APPENDIX F

Water Balance Calculations

CROZIER CONSULTING ENGINEERS

Project Name: Glenelg Expansion Lands
Project No: 1060-6220
Modelled By: KS
Checked By: NCO
Date: 2023.08.15

Water Budget - Pre-Development
Project Name: Glenelg Expansion Lands
Water Balance/Water Budget Assessment

Pre-development area available for infiltration (landscaped/lawn area considered to infiltrate)
Pre-development area not available for infiltration (total site area less landscaped area noted above)
Remaining Impervious area (e.g. parking asphalt area)

Note: site land use areas consistent with Pre-Development SWM hydrologic modeling & calculations

Catchment Designation	Site					Glenelg Phase 2 Lands	
	Pervious Area to CP Trail	Pervious Area to North Tile Drain	Pervious Area to South Residential	Pervious Area to Southeast Tile Drain	Pervious Area to East Tile Drain	Pervious Area from Glenelg Phase 2 Lands - External	Totals
Area (m^2)	43155	133253	29951	19303	26551	7784	259997
Pervious Area (m^2)	43155	133253	29951	19303	26551	7784	259997
Impervious Area (m^2)	0	0	0	0	0	0	0
Infiltration Factors							
Topography Infiltration Factor	0.25	0.25	0.25	0.25	0.25	0.25	
Soil Infiltration Factor	0.2	0.2	0.2	0.2	0.2	0.2	
Land Cover Infiltration Factor	0.1	0.1	0.1	0.1	0.1	0.1	
MOE Infiltration Factor	0.55	0.55	0.55	0.55	0.55	0.55	
Actual Infiltration Factor	0.55	0.55	0.55	0.55	0.55	0.55	
Run-off Coefficient	0.25	0.25	0.25	0.25	0.25	0.25	
Runoff from Impervious Surfaces *	0	0	0	0	0	0	
Inputs (per Unit Area)							
Precipitation (mm/yr)	1106	1106	1106	1106	1106	1106	1106
Run-On (mm/yr)	0	0	0	0	0	0	0
Other Inputs (mm/yr)	0	0	0	0	0	0	0
Total Inputs (mm/yr)	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**
Outputs (per Unit Area)							
Precipitation Surplus (mm/yr)	573	573	573	573	573	573	573
Net Surplus (mm/yr)	573	573	573	573	573	573	573
Green Roof Evapotranspiration (mm/yr)	0	0	0	0	0	0	0
Wetland Cell Evapotranspiration (mm/yr)	0	0	0	0	0	0	0
Evapotranspiration (mm/yr) *	533	533	533	533	533	533	533
Total Evapotranspiration (mm/yr)	533	533	533	533	533	533	533
Infiltration (mm/yr)	315	315	315	315	315	315	315
Topsoil Amendment Infiltration(mmyr)	0	0	0	0	0	0	0
Bioretention Infiltration(mmyr)	0	0	0	0	0	0	0
Total Infiltration (mm/yr)	315	315	315	315	315	315	315
Runoff Pervious Areas (mm/yr)	258	258	258	258	258	258	258
Runoff Impervious Areas (mm/yr)	0	0	0	0	0	0	0
Total Runoff (mm/yr)	258	258	258	258	258	258	258
Total Outputs (mm/yr)	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**
Difference (Inputs- Outputs)	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Inputs (Volumes)							
Precipitation (m^3/yr)	47738	147404	33132	21353	29371	8611	287609
Run-On (m^3/yr)	0	0	0	0	0	0	0
Other Inputs (m^3/yr)	0	0	0	0	0	0	0
Total Inputs (m^3/yr)	**47738**	**147404**	**33132**	**21353**	**29371**	**8611**	**287609**
Outputs (Volumes)							
Precipitation Surplus (m^3/yr)	24740	76393	17171	11066	15221	4462	149054
Net Surplus (m^3/yr)	24740	76393	17171	11066	15221	4462	149054
Green Roof Evapotranspiration (m^3/yr)	0	0	0	0	0	0	0
Wetland Cell Evapotranspiration (m^3/yr)	0	0	0	0	0	0	0
Evapotranspiration (m^3/yr) *	22998	71012	15961	10287	14149	4148	138555
Total Evapotranspiration (m^3/yr)	22998	71012	15961	10287	14149	4148	138555
Infiltration (m^3/yr)	13607	42016	9444	6086	8372	2454	81979
Topsoil Amendment Infiltration(mmyr)	0	0	0	0	0	0	0
Bioretention Infiltration(m^3/yr)	0	0	0	0	0	0	0
Total Infiltration (m^3/yr)	13607	42016	9444	6086	8372	2454	81979
Runoff Pervious Areas (m^3/yr)	11133	34377	7727	4980	6850	2008	67074
Runoff Impervious Areas (m^3/yr)	0	0	0	0	0	0	0
Total Runoff (m^3/yr)	11133	34377	7727	4980	6850	2008	67074
Total Outputs (m^3/yr)	**47738**	**147404**	**33132**	**21353**	**29371**	**8611**	**287609**
Difference (Inputs- Outputs)	**0**	**0**	**0**	**0**	**0**	**0**	**0**

NOTES:
* Evaporation from impervious areas was assumed to be 20% of precipitation.

