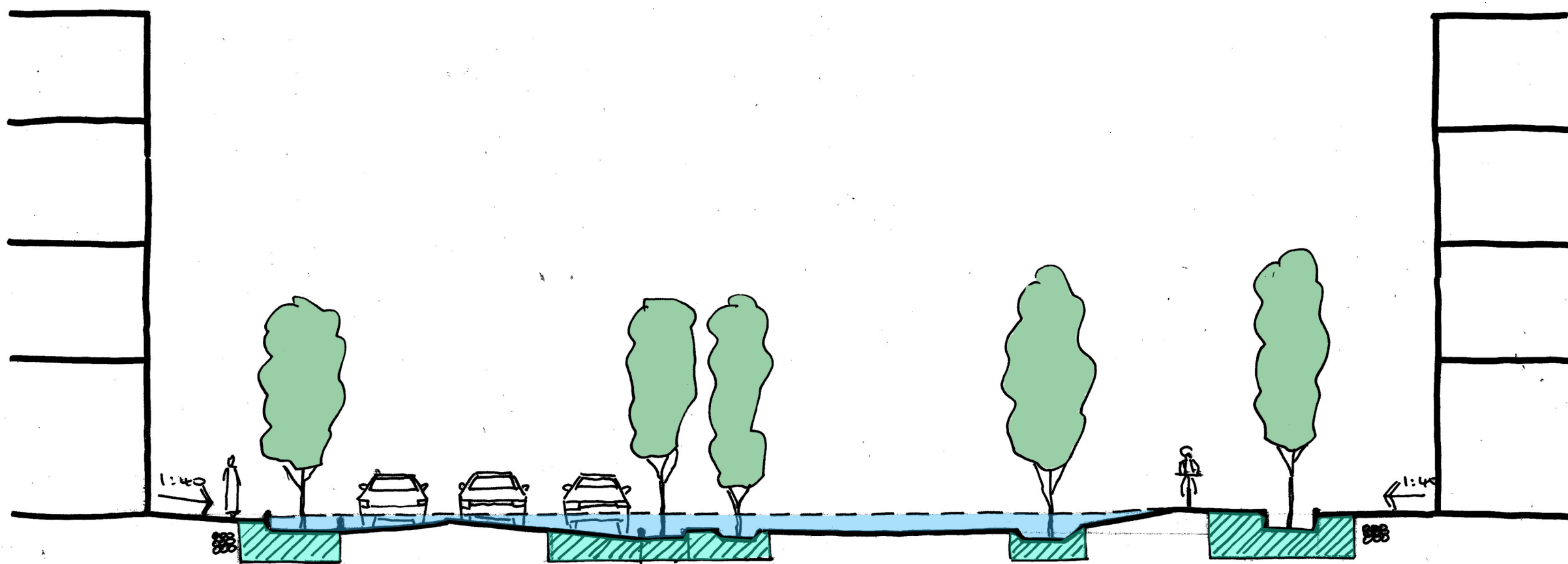
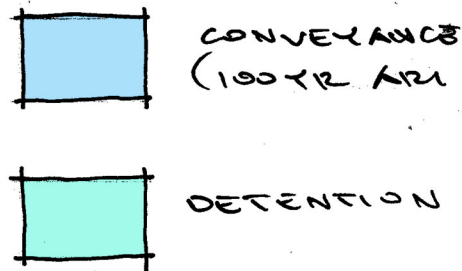


NOTES -

- ALL TREE PITS  $\geq$  2NO. MIN. AGI FOR CONVEYANCE
- COMBINED UTILITY CORRIDOR IN FOOTPATHS,  $\geq$  ROOT CONTROL BARRIER SEPERATION BETWEEN TREE PITS & UTILITIES. PROPOSED UTILITIES TO BE LOCATED 3-4M FROM BUILDING LINES.
- FOOTPATHS TO HAVE 1M MIN. PERMEABLE PAVING BEHIND KERB.
- TREE PITS  $\geq$  CELLS OR STRUCTURAL SOIL AS PER CITY OF TORONTO "BEST PRACTICE MANUAL." (2013)
- DETENTION  $\approx$  3.6m<sup>2</sup> (TARGET 3.2m<sup>2</sup> BASED ON RAMBOLL BREAKDOWN)
- CONVEYANCE  $\approx$  10m<sup>2</sup> BASED ON (A) TREEPIT / RAINGARDENS AVG. 400MM / 1.66m<sup>2</sup>  
 (B) ROAD AVG. 350MM / 2.84m<sup>2</sup>  
 (C) CYCLE PATH AVG. 325MM / 1.95m<sup>2</sup>  
 (D) LINEAR PARK AVG. 350MM / 3.60m<sup>2</sup>.

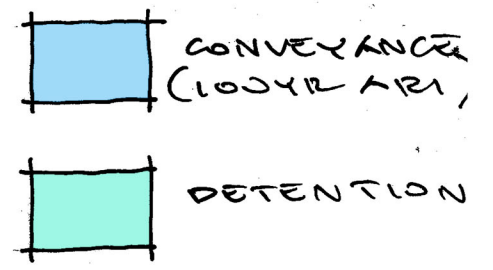
GRAHAM ST  
 SKO1-A  
 NTS.  
 GHDW  
 8.10.2018.

GREEN STREET (ALTERNATE GENERAL ARRANGEMENT)  
 GRAHAM ST - GREEN ST  
 (34 M W LINEAR PARK.)

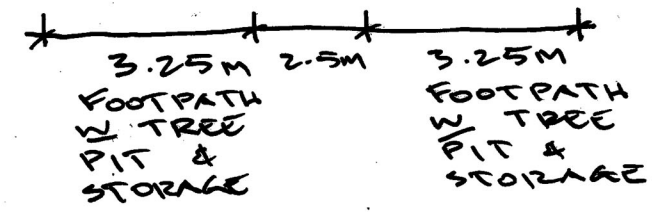
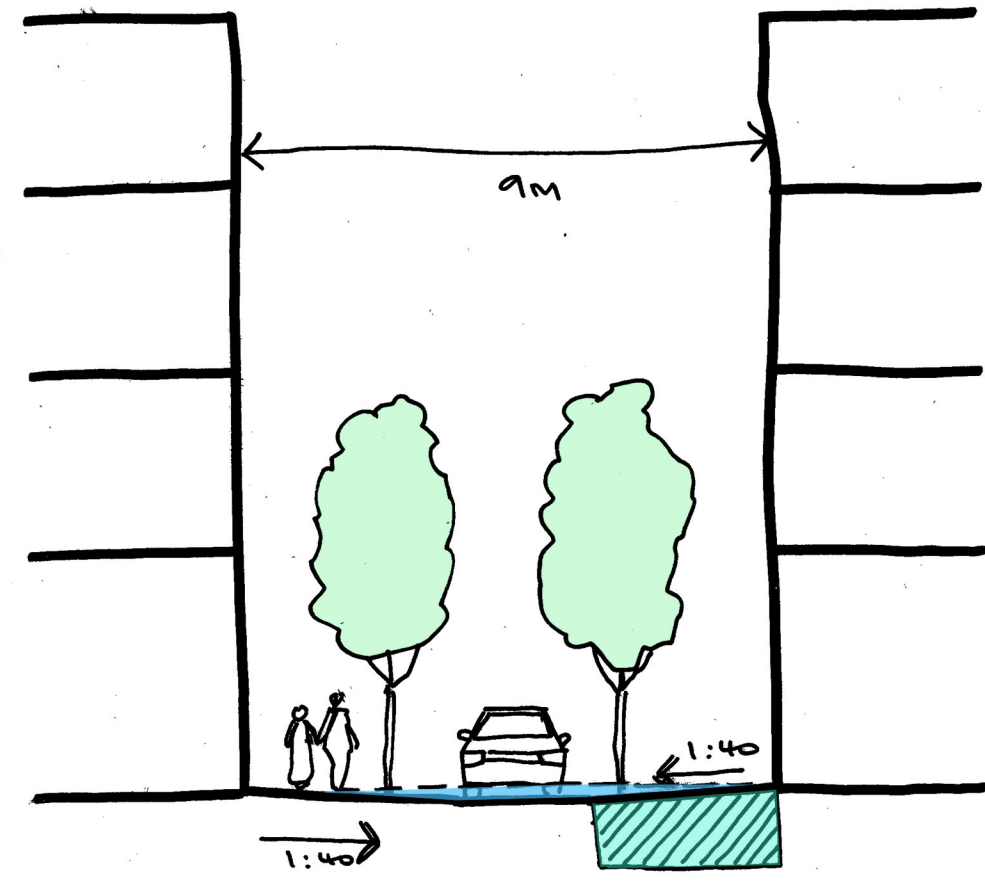
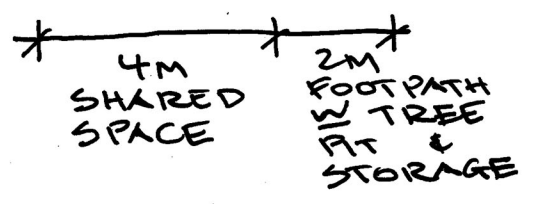
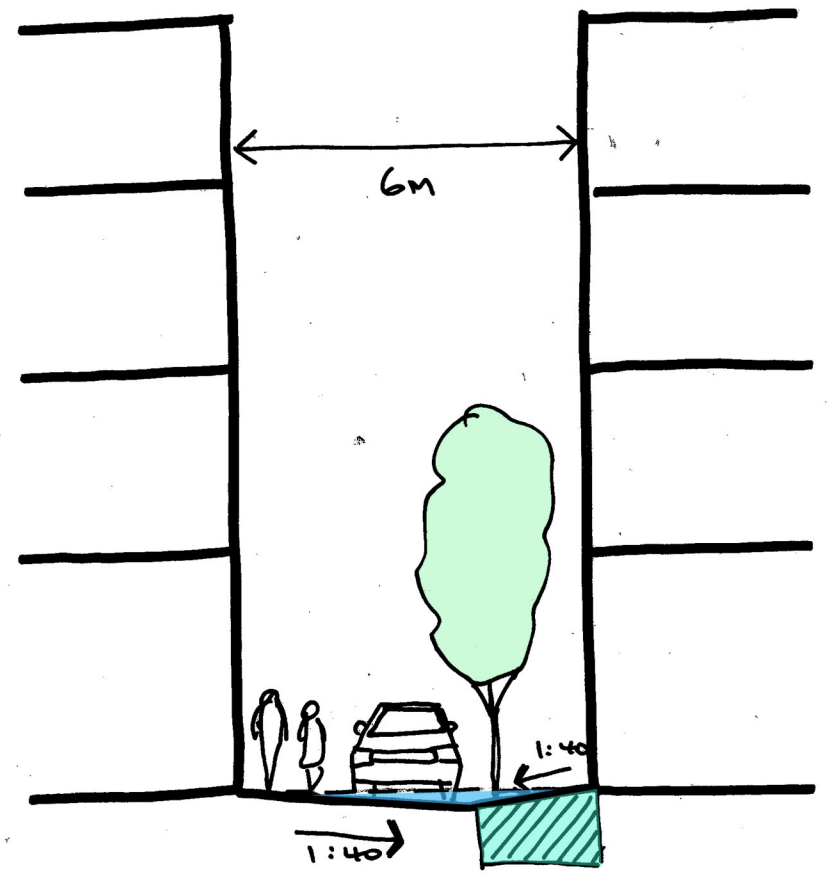


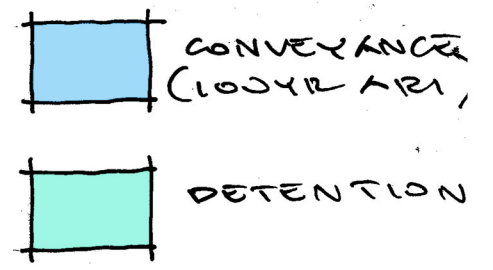
NOTES - AS PER SK01-A.

GRAHAM ST  
 SK01-B  
 NTS  
 GHDW  
 8.10.2018.



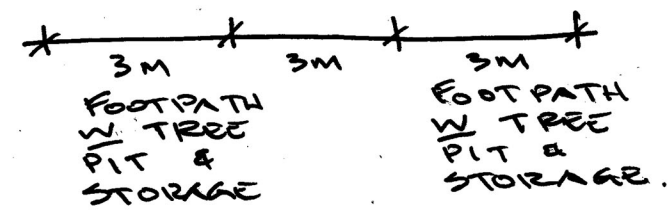
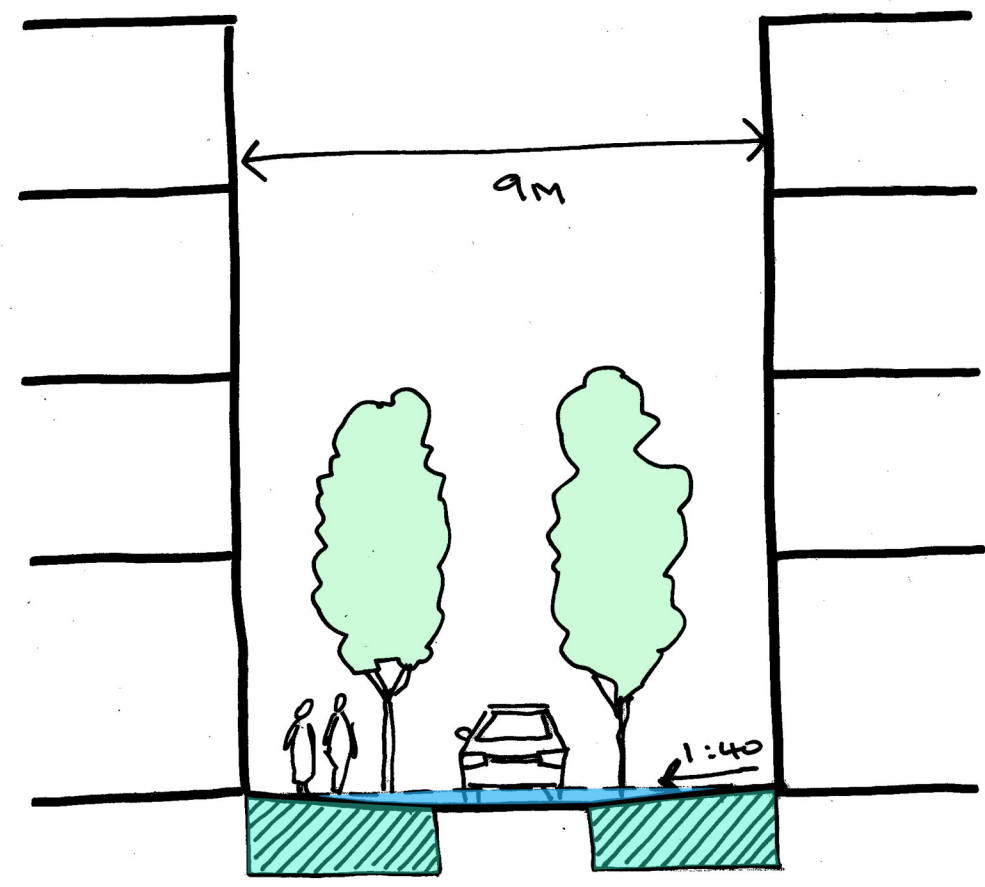
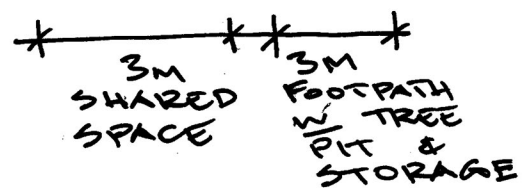
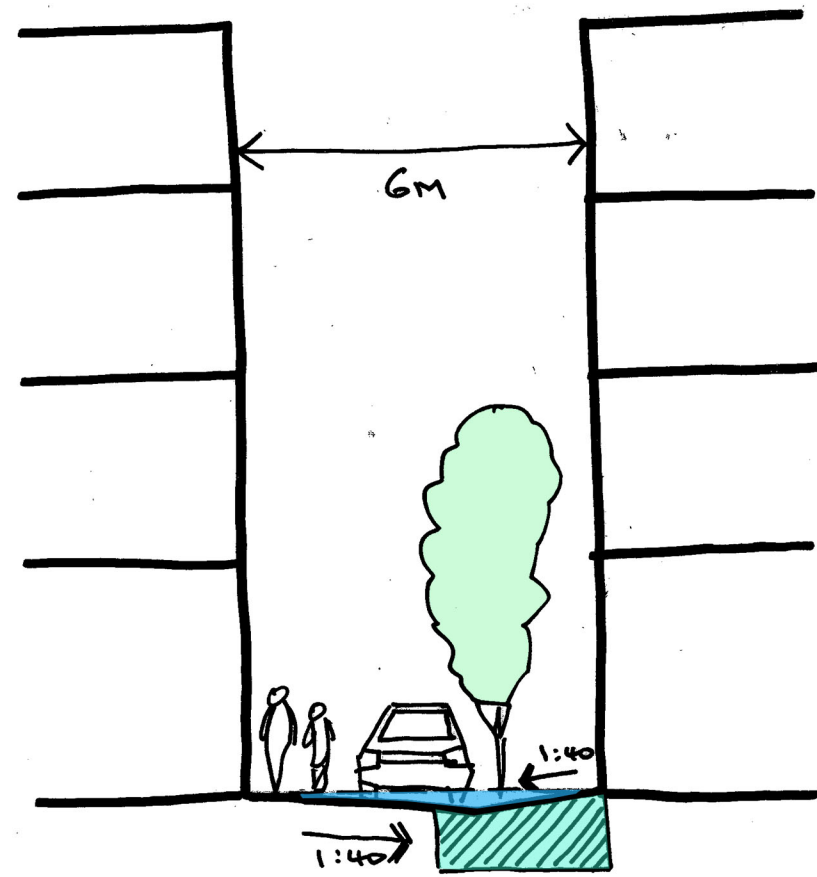
BLUE LANEWAY.  
NEW LANEWAY (6M & 9M.)





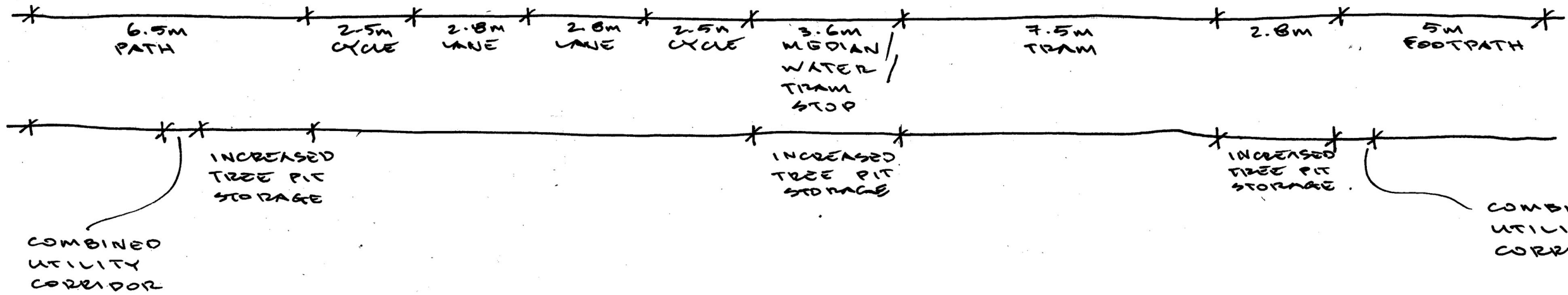
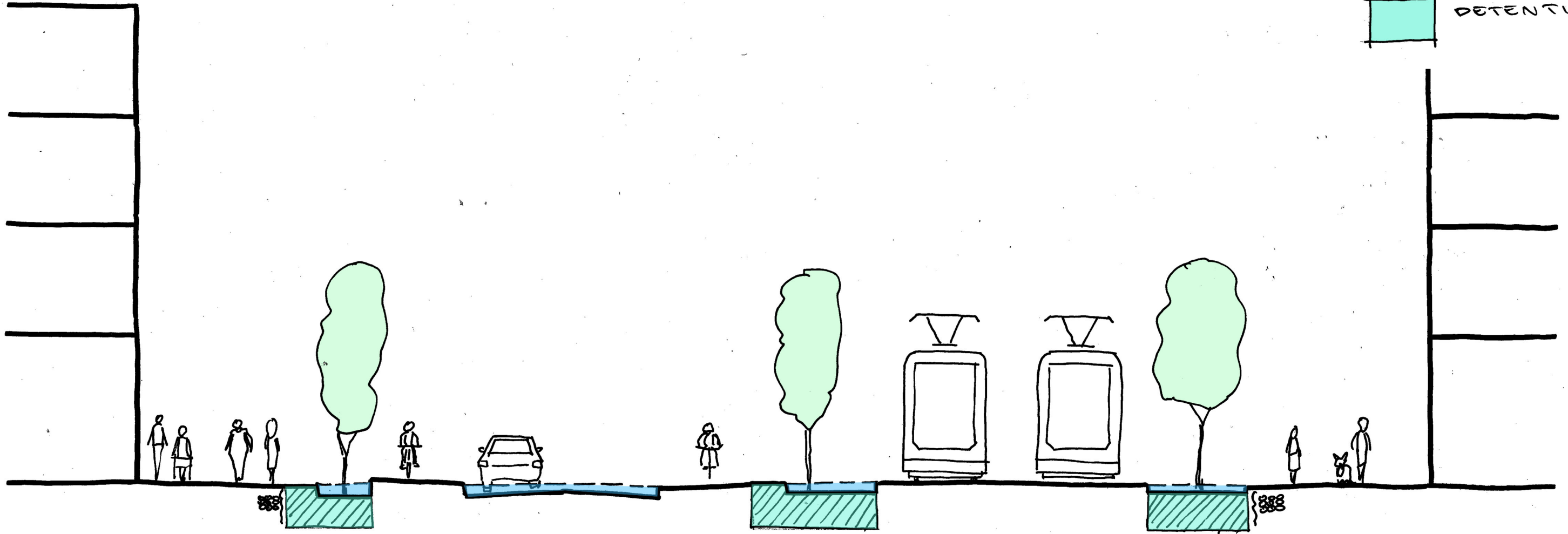
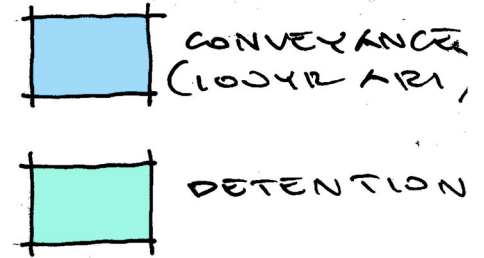
BLUE LANEWAY  
 NEW LANEWAY (6M & 9M.)

