City of Guelph

Stormwater Management Master Plan

Appendix D – Preliminary Recommendations for Existing Stormwater Facilities and OGS Units

January 2022

Prepared for:
The City of Guelph

Stormwater Management Master Plan

Appendix D: Preliminary Recommendations for Existing Stormwater Facilities and OGS Units

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Project: **Guelph Stormwater Management Master Plan**

Subject: **Preliminary Recommendations for Existing Stormwater Facilities and OGS Units**

As part of the Stormwater Management Master Plan (SWMMP) for the City of Guelph, Aquafor has completed several investigations into the performance of the City's existing stormwater management facilities (SWMF). These have been summarized in the following reports:

- Stormwater Management Facility Inspection Summary (Aquafor Beech, 2021)
- Stormwater Management Facilities, OGS and Catchments Report (Aquafor Beech, 2021)

Aquafor has also reviewed SWM facility recommendations arising from previous reports, as well as City SWMF and OGS sediment removal data:

- City of Guelph Stormwater Management Master Plan (AMEC, 2012)
- City of Guelph 2014 Stormwater Management Facilities Inventory, Assessment, and Maintenance Needs Study Report (CH2M HILL, 2015)
- SWM ponds Sediment Removal, Hauling and Disposal Cost (2016-2020)
- Various OGS inspection and sediment removal spreadsheets (2015-2020)
- Available ECAs and SWM reports (various dates)

1 Stormwater Management Facilities

1.1 Recommended Actions

Aquafor has developed a comprehensive spreadsheet recommending next steps for each SWMF (**Table 1**). Recommended actions include:

- Revise Classification – since many facilities have been re-classified to match the classification in their original design report, it is recommended that the City update their database to match the design report classification.
- Additional Study – Various additional studies may be recommended to determine what actions are recommended for a SWMF (eg. retrofit, etc).
    - Confirm Level of Service – the level of quantity or quality control provided by a facility was not always available. For facilities where the quantity or quality control level is unknown, it is recommended that the City investigate whether the desired level of service is being achieved. The City currently specifies Enhanced water quality control, and post-to-pre control of the 2-100 year peak flows for quantity control.
    - Efficiency of SWMF at High Risk of Failure – these facilities were found to have a high combined risk score; extreme or large catchment area risk score or imperviousness risk score; and/or had insufficient permanent pool or extended detention volumes by the *2021 Stormwater Management Facilities, OGS and Catchments Report* due to

changes in the catchment area or imperviousness and changes to minimum water quality treatment thresholds. This report recommended the completion of water quality sampling, preferably using Event Mean Concentration (EMC) methodology, to help determine the actual efficiency of these facilities and identify whether a retrofit is recommended. The City's existing SWM pond monitoring program could be expanded to include this EMC sampling.
    - Maintenance Inspection – Ponds 127–129 were only identified in 2021, and were therefore not included in the 2014 or 2020 inspections.
    - Bathymetric and Topographic Surveys – Since the last bathymetric surveys were completed in 2014, it is recommended that the City survey all ponds not currently recommended for sediment removal to enable prioritization of future sediment removal activities.
    - Due to a lack of design information, it was not possible to identify whether some facilities were at a high risk of failure. Bathymetric and topographic surveys, followed by detailed modeling of pond function, are recommended to be completed by the City to determine whether the facilities are at risk of failure.

- Maintenance – SWMF maintenance activities to address pond deficiencies have been recommended through the *2021 Stormwater Management Facility Inspection Summary* and through the *2014 SWMF Report*. All maintenance recommendations from the *2014 SWMF Report* were carried forward, unless the City confirmed these maintenance activities had been completed. A full summary of uncompleted maintenance activities is provided in **Appendix A.**

- Sediment Removal – The *2014 SWMF Report* completed bathymetry on many of the City's SWMF, and identified which facilities required sediment removal (i.e., clean-out of all sediment accumulation within the pond). These facilities were cross-checked against the City's spreadsheet identifying sediment removal, and the remaining facilities were included in the recommendation for sediment removal activities. Additional facilities may require sediment removal; however, without the completion of additional bathymetric studies these additional facilities cannot be identified.

- Retrofit – Multiple purposes of retrofit were included in the spreadsheet to allow for retrofit prioritization. If multiple retrofit needs were identified for a facility based on the results of previous assessments, the purpose with the broadest scope was listed as the recommended action in **Table 1:**
    - Level of Service – since the design level of service of these facilities doesn't meet the City's current standards, it is recommended that these facilities be retrofitted to meet the City's current standards, or the maximum extent possible. Since the Level of Service was unknown for several facilities, the need for this work is contingent on confirmation of the facility's design Level of Service.
        - Eg. Pond 54 was designed to provide Normal (Level 2) water quality treatment, and therefore doesn't meet the City's current standard to provide Enhanced quality control. A Level of Service retrofit was therefore recommended.
    - Construction Issue – the *2014 SWMF Report* identified several facilities where there were significant differences between the design plan and profile and the results of the bathymetry survey which were unlikely to be attributed to sediment accumulation. It is recommended that these deficiencies be corrected.

- Includes Level of Service retrofits, if applicable.
- Eg. Bathymetry in 2014 found that Pond 100 varied significantly from the design drawing (Construction Issue). Pond 100 also only provides quantity control to the 5-year event (Level of Service). A Construction Issue retrofit was therefore recommended.

