Appendix I – Cost Framework Memorandum

Memorandum

29 October 2018

To	Melbourne Water Corporation		
Copy to			
From	Ryan Brotchie	Tel	+61 3 8687 8827
Subject	Draft Costing Framework for Differential Costing	Job no.	3136555

1 Introduction

This memorandum presents a draft framework (or logical structure) for preparing the difference in costing of the 'hybrid' drainage option for Fishermans Bend, and lists the elements which GHD will cost to develop this differential costing as part of our commission for Melbourne Water related to drainage..

The immediate purpose of this memorandum is to inform the parties who are developing Infrastructure Contributions Plan (ICP) and ensure alignment between all parties contributing to the development of the ICP. Given the ICP timelines, this will be issued as a working draft for discussion and refined throughout the project.

2 Background

The baseline drainage plan for the Fishermans Bend was developed by GHD for Melbourne Water in 2018. This identified the augmentations to the *existing* drainage network required to meet the defined level of service for Fishermans Bend. This included pipe upgrades, new pump stations and a levee. The baseline plan also included mandated rainwater tanks in the private realm providing a flood mitigation function.

The current Water Sensitive Cities Drainage and Flood Management Strategy is investigating a 'hybrid' drainage option. This involves use of green and blue infrastructure in streetscapes and public open spaces to increase flood detention storage volumes and flood conveyance capacity at the surface (i.e. prior to entering the underground drainage network), potentially reducing the extent of pipe upgrades and pump stations. This will result in an increased cost for drainage elements in the streetscape, and potentially a reduced cost for the major pipe/pump augmentations identified in the baseline drainage plan.

3 Drainage Components

Table 1 below identifies all the elements that contribute or interact with drainage function in Fishermans Bend, and clearly states which elements are (i) featured in the baseline option and hybrid option (ii) whether that element is different between the baseline vs. hybrid option, and importantly (iii) whether GHD is proposing to quantify and cost that element.

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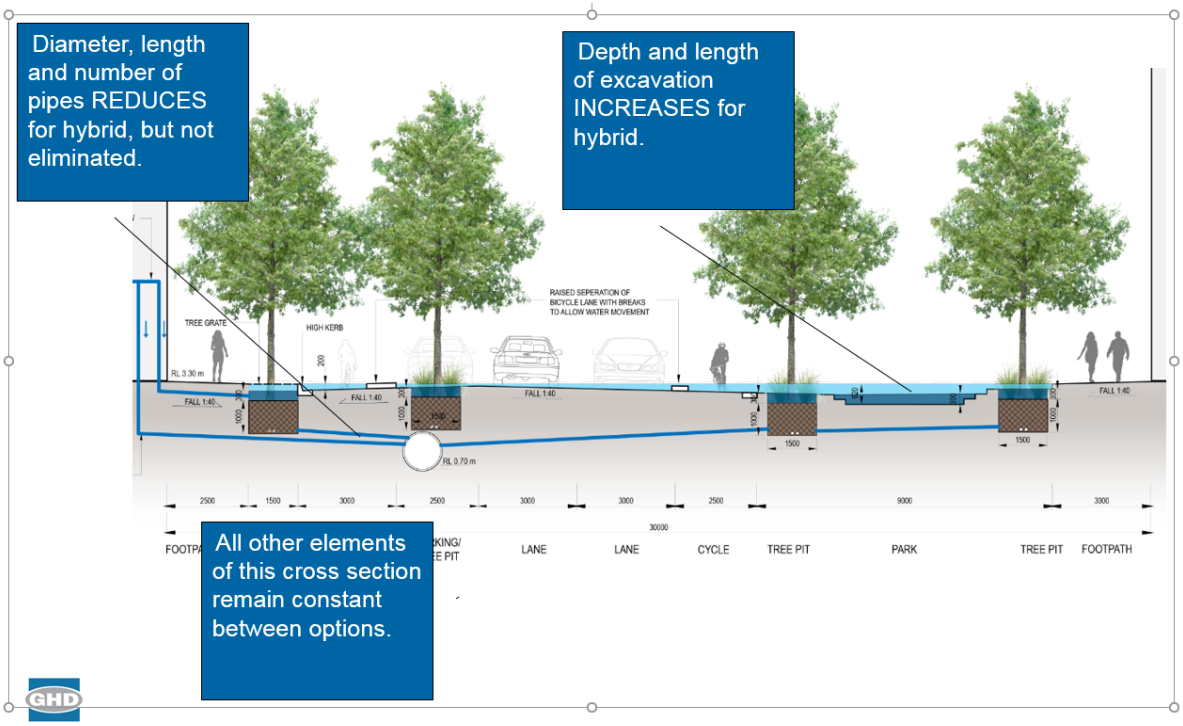
It is important to note that some elements GHD will be costing will be total costs for the infrastructure component, but many others will simply be a relative cost. That is, the additional or incremental cost between the hybrid option and the baseline option. For example, to obtain more flood storage in the streetscape, additional excavation can be done to 'lower' a linear park. GHD will be quantifying and costing the elements that relate to providing the additional flood storage, which is simply the excavation. We would not be costing the tree, tree pit, edge treatments for the tree pit, grates, and strata cells that would be installed for a standard tree pit regardless of drainage function, as these are common between the two options.