ADDITIONAL STORAGE OPTION





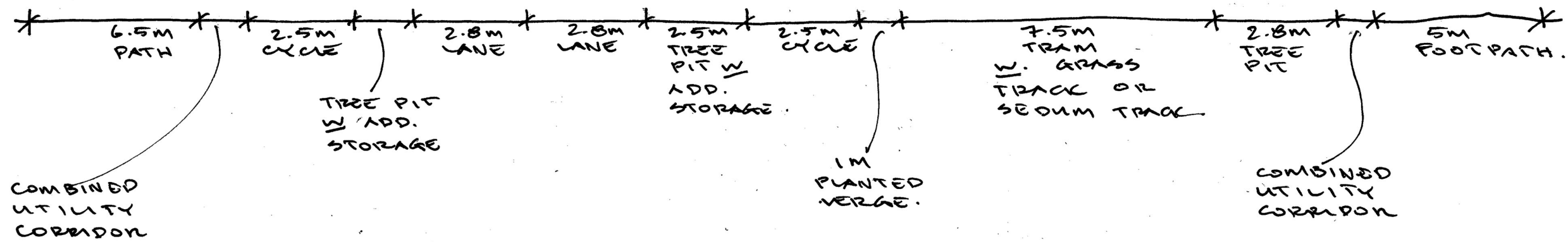
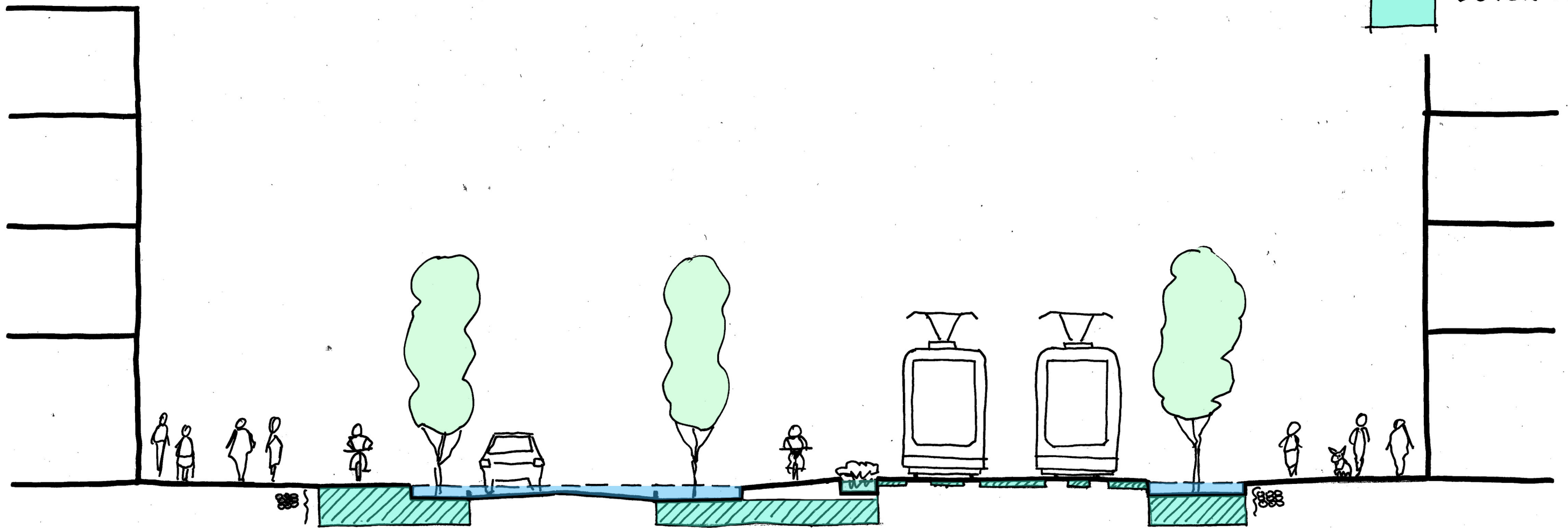
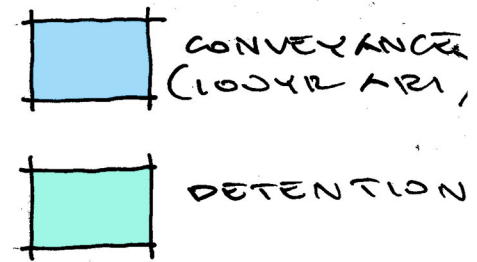
CLOUDBURST BOULEVARD  
 PLUMMER ST. CIVIC (36m)  
 FENNEL ST.



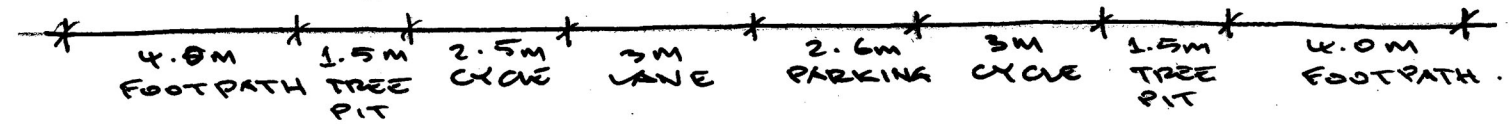
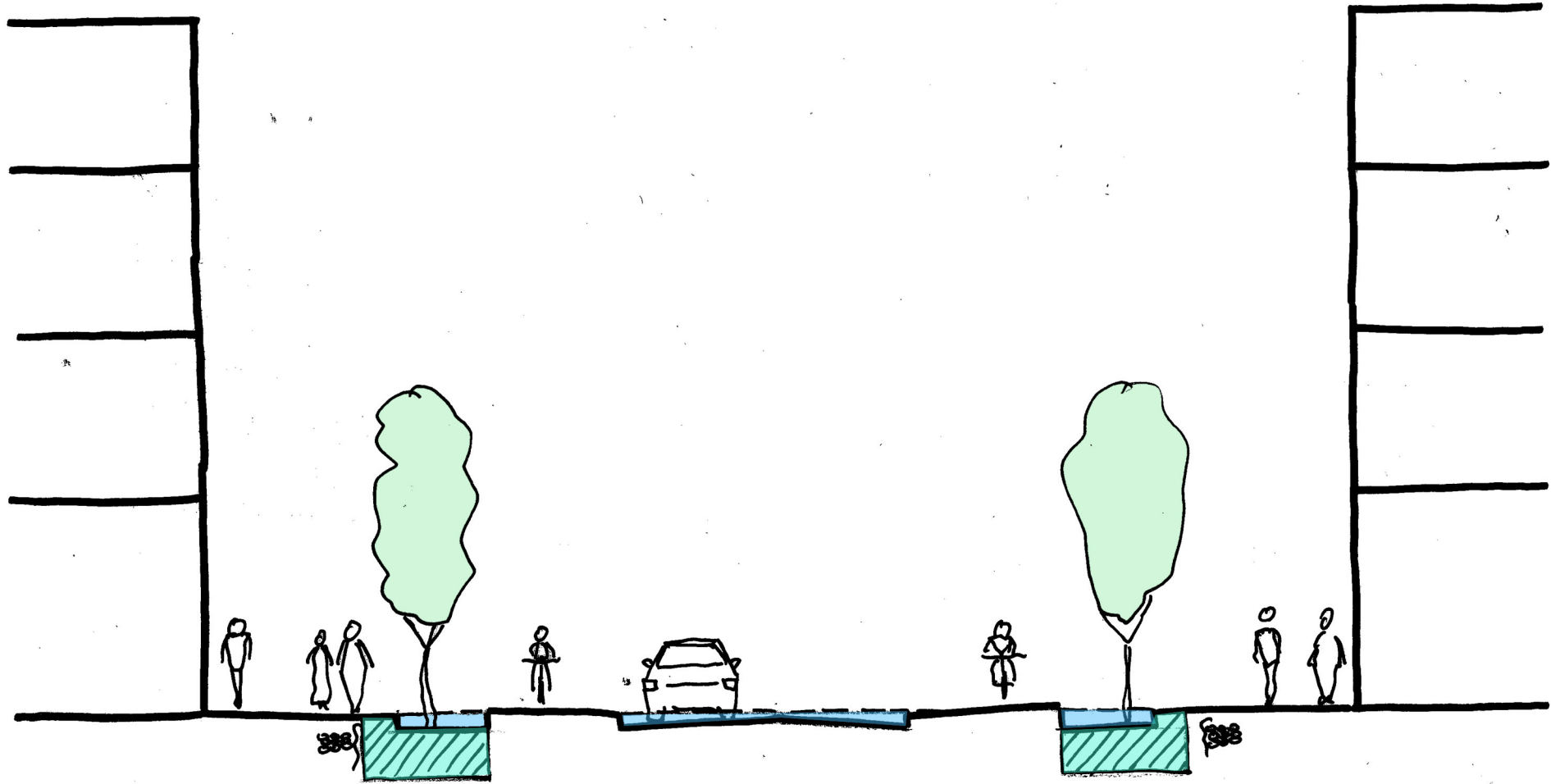
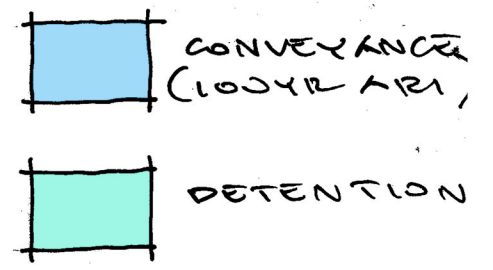
CLOUDBURST  
PLUMMER ST  
FENNEL ST.

BOULEVARD  
CIVIC (36m)

ADDITIONAL STORAGE  
OPTION.

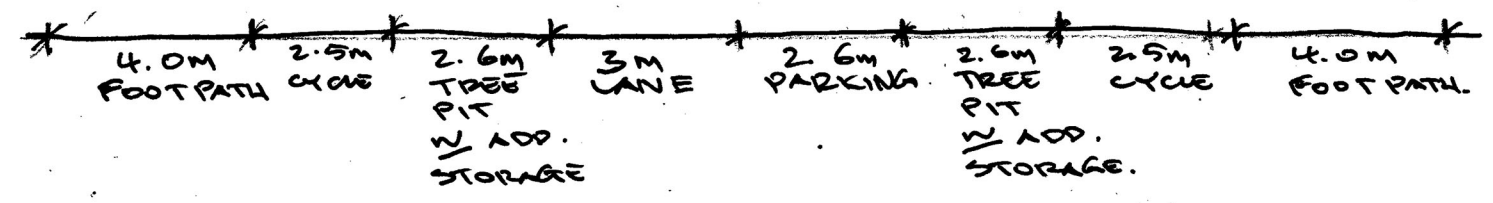
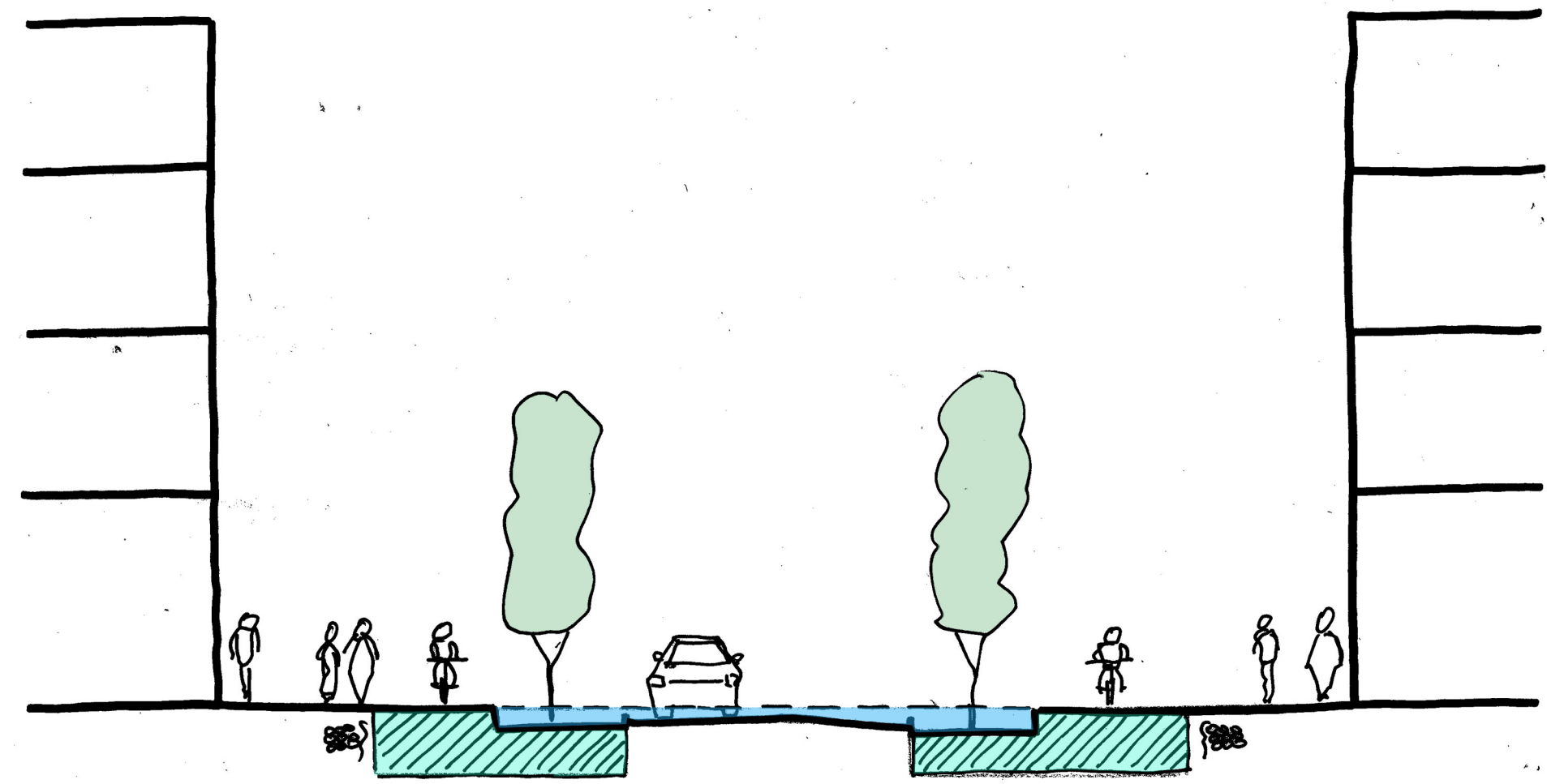
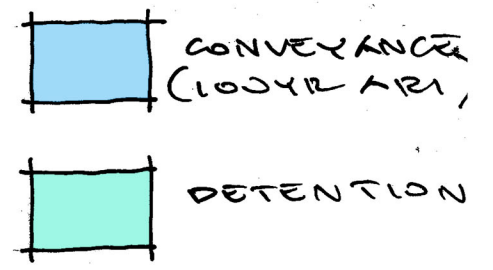


GREEN STREET  
NEW STREET (22m)

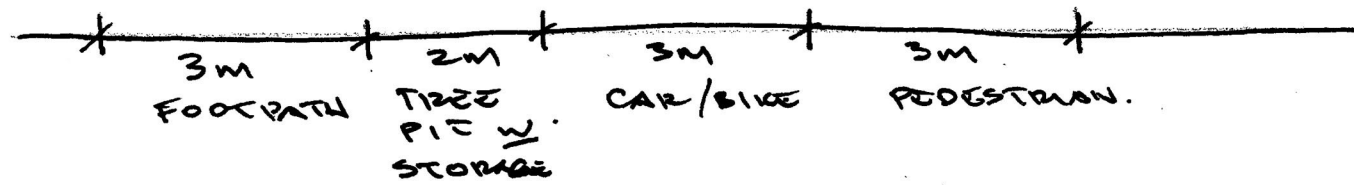
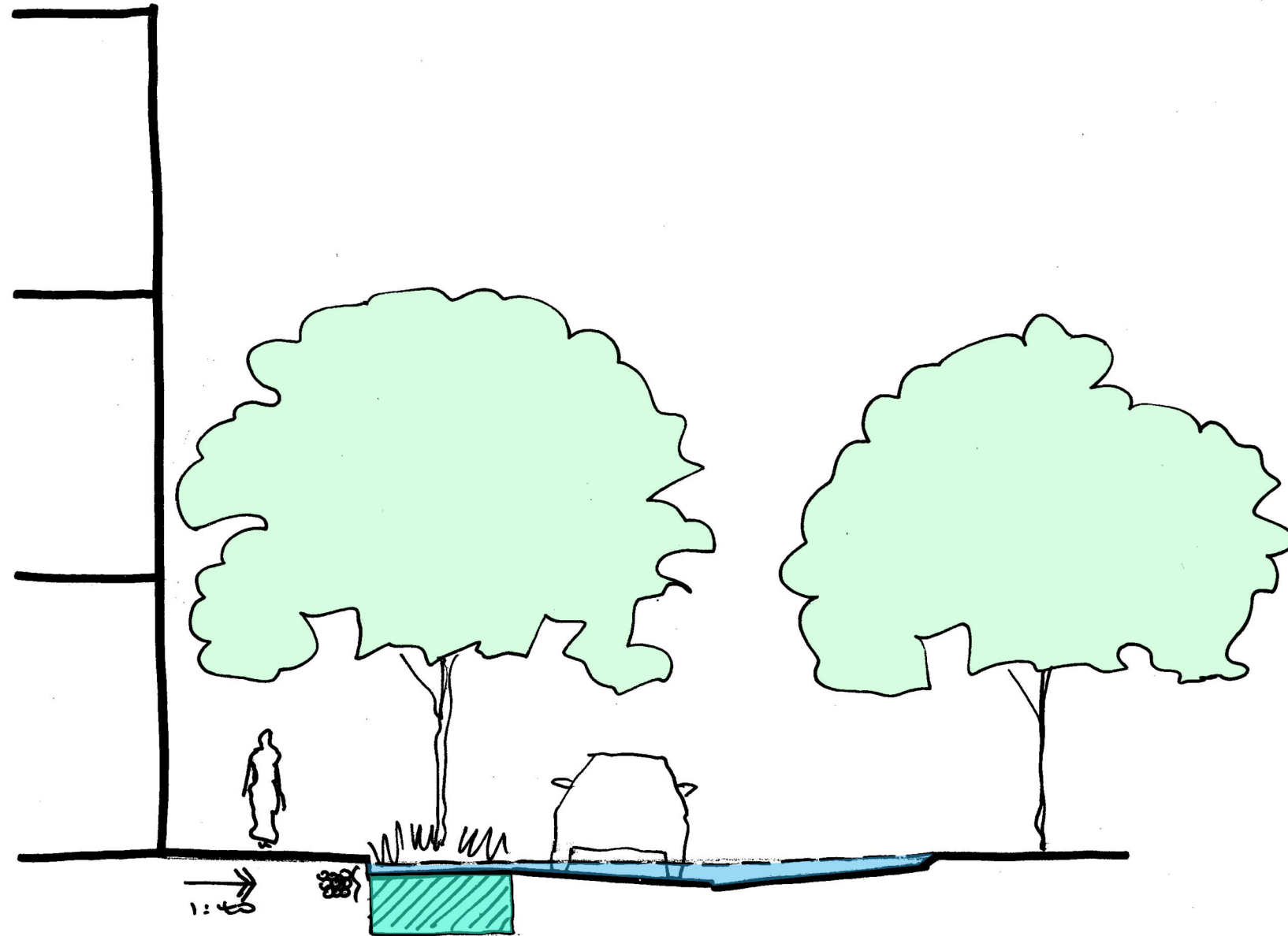
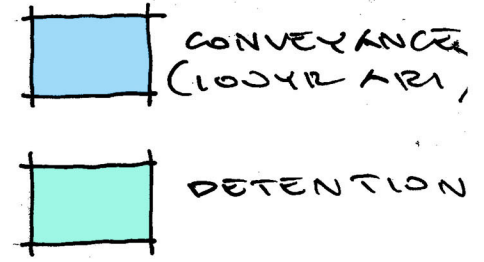