- Dry to Wet – the *2012 SWM-MP* recommended these facilities to be retrofit from a dry to wet facility. SWMF 26 was reclassified to an infiltration facility, not a dry pond, so this recommendation was not carried forward for this facility.
  - Includes Construction Issue and Level of Service retrofits, if applicable.
  - Eg. Pond 18 was recommended for Dry to Wet Retrofit in the 2012 SWM-MP and doesn't meet current level of service as it currently only provides 10-year quantity control. A Dry to Wet retrofit was therefore recommended.
- Retrofit – the need for retrofit of these facilities arose from Aquafor's inspection or from the *2012 SWM-MP*.
  - Includes Dry to Wet, Construction Issue, and Level of Service retrofits, if applicable.
  - Eg. Pond 20 was underexcavated (Construction Issue), only provides 5-year quantity control and unknown quality control (Level of Service), and was recommended for retrofit as it is an infiltration facility that was observed to maintain high levels of standing water. A Retrofit was therefore recommended.

Table 1: SWM Facility Recommendations

SWM Pond #	Existing GIS Classification	Design Report Classification	Results of Previous Assessments[1]							Recommended Action[2]				
			Results of 2012 SWM-MP	2014 Study Identified Differences from Design (i.e., Construction Issue)	Sediment Removal Year (per 2014 Study)	Uncompleted Maintenance from 2014 Study	2020 Maintenance Inspection Outcome	Doesn't Meet Current Level of Service (LOS)[3]	Catchments at Risk (2021)	Revise Classification	Additional Study	Maintenance	Sediment Removal	Retrofit
1	Dry[4]	Wetland	Storm Sewer Outlet Retrofit [complete]	-	-	-	Maintenance	-	-	y	-	y	-	-
2	Dry	Infiltration	-	-	-	Yes	Retrofit	Unknown Quantity or Quality	-	y	LOS; Missing Design Info	y	-	Retrofit
3	Dry	Infiltration	Grading and Outlet Reconfiguration	Plan form approx. 10 m smaller than design diameter; forebay bottom approx. 1m above design elevation	2019	Yes	Retrofit	Unknown Quantity or Quality	-	y	LOS; Missing Design Info	y	y	Retrofit
4	Wet	Infiltration	-	-	-	-	-	Unknown Quantity or Quality	-	y	LOS; Missing Design Info	-	-	-
5	Dry	Infiltration - Online	-	-	-	Yes	Maintenance	Unknown Quality	-	y	LOS; Missing Design Info	y	-	-
6	Dry	Infiltration - Online	-	-	-	Yes	Maintenance	Unknown Quality	-	y	LOS; Missing Design Info	y	-	-
7	Dry	Infiltration	-	-	-	Yes	Retrofit	Unknown Quantity or Quality	-	y	LOS; Missing Design Info	y	-	Retrofit
8	Dry	Wet	-	-	-	Yes	Maintenance	Unknown Quantity or Quality	Small Catchment Risk	y	LOS; Missing Design Info	y	-	-
9	Dry	Dry	Retrofit Dry to Wet Pond	-	-	Yes	Maintenance	5-year Quantity	-	-	Missing Design Info	y	-	Dry to Wet
10	Dry	Infiltration	-	-	-	Yes	Retrofit	Unknown Quantity or Quality	Small Catchment Risk	y	LOS; Missing Design Info	y	-	Retrofit

[1] A dash (-) indicates Not Applicable (i.e., no issues warranting actions identified in previous assessments).
[2] A dash (-) indicates Not Applicable (i.e., no recommended action).
[3] Where Level of Service is listed as "Unknown" this means that either the information was not present in the design report or ECA, or that no design report or ECA was available.
[4] Redesigned as a wetland in 2017, but GIS classification not yet updated after construction concluded.

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11	Dry	Infiltration	Grading and Outlet Reconfiguration	-	-	Yes	Retrofit	Unknown Quantity or Quality	Low Combined Risk	y	LOS	y	-	Retrofit
12	Dry	Dry - Online	-	-	-	Yes	Maintenance	-	Minimal Catchment Risk	y	Missing Design Info	y	-	-
13	Dry	Infiltration	-	-	-	Yes	Maintenance	Unknown Quantity or Quality	-	y	LOS; Missing Design Info	y	-	-
14	Dry	Infiltration	-	-	-	Yes	Maintenance	Unknown Quality	Minimal Catchment Risk	y	LOS; Missing Design Info	y	-	-
15	Wet	Wet	-	-	-	Yes	-	Unknown Quality	Extreme Catchment Risk	-	LOS; Efficiency; Missing Design Info	y	-	-
16	Dry	Wet	-	-	-	Yes	-	-	-	y	Missing Design Info	y	-	-
17	Dry	Dry with Infiltration	-	-	-	Yes	Maintenance	Unknown Quality	-	y	LOS; Missing Design Info	y	-	-
18	Dry	Dry	Retrofit Dry to Wet Pond	-	-	Yes	Maintenance	10-year Quantity	Medium Combined Risk	-	-	y	-	Dry to Wet
19	Dry	Wet	-	-	-	Yes	Maintenance	Unknown Quantity or Quality	-	y	LOS; Missing Design Info	y	-	-
20	Dry	Infiltration	-	Underexcavated (pond bottom approx. 8m narrower than design drawing)	-	-	Retrofit	5-year Quantity; Unknown Quality	Extreme Catchment Risk	y	LOS; Efficiency; Missing Design Info	-	-	Retrofit
21	Dry	Dry	Retrofit Dry to Wet Pond	-	-	Yes	Maintenance	5-year Quantity	Moderate Catchment Risk	-	Missing Design Info	y	-	Dry to Wet
22	Dry	Infiltration	Grading and Outlet Reconfiguration	-	2022	Yes	Retrofit	Unknown Quantity or Quality	Low Combined Risk	y	LOS	y	y	Retrofit
23	Dry	Dry	-	-	-	Yes	Maintenance	5-year Quantity		-	Missing Design Info	y	-	LOS
24	Dry	Wet	New Oil Grit Separator	-	-	Yes	Maintenance	Unknown Quality	Minimal Catchment Risk	y	LOS; Missing Design Info	y	-	-

