APPENDIX E

SWM Facility Calculations

CROZIER & ASSOCIATES
Consulting Engineers

Water Quality Requirements
Project #: 1060-6220
Project: Glenelg Expansion Lands
Date: 2023.05.24
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	16.63	69%		0
POST-3	0.71	78%		0
WEIGHTED IMP	**18.90**	**68%**	16.08	**3038**

MOE Total WQ Volume (m^3/ha)	220
MOE ED Volume (m^3/ha)	40
MOE ED Volume (m^3)	756
MOE PP Volume (m^3/ha)	180
MOE PP Volume (m^3)	3408
Pond Required ED Volume (m^3)	3038
Pond Required PP Volume (m^3)	3408
Available ED Volume (m^3)	3228
Provided PP Volume (m^3)	4060

Project:	1060-6220
Project No.:	Glenelg Expansion Lands
File:	Extended Detention
Design by:	K. Swain
Date:	2023.05.25

EXTENDED DETENTION SPECIFICATIONS - SWM FACILITY
(Per MECP)

Extended Detention Volume (Area x runoff from 25mm event)		3300
t (drawdown time - seconds, *hours in italics*)	*24.0*	86400
Ao (cross section area of orifice - sqm)		0.0346
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)		5836

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

Ao = 0.035340114 sqm d = 212 mm

Extended Detention Orifice Diameter (as designed) d = **210** mm

ACTUAL DRAWDOWN TIME
*Neglecting tailwater conditions

Extended Detention Volume Used	2527
d (orifice diameter, mm)	210
h (maximum head acting on orifice for extended detention, m)	0.45
Ao (cross section area of orifice, m^2)	0.0346
C (discharge coefficient)	0.64
Ap (average surface area for extended detention, m^2)	5667

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

t (hours) 21.5

CROZIER CONSULTING ENGINEERS

Project:	Glenelg Expansion Lands
Project No.:	1060-6220
File:	SWMF Calculations
Design by:	K. Swain
Date:	2023.05.24

SWMF
STAGE STORAGE DISCHARGE

Outlet Structure		
E.D. Orifice Diameter:	0.210	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	0.53	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	5155	0	0.000	0.000	0.000	0.00	0.000	**0.000**	**0.000**
	516.60	0.10	5462	531	0.000	0.000	0.000	0.00	0.000	0.000	0.053
	516.70	0.20	5770	1092	0.030	0.000	0.000	0.00	0.000	0.030	0.109
	516.80	0.30	6077	1685	0.043	0.000	0.000	0.00	0.000	0.043	0.168
	516.90	0.40	6385	2308	0.053	0.000	0.000	0.00	0.000	0.053	0.231
25mm	516.95	0.45	5155	2527	0.058	0.000	0.000	0.00	0.000	0.058	0.253
ED	517.05	0.55	6846	3300	0.065	0.000	0.000	0.00	0.000	**0.065**	**0.330**
2YR CHI	517.10	0.60	6905	3644	0.069	0.000	0.011	0.00	0.000	0.080	0.364
	517.15	0.65	6963	3991	0.072	0.000	0.031	0.00	0.000	0.103	0.399
	517.20	0.70	7022	4340	0.076	0.000	0.057	0.00	0.000	0.132	0.434
5YR CHI/2YR SCS	517.30	0.80	7139	5048	0.082	0.000	0.122	0.00	0.000	0.204	0.505
10YR CHI	517.40	0.90	7257	5768	0.088	0.000	0.202	0.00	0.000	0.289	0.577
25YR CHI	517.42	0.92	7280	5914	0.089	0.000	0.219	0.00	0.000	0.308	0.591
	517.50	1.00	7374	6500	0.093	0.000	0.294	0.00	0.000	**0.387**	**0.650**
50YR CHI/5YR SCS	517.51	1.01	7386	6574	0.093	0.000	0.304	0.00	0.000	0.398	0.657
100YR CHI	517.60	1.10	7492	7243	0.098	0.000	0.398	0.00	0.000	0.496	0.724
10YR SCS	517.70	1.20	7609	7998	0.103	0.000	0.511	0.00	0.000	0.614	0.800
	517.78	1.28	7703	8611	0.106	0.000	0.608	0.00	0.000	0.715	0.861
	517.80	1.30	7726	8765	0.107	0.000	0.633	0.00	0.000	**0.741**	**0.876**
25YR SCS	517.90	1.40	7844	9543	0.112	0.000	0.764	0.00	0.000	0.876	0.954
	517.91	1.41	7855	9622	0.112	0.000	0.778	0.00	0.000	0.890	0.962
50YR SCS	518.00	1.50	7961	10334	0.116	0.000	0.903	0.00	0.000	1.019	1.033
100YR SCS	518.06	1.56	8032	10813	0.118	0.000	0.990	0.00	0.000	1.108	1.081
	518.20	1.70	8196	11949	0.124	0.000	1.203	0.00	0.000	**1.327**	**1.195**
	518.30	1.80	8313	12775	0.128	0.000	1.363	0.00	0.000	1.491	1.277
	518.40	1.90	8431	13612	0.132	0.000	1.530	0.00	0.000	1.661	1.361
Regional HWL	518.50	2.00	8548	14461	0.135	0.000	1.703	5.00	0.000	**1.838**	**1.446**
	518.60	2.10	8668	15322	0.139	0.000	1.882	5.02	0.292	2.312	1.532
	518.70	2.20	8787	16194	0.142	0.000	2.067	5.03	0.828	3.037	1.619
TOP	518.80	2.30	8907	17079	0.145	0.000	2.258	5.05	1.526	**3.929**	**1.708**

Project No:	1060-6220
Project:	Glenelg Expansion Lands
File:	Forebay Design
Design by:	K. Swain
Date:	2023-05-24

Forebay Design Calculations

	Variable	*Value*
Forebay Settling Length	Length of forebay (m)	56.0
	Average Width of forebay (m)	7.0
	Length-to-width ratio of forebay	8.0
	Peak flow rate from forebay in quality event (m^3/s)	0.054
	Settling velocity (m/s)	0.0003
	Required Forebay Length (m)	**38**
Dispersion Length	Inlet flowrate in 5 year event (m^3/s)	3.508
	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)	**56**
Velocity in Forebay Check	Depth of forebay in 10 year event (m) **	2.20
	Cross sectional area (m^2)	22.0
	10 Year Event Flowrate (m^3/s)	4.17
	Velocity in Forebay (m/s)*	**0.19**
Forebay Bottom Width	Length of forebay (m)	56.0
	Minimum Forebay Bottom Width (m)	**7.00**
DESIGN FOREBAY LENGTH (m)		**56.0**
DESIGN BOTTOM WIDTH (m)		**7.0**

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