GREEN STREET  
NEW STREET (22M)

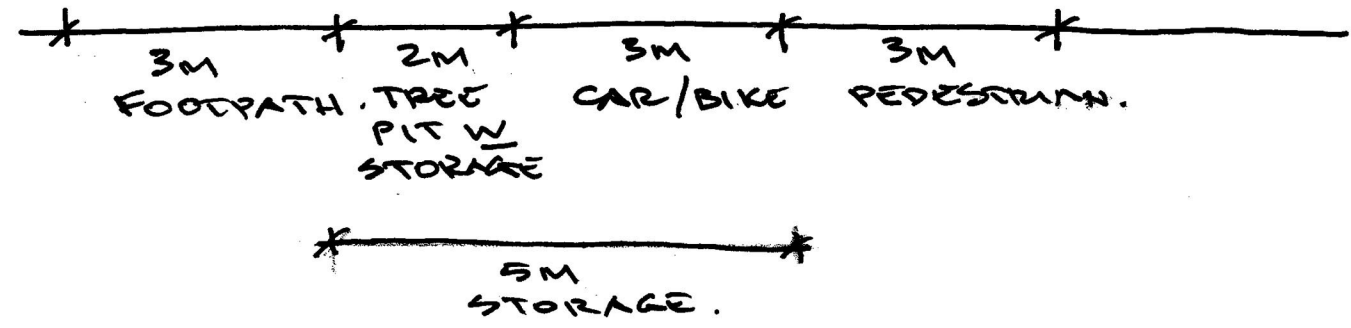
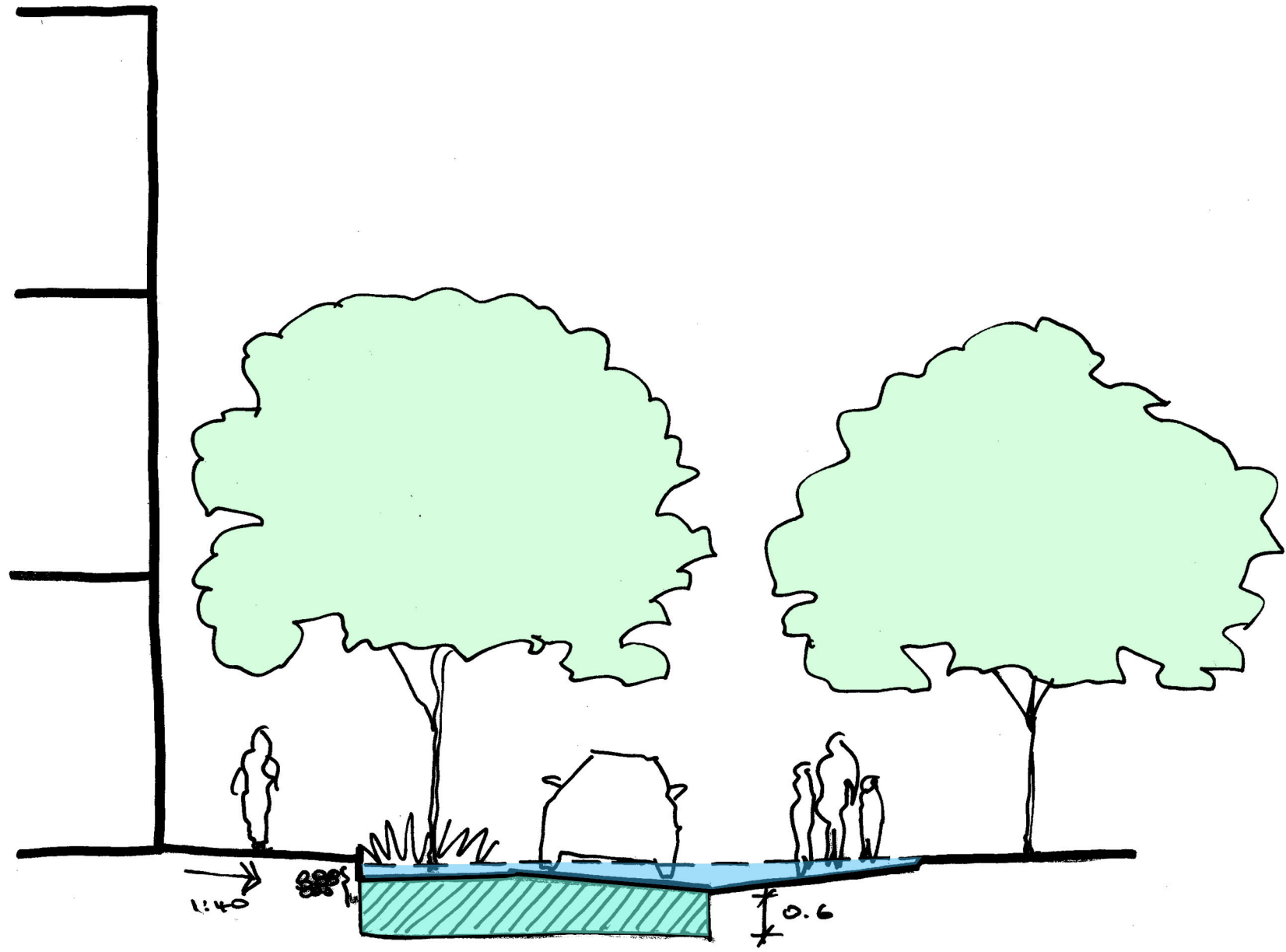
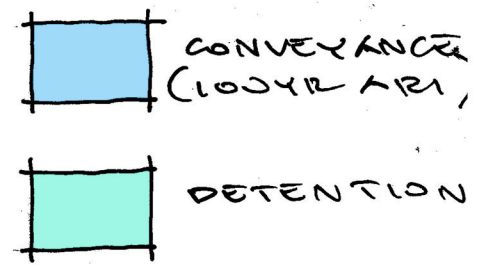
ADDITIONAL STORAGE OPTION.



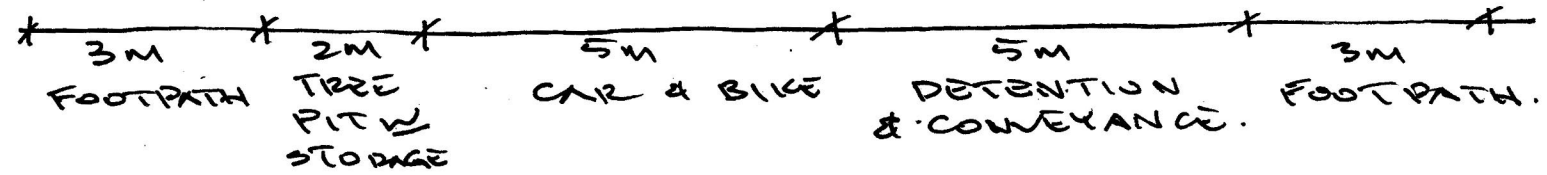
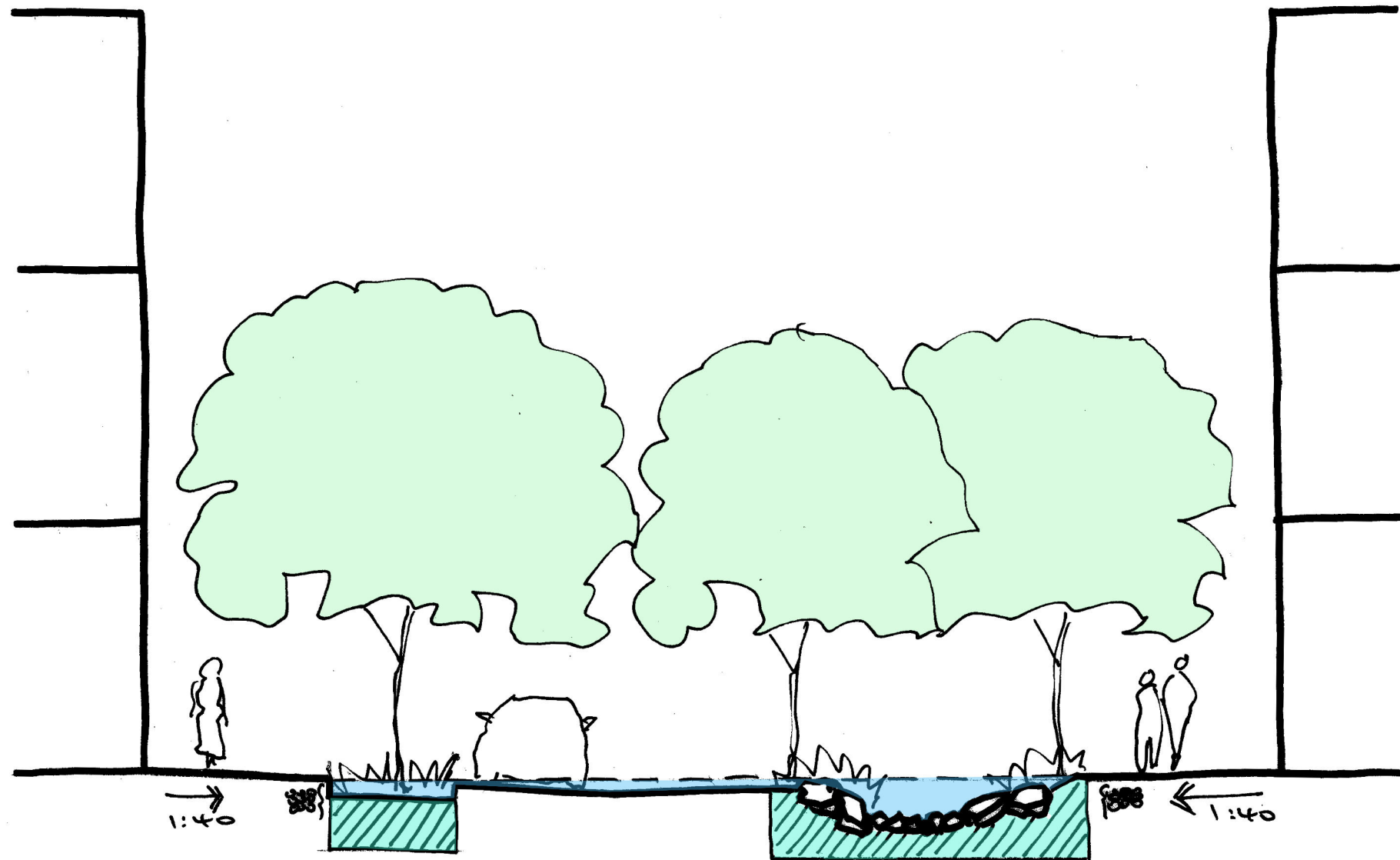
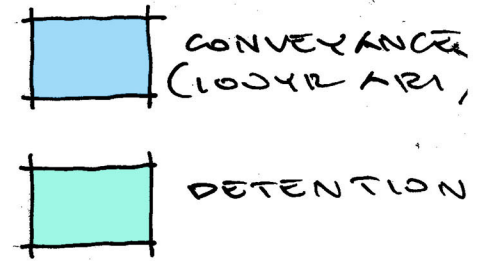
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TO OPEN SPACE.



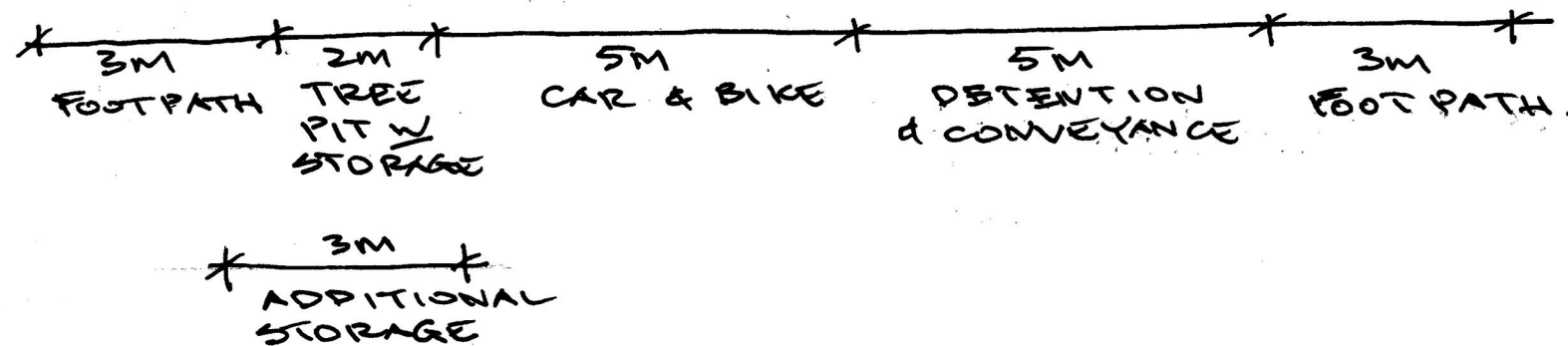
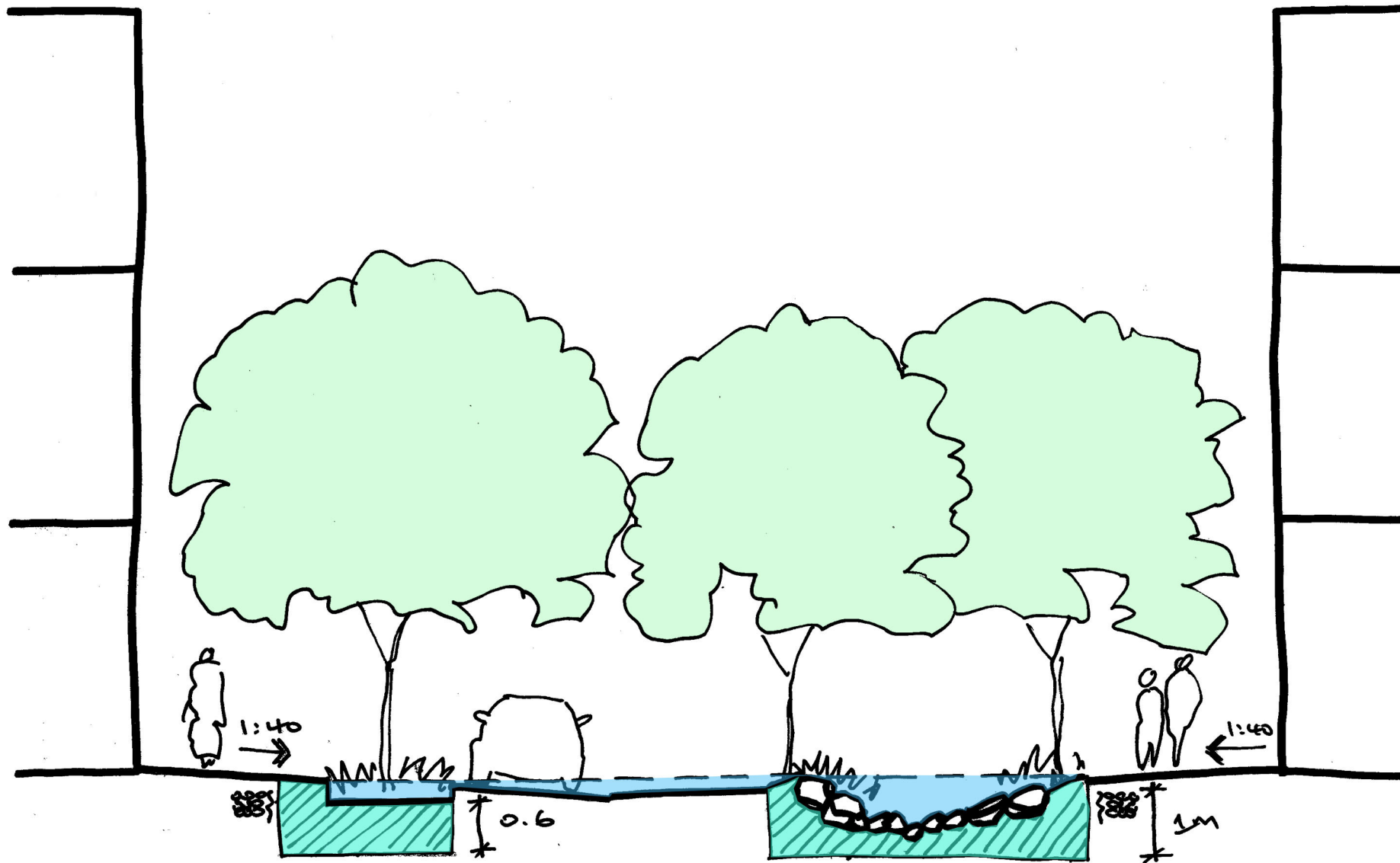
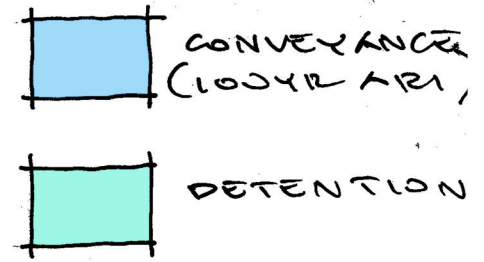
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 LOCAL STREET ADJACENT  
 TO OPEN SPACE.  
 ADDITIONAL STORAGE  
 OPTION.



SECTION B  
LOCAL STREET W  
LINEAR PARK.