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25	Dry	Infiltration	-	-	-	Yes	Retrofit	Unknown Quality	Medium Combined Risk	y	LOS	y	-	Retrofit
26	Dry	Infiltration	Retrofit Dry to Wet Pond [note, facility reclassified as infiltration in 2020]	-	-	Yes	Retrofit	Unknown Quality	Medium Combined Risk	y	LOS	y	-	Retrofit
27	Dry	Dry	Retrofit Dry to Wet Pond	-	-	Yes	Maintenance	-	Large Catchment Risk	-	Efficiency; Missing Design Info	y	-	Dry to Wet
28	Wet	Wet	-	-	-	Yes	-	-	Minimal Catchment Risk; Insufficient Extended Detention	-	Efficiency; Missing Design Info	y	-	-
29	Dry	Dry	-	-	-	Yes	Maintenance	-	Medium Combined Risk	-	-	y	-	-
30	Dry	Dry	-	-	-	Yes	Maintenance	-	Low Combined Risk	-	-	y	-	-
31	Dry	Dry	-	-	-	Yes	Maintenance	Unknown Quality	Low Combined Risk	-	LOS	y	-	-
32	Dry	Dry	-	-	-	Yes	Maintenance	5-year Quantity	-	-	Missing Design Info	y	-	LOS
33	Wet	Wet	-	Pond bottom elevations significantly different from design (cannot be attributed to sedimentation)	-	Yes	-	Unknown Quality	Low Combined Risk	-	LOS	y	-	Construction Issue
34	Dry	Dry	-	Pond differed considerably from design drawing	-	Yes	Maintenance	Level 2	Low Combined Risk	-	-	y	-	Construction Issue

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			Results of 2012 SWM-MP	2014 Study Identified Differences from Design (i.e., Construction Issue)	Sediment Removal Year (per 2014 Study)	Uncompleted Maintenance from 2014 Study	2020 Maintenance Inspection Outcome	Doesn't Meet Current Level of Service (LOS)[3]	Catchments at Risk (2021)	Revise Classification	Additional Study	Maintenance	Sediment Removal	Retrofit
35	Wet	Wet	-	Some underexcavated areas	2015	Yes	-	Level 3	Low Combined Risk; Insufficient PP; Insufficient Extended Detention	-	Efficiency	y	y	Construction Issue
36	Wet	Wet	-	Pond not constructed in accordance with design drawing. Could not properly consider sediment removal volumes.	2023	Yes	-	Level 3	Medium Combined Risk; Insufficient PP; Insufficient Extended Detention	-	Efficiency	y	y	Construction Issue
37	Wet	Wet	-	-	2025	Yes	-	Level 2	Low Combined Risk; Insufficient PP	-	Efficiency	y	y	LOS
38	Dry	Dry	Retrofit Dry to Wet Pond	Pond varies significantly from design drawing. Could not properly consider sediment removal volumes.	-	Yes	Maintenance	-	Low Combined Risk	-	-	y	-	Dry to Wet
39	Wet	Wet	-	Pond varies significantly from design drawing. Could not properly consider sediment removal volumes.	-	Yes	-	Unknown Quality	Low Combined Risk	-	LOS	y	-	Construction Issue
40	Greenway	Greenway	-	-	-	Yes	-	-	Minimal Catchment Risk	-	Missing Design Info	y	-	-
41	Greenway	Greenway	-	-	-	-	-	-	Minimal Catchment Risk	-	Missing Design Info	-	-	-
42	Greenway	Greenway	-	-	-	Yes	-	-	Minimal Catchment Risk	-	Missing Design Info	y	-	-
43	Greenway	Greenway	-	-	-	Yes	-	-	Moderate Catchment Risk	-	Missing Design Info	y	-	-

