Appendix D – Hybrid Strategy Development

This appendix is included to demonstrate the decision process for adopting or not adopting distributed in certain catchments.

Since this memorandum was prepared, it was agreed that the Todd Rd Drain catchment should have the baseline drainage infrastructure pipeline upgrades removed, as they provided minimal flood mitigation benefit within Fishermans Bend.

The costs for this sub-catchment, and the representation of the catchment as “baseline approach/red” catchment, should be ignored, as no augmentations are required.

Memorandum

14 January 2019

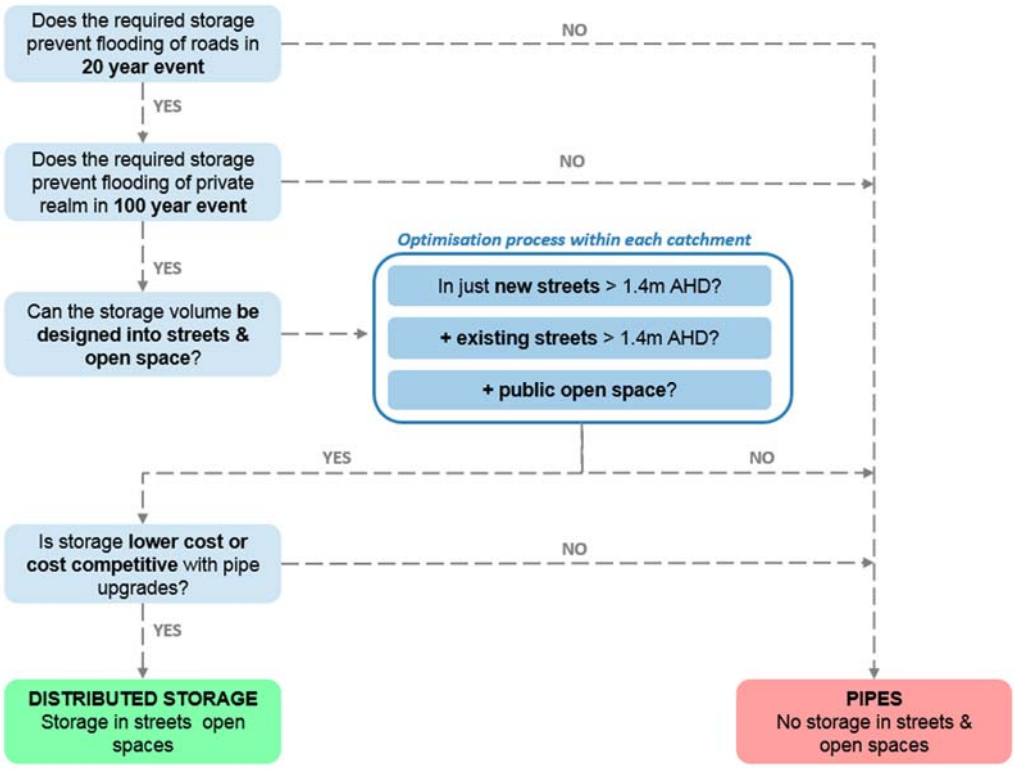
To	Fishermans Bend Working Group		
Copy to			
From	Ryan Brotchie	Tel	+61 3 8687 8827
Subject	Hybrid Strategy Development	Job no.	3136555

1 Introduction

This memorandum summarises the overarching decision making process underpinning the decision to propose distributed flood storages rather than pipe upgrades as part of the Water Sensitive Drainage and Flood Management Strategy for Fishermans Bend, collaboratively developed by the Fishermans Bend Taskforce Drainage Working group in late 2018.

2 Catchment Based Decision Making

For each of the twelve sub-catchments in Fishermans Bend, there was a decision process to determine whether or not to use distributed storages to manage stormwater flooding. The decision framework used is shown below:



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It is important to note that this decision framework only includes physical, or technical, feasibility criteria and preliminary capital cost estimates. There are further considerations that will need to be worked through before committing to the distributed storages approach, including addressing risks and other implementation issues and more detailed planning.