CROZIER CONSULTING ENGINEERS

Project Name: Glenelg Expansion Lands
Project No: 1060-6220
Modelled By: KS
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Date: 2023.08.15

Water Budget - Post-Development *Without Mitigation*
Project Name: Glenelg Expansion Lands
Water Balance/Water Budget Assessment

Post-development area available for infiltration (landscaped/lawn area considered to infiltrate)
Post-development area not available for infiltration (total site area less landscaped area noted above)
Remaining Impervious area (e.g. parking asphalt area, building/rooftop area)

Note: site land use areas consistent with Post-Development SWM hydrologic modeling & calculations

Catchment Designation	Site			Glenelg Phase 2 Lands		
	Pervious Area	Impervious Block Area	Impervious Road Area	Pervious Area	Impervious Area	Totals
Area (m^2)	96343	87208	68662	6256	1528	259997
Pervious Area (m^2)	96343	0	0	6256	0	102599
Impervious Area (m^2)	0	87208	68662	0	1528	157398
Infiltration Factors						
Topography Infiltration Factor	0.25	0	0	0.25	0	
Soil Infiltration Factor	0.2	0	0	0.2	0	
Land Cover Infiltration Factor	0.1	0	0	0.1	0	
MOE Infiltration Factor	0.55	0	0	0.55	0	
Actual Infiltration Factor	0.55	0	0	0.55	0	
Run-off Coefficient	0.25	1	1	0.25	1	
Runoff from Impervious Surfaces *	0	0.8	0.8	0	0.8	
Inputs (per Unit Area)						
Precipitation (mm/yr)	1106	1106	1106	1106	1106	1106
Run-On (mm/yr)	0	0	0	0	0	0
Other Inputs (mm/yr)	0	0	0	0	0	0
Total Inputs (mm/yr)	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**
Outputs (per Unit Area)						
Precipitation Surplus (mm/yr)	573	885	885	573	885	760
Net Surplus (mm/yr)	573	885	885	573	885	760
Green Roof Evapotranspiration (mm/yr)	0	0	0	0	0	0
Wetland Cell Evapotranspiration (mm/yr)	0	0	0	0	0	0
Evapotranspiration (mm/yr) *	533	221	221	533	221	346
Total Evapotranspiration (mm/yr)	533	221	221	533	221	346
Infiltration (mm/yr)	315	0	0	315	0	126
Topsoil Amendment Infiltration(mmyr)	0	0	0	0	0	0
Bioretention Infiltration(mmyr)	0	0	0	0	0	0
Total Infiltration (mm/yr)	315	0	0	315	0	126
Runoff Pervious Areas (mm/yr)	258	0	0	258	0	103
Runoff Impervious Areas (mm/yr)	0	885	885	0	885	531
Total Runoff (mm/yr)	258	885	885	258	885	634
Total Outputs (mm/yr)	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**
Difference (Inputs- Outputs)	**0**	**0**	**0**	**0**	**0**	**0**
Inputs (Volumes)						
Precipitation (m^3/yr)	106575	96469	75954	6920	1690	287609
Run-On (m^3/yr)	0	0	0	0	0	0
Other Inputs (m^3/yr)	0	0	0	0	0	0
Total Inputs (m^3/yr)	**106575**	**96469**	**75954**	**6920**	**1690**	**287609**
Outputs (Volumes)						
Precipitation Surplus (m^3/yr)	55232	77176	60763	3586	1352	198110
Net Surplus (m^3/yr)	55232	77176	60763	3586	1352	198110
Green Roof Evapotranspiration (m^3/yr)	0	0	0	0	0	0
Wetland Cell Evapotranspiration (m^3/yr)	0	0	0	0	0	0
Evapotranspiration (m^3/yr) *	51342	19294	15191	3334	338	89499
Total Evapotranspiration (m^3/yr)	51342	19294	15191	3334	338	89499
Infiltration (m^3/yr)	30378	0	0	1973	0	32350
Topsoil Amendment Infiltration(m^3/yr)	0	0	0	0	0	0
Bioretention Infiltration(m^3/yr)	0	0	0	0	0	0
Total Infiltration (m^3/yr)	30378	0	0	1973	0	32350
Runoff Pervious Areas (m^3/yr)	24855	0	0	1614	0	26469
Runoff Impervious Areas (m^3/yr)	0	77176	60763	0	1352	139291
Total Runoff (m^3/yr)	24855	77176	60763	1614	1352	165759
Total Outputs (m^3/yr)	**106575**	**96469**	**75954**	**6920**	**1690**	**287609**
Difference (Inputs- Outputs)	**0**	**0**	**0**	**0**	**0**	**0**

Pre-Development Total Infiltration:
81979 m^3/yr

NOTES:
* Evaporation from impervious areas was assumed to be 20% of precipitation.

CROZIER CONSULTING ENGINEERS

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Water Budget - Post-Development *with Mitigation*
Project Name: Glenelg Expansion Lands
Water Balance/Water Budget Assessment

Post-development area available for infiltration (lawn/landscaped area considered to infiltrate).