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44	Greenway	Greenway	-	-	-	Yes	-	-	Extreme Catchment Risk	-	Efficiency; Missing Design Info	y	-	-
45	Greenway	Greenway	-	-	-	Yes	-	-	Extreme Catchment Risk	-	Efficiency; Missing Design Info	y	-	-
46	Greenway	Greenway	-	-	-	Yes	-	-	Extreme Catchment Risk	-	Efficiency; Missing Design Info	y	-	-
47	Greenway	Greenway	-	-	-	Yes	-	-	Extreme Catchment Risk	-	Efficiency; Missing Design Info	y	-	-
48	Greenway	Greenway	-	-	-	Yes	-	-	Extreme Catchment Risk	-	Efficiency; Missing Design Info	y	-	-
49	Greenway	Greenway	-	-	-	-	-	-	-	-	Missing Design Info	-	-	-
50	Greenway	Greenway	-	-	-	Yes	-	-	-	-	Missing Design Info	y	-	-
53	Wet	Wetland	-	-	2024	Yes	-	5-year Quantity; Level 2 Quality	Low Combined Risk	y	-	y	y	LOS
54	Wet	Wet	-	-	-	Yes	-	Level 2	Medium Combined Risk	-	-	y	-	LOS
55	Wet	Wet	-	Pond bottom approx. 0.5m higher than design.	-	-	-	Unknown Quantity; Level 2 Quality	Extreme Imperviousness Risk	-	LOS; Efficiency; Missing Design Info	-	-	Construction Issue
56	Greenway	Greenway	-	-	-	Yes	-	5-year Quantity	Large Catchment Risk	-	Efficiency; Missing Design Info	y	-	LOS
57	Greenway	Greenway	-	-	-	Yes	-	5-year Quantity	Moderate Catchment Risk	-	Missing Design Info	y	-	LOS
58	Greenway	Greenway	-	-	-	-	-	5-year Quantity	Large Catchment Risk	-	Efficiency; Missing Design Info	-	-	LOS
59	Greenway	Greenway	-	-	-	Yes	-	5-year Quantity	Large Catchment Risk	-	Efficiency; Missing Design Info	y	-	LOS

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60	Greenway	Greenway	-	-	-	Yes	-	5-year Quantity	Minimal Catchment Risk	-	Missing Design Info	y	-	LOS
61	Greenway	Greenway	-	-	-	Yes	-	5-year Quantity	Minimal Catchment Risk	-	Missing Design Info	y	-	LOS
62	Greenway	Greenway	-	-	-	Yes	-	-	Medium Combined Risk	-	-	y	-	-
63	Greenway	Greenway	-	-	-	Yes	-	-	Medium Combined Risk	-	-	y	-	-
64	Greenway	Greenway	-	-	-	Yes	-	-	Medium Combined Risk	-	-	y	-	-
65	Greenway	Greenway	-	-	-	Yes	-	-	Medium Combined Risk	-	-	y	-	-
66	Greenway	Greenway	-	-	-	Yes	-	-	High Combined Risk	-	Efficiency	y	-	-
67	Greenway	Greenway	-	-	-	-	-	-	Minimal Catchment Risk	-	Missing Design Info	-	-	-
68	Greenway	Greenway	-	-	-	Yes	-	-	Medium Combined Risk	-	-	y	-	-
69	Greenway	Greenway	-	Pond varies significantly from design drawing. Could not properly consider sediment removal volumes.	-	Yes	-	-	Large Catchment Risk	-	Efficiency; Missing Design Info	y	-	Construction Issue
70	Greenway	Greenway	-	-	-	Yes	-	-	Large Catchment Risk	-	Efficiency; Missing Design Info	y	-	-
71	Greenway	Greenway	-	-	-	Yes	-	-	Large Catchment Risk	-	Efficiency; Missing Design Info	y	-	-
72	Greenway	Greenway	-	-	-	Yes	-	-	Large Catchment Risk	-	Efficiency; Missing Design Info	y	-	-
73	Wet	Wet with Infiltration Basin	-	Plan form approx. 5m smaller in diameter than design drawing.	-	Yes	-	-	Low Combined Risk; Insufficient	y	Efficiency	y	-	Construction Issue

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									Extended Detention					
74	Dry	Wet with Infiltration Basin	-	-	2023	Yes	Maintenance	-	Low Combined Risk; Insufficient Extended Detention	y	Efficiency	y	y	-
75	Dry	Wet with Infiltration Basin	Grading and Outlet Reconfiguration	-	-	Yes	Maintenance	-	Low Combined Risk; Insufficient Extended Detention	y	Efficiency	y	-	Retrofit
76	Dry	Wet	-	-	-	Yes	Maintenance	-	Low Combined Risk	y	-	y	-	-
77	Greenway	Greenway	-	-	-	-	-	-	Extreme Catchment Risk	-	Efficiency; Missing Design Info	-	-	-
78	Greenway	Greenway	-	-	-	Yes	-	-	-	-	Missing Design Info	y	-	-
79	Wet	Dry	-	Pond bottom elevations significantly different from design drawing. Could not properly consider sediment removal volumes.	-	Yes	-	-	Low Combined Risk	y	-	y	-	Construction Issue
80	Dry	Dry	-	-	-	Yes	Maintenance	-	-	-	Missing Design Info	y	-	-
81	Wet	Dry	-	-	-	Yes	-	-	Low Combined Risk	y	-	y	-	-
82	Wet	Wet	-	-	-	-	-	Level 2	Low Combined Risk; Insufficient PP	-	Efficiency	-	-	LOS