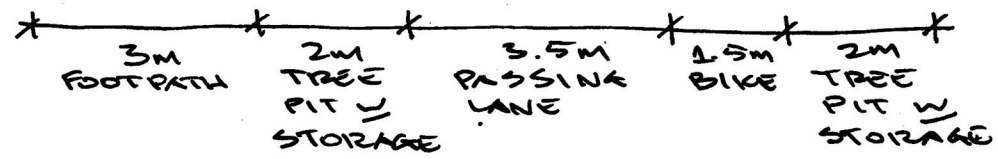
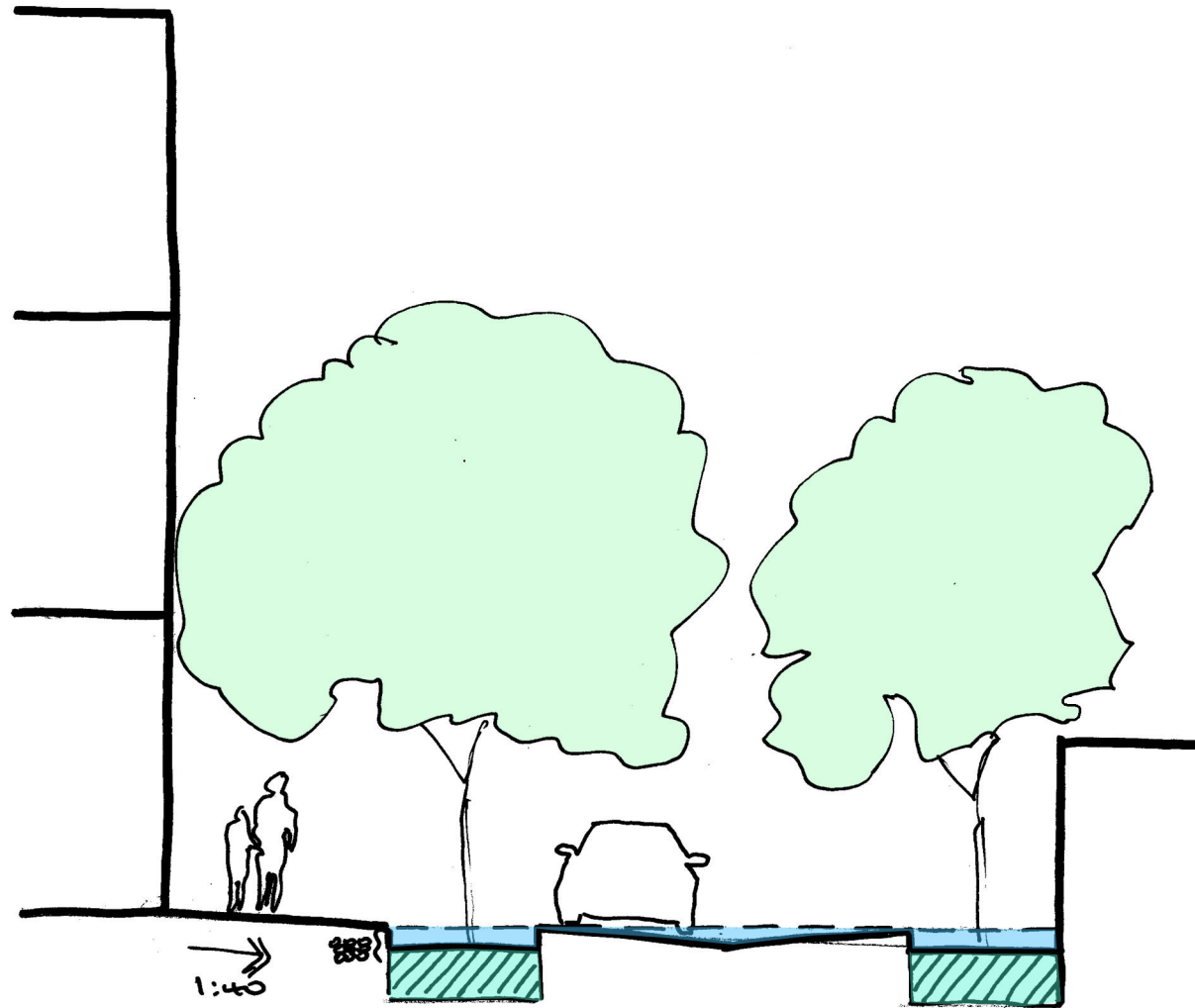
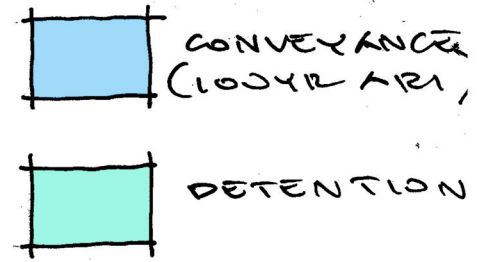


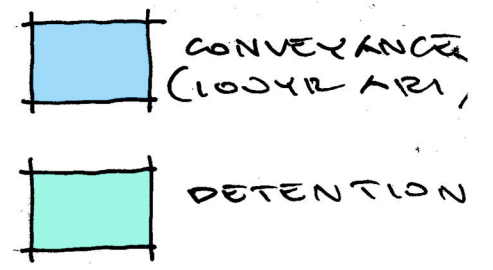
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 LOCAL STREET w/  
 LINEAR PARK.  
 ADDITIONAL  
 STORAGE  
 OPTION.



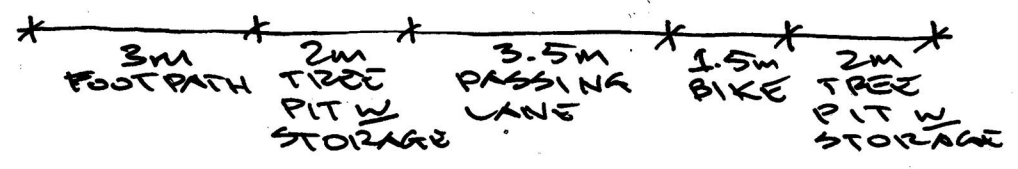
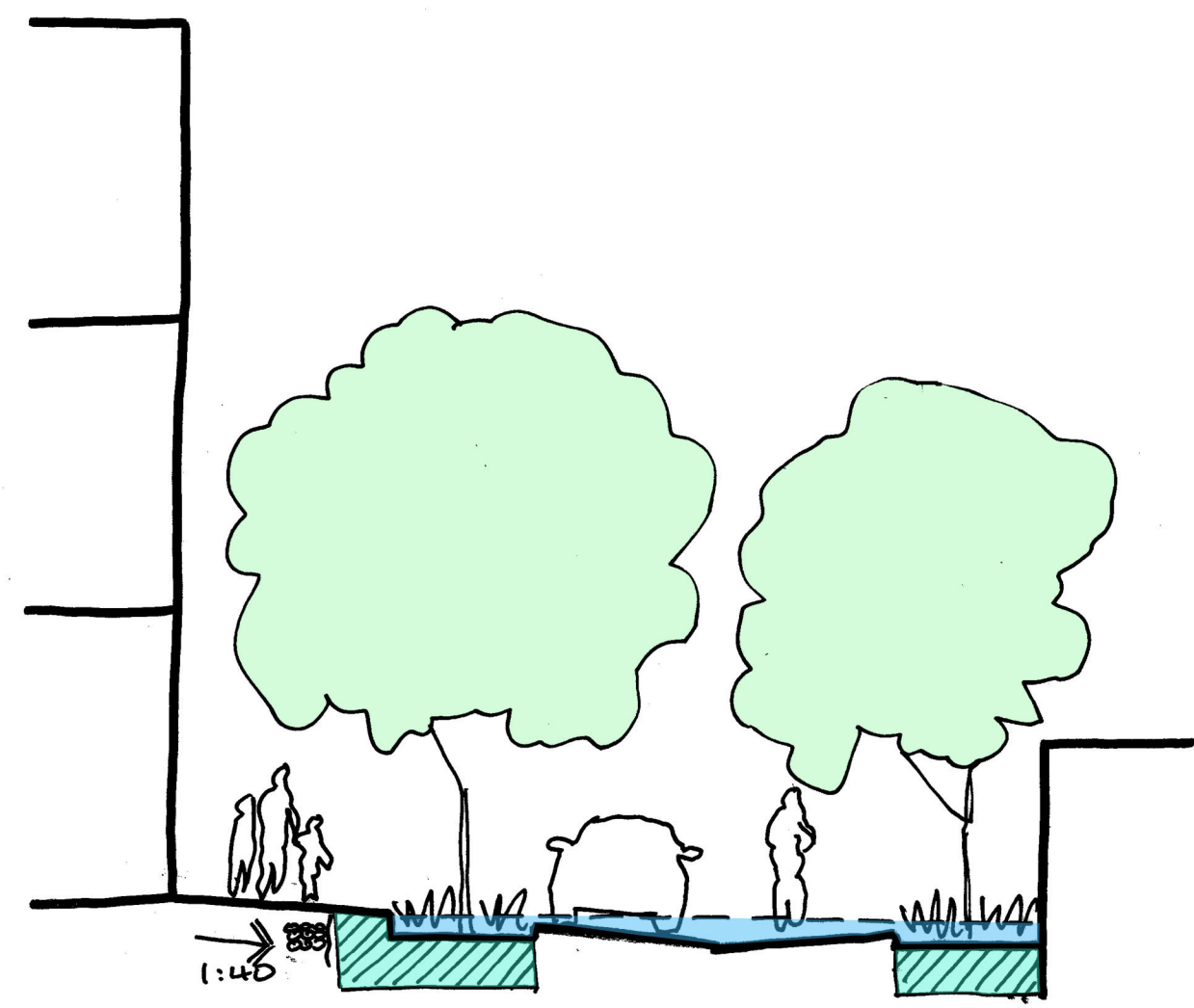


SECTION C  
LOCAL STREET  
ADJ. TO TRAM  
BRIDGE

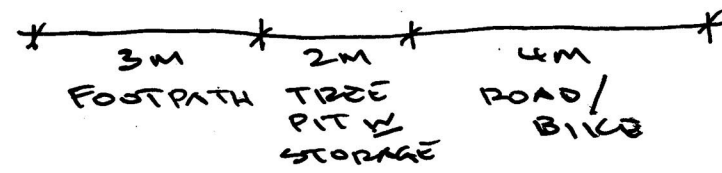
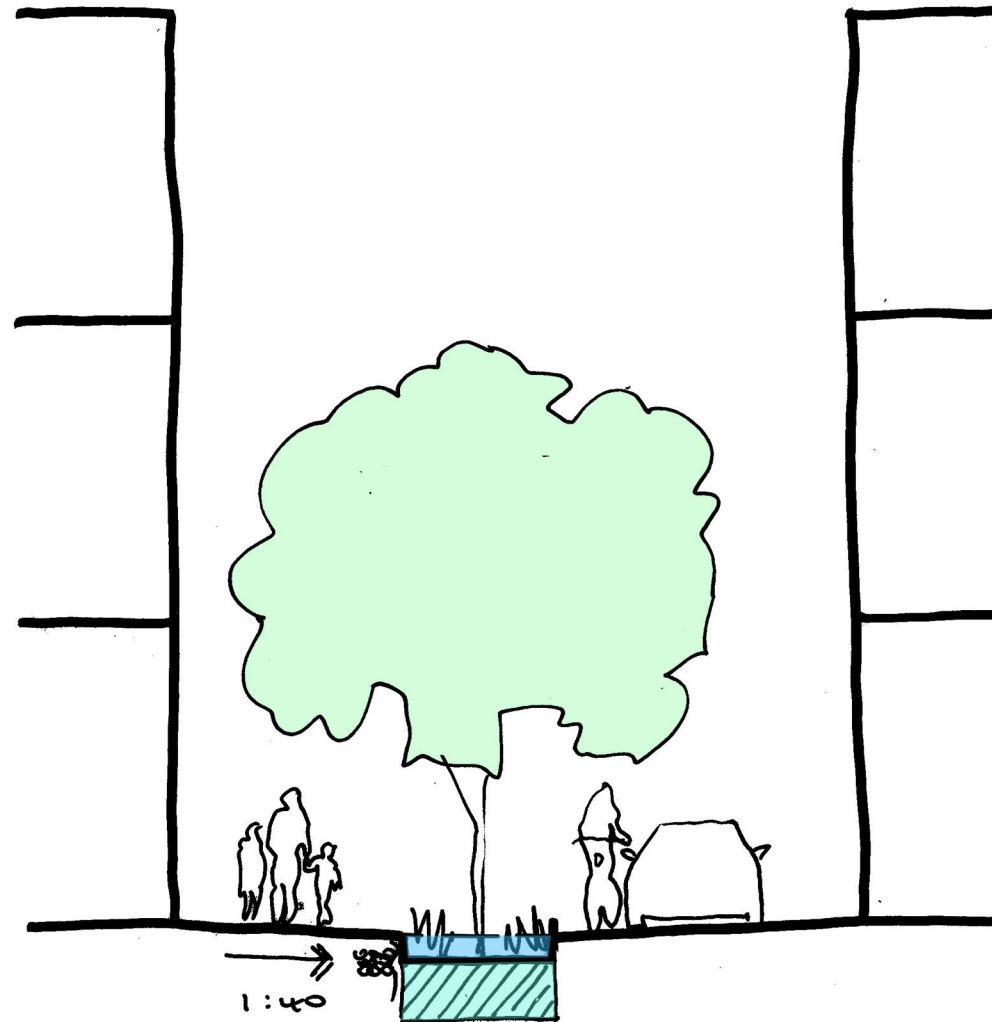
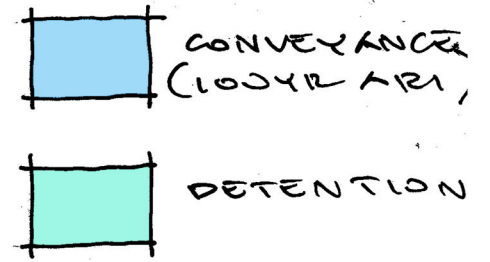


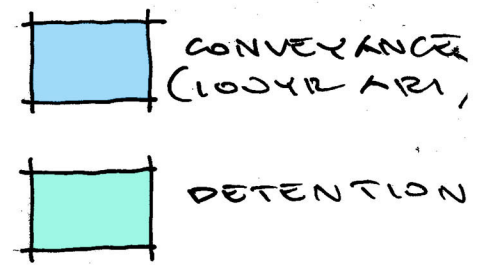


SECTION C  
LOCAL STREET  
ADJ. TO TRAM  
BRIDGE.  
ADDITIONAL  
STORAGE  
OPTION.

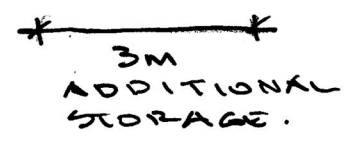
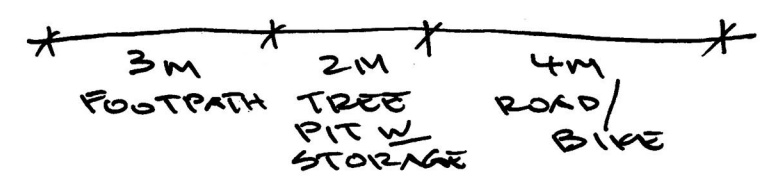
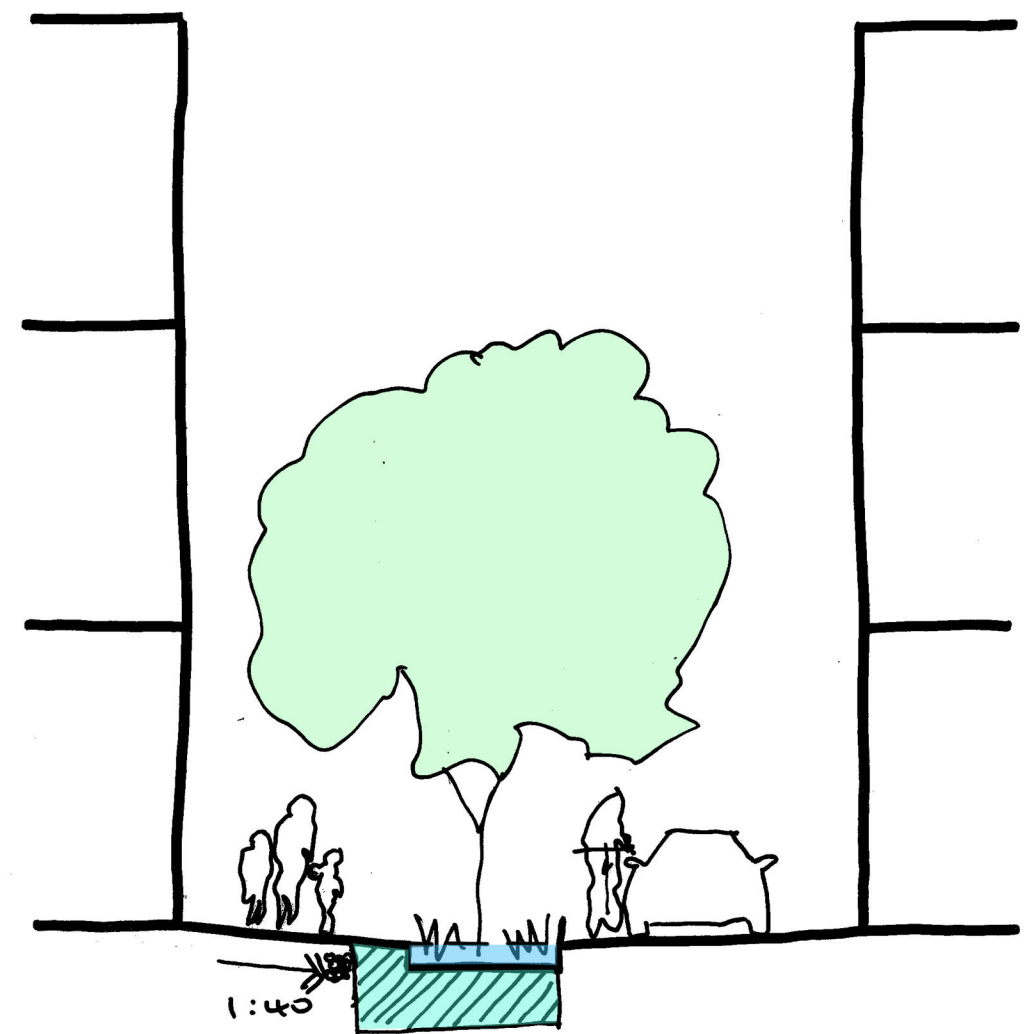


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ONEWAY  
LANEWAY

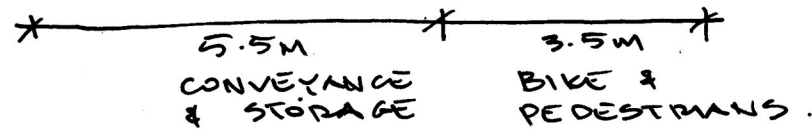
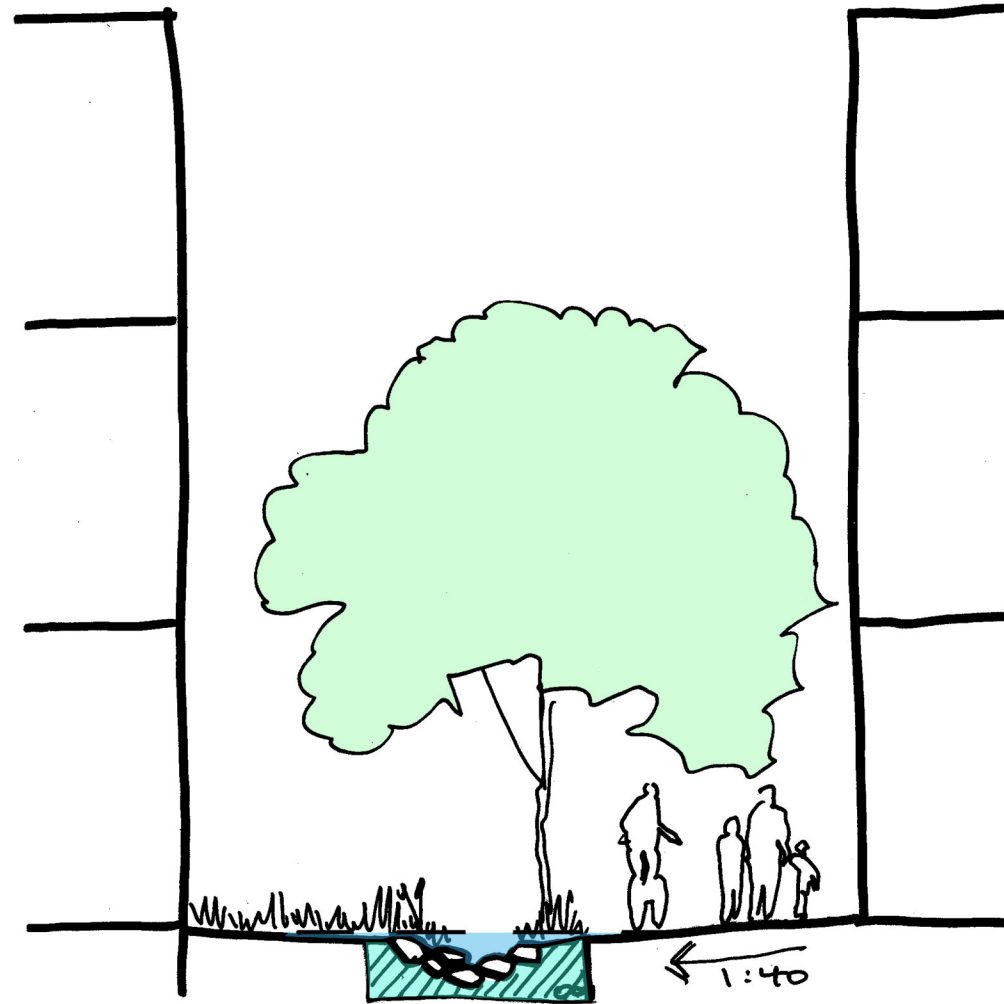
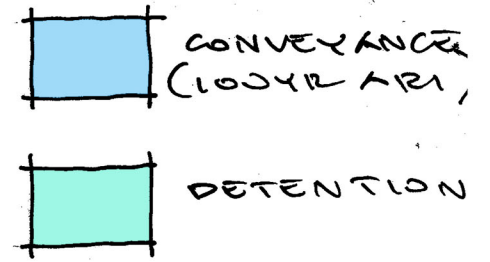


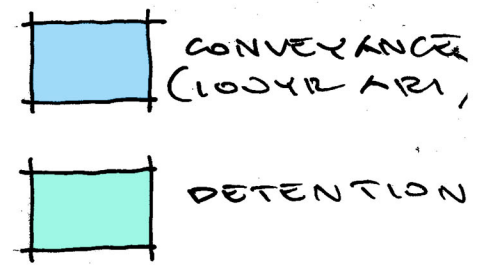


SECTION D.  
ONEWAY  
LANEWAY.  
ADDITIONAL  
STORAGE  
OPTION.