The sections below show the results from application of this framework.

3 Definitions: Required Storage and Feasible Storages

For the purpose of this memorandum, the quantity of streetscape storage has been described in two ways. Firstly, the **"required storage",** which refers to the storage volume identified by flood modelling that is needed in a given sub-catchment to avoid triggering a pipe upgrade (represented by there being a "spill" volume). Secondly, the **"feasible storage",** which refers to the storage volume that is 'feasible' to design into the streetscape and/or public open space, incorporating the various constraints considered in the project.

4 Application of Framework

Table 1 compares the flood storage volumes required in each sub-catchment to avoid a spill in the 5 and 20 year events, against the feasible storage volumes in (i) all streets and public open space, and (ii) all streets. The latter excludes public open spaces.

Table 1. Storage volumes (a) required to achieve LoS (b) feasible to design into streetscape

	Storage Estimates (m3)			
	Required		Feasible Storage (all above 1.4m AHD)	
Catchment	5 YR	20 YR	All Streets and POS	All Streets
Butchers Ln Drain	34	413	1,463	727
Cargo Ln PS	4,818	14,316	26,326	8,254
Cargo Ln PS East	25,570	39,249	15,629	2,980
Hall St PS	2,317	4,198		
Poolman St Drain	582	1,575	345	345
River Esplanade PS	509	2,987	50,424	15,313
Sabre Drive PS	-	-		
Salmon St Drain	1,915	12,515	70,697	13,730
Salmon St PS	623	2,936		
Todd Rd Drain	7,105	19,870	3,790	1,087
Todd Rd PS	5	620		
Westgate Lakes	-	-		
Grand Total	**43,477**	**98,679**	**168,673**	**42,436**

Legend

Feasible storage > 20 YR requirement
Feasible storage > 5 YR requirement
Feasible storage < 5 YR requirement

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Table 2 reports the cost estimates for within-catchment pipe upgrades to address hydraulic capacity constraints from the baseline drainage plan (GHD, 2018) broken into sub-catchments. This identifies simply whether there is a potential in any given catchment to avoid these pipe upgrades. *Noting there may be other drivers to introduce storages, including if there are downstream constraints outside of Fishermans Bend (for catchments draining South) or reducing the required pumping capacity at the pump stations (for catchments draining North).*

Table 2. Baseline drainage plan within-catchment pipeline costs (GHD, 2018)

	Cost Estimates (Baseline Drainage, $M)	
Catchment	Upgrades (in catchment)	Potential to avoide a drainage cost in FB?
Butchers Ln Drain		No upgrades to avoid
Cargo Ln PS	$ 8.9	Yes
Cargo Ln PS East	$ 4.2	Yes
Hall St PS	$ 3.4	Yes
Poolman St Drain		No upgrades to avoid
River Esplanade PS	$ 9.3	Yes
Sabre Drive PS	$ -	No upgrades to avoid
Salmon St Drain	$ 13.2	Yes
Salmon St PS	$ 4.3	Yes
Todd Rd Drain	$ 5.4	Yes
Todd Rd PS	$ -	No upgrades to avoid
Westgate Lakes		No upgrades to avoid
Grand Total	$ 48.7	

Table 3 below summarises the cost of excavation and soil disposal/remediation for distributed storages ($M).

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Table 3. Distributed storage costs

	Cost of Excavation & Soil Disposal/Remediation for Storages ($M)	
Catchment	5 YR	20 YR
Butchers Ln Drain	$ 0.0	$ 0.2
Cargo Ln PS	$ 1.9	$ 5.7
Cargo Ln PS East	$ 10.2	$ 15.7
Hall St PS	$ 0.9	$ 1.7
Poolman St Drain	$ 0.2	$ 0.6
River Esplanade PS	$ 0.2	$ 1.2
Sabre Drive PS	$ -	$ -
Salmon St Drain	$ 0.8	$ 5.0
Salmon St PS	$ 0.2	$ 1.2
Todd Rd Drain	$ 2.8	$ 7.9
Todd Rd PS	$ 0.0	$ 0.2
Westgate Lakes	$ -	$ -
Grand Total	$ 17.4	$ 39.5

Table 4 compares the cost of within-catchment pipe upgrades and distributed storages.