Post-development area not available for infiltration (total site area less landscaped area noted above)
Remaining Impervious area (e.g. parking asphalt area, building/rooftop area)

Catchment Designation	Site - Post-Development																		
	Draining to CP Trail (Outlet #1)				Draining to Southeast Tile Drain (Outlet #4)					Draining to East Tile Drain (Outlet #3)		Draining to North Tile Drain (Outlet #2)							
	Pervious Area Draining Uncontrolled to CP Trail	Impervious Area Draining Uncontrolled to CP Trail	Pervious Area Draining from TR-1 (Glenelg Phase 2 Lands)	Impervious Area Draining from TR-1 (Glenelg Phase 2 Lands)	Pervious School Block Draining to Southeast Tile Drain	Impervious School Block Draining to Southeast Tile Drain	Impervious School Roof Draining to Southeast Tile Drain	Impervious Park Draining to Southeast Tile Drain	Pervious Back Lots and Park Area Draining to Southeast Tile Drain	Pervious Back Lots Draining Uncontrolled to East Tile Drain	Impervious Walkway Draining Uncontrolled to East Tile Drain	Impervious Area Tributary to North Tile Drain	Pervious Area Tributary to North Tile Drain	Uncontrolled Impervious Area Tributary to North Tile Drain	Uncontrolled Pervious Area Tributary to North Tile Drain	Impervious SWM Pond Block Tributary to North Tile Drain	Pervious SWM Pond Block Tributary to North Tile Drain	Totals
Area (m^2)	8860	1338	6256	1528	14918	4232	14000	276	5566	2848	1701	123322	55063	3198	1285	7803	7803	259997
Pervious Area (m^2)	8860	0	6256	0	14918	0	0	0	5566	2848	0	0	55063	0	1285	0	7803	102599
Impervious Area (m^2)	0	1338	0	1528	0	4232	14000	276	0	0	1701	123322	0	3198	0	7803	0	157398
Infiltration Factors																		
Topography Infiltration Factor	0.25	0	0.25	0	0.25	0	0	0	0.25	0.25	0	0	0.25	0	0.25	0	0.25	
Soil Infiltration Factor	0.2	0	0.2	0	0.2	0	0	0	0.2	0.2	0	0	0.2	0	0.2	0	0.2	
Land Cover Infiltration Factor	0.1	0	0.1	0	0.1	0	0	0	0.1	0.1	0	0	0.1	0	0.1	0	0.1	
MOE Infiltration Factor	0.55	0	0.55	0	0.55	0	0	0	0.55	0.55	0	0	0.55	0	0.55	0	0.55	
Actual Infiltration Factor	0.55	0	0.55	0	0.55	0	0	0	0.55	0.55	0	0	0.55	0	0.55	0	0.55	
Run-off Coefficient	0.25	1.00	0.25	1.00	0.25	1.00	1.00	1.00	0.25	0.25	1.00	1.00	0.25	1.00	0.25	1.00	0.25	
Runoff from Impervious Surfaces *	0	0.8	0	0.8	0	0.8	0.8	0.8	0	0	0.8	0.8	0	0.8	0	0.8	0	
Inputs (per Unit Area)																		
Precipitation (mm/yr)	1106	1106	1106	1106	1106	1106	1106	1106	1106	1106	1106	1106	1106	1106	1106	1106	1106	1106
Run-On (mm/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Inputs (mm/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Inputs (mm/yr)	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**	1106
Outputs (per Unit Area)																		
Precipitation Surplus (mm/yr)	573	885	573	885	573	885	885	885	573	573	885	885	570	885	573	885	573	738
Net Surplus (mm/yr)	573	885	573	885	573	885	885	885	573	573	885	885	570	885	573	885	573	738
Green Roof Evapotranspiration (mm/yr)	0	0	0	0	0	0	708	0	0	0	0	0	0	0	0	0	0	42
Wetland Cell Evapotranspiration (mm/yr)	0	0	0	0	0	0	0	0	0	0	0	2	3	0	0	0	0	0
Evapotranspiration (mm/yr) *	533	221	533	221	533	221	221	221	533	533	221	221	533	221	533	221	533	368
Total Evapotranspiration (mm/yr)	533	221	533	221	533	221	929	221	533	533	221	223	536	221	533	221	533	410
Infiltration (mm/yr)	315	0	315	0	315	0	0	0	315	315	0	0	313	0	315	0	315	148
Topsoil Amendment Infiltration(mm/yr)	64	0	0	0	64	0	0	0	64	64	0	0	64	0	64	0	64	27
Bioretention Infiltration(mm/yr)	0	0	0	0	0	498	0	0	0	0	0	0	0	0	0	0	0	29
Total Infiltration (mm/yr)	380	0	315	0	380	498	0	0	380	380	0	0	378	0	380	0	380	204
Runoff Pervious Areas (mm/yr)	193	0	258	0	193	0	0	0	193	193	0	0	192	0	193	0	193	95
Runoff Impervious Areas (mm/yr)	0	885	0	885	0	387	177	885	0	0	885	883	0	885	0	885	0	397
Total Runoff (mm/yr)	193	885	258	885	193	387	177	885	193	193	885	883	192	885	193	885	193	492
Total Outputs (mm/yr)	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**	**1106**
Difference (Inputs- Outputs)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**			0
Inputs (Volumes)																		
Precipitation (m^3/yr)	9801	1480	6920	1690	16502	4681	15487	305	6157	3150	1882	136419	60911	3538	1421	8632	8632	287609
Run-On (m^3/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Inputs (m^3/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Inputs (m^3/yr)	**9801**	**1480**	**6920**	**1690**	**16502**	**4681**	**15487**	**305**	**6157**	**3150**	**1882**	**136419**	**60911**	**3538**	**1421**	**8632**	**8632**	**287609**
Outputs (Volumes)																		
Precipitation Surplus (m^3/yr)	5079	1184	3586	1352	8552	3745	12389	244	3191	1633	1505	109135	31381	2830	737	6905	4473	197924
Net Surplus (m^3/yr)	5079	1184	3586	1352	8552	3745	12389	244	3191	1633	1505	109135	31381	2830	737	6905	4473	197924
Green Roof Evapotranspiration (m^3/yr) *	0	0	0	0	0	0	9912	0	0	0	0	0	0	0	0	0	0	9912
Wetland Cell Evapotranspiration (m^3/yr)	0	0	0	0	0	0	0	0	0	0	0	247	186	0	0	0	0	432
Evapotranspiration (m^3/yr) *	4722	296	3334	338	7950	936	3097	61	2966	1518	376	27284	29344	708	685	1726	4158	89499
Total Evapotranspiration (m^3/yr)	4722	296	3334	338	7950	936	13009	61	2966	1518	376	27530	29529	708	685	1726	4158	99843
Infiltration (m^3/yr)	2794	0	1973	0	4704	0	0	0	1755	898	0	0	17260	0	405	0	2460	32248
Topsoil Amendment Infiltration(m^3/yr)	571	0	0	0	962	0	0	0	359	184	0	0	3530	0	83	0	503	6193
Bioretention Infiltration(m^3/yr)	0	0	0	0	0	2107	0	0	0	0	0	0	0	0	0	0	0	2107
Total Infiltration (m^3/yr)	3365	0	1973	0	5666	2107	0	0	2114	1082	0	0	20790	0	488	0	2964	40548
Runoff Pervious Areas (m^3/yr)	1714	0	1614	0	2886	0	0	0	1077	551	0	0	10591	0	249	0	1510	20192
Runoff Impervious Areas (m^3/yr)	0	1184	0	1352	0	1639	2478	244	0	0	1505	108888	0	2830	0	6905	0	127026
Total Runoff (m^3/yr)	1714	1184	1614	1352	2886	1639	2478	244	1077	551	1505	108888	10591	2830	249	6905	1510	147218
Total Outputs (m^3/yr)	**9801**	**1480**	**6920**	**1690**	**16502**	**4681**	**15487**	**305**	**6157**	**3150**	**1882**	**136419**	**60911**	**3538**	**1421**	**8632**	**8632**	**287609**
Difference (Inputs- Outputs)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0