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83	Wet	Wet	-	-	-	Yes	-	-	Low Combined Risk; Insufficient PP	-	Efficiency	y	-	-
84	Greenway	Greenway	-	-	-	Yes	-	-	Low Combined Risk	-	-	y	-	-
85	Greenway	Greenway	-	-	-	Yes	-	-	Low Combined Risk	-	-	y	-	-
86	Wet	Wet	-	Centre pond may not have been excavated to design depths.	-	Yes	-	-	Low Combined Risk; Insufficient PP	-	Efficiency	y	-	Construction Issue
87	Wet	Wet	-	Pond varies significantly from design drawing. Could not properly consider sediment removal volumes.	2021	Yes	-	-	Medium Combined Risk; Insufficient PP	-	Efficiency	y	y	Construction Issue
88	Wet	Wet	-	-	-	Yes	-	-	Low Combined Risk; Insufficient PP	-	Efficiency	y	-	-
89	Greenway	Greenway	-	-	-	Yes	-	-	Low Combined Risk	-	-	y	-	-
90	Greenway	Greenway	-	-	-	Yes	-	-	Low Combined Risk	-	-	y	-	-
91	Greenway	Greenway	-	-	-	Yes	-	-	Low Combined Risk	-	-	y	-	-
92	Greenway	Greenway	-	-	-	Yes	-	-	Low Combined Risk	-	-	y	-	-
93	Wet	Wet	-	-	-	Yes	-	-	Low Combined Risk; Insufficient Extended Detention	-	Efficiency	y	-	-
94	Greenway	Greenway	-	-	-	Yes	-	-	-	-	Missing Design Info	y	-	-
95	Wet	Wet	-	-	-	-	-	-	-	-	-	-	-	-

SWM Pond #	Existing GIS Classification	Design Report Classification	Results of Previous Assessments[1]							Recommended Action[2]				
			Results of 2012 SWM-MP	2014 Study Identified Differences from Design (i.e., Construction Issue)	Sediment Removal Year (per 2014 Study)	Uncompleted Maintenance from 2014 Study	2020 Maintenance Inspection Outcome	Doesn't Meet Current Level of Service (LOS)[3]	Catchments at Risk (2021)	Revise Classification	Additional Study	Maintenance	Sediment Removal	Retrofit
96	Dry	Dry	-	-	-	Yes	Maintenance	Level 3	Low Combined Risk	-	-	y	-	LOS
97	Wet	Wet	-	-	-	-	-	-	Low Combined Risk	-	-	-	-	-
98	Dry	Infiltration	-	-	-	Yes	Maintenance	-	Low Combined Risk	-	-	y	-	-
99	Wet	Wet	-	-	-	Yes	-	-	Low Combined Risk; Insufficient PP	-	Efficiency	y	-	Construction Issue
100	Wet	Wetland	-	Pond varies significantly from design drawing. Could not properly assess sediment deposition patterns.	-	Yes	-	5-year Quantity	Low Combined Risk	y	-	y	-	Construction Issue
101	Wet	Wetland	-	Toe of slope on SW side of pond is approx. 5m further inside pond than in design.	-	Yes	-	5-year Quantity	Low Combined Risk	y	-	y	-	Construction Issue
102	Wet	Wet	-	-	-	Yes	-	-	Low Combined Risk	-	-	y	-	-
103	Dry	Dry	-	-	-	-	Maintenance	Level 3	Minimal Catchment Risk	-	Missing Design Info	y	-	LOS
104	Dry	Infiltration	-	-	-	Yes	Maintenance	-	Low Combined Risk	y	-	y	-	-
105	Dry	Wet	-	-	-	-	Retrofit	-	Minimal Catchment Risk	y	LOS; Missing Design Info	-	-	Retrofit
106	Wet	Wet	-	Pond varies significantly from design drawing.	-	-	-	Unknown Quality	Low Combined Risk	-	LOS	-	-	Construction Issue
107	Wet	Wet with Infiltration Basin	-	-	2025	Yes	-	-	Low Combined Risk	y	-	y	y	-

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			Results of 2012 SWM-MP	2014 Study Identified Differences from Design (i.e., Construction Issue)	Sediment Removal Year (per 2014 Study)	Uncompleted Maintenance from 2014 Study	2020 Maintenance Inspection Outcome	Doesn't Meet Current Level of Service (LOS)[3]	Catchments at Risk (2021)	Revise Classification	Additional Study	Maintenance	Sediment Removal	Retrofit
108	Wet	Wet with Infiltration Basin	-	Pond bottom elevations should be reviewed with consideration to date of construction to determine if pond was properly constructed.	-	-	-	-	Low Combined Risk	y	-	-	-	Construction Issue
109	Wet	Wet with Infiltration Basin	-	Pond may have been underexcavated at time of construction, or sediment has accumulated.	-	Yes	-	-	Low Combined Risk	y	-	y	y	Construction Issue
110	Wet	Wet	-	-	-	-	-	-	Low Combined Risk	-	-	-	-	-
111	Wet	Wet	-	Pond varies significantly from design drawing.	2024	Yes	-	-	Low Combined Risk; Insufficient PP	-	Efficiency	y	y	Construction Issue
112	Wet	Wet	-	-	-	Yes	-	-	-	y	-	y	-	Construction Issue
113	Wet	Wet	-	-	-	-	-	-	-	y	-	-	-	-
114	Wet	Wet	-	-	-	Yes	-	-	-	y	-	y	-	-
115	Wet	Wet	-	-	-	Yes	-	-	Low Combined Risk	-	-	y	-	-
116	Dry	Infiltration	-	-	-	-	Maintenance	-	Low Combined Risk	y	-	y	-	-
117	Dry	Dry	-	-	-	Yes	Maintenance	-	Low Combined Risk	-	-	y	-	-
118/119	Wet	Wet with Infiltration Basin	-	-	-	Not Surveyed	-	-	Low Combined Risk	y	-	-	-	-
120	Wet	Infiltration	-	-	-	Not Surveyed	-	-	-	y	-	-	-	-
121	Wet	Infiltration	-	-	-	Not Surveyed	-	Unknown Quality	-	y	LOS	-	-	-