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Table 4. Comparison of Pipe Upgrades vs Storage Costs

	Costs ($M)		Difference	
Catchment	Storage required to meet 20 YR LOS	Pipe Upgrades required to meet 20 YR LOS	Storage cost relative to Pipe cost (%)	Potential based on cost (assuming can get the required storage)
Butchers Ln Drain	$ 0.2	$ -		No upgrades to avoid
Cargo Ln PS	$ 5.7	$ 8.9	64%	Cost competitive
Cargo Ln PS East	$ 15.7	$ 4.2	377%	Not cost competitive
Hall St PS	$ 1.7	$ 3.4	49%	Cost competitive
Poolman St Drain	$ 0.6	$ -		No upgrades to avoid
River Esplanade PS	$ 1.2	$ 9.3	13%	Cost competitive
Sabre Drive PS	$ -	$ -		No upgrades to avoid
Salmon St Drain	$ 5.0	$ 13.2	38%	Cost competitive
Salmon St PS	$ 1.2	$ 4.3	27%	Cost competitive
Todd Rd Drain	$ 7.9	$ 5.4	147%	Not cost competitive
Todd Rd PS	$ 0.2	$ -		No upgrades to avoid
Westgate Lakes	$ -	$ -		No upgrades to avoid

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Table 5. Summary of Decision Process

Sub Catchment	Does "required" storage prevent flooding		Can the "required storage" be designed into streets & open space?			Is storage lower cost?				Does storage remove downstream constraints (outside of FB) that cause flooding in FB?	Is a Hybrid Solution Potentially Feasible?
	... of roads in 20 year event?	... of private realm in 100 year event?	All Streets and POS	All Streets	New Streets Only	Storage cost ($M)	Pipe upgrade cost ($M)	Net Cost of Storage ($M)	Is storage lower cost or cost competitive with pipe upgrades?		
HYBRID DRAINAGE											
River Esplanade PS	Yes	Yes	Yes	Yes	Ye	$ 1.2	$ 9.3	-$ 8.1	Lower cost	NA	Yes. Lower cost.
Salmon St Drain	Yes	Yes	Yes	Yes	5 yr only	$ 5.0	$ 13.2	-$ 8.2	Lower cost	NA	Yes. Lower cost.
Salmon St PS	Yes	Yes	-	-	-	$ 1.2	$ 4.3	-$ 3.1	Lower cost	NA	Probably. Lower cost than pipes.
Hall St PS	Yes	Yes	-	-	-	$ 1.7	$ 3.4	-$ 1.8	Lower cost	NA	Probably. Lower cost than pipes.
Poolman St Drain	Yes	Yes	No	No	No	$ 0.6	$ -	$ 0.6	No upgrades to avoid	Yes	Yes, alleviates downstream constraints
Butchers Ln Drain	Yes	Yes	Yes	Yes	5 yr only	$ 0.2	$ -	$ 0.2	No upgrades to avoid	Yes	Yes, alleviates downstream constraints
Sub-total						**$ 9.8**	$ 30.2	**-$ 20.3**			
BASELINE DRAINAGE											
Cargo Ln PS East	Yes	TBC	No	No	No	$ 15.7	$ 4.2	$ 11.5	Not cost competitive	NA	No, storage not achievable nor cost effective
Cargo Ln PS	No	No	Yes	5 yr only	No	$ 5.7	$ 8.9	-$ 3.2	Lower cost	NA	No, storage doesn't prevent flooding
Todd Rd PS	Yes	Yes	-	-	-	$ 0.2	$ -	$ 0.2	No upgrades to avoid	NA	No, no upgrades to avoid
Sabre Drive PS	NA	NA	-	-	-	$ -	$ -	$ -	No upgrades to avoid	NA	No, no upgrades to avoid
Todd Rd Drain	Yes	Yes	No	No	No	$ 7.9	$ 5.4	$ 2.5	Not cost competitive	NA	No, storage not achievable nor cost effective
Westgate Lakes	NA	NA	-	-	-	$ -	$ -	$ -	No upgrades to avoid	NA	No, no upgrades to avoid
Sub-total							**$ 18.5**				