Runoff draining to CP Tile Drain decreased by **47% (5,269 m^3/yr)** in Post-Development Conditions
Runoff draining to Southeast Tile Drain increased by **67% (3,344 m^3/yr)** in Post-Development Conditions
Runoff draining to East Tile Drain decreased by **70% (4,793 m^3/yr)** in Post-Development Conditions
Runoff draining to North Tile Drain increased by **281% (96,597 m^3/yr)** in Post-Development Conditions

Pre-Development Total Infiltration:
315 mm/yr
Note:
621.9 mm
Precipitation available between Apr-Oct (non-winter months).
Therefore available for infiltration into non-frozen soil

NOTES:
* Evaporation from impervious areas was assumed to be 20% of precipitation.
* Evaporation from green roof is 84% of precipitation per Green Roof specification.
* Runoff Reduction for bioretention facilities assumed to be 45% based on Low Impact Development Stormwater Managemen Planning and Design Guide by CVC and TRCA (2010).

Project: Glenelg Expansion Lands
Project No: 1060-6220
Modelled By: KS
Checked By: NCO
Date: 2023.08.15

Water Budget Summary
Project Name: Glenelg Expansion Lands
Water Balance/Water Budget Assessment

Characteristic	Site				
	Pre-Development	Post-Development	Post-Development *with Mitigation*	Change (Pre to Post)	Change (Pre to Post) *with Mititgation*
Inputs (Volumes)					
Precipitation (m^3/yr)	287609	287609	287609	0%	0%
Run-On (m^3/yr)	0	0	0	0%	0%
Other inputs (m^3/yr)	0	0	0	0%	0%
Total Inputs (m^3/yr)	**287609**	**287609**	**287609**	**0**	**0**
Outputs (Volumes)					
Precipitation Surplus (m^3/yr)	149054	198110	197924	33%	33%
Net Surplus (m^3/yr)	149054	198110	197924	33%	33%
Green Roof Evapotranspiration (m^3/yr)	0	0	9912	-	**9912 m3/yr**
Wetland Cell Evapotranspiration (m^3/yr)	0	0	432	-	**432 m3/yr**
Evapotranspiration (m^3/yr)	138555	89499	89499	-35%	-35%
Total Evapotranspiration (m^3/yr)	138555	89499	99843	-35%	-28%
Infiltration (m^3/yr)	81979	32350	32248	-61%	-61%
Topsoil Amendment Infiltration (m^3/yr)	0	0	6193	-	**6193 m3/yr**
Bioretention Infiltration (m^3/yr)	0	0	2107	-	**2107 m3/yr**
Total Infiltration (m^3/yr)	**81979**	**32350**	**40548**	-61%	-51%
Runoff Pervious Areas (m^3/yr)	67074	26469	20192	-61%	-70%
Runoff Impervious Areas (m^3/yr)	0	139291	127026	-	-
Total Runoff (m^3/yr)	67074	165759	147218	147%	119%
Total Outputs (m^3/yr)	**287609**	**287609**	**287609**	0%	0%

NOTES:
Months contributing to Water Balance (winter months not considered due to freezing effects) - April, May, June, July, August, September, October = 7 months