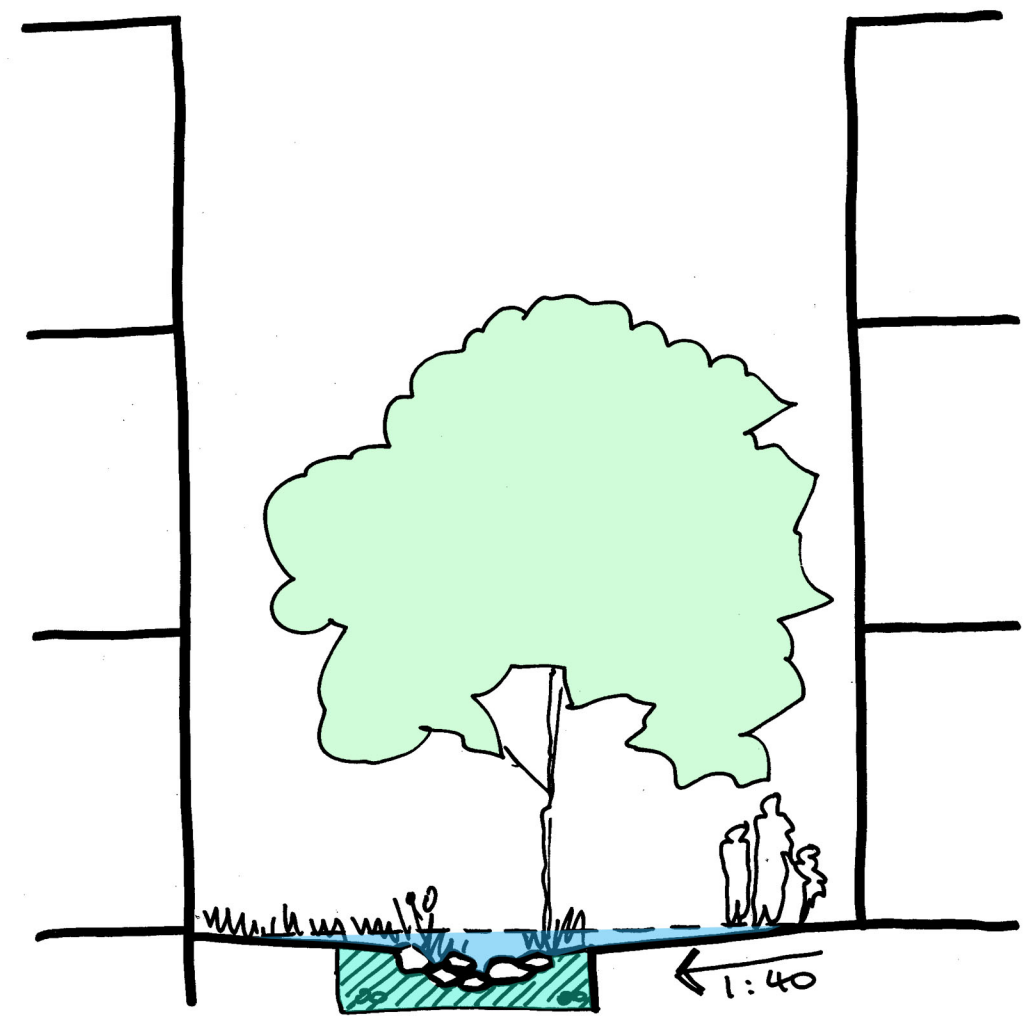


SECTION E  
PEDESTRIAN  
LANEWAY.

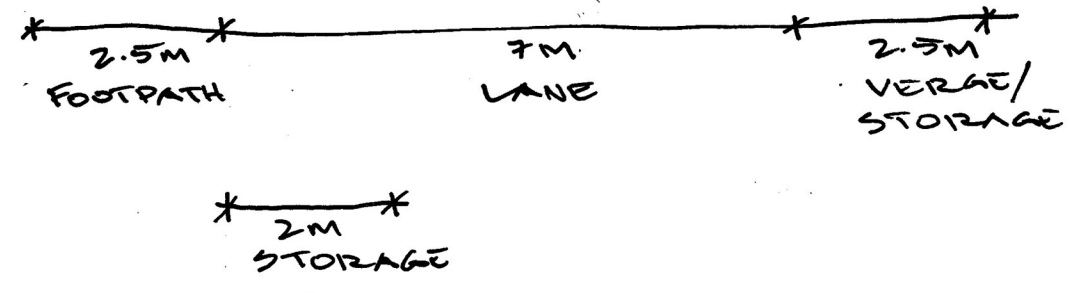
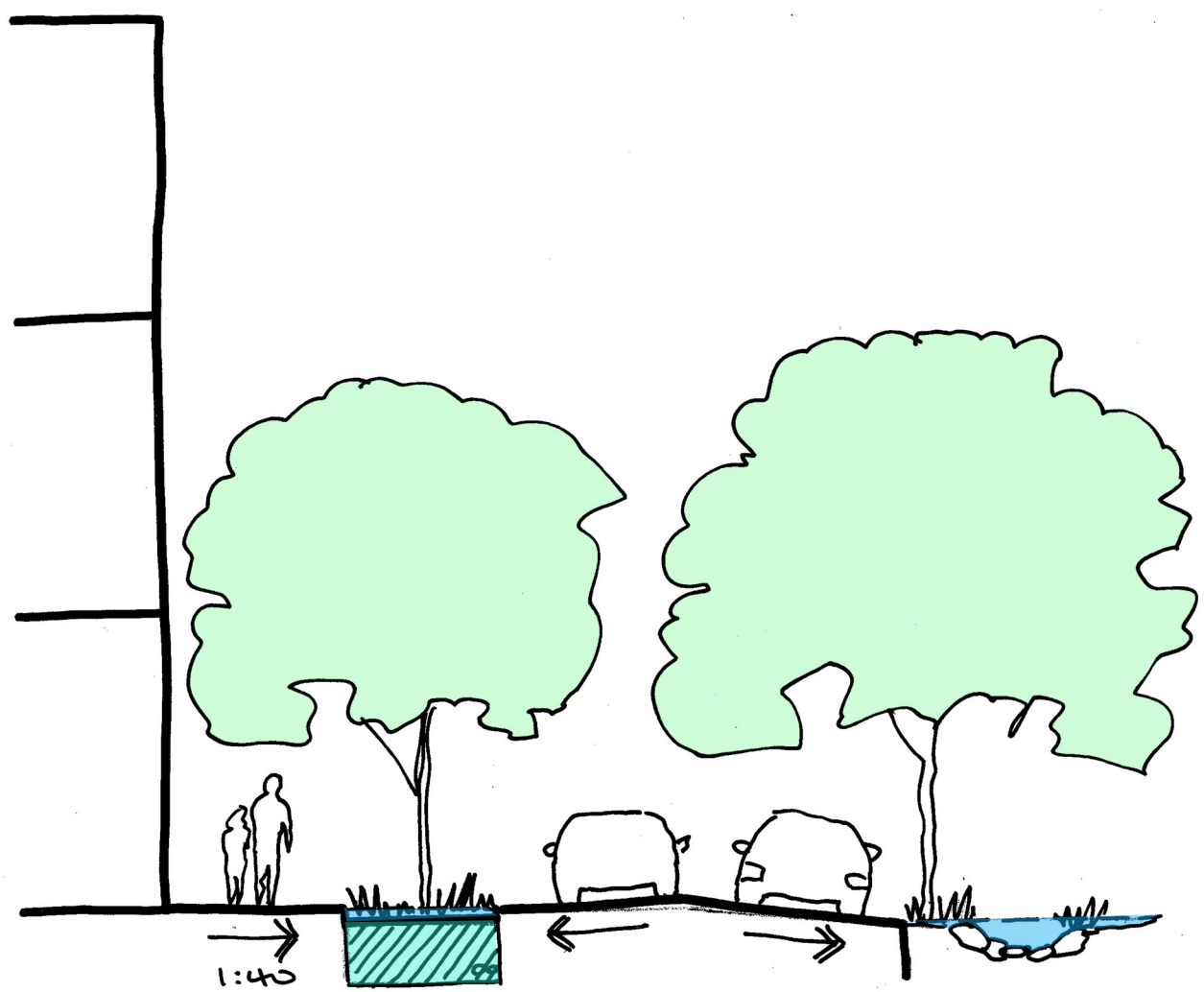
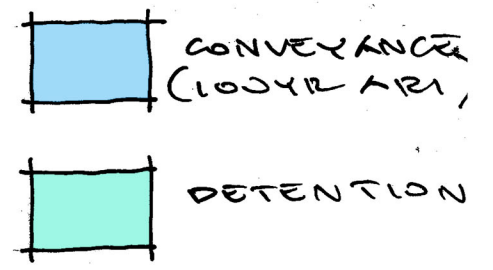




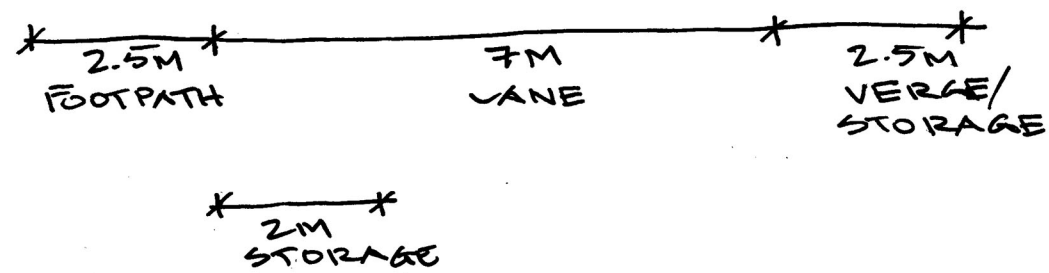
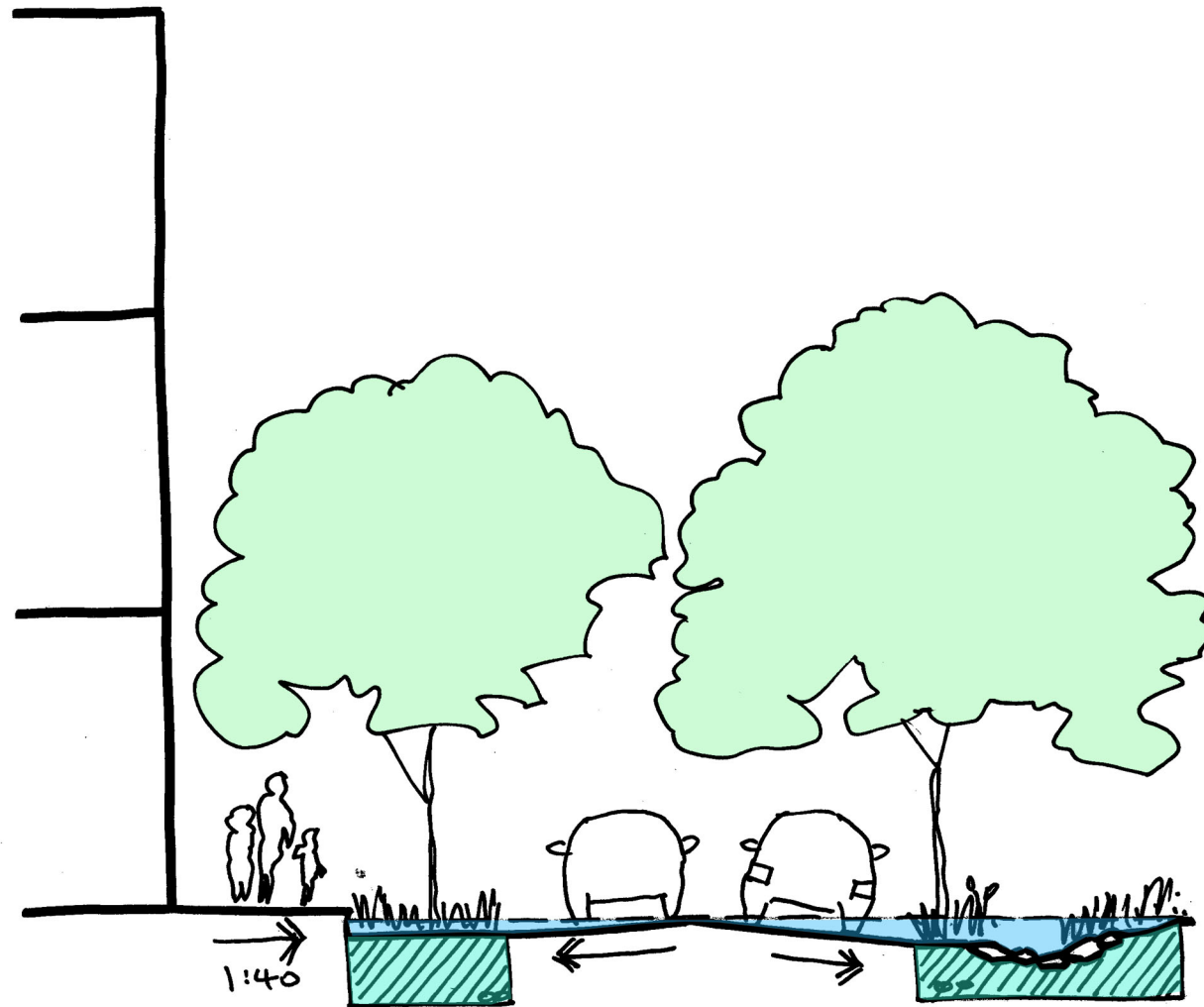
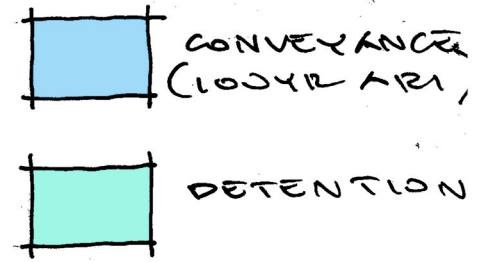
SECTION E  
PEDESTRIAN  
LANEWAY.  
ADDITIONAL  
STORAGE  
OPTION.



SECTION F  
SERVICE ROAD.

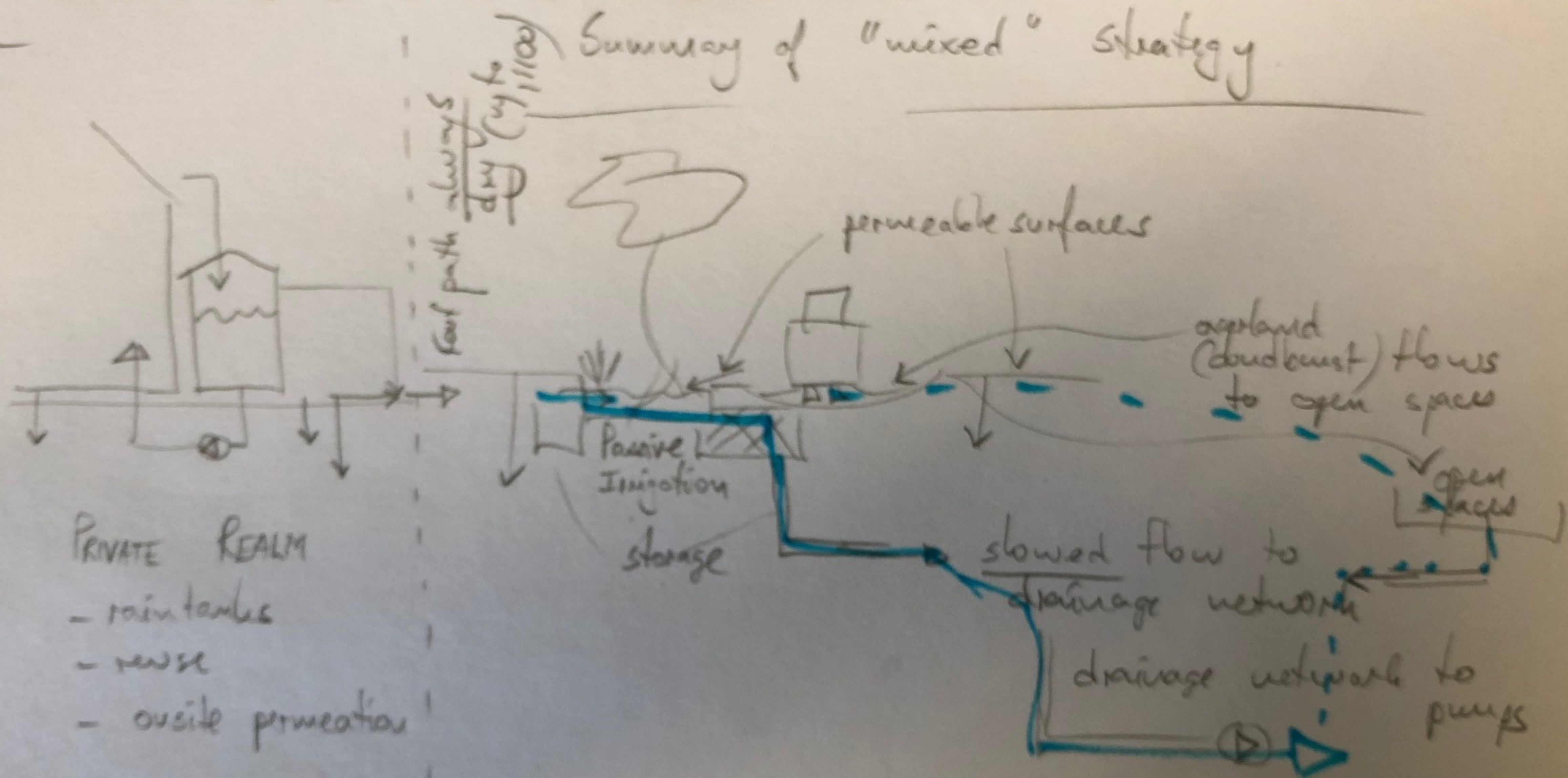


SECTION F  
SERVICE ROAD.  
ADDITIONAL  
STORAGE  
OPTION.