The difference between the features of the baseline streetscape and a streetscape for a Hybrid option is highlighted in Figure 1 below.

Figure 1 Comparison between Baseline and example Hybrid



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Class	Type	Baseline	Hybrid	Difference between Hybrid and Baseline	Is the drainage element costed by GHD?
Private realm: **At the property**	**Rainwater tanks**	Yes	Yes	None/negligible	No.
	Connections (to point of discharge)	Yes	Yes	None/negligible	No
Public realm: **Streetscape**	**Trees and green infrastructure**	Yes	Yes	None/negligible	No.
	Road and footpath infrastructure (pavement, curb, etc.)	Yes	Yes	None/negligible	No
	Landscape elements, edge treatment of tree pits, deeper footpath step downs, etc.	Yes	Yes	None/negligible	No
	Storage (strata cells)	Yes	Yes	Increased cost	Yes (incremental cost for additional strata cells required, above the standard tree pit design).
	Storage (detention chambers)	No	Yes	Increased cost	Yes (total).
	Excavation (surface or below ground storage	Yes	Yes	Increased cost	Yes (incremental cost for additional excavation of material required).
	Soil media	Yes	Yes	Increased cost	Yes (incremental cost for additional media required).
Public realm: **Open space**	**Re-grading or re-profiling roads** to convey more water to open spaces	No	Yes	Unknown. Potentially results in increased cost.	No. Currently no basis for quantifying/costing. Requirement for
	Storages within new or existing open spaces	No	Yes	Increased cost	Yes (incremental cost for excavation and, storage vessel or batters /embankments). *Noting landscaping and other costs are not allowed for.*
Minor Underground Drainage	**Pits** and connections	Yes	Yes	None/negligible	No
	Pipes	Yes	Yes	None/negligible	No
Major Underground Drainage	**Pipes**	Yes	Yes	Reduced cost (TBC)	Yes (total cost)
	Pumps	Yes	Yes	Reduced cost (TBC)	Yes (total cost)
	Levee	Yes	Yes	None/negligible	To be discussed

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Table 1 Drainage Components

It is important to note that many components of the streetscape are inherent in Council's urban design, irrespective of the drainage and flood management strategy that is developed. These elements include green infrastructure (trees and other vegetation), blue infrastructure (e.g. visible water in the landscape) and more generally the urban design that councils have expressed in their original cross-sections and plans, which are consistent across all options and do not change as a result of the drainage/flood strategy.

4 Total Drainage Costs

The total drainage costs for Fishermans Bend will need to be compiled by different parties. Table 1 identifies all of the total and incremental elements that GHD will cost, as part of the Hybrid option. It is important to note that where GHD is costing an *incremental* cost, another party is assumed to be quantifying and costing the total original or standard cost of the element.

The sections below articulates the cost comparison for the Hybrid Option.

