APPENDIX E

SWM Facility Calculations

CROZIER & ASSOCIATES
Consulting Engineers

Water Quality Requirements
Project #: 1060-6220
Project: Glenelg Expansion Lands
Date: 2023.08.14
By: KS

Water Quality Requirements for Wet Pond

Areas Contributing	Area (ha)	% Imp	25mm RV (mm)	25mm RV (m^3)
SWMF	1.56	50%		0
POST-2	17.13	69%		0
POST-3	0.71	74%		0
WEIGHTED IMP	**19.40**	**68%**	16.12	**3128**

MOE Total WQ Volume (m^3/ha)	220
MOE ED Volume (m^3/ha)	40
MOE ED Volume (m^3)	776
MOE PP Volume (m^3/ha)	180
MOE PP Volume (m^3)	3498
Pond Required ED Volume (m^3)	3128
Pond Required PP Volume (m^3)	3498
Available ED Volume (m^3)	3559
Provided PP Volume (m^3)	3894

CROZIER
CONSULTING ENGINEERS

Project:	1060-6220
Project No.:	Glenelg Expansion Lands
File:	Extended Detention
Design by:	K. Swain
Date:	2023.08.14

EXTENDED DETENTION SPECIFICATIONS - SWM FACILITY
(Per MECP)

Extended Detention Volume (Area x runoff from 25mm event)		3559
t (drawdown time - seconds, *hours in italics*)	*24.0*	86400
Ao (cross section area of orifice - sqm)		0.0330
h (maximum water elevation above orifice for extended detention- m)		0.55
C (discharge coefficient)		0.64
Ap (average surface area for extended detention - sqm)		6328

t = 2*Ap*(h^0.5)/(C*Ao*(g*2)^0.5)

Ao = 0.03832096 sqm d = 221 mm

Extended Detention Orifice Diameter (as designed) d = **205** mm

ACTUAL DRAWDOWN TIME
*Neglecting tailwater conditions

Extended Detention Volume Used	2674
d (orifice diameter, mm)	205
h (maximum head acting on orifice for extended detention, m)	0.44
Ao (cross section area of orifice, m^2)	0.0330
C (discharge coefficient)	0.64
Ap (average surface area for extended detention, m^2)	6135

t = 2*Ap*(h^0.5)/(C*Ao*(g*2)^0.5)

t (hours) 24.2

CROZIER CONSULTING ENGINEERS

Project:	Glenelg Expansion Lands
Project No.:	1060-6220
File:	SWMF Calculations
Design by:	K. Swain
Date:	2023.08.14

SWMF
STAGE STORAGE DISCHARGE

Outlet Structure		
E.D. Orifice Diameter:	0.205	m
E.D. Orifice Invert Elevation:	516.50	m
V-notch angle	0	degrees
V-notch constant	0.00	const
V-notch invert	0.00	m
Rect weir length	0.55	m
Rect weir invert	517.05	m
Extended Detention Depth:	0.55	m

Main Cell Spillway		
Emergency Spill Elev.	518.5	m
Emerg Spill Bot. Width	5	m
Trap. Side Slopes	8%	