# Summary of "mixed" Strategy

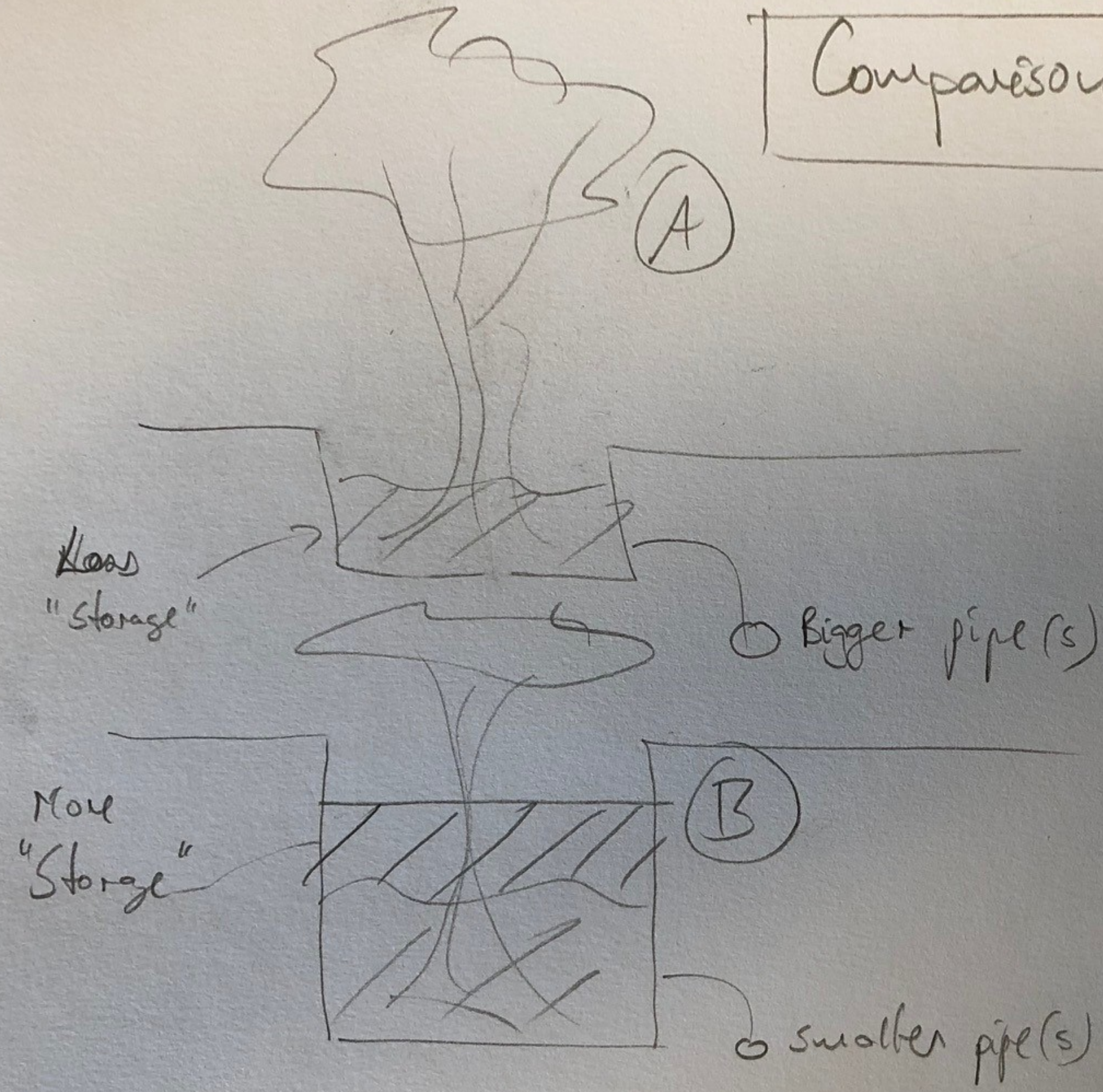


- PRIVATE REALM
- rain tanks
  - reuse
  - onsite permeation

————— < 20yr ARI

- - - - - < 100yr ARI

# Comparison



Item	Costs	
	A	B
Pipes/pumps	More	Less
Excavation	Less	More
Cleaning/Local Maintenance	Less	More (P)
Construction of start costs	Less	More
Benefits ?		

# Attachment 3

GHD cross-sections v2 for Steering Committee meeting on 24th Oct

**NOTES:**

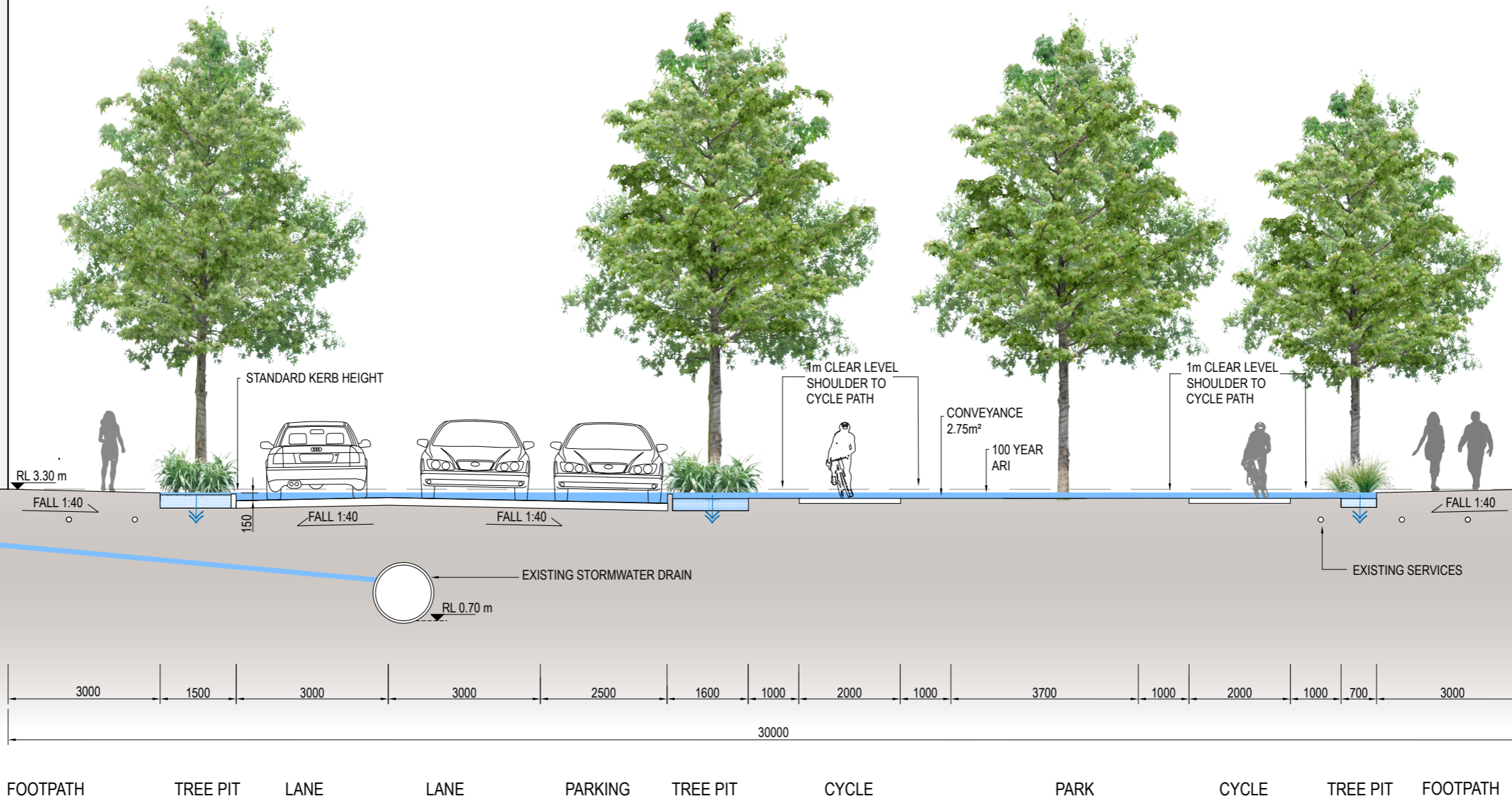
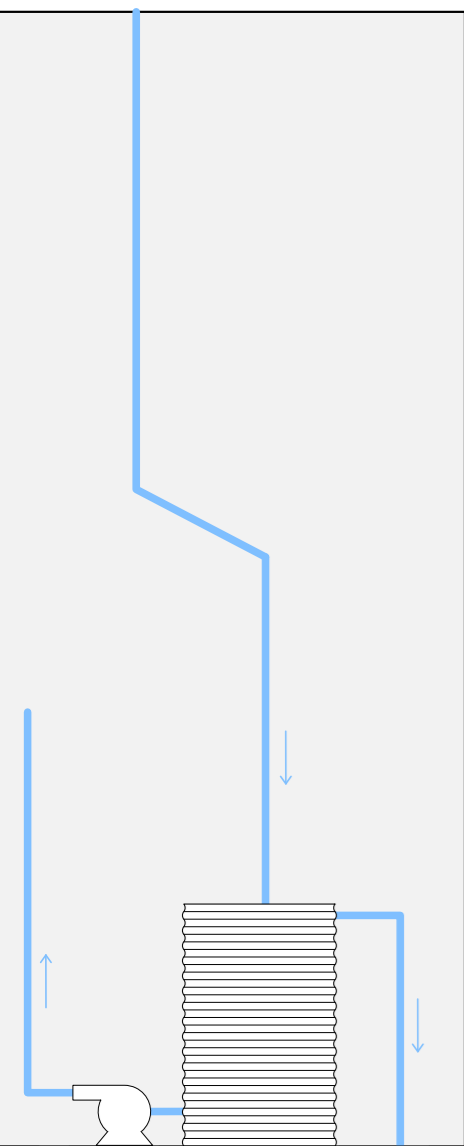
DETENTION CHARACTERISTICS ARE LIKELY TO VARY ALONG THE STREET DUE TO DIFFERENT CONSTRAINTS (I.E. AT INTERSECTIONS) AND THERE WILL BE A REQUIREMENT TO HAVE MORE DETENTION IN SOME AREAS TO OFFSET THE LOSS OF DETENTION IN OTHERS

IN SOME AREAS THERE WILL BE A TRADE-OFF BETWEEN CONVEYANCE AND DETENTION REQUIREMENTS ABOVE THE GROUND. IN OTHERS THERE WILL NOT BE A TRADE-OFF. THE TRADE-OFF IS SUBJECT TO THE ADOPTED FLOOD STRATEGY FOR EACH SECTION OF STREET. FOR EXAMPLE CERTAIN STREETS ( I.E. CLOUDBURST BLVDS) MAY STRATEGICALLY CONVEY MORE STORMWATER THAN OTHERS. WE HAVE ATTEMPTED TO MAXIMISE THE CONVEYANCE AREA IN THE STREETScape, HOWEVER WE NOTE THAT THIS COULD BE REDUCED TO ACCOMMODATE MORE DETENTION AT THE SURFACE, SUBJECT TO THE ROLE THE PARTICULAR SECTION OF STREET PLAYS IN CONVEYING FLOOD WATERS.

THE CYCLE PATH WITHIN THE LINEAR PARK WAS ORIGINALLY SPLIT TO PROVIDE A HIGHER LEVEL OF FLOOD PROTECTION (I.E. ABOVE THE 100 YR ARI). WE NOW UNDERSTAND THIS IS NOT REQUIRED. AS A RESULT THE CYCLE PATH CAN BE CONSOLIDATED BACK TO ONE BIDIRECTIONAL CYCLE PATH WITHOUT IMPACTING THE CONVEYANCE OR DETENTION AREA REQUIREMENTS.

CONVEYANCE - 2.75 m<sup>2</sup>

SURFACE DETENTION - 0.85 m<sup>2</sup>



**OPTION 1 - STANDARD DRAINAGE**



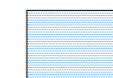
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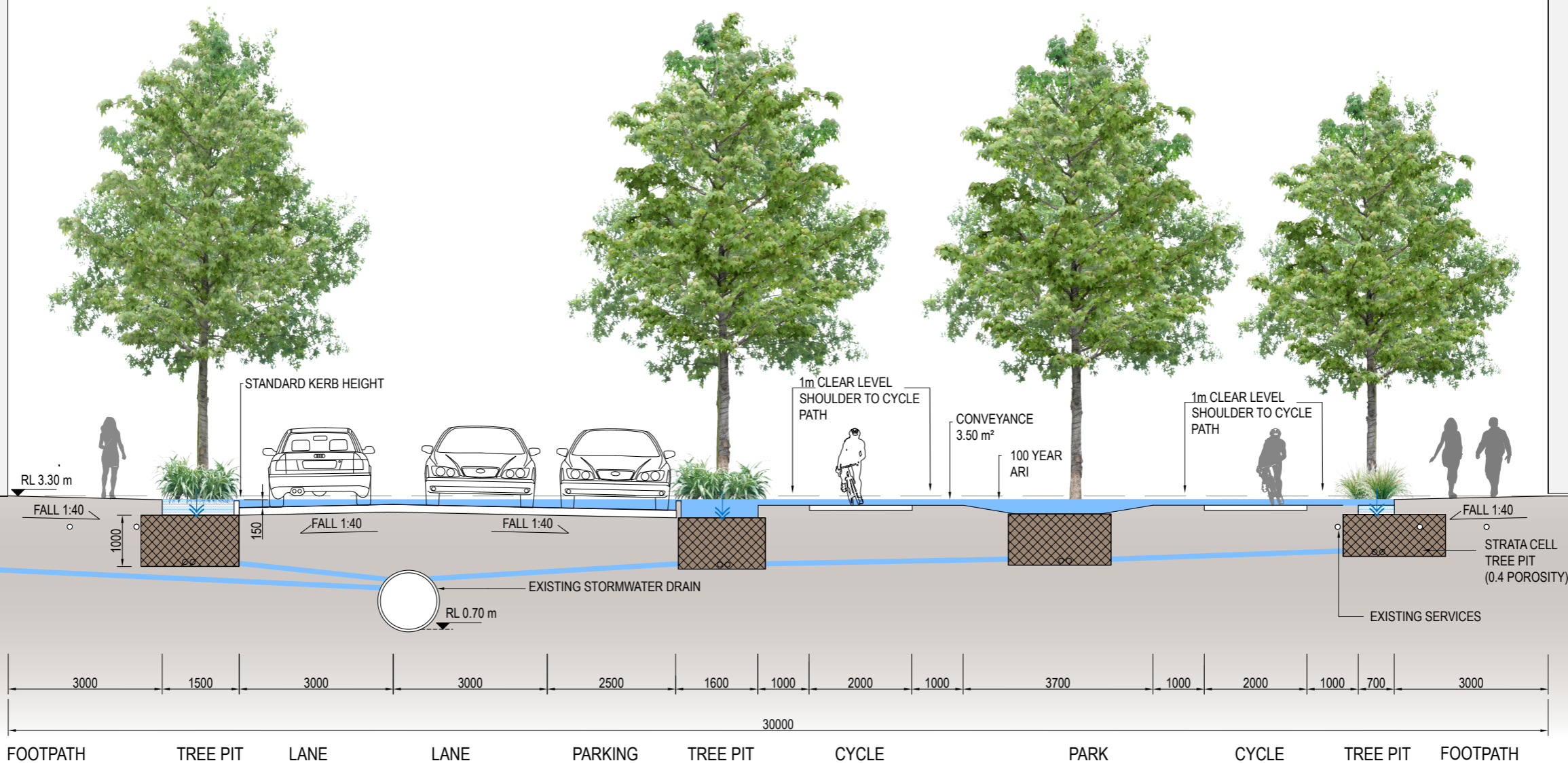
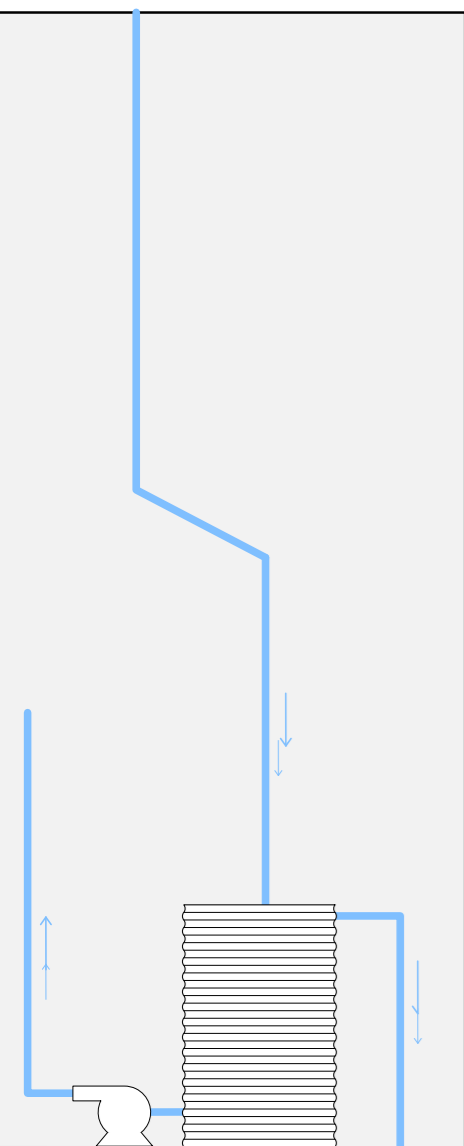
**NOTES:**

DETENTION CHARACTERISTICS ARE LIKELY TO VARY ALONG THE STREET DUE TO DIFFERENT CONSTRAINTS (I.E. AT INTERSECTIONS) AND THERE WILL BE A REQUIREMENT TO HAVE MORE DETENTION IN SOME AREAS TO OFFSET THE LOSS OF DETENTION IN OTHERS

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-  CONVEYANCE - 3.50 m<sup>2</sup>
-  EFFECTIVE UNDERGROUND DETENTION - 2.94 m<sup>2</sup> (ASSUMING 40% POROSITY FOR BELOW GROUND DETENTION)
-  SURFACE DETENTION - 0.54 m<sup>2</sup>



**OPTION 2 - STANDARD TREE PIT CELLS FOR DETENTION**

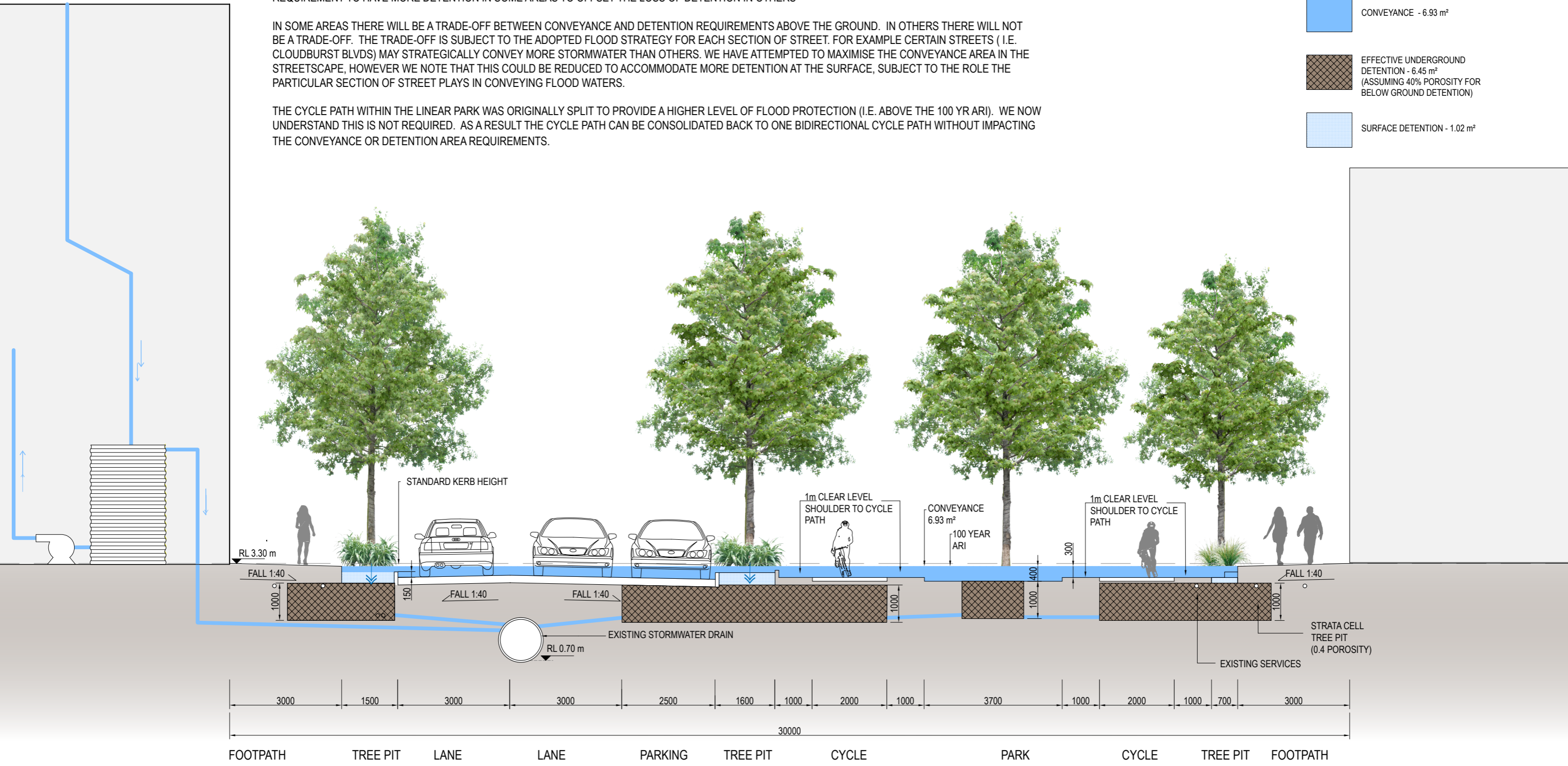
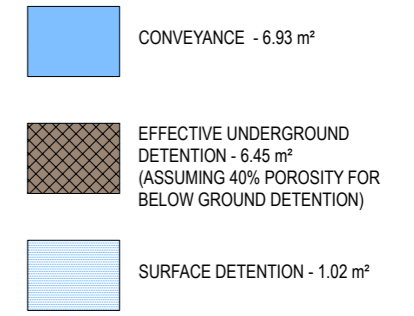
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**NOTES:**