SWM Pond #	Existing GIS Classification	Design Report Classification	Results of Previous Assessments[1]							Recommended Action[2]				
			Results of 2012 SWM-MP	2014 Study Identified Differences from Design (i.e., Construction Issue)	Sediment Removal Year (per 2014 Study)	Uncompleted Maintenance from 2014 Study	2020 Maintenance Inspection Outcome	Doesn't Meet Current Level of Service (LOS)[3]	Catchments at Risk (2021)	Revise Classification	Additional Study	Maintenance	Sediment Removal	Retrofit
122	Wet	Wet	-	-	-	Not Surveyed	-	-	Minimal Catchment Risk	-	Missing Design Info	-	-	-
123	Wet	Dry	-	-	-	Not Surveyed	-	-	-	y	-	-	-	-
126	-	-	-	-	-	Not Surveyed	-	-	-	-	-	-	-	-
127	-	Dry - Online	-	-	-	Not Surveyed	-[5]	5-year Quantity	-	y	Missing Design Info; Maintenance Inspection	y	-	LOS
128	-	Dry - Online	-	-	-	Not Surveyed	-[6]	-	-	y	Missing Design Info; Maintenance Inspection	-	-	-
129	-	Dry - Online	-	-	-	Not Surveyed	-[7]	-	-	y	Missing Design Info; Maintenance Inspection	-	-	-

[5] This pond was only identified during summer 2021 after the 2020 Maintenance Surveys were completed. A cursory review during the 2021 site visit identified the following maintenance needs: missing railings on inlet; erosion between Pond 36 and 127; and water flow into berm on east side of outlet structure. A full maintenance inspection is recommended.
[6] This pond was only identified during summer 2021 after the 2020 Maintenance Surveys were completed. A cursory review during the 2021 site visit identified the following maintenance needs: removal of vegetation from outlet structure. A full maintenance inspection is recommended.
[7] This pond was only identified during summer 2021 after the 2020 Maintenance Surveys were completed. A cursory review during the 2021 site visit identified the following maintenance needs: removal of vegetation from outlet structure. A full maintenance inspection is recommended.

1.2 Estimated Costs

Preliminary costs were developed, where possible, for the recommendations presented in **Table 1**. A summary of these costs is presented below. A full cost table for each facility is provided in **Appendix B.**

- Revise Classification – No costs were associated with this recommendation.
- Additional Study – Several additional studies were identified, as described below:
    - Topographic and Bathymetric Survey ($10,000/facility) to be used to confirm level of service, provide missing design information, and prioritize future sediment cleanouts. A survey was recommended of all ponds, except those constructed, retrofitted, or cleaned out since 2016.
    - Modelling of Pond Function ($10,000/facility) to be used to confirm level of service, provide missing design information, estimate efficiency of facility, and as part of pond retrofits.
    - EMC Monitoring ($5,000 per facility) to be used to estimate efficiency of facility. This cost assumes the City owns the monitoring equipment, including autosamplers and level loggers. This cost also assumes the monitoring is being completed as part of a larger monitoring project (eg. the City's existing pond monitoring program) and that the samples are analyzed for total suspended solids, phosphorus, and chloride. The monitoring equipment costs approximately $30,000 to outfit one facility, but can be moved to other facilities after the end of the monitoring period at one facility. The modelling may be sufficient to estimate facility efficiency; the monitoring would act as a confirmation.
    - Maintenance Inspection of Ponds 127–129 ($500/facility) as these ponds were added to the City's database after the pond inspection was completed. This cost assumes the maintenance inspection is completed concurrently with the topographic and bathymetric survey.
- Maintenance – Maintenance costs estimated through the *2014 SWMF Report* for activities that have yet to be completed have been carried forward, assuming 2% annual inflation. A preliminary and conservative cost estimate of $11,800 was applied to each facility where Aquafor identified additional maintenance activities in 2020. This cost was estimated from the maximum maintenance cost identified in 2014. Generally, if both Aquafor and CH2M Hill identified maintenance requirements, the total cost was estimated at $11,800. However, if significantly more maintenance activities were found in 2014 in addition to those identified in 2020 and the City did not note that maintenance had been completed, a portion of these costs were added to $11,800. All maintenance costs are a one-time cost associated with remedial measures to address issues identified during site visits in 2014 or 2020.
- Sediment Removal – Sediment removal volumes from the *2014 SWMF Report* were carried forward for facilities where sediment removal has not yet occurred. Sediment loading between 2014 and 2021 was approximated using the MECP estimated annual sediment loadings provided in Table 6.3 of the 2003 Stormwater Management Planning and Design Manual. City-supplied costs for sediment removal in 2017 and 2019 were reviewed, and the median cost of $\$150/m^3$ of sediment was used to estimate costs to remove, haul, and dispose of sediment. Environmental chemical testing for compliance with the Excess Soil Regulations (O.Reg. 406/19) was also included in the cost estimate, assuming an additional cost of $15,000

per facility. It is assumed that the bathymetric and topographic survey would be completed concurrently, otherwise an additional $10,000 per facility would be included to complete the survey prior to sediment removal.