5 Costs for Hybrid Option: Public Realm Drainage Components

The cost assumptions and cost rates for the public realm drainage components of the hybrid drainage option are listed in Note: A key element of the cost difference is the need for additional excavation in these potentially contaminated soils. GHD can develop estimates for the additional quantities, but suggest that the Task-Force provide a cost for excavation and remediation of soils so that this value is consistent across all cost estimation.

Table 2 below.

Note that this table shows that the costs of below ground dedicated storage elements is high, and therefore the preferred approach is to find storage 'above' ground, for example in the air space above a linear park etc.

However, we have included these first-cut indicative costs for the below ground elements for completeness.

Type	General Costing Approach	Quantity Assumptions	Cost Rates
Excavation (surface or below ground storage)	Incremental cost for additional excavation of material required.	TBD	**TBD (See Note)**
Underground storage (strata cells) ***Not the preferred approach.***	Incremental cost for additional strata cells required, above the standard tree pit design. *Derived as Cost per 10m length of street (then scaled accordingly).*	Trees are spaced every 10 m Strata cells applied as width (as per section) x 4 m long arrangement (for each tree). Per 10m of streetscape:	Cost per modular unit (0.5m * 0.5m * 0.25 m depth) ~$40/unit (applied to derived dimensions)

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		Option 2 & 4 – strata cells (2 m by 4 m x 1 m) for each tree by 4 trees within streetscape *Option 3 - strata cells (15 m by 4 m x 1 m) across full width of streetscape*	
Underground storage (detention chambers) ***Not the preferred approach.***	Total cost. *Derived as Cost per 10m length of street (then scaled accordingly).*	Per 10m of streetscape: *Option 4 – Stormtech detention storage chambers (5m wide x 1 m depth x 10 m)*	$500/kl – based on a coarse adjustment from a very old cost curve derived for a project in 2012 - Stormtech detention chambers
Soil media	Incremental cost for additional media required.		
Storages within new or existing open spaces	Incremental cost for additional excavation required to accommodate active flood storage volume.		**See Note Below.**
	Total cost of storage vessel for active flood storage		
	Total cost for structural components required (e.g. batters / embankments).		

Note: A key element of the cost difference is the need for additional excavation in these potentially contaminated soils. GHD can develop estimates for the additional quantities, but suggest that the Task-Force provide a cost for excavation and remediation of soils so that this value is consistent across all cost estimation.

Table 2 Cost Approach for Public Realm Drainage Components

6 Scaling up from street scale to whole of Fishermans Bend

GHD and the stakeholders have worked collaboratively and developed cross-sections for a select number of street typologies, based on Council's cross-sections, and identified feasible detention storage volumes that can be accommodate in these cross-sections. These volumes will then be (or have been) extrapolated to the remaining street typologies. This is summarised in the Figure below as "calculated" and "interpolated" street typologies. This will enable us to then apply a typical storage volume for each of the different typologies across the whole study area.

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Figure 2

Calculated
22 m local
30 m Green
34 m Green
36 m Cloudburst Blvd

Interpolated
1. Arterial Road (30m)
2. Arterial Road with tram (30m)
3. Plummer / Fennell Street civic boulevard (36m)
4. Buckhurst Street civic boulevard (30m)
5. Collector Street with bus (30m)
6. Collector / Local Street with 12m linear park (30m)
7. Collector / Local Street with on-street car parking (30-34m). No linear park specified
8. Local Street with 12m linear park (34m)
9. Local Street with 12m linear park and recreational cycling path (30-34m)
10. Local Street (20-22m)
11. Local Street no separated cycle path (20m)
12. Local Street (13-15m)
13. Blue St (6 m)

7 Existing vs. New Streets

The GIS provided for the proposed road, laneway and open space layout for Fishermans Bend identifies what is existing vs. new roads and also different street types. The breakdown, for each precinct and overall, is expressed by the total area of the road reserve (*this was considered a better proxy for storage availability than road length*).

This identifies that 69% of the road reserves are existing and 31% are new. Of the new roads, these are predominantly 22m wide roads (11%), linear open space (7%) and 6m wide laneways (5%).