DETENTION CHARACTERISTICS ARE LIKELY TO VARY ALONG THE STREET DUE TO DIFFERENT CONSTRAINTS (I.E. AT INTERSECTIONS) AND THERE WILL BE A REQUIREMENT TO HAVE MORE DETENTION IN SOME AREAS TO OFFSET THE LOSS OF DETENTION IN OTHERS

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**OPTION 3A - INCREASED CONVEYANCE AND DETENTION**






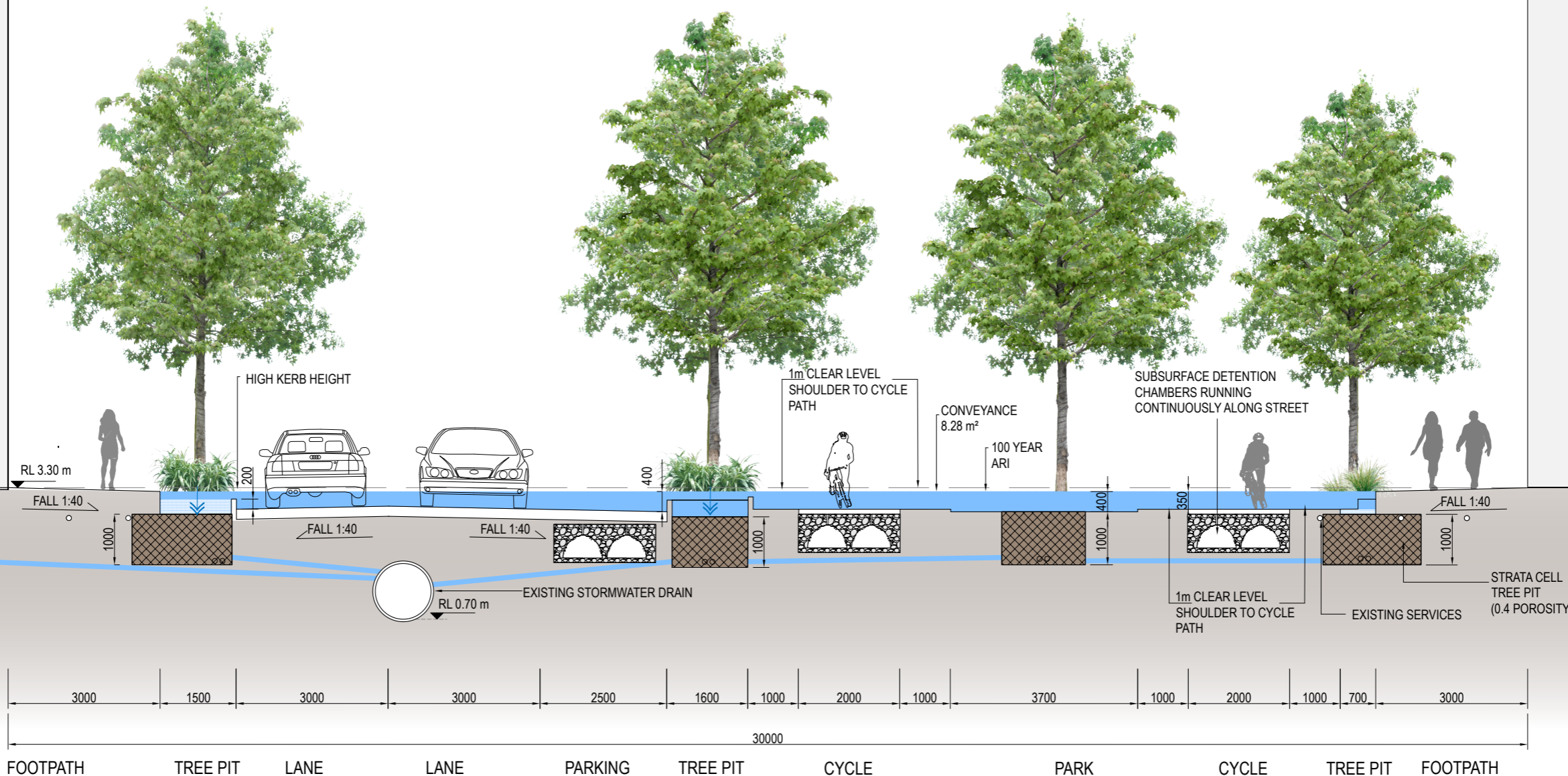
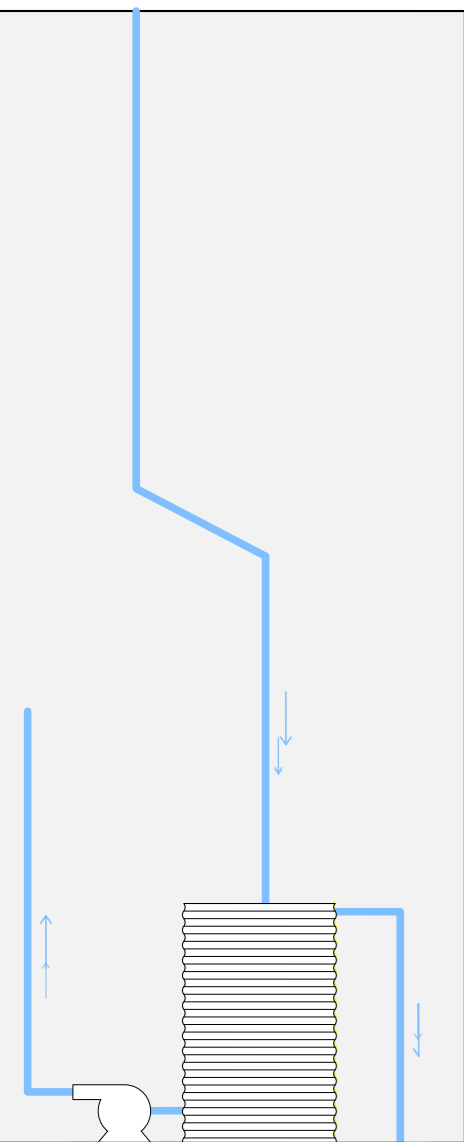
**NOTES:**

DETENTION CHARACTERISTICS ARE LIKELY TO VARY ALONG THE STREET DUE TO DIFFERENT CONSTRAINTS (I.E. AT INTERSECTIONS) AND THERE WILL BE A REQUIREMENT TO HAVE MORE DETENTION IN SOME AREAS TO OFFSET THE LOSS OF DETENTION IN OTHERS

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THE CYCLE PATH WITHIN THE LINEAR PARK WAS ORIGINALLY SPLIT TO PROVIDE A HIGHER LEVEL OF FLOOD PROTECTION (I.E. ABOVE THE 100 YR ARI). WE NOW UNDERSTAND THIS IS NOT REQUIRED. AS A RESULT THE CYCLE PATH CAN BE CONSOLIDATED BACK TO ONE BIDIRECTIONAL CYCLE PATH WITHOUT IMPACTING THE CONVEYANCE OR DETENTION AREA REQUIREMENTS.

-  CONVEYANCE - 8.28 m<sup>2</sup>
-  EFFECTIVE UNDERGROUND DETENTION - 5.59 m<sup>2</sup>  
(ASSUMING 40% POROSITY FOR BELOW GROUND DETENTION)
-  SURFACE DETENTION - 0.49 m<sup>2</sup>




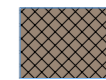
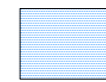
**OPTION 3B - MAXIMISING CONVEYANCE AND DETENTION**

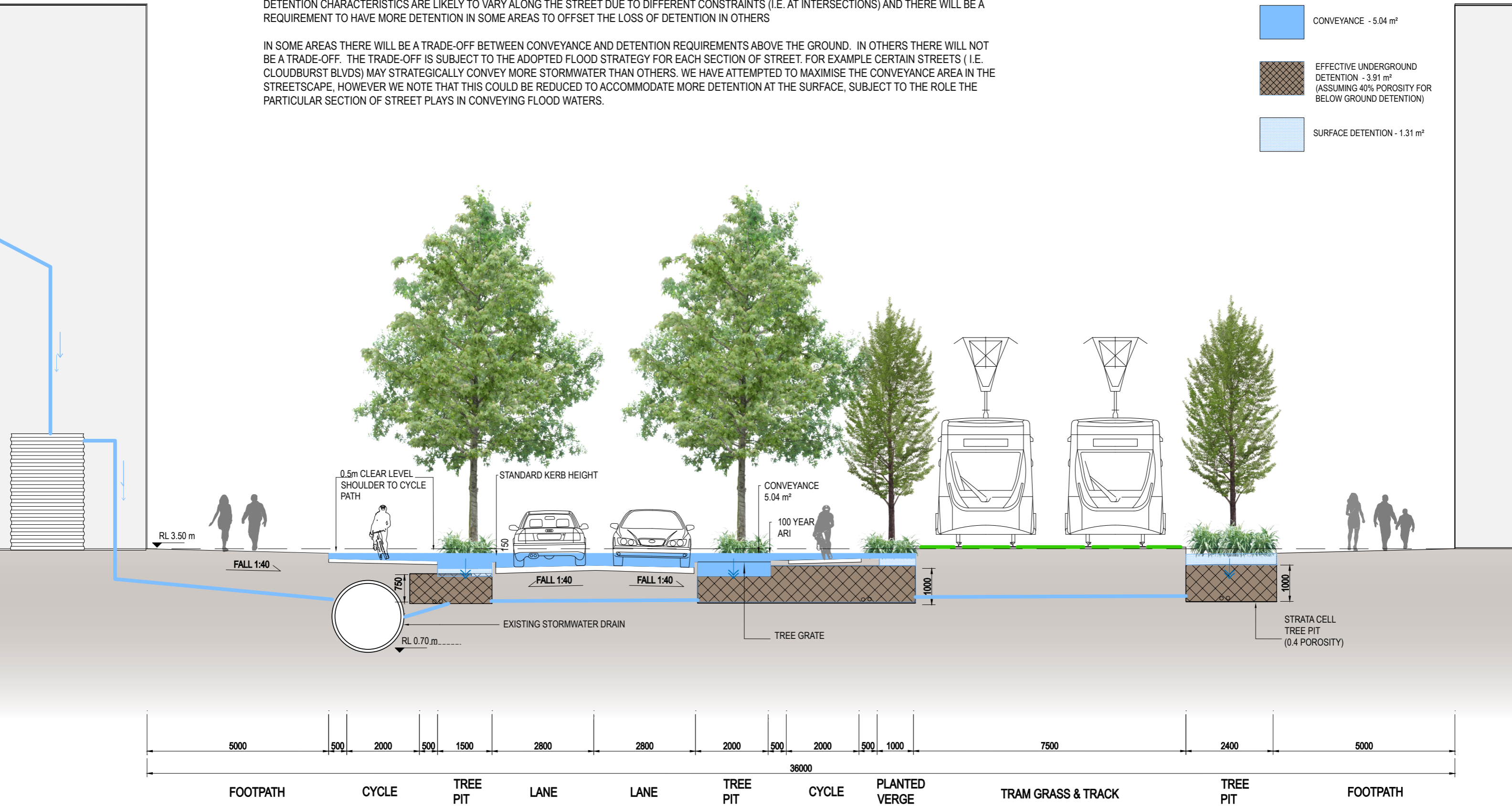
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**NOTES:**

DETENTION CHARACTERISTICS ARE LIKELY TO VARY ALONG THE STREET DUE TO DIFFERENT CONSTRAINTS (I.E. AT INTERSECTIONS) AND THERE WILL BE A REQUIREMENT TO HAVE MORE DETENTION IN SOME AREAS TO OFFSET THE LOSS OF DETENTION IN OTHERS

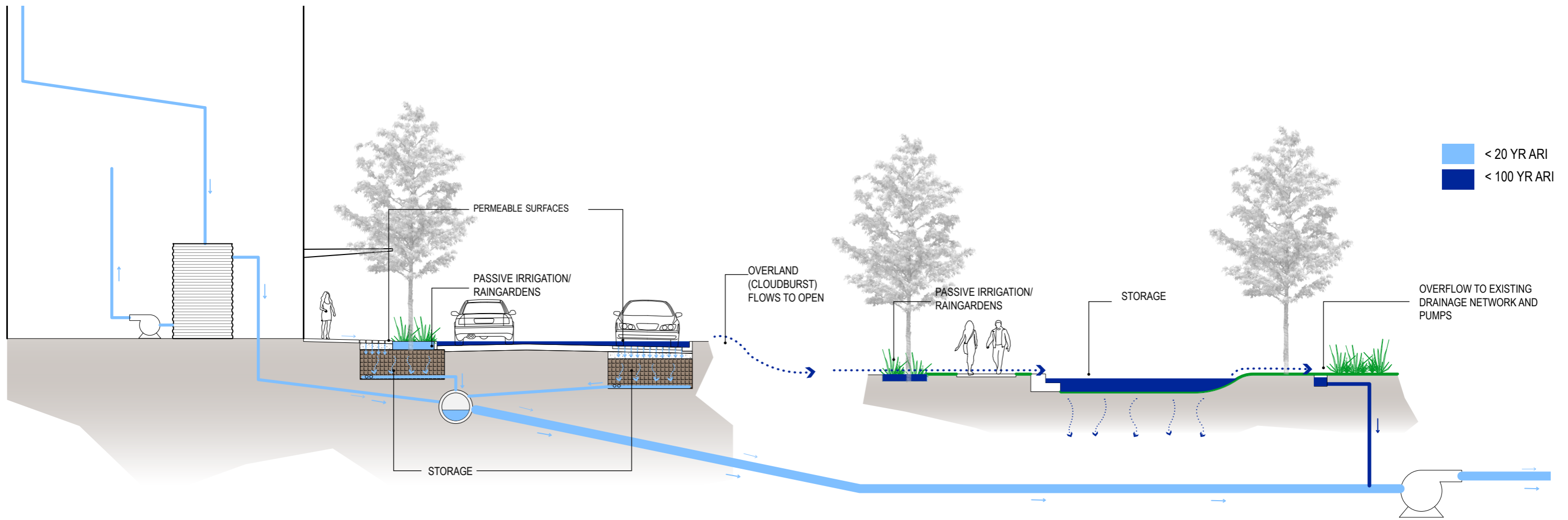
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-  CONVEYANCE - 5.04 m<sup>2</sup>
-  EFFECTIVE UNDERGROUND DETENTION - 3.91 m<sup>2</sup>  
(ASSUMING 40% POROSITY FOR BELOW GROUND DETENTION)
-  SURFACE DETENTION - 1.31 m<sup>2</sup>



SCALE 1:100 @A3 





■ < 20 YR ARI  
■ < 100 YR ARI

**PRIVATE REALM**

- RAIN TANKS
- REUSE
- ONSITE PERMEATION

**PUBLIC STREET**

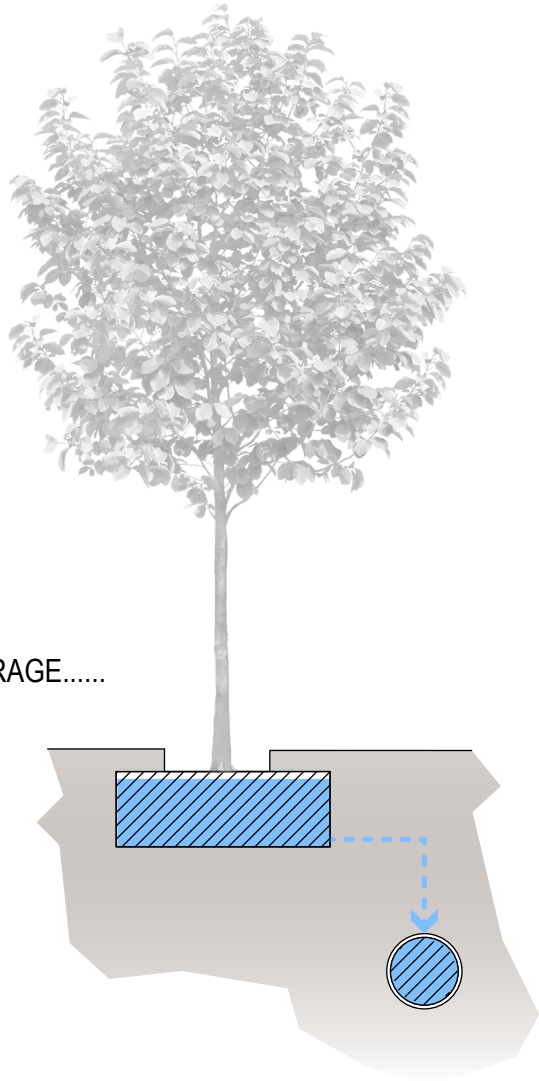
- PERMEABLE PAVING
- RAINGARDENS
- PASSIVE IRRIGATION
- STORAGE

**PUBLIC OPEN SPACE**

- STORAGE
- PERMEABLE PAVING
- RAINGARDENS
- PASSIVE IRRIGATION

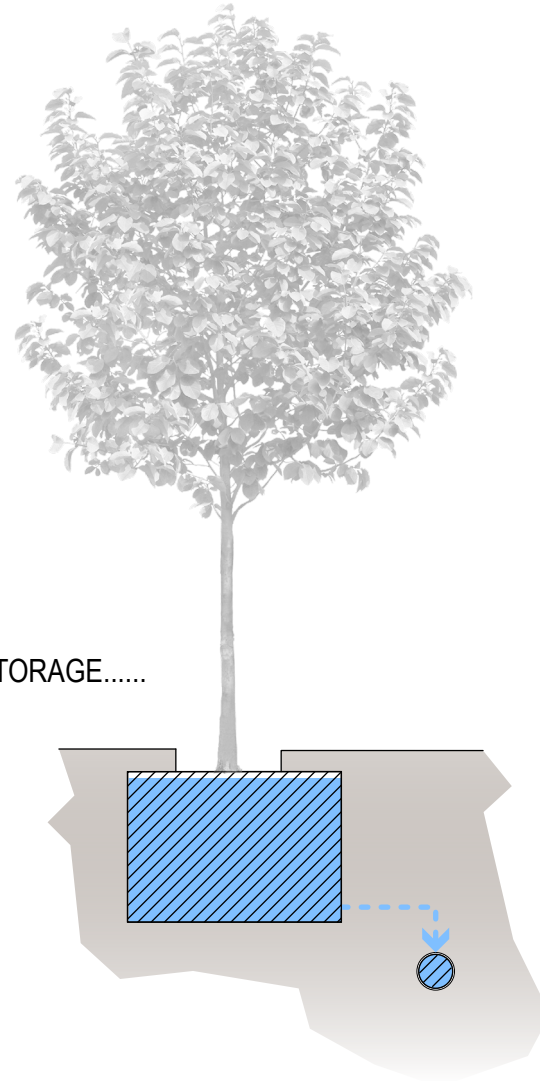
**DRAINAGE INFRASTRUCTURE**

- PITS
- PIPES
- PUMPS



LESS STORAGE.....

BIGGER PIPE.