	Pond Dimensions				Outlet Structure			Cell Spillway			
	Elev.	Depth Above PP	Area	Storage Volume	ED Orifice Discharge	V-notch Discharge	Rect. Weir Discharge	Emerg. Weir Ave. Width	Emerg. Weir Discharge	Total Discharge	Storage
	(m)	(m)	(sqm)	(cu.m)	(cu.m/s)	(cu.m/s)	(cu.m/s)	(m)	(cu.m/s)	(cu.m/s)	(ha-m)
PP	516.50	0.00	5549	0	0.000	0.000	0.000	0.00	0.000	**0.000**	**0.000**
	516.60	0.10	5901	572	0.000	0.000	0.000	0.00	0.000	0.000	0.057
	516.70	0.20	6253	1180	0.029	0.000	0.000	0.00	0.000	0.029	0.118
	516.80	0.30	6604	1823	0.042	0.000	0.000	0.00	0.000	0.042	0.182
	516.90	0.40	6956	2501	0.051	0.000	0.000	0.00	0.000	0.051	0.250
25mm	516.94	0.44	5549	2674	0.054	0.000	0.000	0.00	0.000	0.054	0.267
ED	517.05	0.55	7484	3559	0.063	0.000	0.000	0.00	0.000	**0.063**	**0.356**
2YR CHI	517.10	0.60	7545	3935	0.066	0.000	0.011	0.00	0.000	0.077	0.393
	517.20	0.70	7668	4695	0.072	0.000	0.059	0.00	0.000	0.131	0.470
5YR CHI	517.21	0.71	7681	4772	0.073	0.000	0.065	0.00	0.000	0.138	0.477
10YR CHI/2YR SCS	517.30	0.80	7791	5468	0.078	0.000	0.127	0.00	0.000	0.205	0.547
25YR CHI	517.40	0.90	7914	6254	0.084	0.000	0.210	0.00	0.000	0.293	0.625
	517.41	0.91	7926	6333	0.084	0.000	0.219	0.00	0.000	0.303	0.633
50YR CHI/5YR SCS	517.50	1.00	8037	7051	0.089	0.000	0.305	0.00	0.000	**0.394**	**0.705**
100YR CHI	517.56	1.06	8111	7536	0.092	0.000	0.369	0.00	0.000	0.460	0.754
	517.60	1.10	8160	7861	0.093	0.000	0.413	0.00	0.000	0.506	0.786
10YR SCS	517.70	1.20	8283	8683	0.098	0.000	0.530	0.00	0.000	0.628	0.868
25YR SCS	517.78	1.28	8381	9350	0.102	0.000	0.631	0.00	0.000	0.733	0.935
	517.80	1.30	8406	9518	0.102	0.000	0.657	0.00	0.000	**0.760**	**0.952**
50YR SCS	517.90	1.40	8529	10364	0.107	0.000	0.793	0.00	0.000	0.900	1.036
	517.92	1.42	8553	10535	0.107	0.000	0.821	0.00	0.000	0.929	1.054
	518.00	1.50	8652	11223	0.111	0.000	0.937	0.00	0.000	1.048	1.122
100YR SCS	518.10	1.60	8774	12095	0.115	0.000	1.089	0.00	0.000	1.203	1.209
	518.20	1.70	8897	12978	0.118	0.000	1.248	0.00	0.000	**1.366**	**1.298**
	518.30	1.80	9020	13874	0.122	0.000	1.414	0.00	0.000	1.536	1.387
	518.40	1.90	9143	14782	0.125	0.000	1.587	0.00	0.000	1.713	1.478
Regional HWL	518.50	2.00	9266	15716	0.129	0.000	1.767	5.00	0.000	**1.896**	**1.572**
	518.60	2.10	9391	16649	0.132	0.000	1.953	5.02	0.292	2.377	1.665
	518.70	2.20	9517	17594	0.136	0.000	2.145	5.03	0.828	3.109	1.759
TOP	518.80	2.30	9642	18552	0.139	0.000	2.343	5.05	1.526	**4.008**	**1.855**

Project No:	1060-6220
Project:	Glenelg Expansion Lands
File:	Forebay Design
Design by:	K. Swain
Date:	2023.08.14

Forebay Design Calculations

	Variable	*Value*
Forebay Settling Length	Length of forebay (m)	58.0
	Average Width of forebay (m)	7.3
	Length-to-width ratio of forebay	7.9
	Peak flow rate from forebay in quality event (m^3/s)	0.052
	Settling velocity (m/s)	0.0003
	Required Forebay Length (m)	**37**
Dispersion Length	Inlet flowrate in 5 year event (m^3/s)	3.601
	Depth of of the permanent pool in the forebay (m)	1.00
	Desired velocity in the forebay (m/s)	0.5
	Length of Dispersion (m)	**58**
Velocity in Forebay Check	Depth of forebay in 10 year event (m) **	2.20
	Cross sectional area (m^2)	22.7
	10 Year Event Flowrate (m^3/s)	4.28
	Velocity in Forebay (m/s)*	**0.19**
Forebay Bottom Width	Length of forebay (m)	58.0
	Minimum Forebay Bottom Width (m)	**7.25**
DESIGN FOREBAY LENGTH (m)		**58.0**
DESIGN BOTTOM WIDTH (m)		**7.3**

* Desired maximum average velocity in the forebay is 0.15 m/s, per MOE 2003, Page 4-56