Further reconciliation and QA is need to align this data with the street typologies presented in the previous section. However it does ***highlight the importance of distinguishing between solutions for new and existing streets, and clarifying what assumptions will be made for existing streets***.

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ROADS							
Sum of Area_m2		Precinct					
EXISTING	LU_SUBTYPE	Employment	Lorimer	Montague	Sandridge	Wirraway	Grand Total
NEW	10m Wide Landscape Setback	4.34	5002.58				5007
NEW	Indicative New Road 12m		11560.78				11561
NEW	Indicative New Road 22m				14945.17		14945
NEW	New Road 12m		10119.04	631.08	3526.32		14276
NEW	New Road 18m		2798.68				2799
NEW	New Road 22m		18935.72	1186.15	53596.66	49363.17	123082
NEW	Laneway_3m		2523.53	1439.2	2317.9	2502.97	8784
NEW	Laneway_6m		5531.07	7653.56	18305.86	18118.27	49609
NEW	Laneway_9m			3502.08			3502
NEW	Linear Open Space	25.12	5074.59	19275.04	30614.17	19900.41	74889
TBC	Road Widening				8723.06	13398.14	22121
EXISTING	Existing Road Casement	246924.4	38611.7	133702.02	172003.13	160940.54	752182
		246954	**100158**	**167389**	**304032**	**264224**	**1082756**
NEW	10m Wide Landscape Setback	0.0%	0.5%				0%
NEW	Indicative New Road 12m		1.1%				1%
NEW	Indicative New Road 22m				1.4%		1%
NEW	New Road 12m		0.9%	0.1%	0.3%		1%
NEW	New Road 18m		0.3%				0%
NEW	New Road 22m		1.7%	0.1%	5.0%	4.6%	11%
NEW	Laneway_3m		0.2%	0.1%	0.2%	0.2%	1%
NEW	Laneway_6m		0.5%	0.7%	1.7%	1.7%	5%
NEW	Laneway_9m			0.3%			0%
NEW	Linear Open Space	0.0%	0.5%	1.8%	2.8%	1.8%	7%
TBC	Road Widening				0.8%	1.2%	2%
EXISTING	Existing Road Casement	22.8%	3.6%	12.3%	15.9%	14.9%	69%
		23%	**9%**	**15%**	**28%**	**24%**	**100%**

8 Differences in Costs for Drainage

The key elements in the drainage are set out in the table below, with commentary on the general expectation of the implication for the costs.

Table 3 Drainage Cost Differences

Drainage Element	Baseline	Hybrid	Comment On Costs
Drains in Lanes	Standard Drains	Above ground channels or similar	Cost difference between surface channel and subsurface drain.

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Drainage Element	Baseline	Hybrid	Comment On Costs
Drains in Streets	Standard Drains to major drainage network	Drains from storages to major drainage network	Drains still required, but for a smaller flow. Cost difference expected to be minor as major costs in installation, not pipe diameter.
Major Drainage Network	Additional or upgrade works required, including pipes and pumps.	Pumps still required, but sizes will be different. In best case, no pipe upgrades required.	Extent of major drainage upgrade for hybrid to be determined as key output of this work.
Open Spaces	Standard	Specific additional drains may be required to drain if used as active storages.	

9 A Note on Costing the Levee

There is no proposed difference in the nature of the 'levee' between the different options, as in all cases it must act to prevent flooding from seawater and/or the Yarra from entering the precinct(s). The hybrid and baseline options are related to dealing with flooding caused by stormwater within the levee.

There are some uncertainties which need resolution before a robust levee costing could be developed.

1. The final required top height of the levee. Should freeboard be added? How much freeboard?
2. The levee must extend beyond Fisherman's Bend in the NE to manage Yarra flooding, and the height of Yarra flooding is currently under review. What height is needed? To what extent should costs for the levee outside FB be included, if their purpose is primarily to protect FB?
3. The levee crosses many different kinds of land, under various current and future ownership and land use. What landscape approach should be assumed? What should be assumed in private versus public land?
4. The levee is needed (in part) as sea-level rise increases over time. What timing and staging should be considered??

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Regards

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