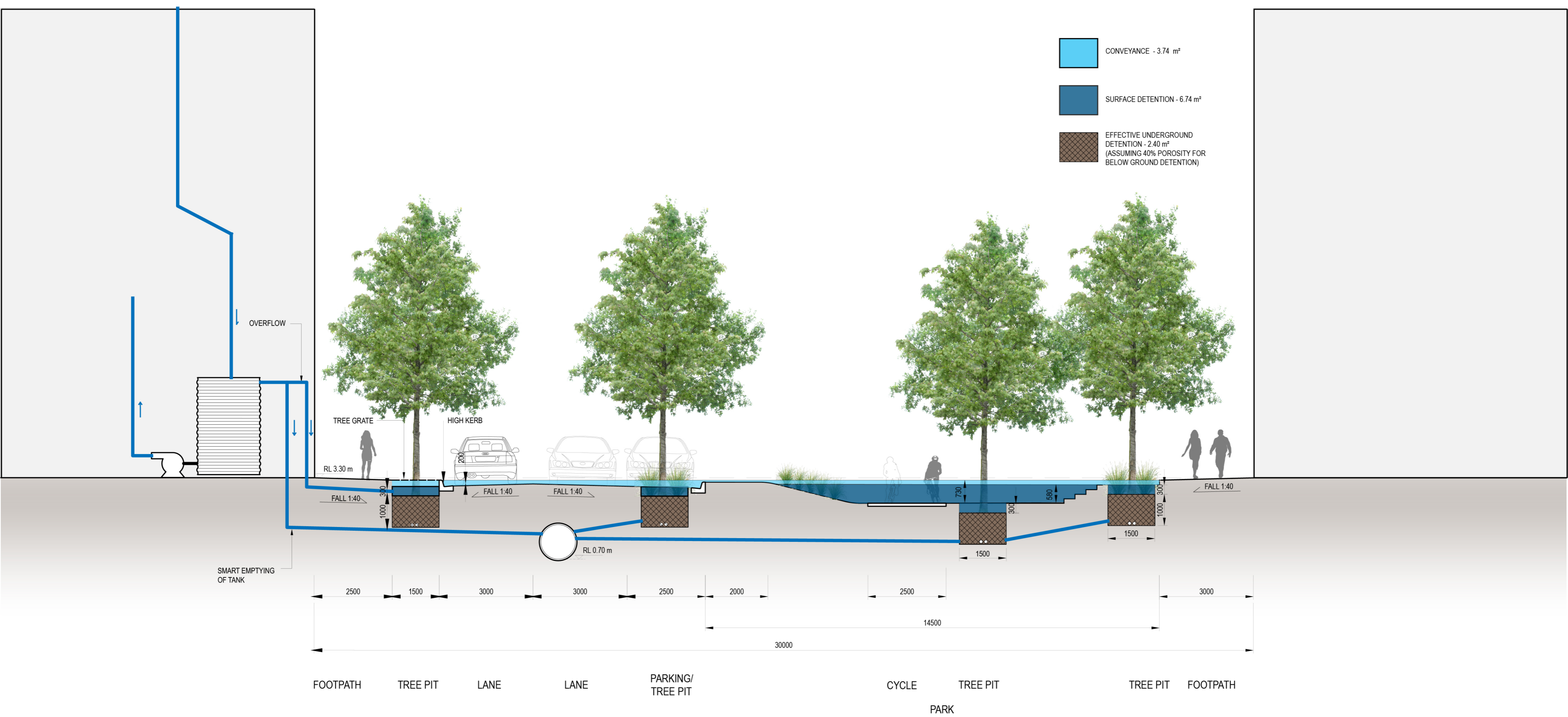
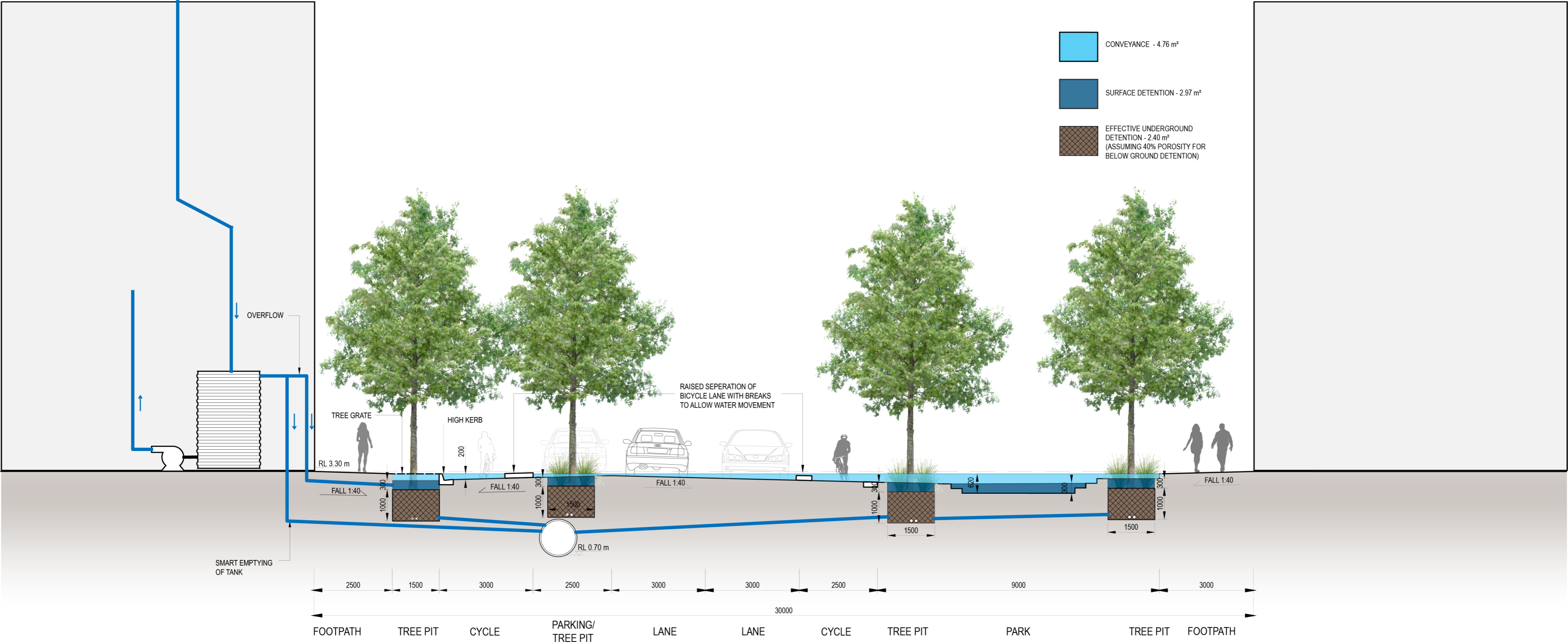


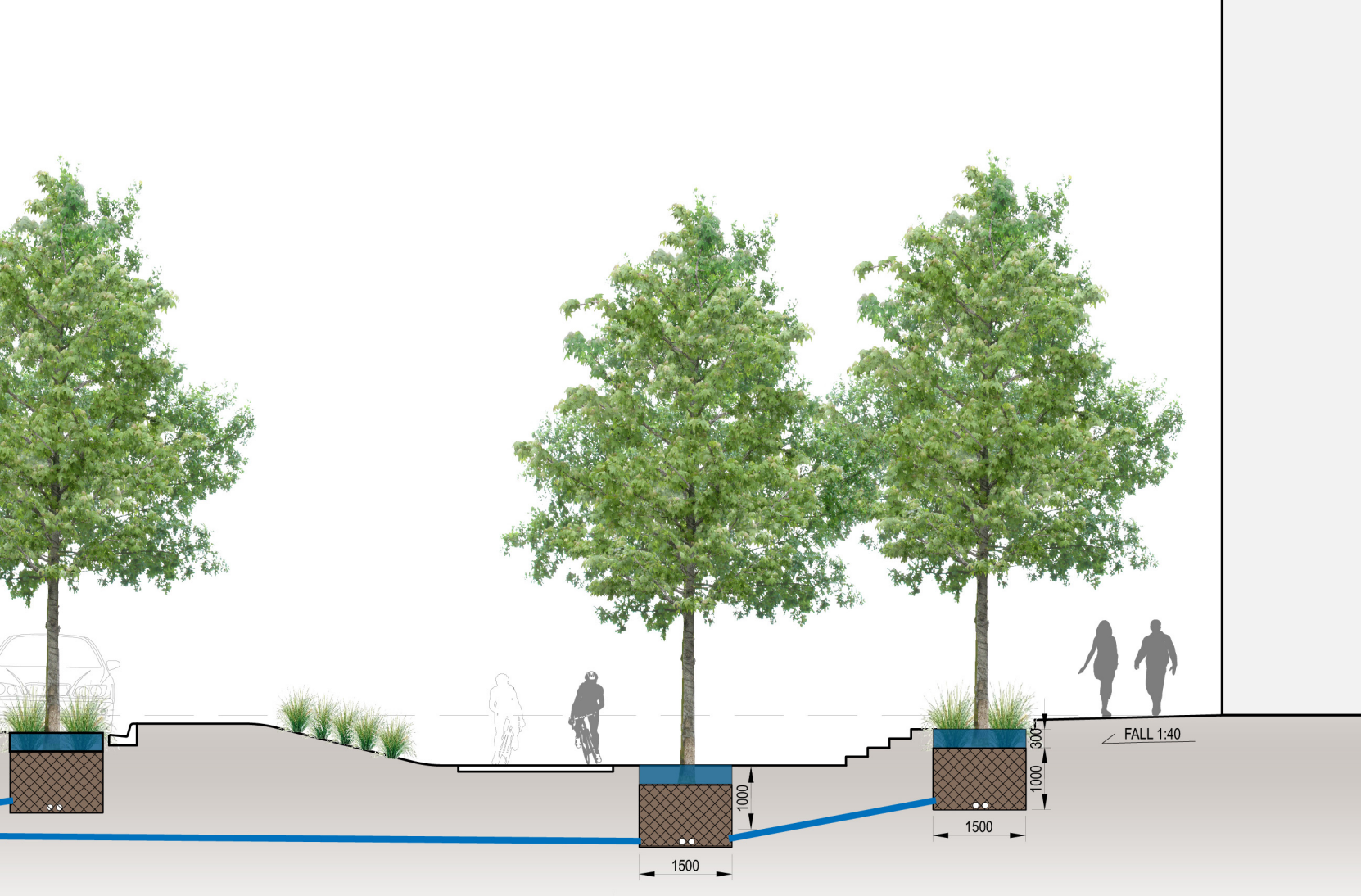
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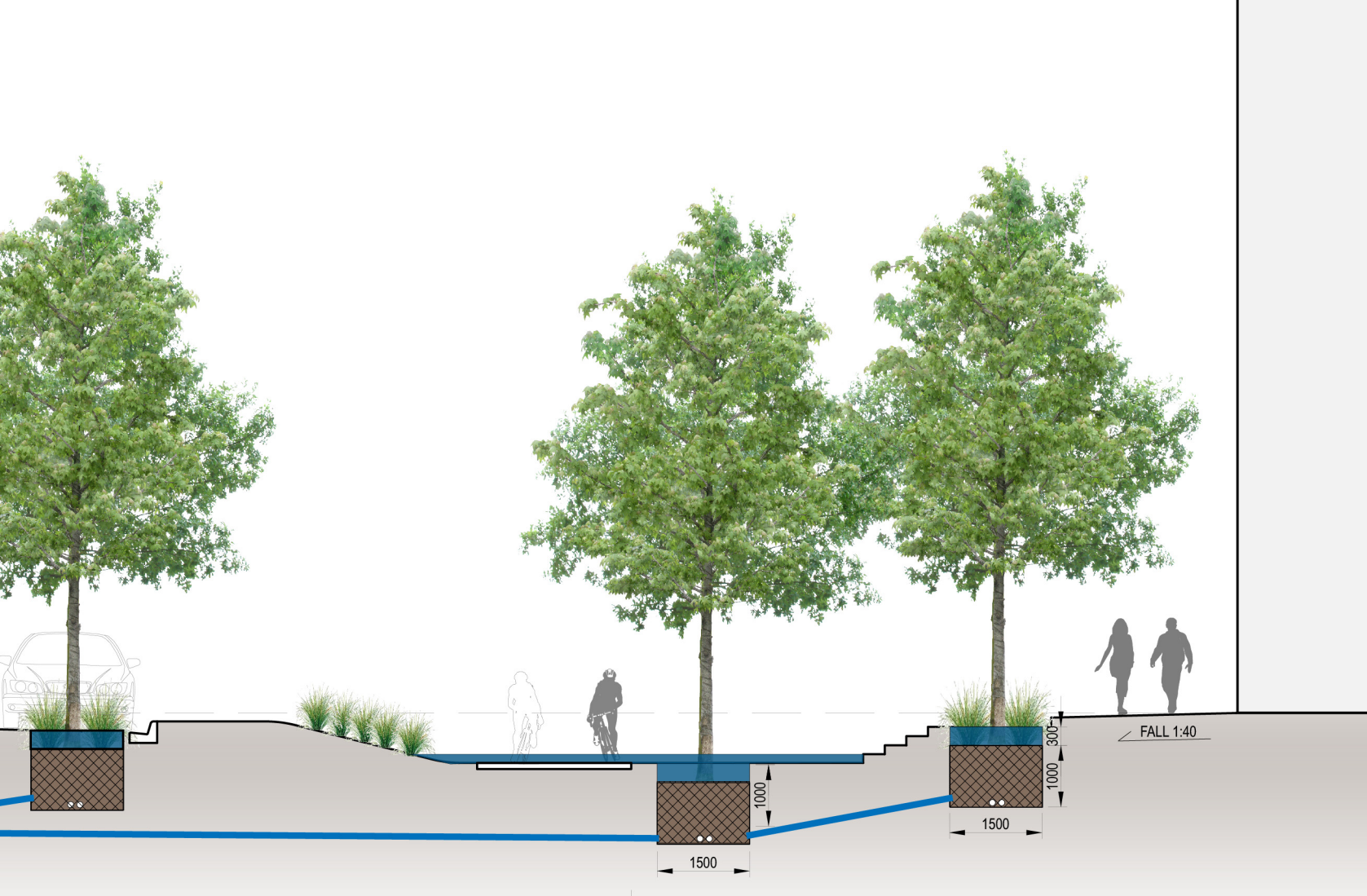
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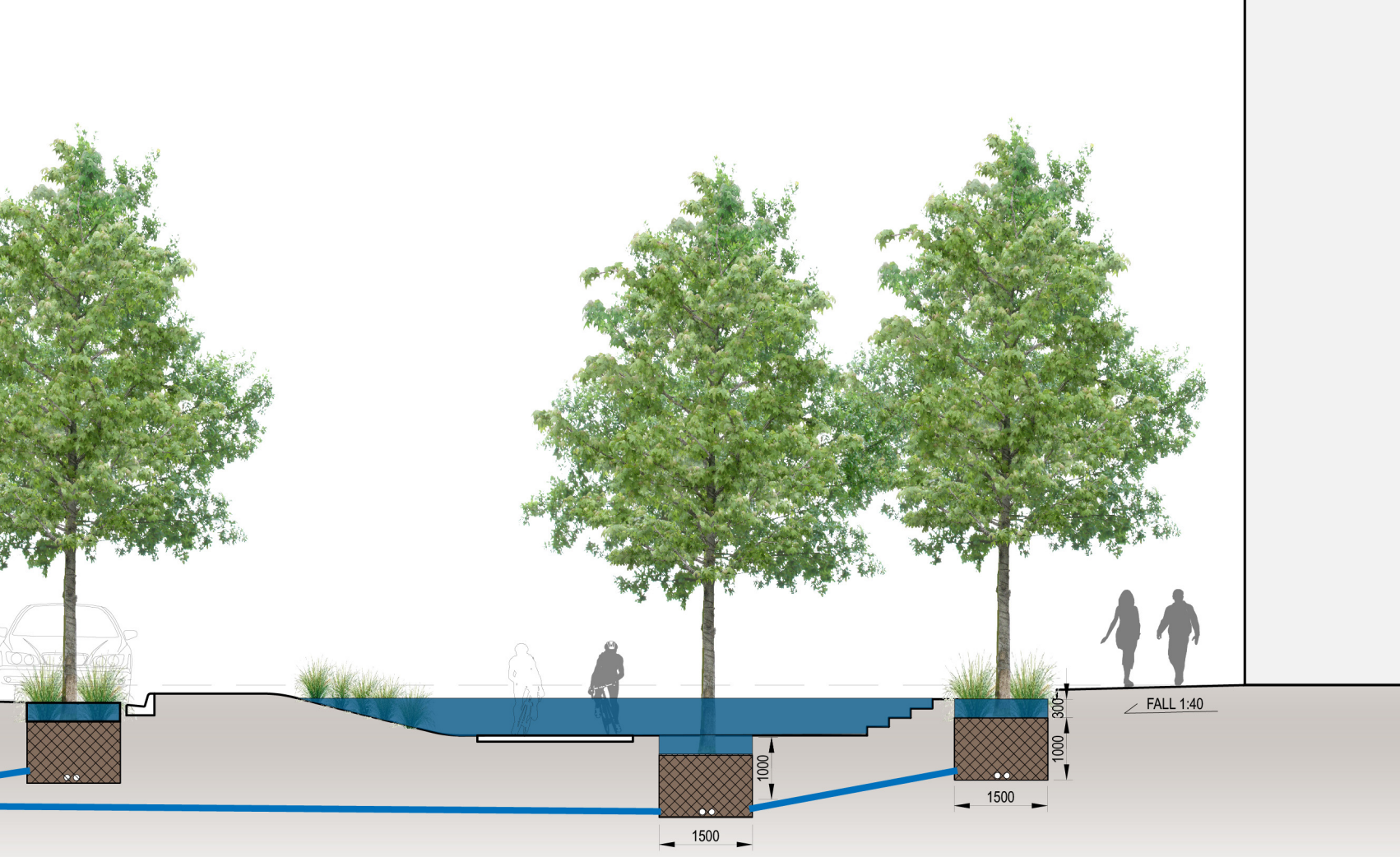
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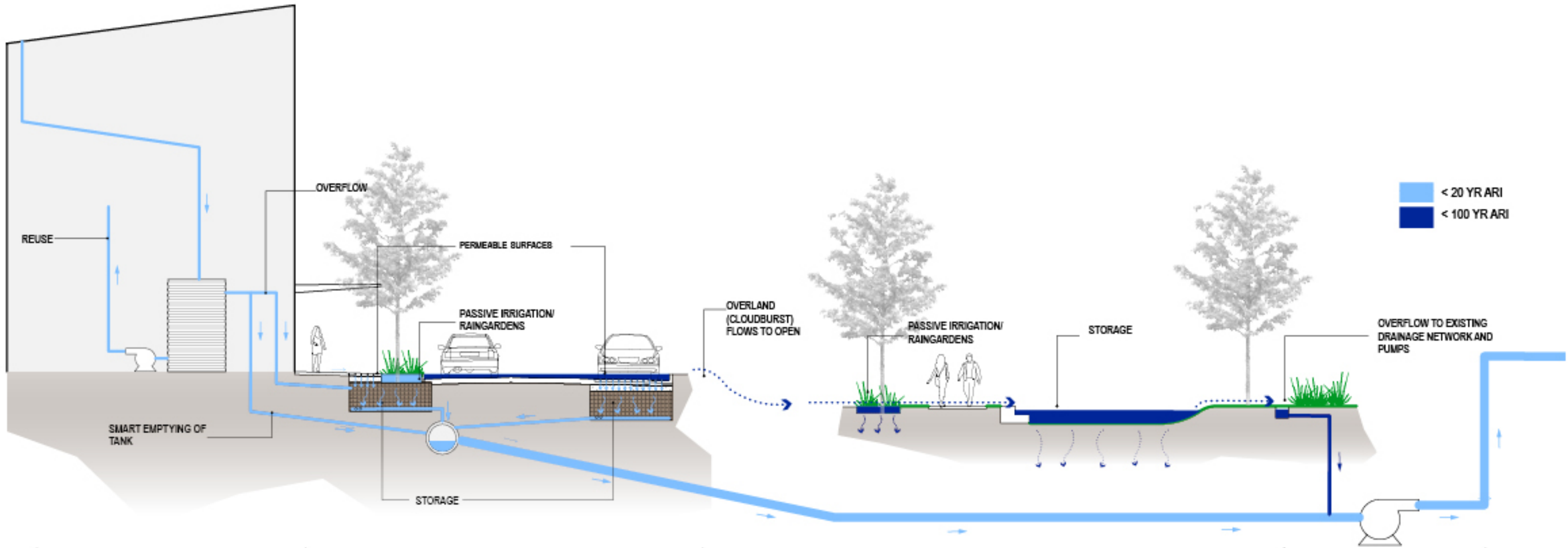
GHD cross-sections v3 for Council meetings on 31st Oct – 2nd Nov











■ < 20 YR ARI  
■ < 100 YR ARI

**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