



Appendix O

Outfall Erosion Protection Calculations



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Northern Corridor Improvements - Outfalls Summary

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 Reviewed: Don Mackintosh
 Date: 15/11/2016

HEADWALL ID ON STORMWATER DRAWINGS	ASSET ID IN NDC (31819 & 33076)	Location	New / Existing	Comment	NZTA (Private) / Auckland Council (Public)	New Proposed Outfall Protection (Y/N)	Upstream Pipe Size (mm)	Area - imp (ha)	Area - per (ha)	Catchment Flow Q100 (L/s)	Direct Flow Q100 (L/s)	Q100 (including Climate Change) (L/s)	Tailwater Depth: 0.4x Diameter (m)	Class	D50 Size - Nominal (mm)	Length (m)	Riprap Rock Thickness (mm)	Riprap Width - Pipe End (m)	Riprap Width - Apron End (m)
OF3	N/A - New Outfall	CU-NEW-01 outlet	New	New combined outfall for Oteha Valley Wetlands and cut-off drain	NZTA	Y	1500	2.2	0	976	1500	2476	0.60	2	150	6.0	500	4.5	8.5
OF5	N/A - NZTA Outfall	CU-EX-03 outlet	Existing	New combined outfall for McClymonts Wetland, CU-EX-03 and cut-off drain	NZTA	Y	825	2	0.3	936	900	1836	0.33	5	500	5.8	1000	2.5	6.3
OF7	N/A - NZTA Outfall	CU-EX-05 outlet	Existing	New outfall for extended culvert	NZTA	Y	825	0	0	0	900	900	0.33	2	150	3.3	500	2.5	4.7
OF8	N/A - New Outfall	Greville Wetland outlet	New	New outfall for proposed Greville Wetland	NZTA	Y	1050	2.9	0.8	1417	0	1417	0.42	3	250	5.3	600	3.2	6.7
OF10	N/A - New Outfall	Greville NB Basin outlet	New	New outfall for proposed Greville Northbound Off-Ramp Dry Basin	NZTA	Y	900	2.1	0	932	0	932	0.36	2	150	3.6	500	2.7	5.1
OF12	Not included within the scope of AC NDC 31819/33076	CU-EX-10 outlet	Existing	No change to existing outfall	Auckland Council	N	1200	No new outfall required. Rock armouring and lining for right bend immediately downstream of outfall (to be completed as separate works in discussion with Auckland Council)											
OF13	Not included within the scope of AC NDC 31819/33076	CU-EX-12 outlet	Existing	Abandoned and replaced with rip-rap apron at outlet of extended culvert	Auckland Council	Y	1500	0	0	0	4600	4600	0.60	4	350	9.0	770	4.5	10.5
OF14	437395	CU-EX-13 outlet	Existing	Abandoned and replaced with rip-rap basin at outlet of extended culvert	Auckland Council	Y	1800	RIP-RAP BASIN 13.0m LONG x 10.2m WIDE WITH 350mm Ø ROCK											
OF15	Not included within the scope of AC NDC 31819/33076	Combined outlet for Constellation Dry Pond and	New	New combined outfall for Constellation High-Level Dry Pond and Caribbean Wetland	Auckland Council	Y	1800	RIP-RAP BASIN 13.0m LONG x 10.2m WIDE WITH 350mm Ø ROCK											
OF16	N/A - New Outfall	Rook Wetland outlet	New	New outfall for proposed Rook Wetland	NZTA	Y	1050	3.0	1.7	1609	0	1609	0.42	3	250	5.3	600	3.2	6.7
OF18	N/A - New Outfall	Near CU-EX-14 outlet	New	New combined outfall for proposed cut-off drains and PM2AH sub-catchment	NZTA	Y	1650	4.5	1.7	2274	3500	5774	0.66	5	500	11.6	1000	5.0	12.7

Notes:
 Rip-rap aprons designed in accordance with HEC-14 (as referenced in TP10)
 Refer to outfall locations on Stormwater Layout Drawings (250310-3PRE-3DES-DRG-1401-1410)
 No changes are proposed to outfalls that are not shown in table above. At those outfalls, the existing peak flow rates and existing outfall structure are considered to be in good working order. Hence, no upgrades to those existing outfalls are proposed as part of the Project.

Northern Corridor Improvements - Riprap Basin Calculations for OF14

Output exported from HY-8

Designed Tallulah Kaegi
Verified Rene van Lierop
Date 8/11/2016

Parameter	Value	Units
Select Culvert and Flow		
Crossing	Caribbean Replacement	
Culvert	Caribbean Culvert	
Flow	12.50	m ³ /s
Culvert Data		
Culvert Width (including multiple barrels)	1.8	m
Culvert Height	1.8	m
Outlet Depth	1.00	m
Outlet Velocity	8.37	m/s
Froude Number	2.68	
Tailwater Depth	1.00	m
Tailwater Velocity	0.00	m/s
Tailwater Slope (SO)	0.0426	
External Dissipator Data		
External Dissipator Category	Streambed Level Structures	
External Dissipator Type	Riprap Basin	
Restrictions		
Froude Number	<3	
Input Data		
Condition to be used to Compute Basin	Best Fit Curve	
Outlet Velocity		
D50 of the Riprap Mixture		
Note:	Minimum HS/D50 = 2 is Obtained if D50 = 0.380 m	
D50 of the Riprap Mixture	0.350	m
DMax of the Riprap Mixture	0.350	m
Results		
Brink Depth	0.997	m
Brink Velocity	8.368	m/s
Depth (YE)	0.864	m
Riprap Thickness	0.700	m
Riprap Foreslope	1.0500	m
Check HS/D50		
Note:	OK if HS/D50 > 2.0	
HS/D50	2.624	
HS/D50 Check	HS/D50 is OK	
Check D50/YE		
Note:	OK if 0.1 < D50/YE < 0.7	
Check D50/YE	0.405	
D50/YE Check	D50/YE is OK	
Basin Length (LB)	13.774	m
Basin Width	10.983	m
Apron Length	4.591	m
Pool Length	9.183	m
Pool Depth (HS)	0.918	m
TW/YE	1.157	
Tailwater Depth (TW)	1.000	m
Average Velocity with TW	0.963	m/s
Critical Depth (Yc)	0.494	m
Average Velocity with Yc	2.115	m/s
Downstream Riprap for High TW		
Distance: 1 LB		
Velocity	4.893	m/s
Size	0.512	m
Distance: 2 LB		
Velocity	2.534	m/s
Size	0.137	m
Distance: 3 LB		
Velocity	1.684	m/s
Size	0.061	m
Distance: 4 LB		
Velocity	1.261	m/s
Size	0.034	m