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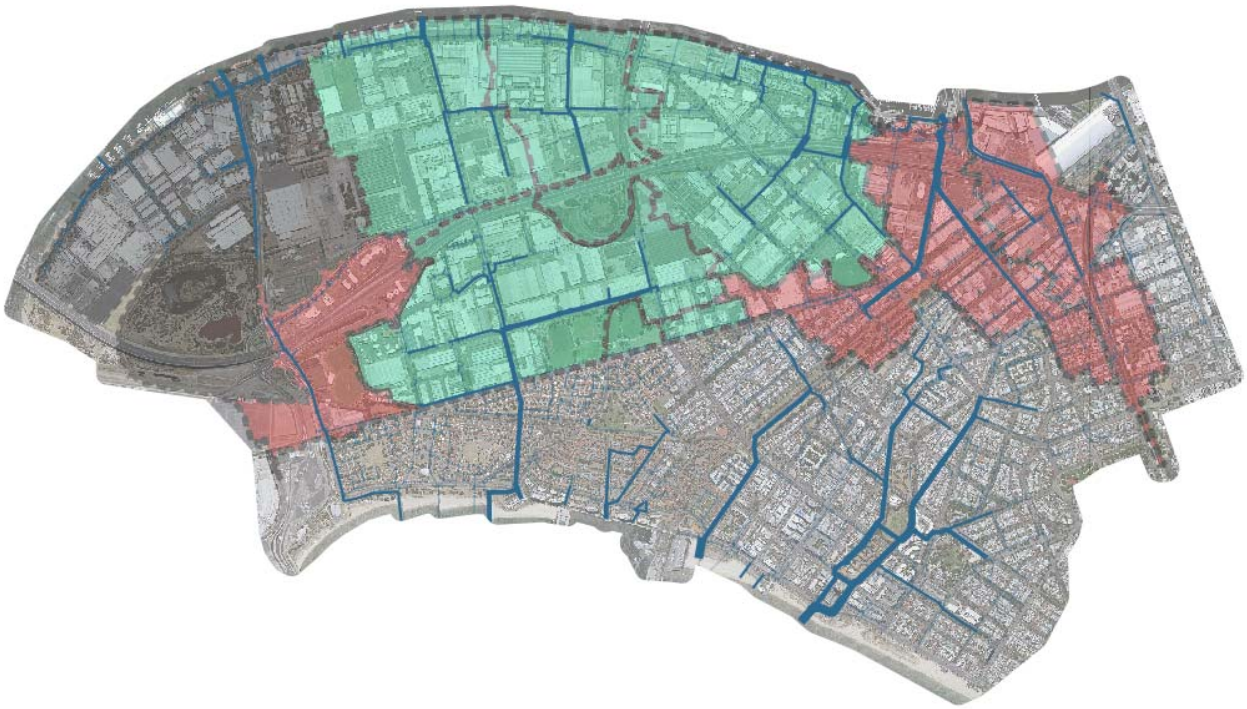
5 The Strategy: Storage vs. Pipe Upgrades

The residual stormwater flooding, as shown in Figure 11 above, can be mitigated in some areas by either capacity upgrades of existing drainage pipes to increase conveyance, or the use of distributed storages to detain stormwater at the surface.

The proposed strategy is shown in the figure below.



This shows:

- Catchments where storages are proposed are shown in **green**.
- Catchments where pipe upgrades are proposed are shown in **red**.
- Catchments where neither is required as there is negligible residual flooding are shown in **grey**.

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6 Limitations

This memorandum must be read in conjunction with the scope and limitations outlined in the Fishermans Bend Water Sensitive Drainage and Flood Management (GHD for Melbourne Water Corporation, 2018).

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The opinions, conclusions and any recommendations in this memorandum and the report are based on assumptions made by GHD described in this memorandum and the report. GHD disclaims liability arising from any of the assumptions being incorrect.

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