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Project No: 1060-6220
Modelled By: KS
Date: 2023.08.15

Design Storm Determination - Bioretention in School Block
Project Name: Glenelg Expansion Lands
Water Balance/Water Budget Assessment

Days with Precipitation (From Climate Data)

	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
>= 0.2 mm	14.6	13	12.8	11.9	13.1	15.3	16.9	98
>= 5 mm	4.7	5.6	5.2	4.5	5.2	6.2	6.1	38
>= 10 mm	2.1	2.9	3.2	2.2	3	3.5	2.9	20
>= 25 mm	0.32	0.64	0.86	0.81	0.81	0.86	0.33	5

Available Precipitation

Storm Event (mm)	**Total Days Per Year**	**Incremental Precipitation (mm/yr)**	**Cummulative Precipitation (mm/yr)**
0.2	98	19.5	19.5
5	38	187.5	207.0
10	20	198.0	405.0
25	5	115.8	520.8
Total	**160**	**520.8**	

Bioretention Infiltration Target: 498 mm/yr

Runoff Coefficient: 1.00

Design Precipitation: 498 mm/yr (Design Infiltration / Contributing RC)

Therefore Min. Design Storm: 22.02 mm

Volume of Storage Required: 93.20 m^3

Project: Glenelg Expansion Lands
Project No: 1060-6220
Modelled By: KS
Date: 2023.08.15

Mitigation Sizing - Bioretention in School Block
Project Name: Glenelg Expansion Lands
Water Balance/Water Budget Assessment

Contributing Drainage Area:	4232	m^2
Runoff Coefficient:	1.00	
Design Storm:	22	mm
Design Runoff/Infiltration Volume:	93.2	m^3

Maximum Depth of Cell

$$d_{cmax} = i*(t_s-d_p/i)/V_r$$

Where:
$d_{c\,max}$ = Maximum cell depth (mm)
i = Infiltration rate for native soils (mm/hr)
V_r = Void space ratio for filter bed and gravel storage layer (assume 0.4)
t_s = Time to drain
d_p = Maximum surface ponding depth (mm)

Assumptions

i^1 =	15	mm/hr
V_r =	0.4	
t_s =	48	hr
d_p =	0	mm
$d_{c\,max}$ =	1.800	m

Hydraulic Conducivity Based on Borehole MW22-316

Hydraulic Conductivity:	2.60E-07	m/s
Screened Strata:	Silty Sand Till	
Percolation Rate:	30	mm/hr
Safety Factor:	2	
Design Percolation Rate:	15	mm/hr

Length of Bioretention:	20	m
Width of Bioretention:	4	m
Number of LIDs:	2	
Storage Depth:	1.500	m
Drawdown Time:	40	hr
Total Volume Retained:	96	m^3

Groundwater Depth Based on Borehole MW22-314

Depth to Groundwater:	4.38	m
Storage Depth:	1.500	m
Clearance from Groundwater:	2.880	m

Therefore, the proposed system will drain within 48 hours and will provide a retention volume that exceeds the volume for mitigation.

Green Roof Hydrologic Model for

School for Kim Swain

Dundalk, Ontario, Canada

prepared by Karen Liu karen@nlsm.ca null

Systems evaluated: Next Level Stormwater profile: StormCap+ Detention 120+25+75

Design Storm: Type II distribution, 132.74 mm total volume, 24 hours total duration

Antecedent conditions: Green roof profile at 100% of ASTM F1815 retention capacity. I.e. gravitational water from any prior rain event has drained out. I.e. simulating conditions within approximately 1 day of a prior rain event.

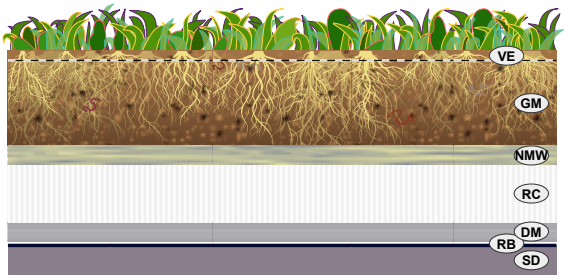
Modeled using Green Roof Diagnostics Green Roof Detention Modeler version 0.1.1

Printed: 2023-08-01

design storm and max allowable outflow rate are provided by client, assumed 250m2 per roof drain

area	profile	size m2	slope (deg)	ballast weight kgM2	dead load kgM2	live load kgM2	combined load kgM2
Overall Project	*varies*	14000	*varies*	*varies*	*varies*	*varies*	*varies*
Area 1	StormCap+ Detention 120+25+75	14000	1.8	116	201	86	288