- Retrofit – Retrofit costs were estimated as described below:
    - For all types of retrofit, a minimum construction cost of $350,000 per facility was used for smaller facilities to account for costs associated with mobilization, demobilization, bonding, erosion and sediment control and dewatering etc. A rate of $350/m^3 of permanent pool volume was used to estimate the construction cost, based on previous studies in the GTHA, and revised to account for new Excess Soil Regulations. $150/m^3 was used to estimate sediment removal costs. Design costs were estimated at 20% of the construction cost. Other general costs included:
        - Hydrogeological Study ($35,000/facility);
        - Environmental Impact Study and Wetland Hydrology Study for facilities which drain to Provincially Significant Wetlands ($35,000/facility); or
        - Permitting ($8,000/facility or $15,000/facility if it drains to a Provincially Significant Wetland).
    - Level of Service - The permanent pool volume required to provide Enhanced quality treatment was estimated using the catchment area and total imperviousness. Several facilities have been identified as not providing the City's current level of service for quantity control, or provide an unknown level of quantity control. Since the feasibility of increasing quantity control is unknown, the cost of a feasibility study was included at $25,000/facility, assuming that the feasibility study takes place at the same time as the topographic/bathymetric survey and modeling. It is expected that the feasibility study would identify the costs to complete a quantity control retrofit.
    - Construction Issue – Excavation and sediment removal volumes were estimated from the *2014 SWMF Report*. Additional excavation volumes were added to upgrade permanent pool sizes to achieve Enhanced treatment.
    - Dry to Wet – The permanent pool volume required to provide Enhanced quality treatment was estimated using the catchment area and total imperviousness.
    - Retrofit – Nine of the 11 facilities recommended for retrofits are infiltration facilities which are not functioning as designed. These facilities will need to be assessed under the proposed Infiltration Policy (current draft October 2021) to determine whether they can be restored to a functioning infiltration facility or whether they will need to be retrofit to a wet facility. The more conservative cost was subsequently carried forward. A retrofit to a wet facility was priced as described above for a Dry to Wet facility. As limited design information was available for most of these facilities, costs were conservatively approximated by assuming a restoration to an infiltration facility would involve a 1m deep excavation across the entire facility footprint at a cost of $350/m^3. Retrofit costs for the remaining two facilities were estimated based on the required works identified.

Table 2: Preliminary Cost Estimates

	Number of Facilities	Estimated Preliminary Construction Cost ($) (millions)
Maintenance	100	$0.61
Sediment Removal	11	$1.59
Additional Study	119	$2.11
Quantity Control Retrofit Feasibility Study	27	$0.68
Level of Service Retrofit	10	$17.63*
Construction Issue Retrofit	16	$22.27*
Dry to Wet Retrofit	11	$17.75*
General Retrofit	11	$20.56*
Total	-	**$83.20***

* Note that retrofit costs associated with increasing the quantity control provided by each facility has not been included, only a feasibility study to examine quantity control increases.

2 Oil and Grit Separators

As of January 2020, the City operates 150 Oil and Gris Separators (OGS), which are currently inspected annually, with sediment removed based on the results of the inspection. From a review of recent inspection spreadsheets, this reactive approach results in OGS units frequently holding more sediment than is recommended by the manufacturer:

- The OGS units cleaned out in 2019 and 2020 contained an average of 167 percent and 173 percent, respectively, of the allowed sediment depth.
- Seven units with more than 100 percent of the allowed sediment depth in 2019 were not cleaned out until 2020.
- The OGS units cleaned out between 2011 and 2018 contained an average of 54 percent to 84 percent of the allowed sediment depth (**Table 3**).

Table 3: Sediment Depth Statistics (2011-2020)

	Average Sediment Depth in Units Cleaned Out (% of maximum)	Count of Units with Sediment Depth >100% of Maximum
2011†	NA	NA
2012	66	0
2013*	NA	NA
2014†	NA	NA
2015	84	8
2016	59	0
2017	56	1
2018	54	7
2019	167	27
2020	173	37

- * No data were available for 2013.
- † Sediment depths for units cleaned out were recorded as 0.

A substantial increase in the number of units that had more than 100 percent of the allowable sediment depth occurred between 2018 and 2019. Similarly, the sediment depth in units cleaned out increased substantially during this same time period. This coincides with a change in the City's de-icing practice, which began including more sand in 2019.

A review of annual rate of change in sediment depth from 2011-2020 found that decreases in sediment depth happened more frequently than cleanouts. For example, a comparison of sediment depths from 2019 to 2020 was conducted on the 20 OGS units with the highest percent of allowed sediment, but which were not cleaned out in 2019. The sediment depth in 15 of these 20 units decreased from 2019 to 2020 without being cleaned out (**Table 4**).

