Technical Memorandum

To	Michael Dixon	Date	23 November 2022
Copies	Michael Price, Miles Vass, Marty Scrogings	**Reference Number**	**01016-RFA-01-CI-TM-002**
From	Geoff Blundstone, Marty Scrogings	**Other Reference**	
Subject	White Patch Esplanade Causeway Reconstruction		

This technical memorandum is intended to document the sensitivity checks for tidal-induced water velocities for the proposed causeway reconstruction at White Patch Esplanade. The calculations were undertaken for the existing culvert arrangement (pre-reconstruction) and the proposed 18m span bridge design and compared with a hypothetical 30m span bridge.

Given that the location of the crossing is some 9 km from the junction of Pumicestone Passage with Moreton Bay, which itself is a sheltered bay adjacent to the open ocean, it is not subject to the tidal inlet dynamics as usually assessed as part of coastal engineering analysis. That is, the Wights Creek / Pumicestone passage junction is generally not subject to the tidal dynamics, and momentum conditions associated with swell/tidal amplitude. As such, the tidal velocities are dictated primarily by the hydraulics associated with the volume of water that passes through the provided opening within the tidal cycle.

The following inputs and assumptions for the various openings are:

- Tidal Levels (site)
  - MHWS = 0.78m RL (m AHD)
  - MSL = 0m RL (m AHD)
  - Area Upstream at MSL = 1945 m^2
  - MLWS = -0.64m RL (m AHD)
- Existing Culvert Arrangement
  - Inlet Cross-sectional area at MSL (A_c) = 5.3m^2
- 18m Span Geometrics
  - Inlet Cross-sectional area at MSL (A_c) = 23m^2
- 30m Span Geometrics
  - Inlet Cross-sectional area at MSL (A_c) = 48 m^2
- Tidal Period
  - 12.42 hrs (estimated after analysing various tide charts for the area)

Discussion

The results from the tidal flow velocities sensitivity calculations show that tidal flows are significantly reduced at the crossing for both the 18m span and 30m span bridge scenarios when compared to the existing culvert condition. In this regard, the 18m span bridge indicates a reduction in tidal velocities of approximately 75%, whilst the 30m span bridge indicates a reduction of the order of 90%.

The further incremental reduction in tidal velocities achieved with a 30m span bridge over the 18m span bridge are not proportional to the additional construction costs and potential additional environmental impacts required to provide this solution.

Regards,

Geoff Blundstone

Tidal Flow Velocities at Wrights Creek Crossing - Calculation Inputs			
Description:	**Variable:**	**Value:**	**Units:**
HAT		1.23	RL [m AHD]
MHWS		0.78	RL [m AHD]
MHWN		0.48	RL [m AHD]
MSL		0	RL [m AHD]
MLWN		-0.33	RL [m AHD]
MLWS		-0.64	RL [m AHD]
LAT		-0.93	RL [m AHD]
Existing Culverts Cross Sectional Area	A_{ex}	5.3	m2
18m Span Cross Sectional Area	A_{18}	23	m2
30m Span Cross Sectional Area	A_{30}	48	m2
Tide Period	T	12.4	hr
Spring Range		1.42	m
Hydraulic Radius	R	0.375	m
White's creek Avg. Surface area	Ab	1945	m2
Fundamentals			
Q=VA			
Time for tide ebb or flood flow	t	6.21	hr
Writes Creek Area at MLS	A_{bay}	1945	m2
MHWS-MLWS (Spring range)	h	1.42	m
Bay water volume	v_{bay}	2761.9	m3
Total discharge for spring tide	**Q**	**0.124**	**m3/s**
Existing Culverts Tidal Velocity	**V_{ex}**	**0.023**	**m/s**
18m Span Tidal Velocity	**V_{18}**	**0.005**	**m/s**
30m Span Tidal Velocity	**V_{30}**	**0.003**	**m/s**
Existing Culverts Tidal Velocity Relative to Exisitng	**V_{ex}**	**0**	**% Reduction**
18m Span Tidal Velocity Relative to Exisitng	**V_{18}**	**75**	**% Reduction**
30m Span Tidal Velocity Relative to Exisitng	**V_{30}**	**90**	**% Reduction**