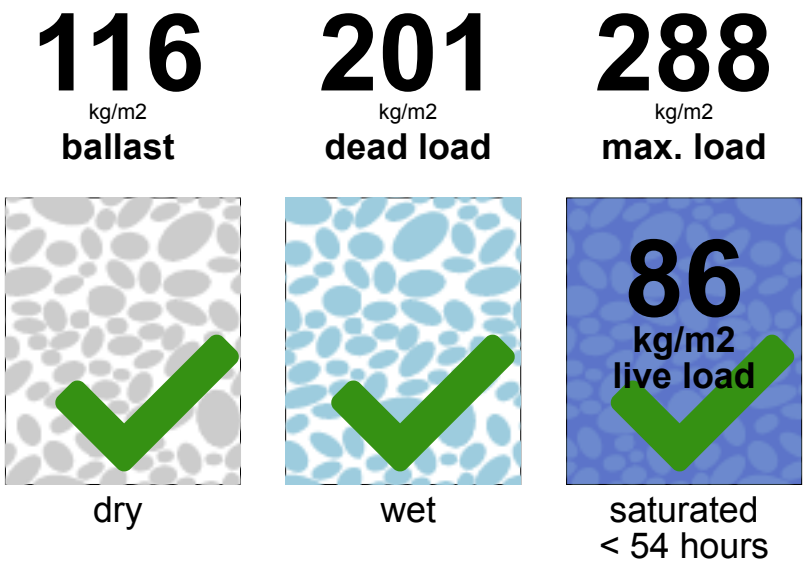
1. Overall Project Weight Summary Table



	thickness	component
VE	12mm	Sedum Blanket
GM	110mm	NL600 Growing Media
NMW	25mm	NL501 Needled Mineral Hydro Blanket
RC	75mm	NL351 Reservoir Cell
DM	5mm	NL350 Detention Mat
XPS	0mm	Extruded Polystyrene Insulation (XPS)
RB	0.7mm	NL120 Protective Fleece
	0mm	allowable ponding
	1.8	deg slope
	56	drains this area
	600mm	drainage length per drain
	*	included in soil/media depth

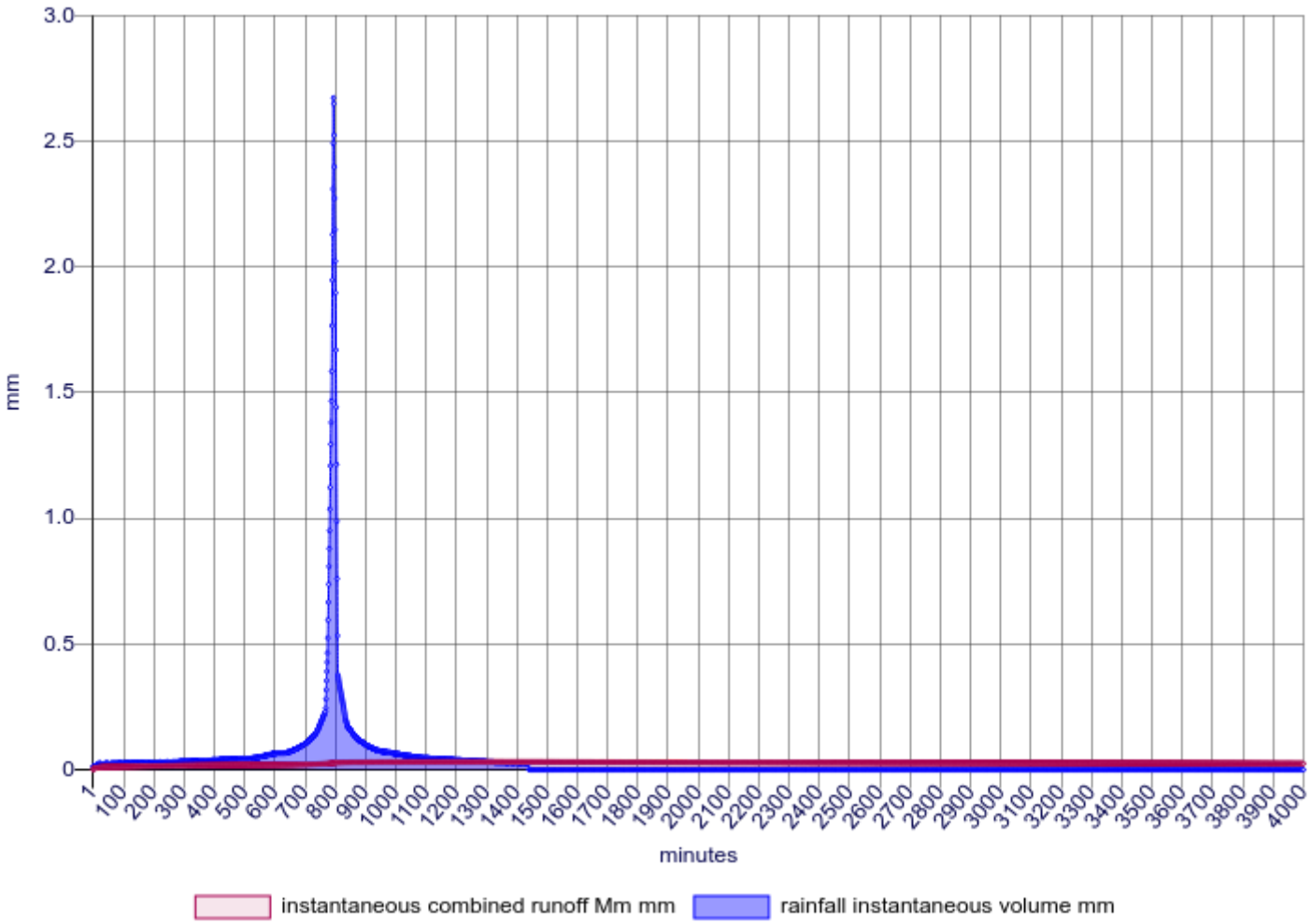
2. Area 1: 14000 m2, Profile: Next Level Stormwater StormCap+ Detention 120+25+75

School roof area = 1.40 ha = 14,000 m2



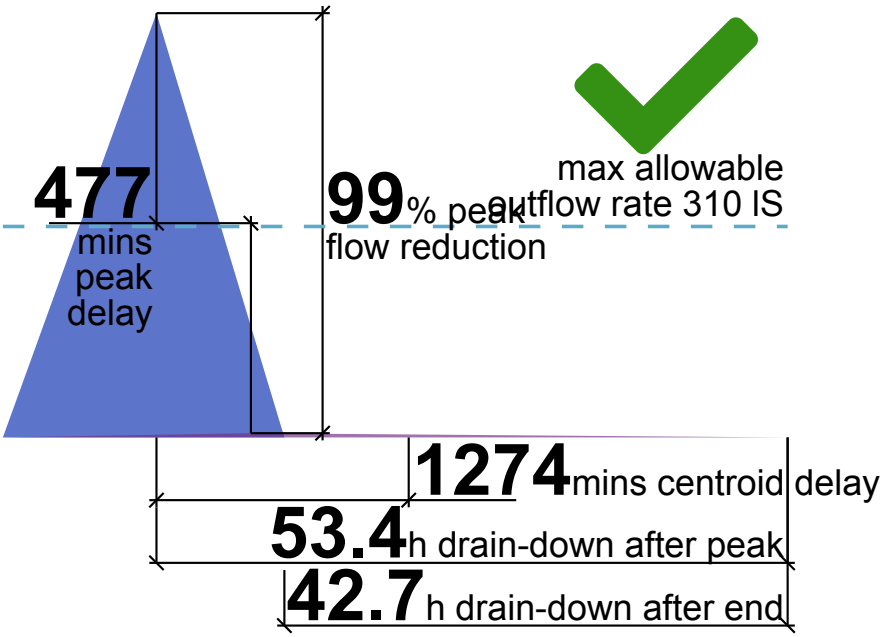
Note: Dead load corresponds with the maximum retention value per ASTM E-2399 / FLL B.2, which is used to estimate worst case scenario for structural conditions.

3. Area 1 Weight Summary



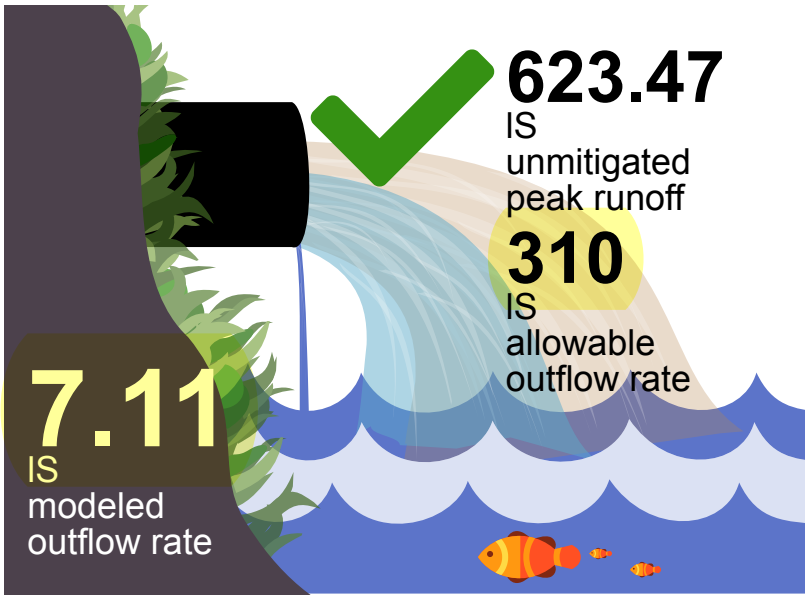
4. Overall Project Detailed Hydrograph

Design Storm: Type II distribution, 132.74 mm total volume, 24 hours total duration



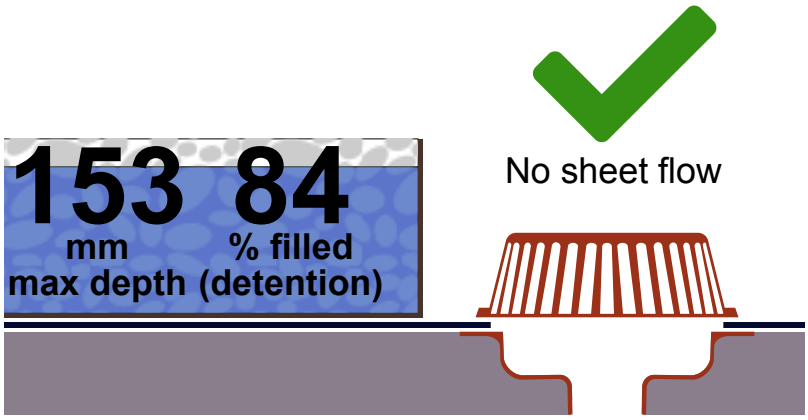
5. Overall Project Diagrammatic Hydrograph

Design Storm: Type II distribution, 132.74 mm total volume, 24 hours total duration



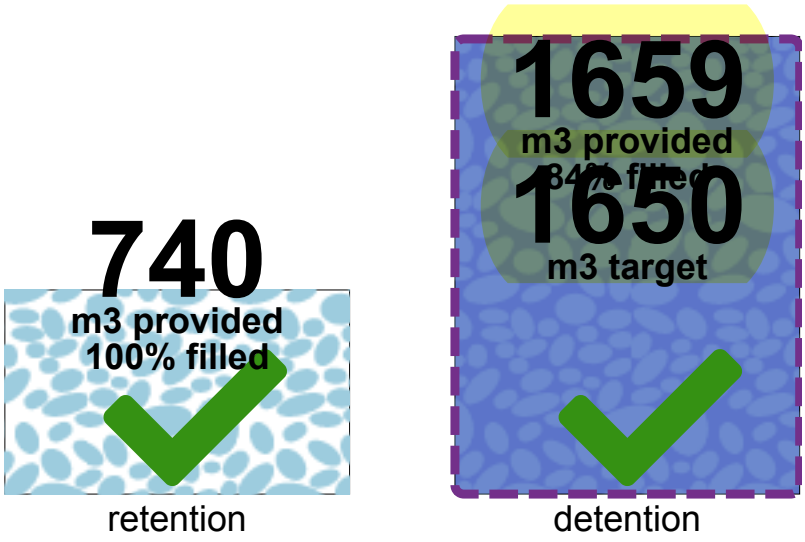
6. Overall Project Diagrammatic Flow Rate Compliance

Design Storm: Type II distribution, 132.74 mm total volume, 24 hours total duration



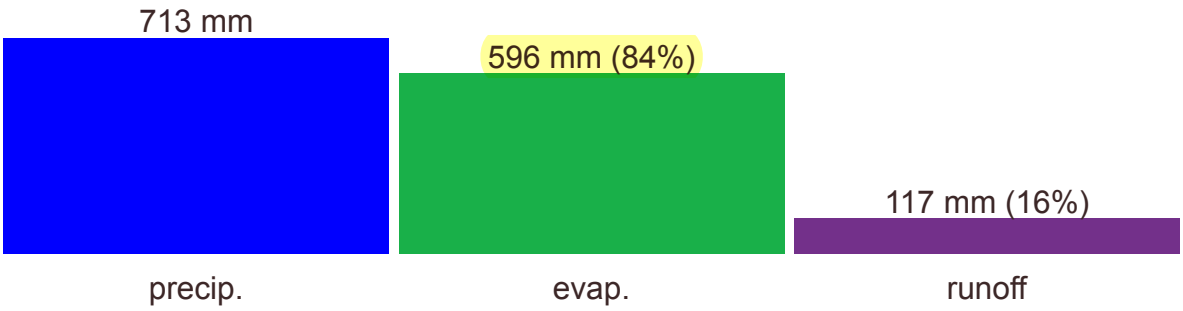
7. Overall Project Diagrammatic Overflow Compliance

Design Storm: Type II distribution, 132.74 mm total volume, 24 hours total duration

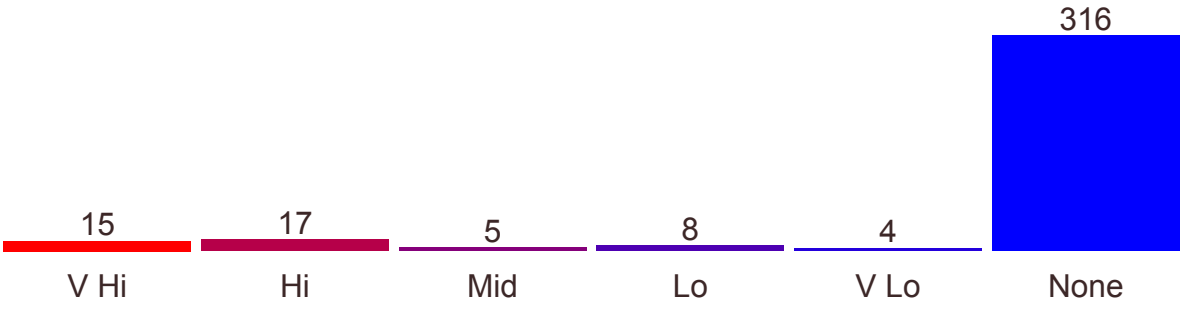


Note: Retention value is likely (modeled) retention, which is lower than the ASTM E-2399 / FLL B.2 maximum storage volume.

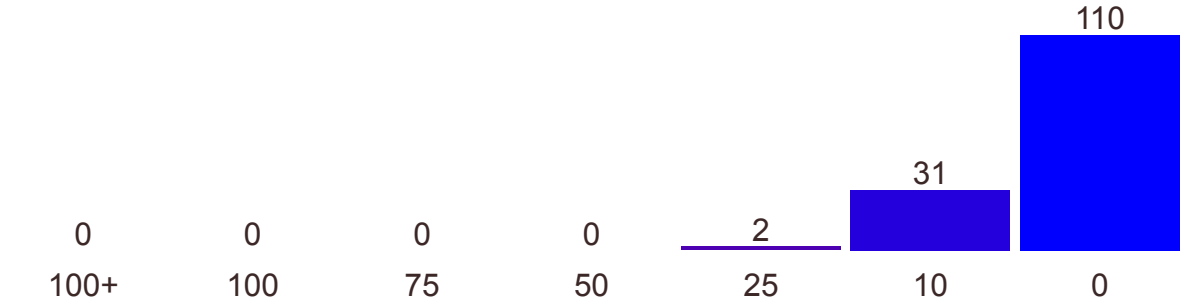
8. Overall Project Storage Summary (Modeled Values)



Rain and Runoff (mm)



Stress Days By Severity



Rain Days By Runoff Volume

9. Overall Project Annual Retention Performance

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