Table 4: Percent of Allowed Sediment

OGS ID	2019 (%)	2020 (%)
PWOPRSTC0000052	152	132
PWOPRSTC0000060	142	81
PWOPRSTC0000065	129	81
PWOPRSTC0000067	142	102
PWOPRSTC0000068	112	20
PWOPRSTC0000077	274	102
PWOPRSTC0000080	381	102
PWOPRSTC0000108	95	102
PWOPRSTC0000054	95	54
PWOPRSTC0000076	89	51
PWOPRSTC0000101	89	381
PWOPRSTC0000066	84	60
PWOPRSTC0000120	84	120
PWOPRSTC0000035	81	122
PWOPRSTC0000059	78	61
PWOPRSTC0000034	76	102
PWOPRSTC0000116	76	13
PWOPRSTC0000127	76	76
PWOPRSTC0000064	75	34
PWOPRSTC0000004	70	51

** Cells highlighted in grey indicate a decrease in sediment depth.*

2.1 Clean-Out Frequency

Sediment trends from 2011 to 2020 were analyzed to determine an average annual loading rate. Decreases in sediment depth were observed 2.1 times more frequently than cleanouts were recorded. To account for these decreases, only years with positive increases in sediment depth were used to estimate the average annual loading rate and therefore the required frequency of cleanout.

The results indicated a cleanout frequency ranging from every 1 year to every 14 years, with a median frequency of every 3 years. The median frequency was used to account for the 1-year and 14-year extremes, most of which were due to infrequent measurements and/or abnormally large or small measurements during one year.

This 3-year frequency of cleanout aligns with standard clean-out recommendations. Most of Guelph's OGS units are Stormceptors. The Stormceptor Technical Manual (Imbrium, 2008) states:

> *Although annual servicing is recommended, the frequency of maintenance may need to be increased or reduced based on local conditions (i.e. if the unit is filling up with sediment more quickly than projected, maintenance may be required semi-annually; conversely once the site has stabilized maintenance may only be required every two or three years).*

The City of Guelph owns 150 OGS units. At a 3-year cleanout rate, 50 units should be cleaned out on an annual basis. This would increase the number of units cleaned out annually; since 2009, the maximum number of units with sediment removed was 38 units in 2015 (**Table 5**).

Table 5: Annual Number of OGS Units Cleaned Out

Year	Number of Units
2009	1
2010	0
2011	20
2012	12
2013	0
2014	18
2015	38
2016	17
2017	10
2018	12
2019	20
2020	34

The City will continue to measure sediment depth in each OGS unit on an annual basis, as some OGS units are prone to filling up every year. The City indicated that, the 2019-2021 average of units with>100% sediment depth is 32 units, with an additional 18 units per year with >75% depth. The City therefore intends to assume for 55 units being cleaned out annually, assuming for a contingency of an additional 5 units.

2.2 Clean-Out Costs

Assuming an average sediment density of 1.8 ton/m^3, as is typical in the City's OGS tracking sheets, the average OGS unit would contain 2.8 tons of sediment at the maximum sediment depth. Invoices from 2017 and 2019 indicate a cost of $499/ton. At 55 OGS units per year, this would total $76,800 annually, rounded to the nearest $100. Additional OGS units may be recommended as part of the SWM-MP; updated costs will therefore be provided as part of the Implementation Plan.

3 Summary

The City of Guelph's network of stormwater facilities and OGS units were analyzed to determine their requirements for maintenance, sediment removal, and retrofit. Most of the City's SWM facilities require at least one of the above works, if not more. The current preliminary cost for maintenance, sediment removal, and retrofits is approximately $83.20 million, although this cost does not include increasing the quantity control provided by these facilities, only the cost associated with a feasibility study to determine whether additional quantity control can be provided.

Cleaning out 55 OGS units per year is anticipated to cost approximately $76,800 annually (2020 Canadian dollars).

4 References

Imbrium (2008). Stormceptor Technical Manual. Retrieved from: https://www.imbriumsystems.com/Portals/0/documents/sc/technical_docs/Stormceptor%20STC%20Technical%20Manual%20Canada.pdf

Appendix A: Incomplete Maintenance Activities Previously Identified in *2014 SWMF Report*

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Pond ID	Duration	Description	Additional Comments	City Comments	Subtotal	Total (2014 dollars)	Total (2021 dollars)
2	Short-Term	Repair manhole support* Investigate wet pond characteristics (large quantity of water in basin; see pond survey)	Algae present- organic odour	None	$3,260	$3,860	$4,434
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Install grate on Inlet 1 Remove aquatic vegetation growing in spillway and vegetation along access route Remediate minor erosion and remove minor sediment build-up at inlets and outlets* Remove garbage			$600		
3	Short-Term	Clear dense vegetation/ fallen limbs surrounding pond Investigate high water level/ eroded banks (also an access route concern) Investigate wet pond characteristics (large quantity of water in basin; see pond survey)	Gate unlocked was found unlocked at time of inspection Algae present	None	$3,520	$10,020	$11,510
	Medium-Term	Remediate Spillway 1 (some cracking and vegetation) Remediate erosion and remove sediment downstream of Spillway 1			$6,500		
	Long-Term	No maintenance recommended			$0		
5	Short-Term	No maintenance recommended	Algae growth in ditch inlet	None	$0	$600	$689
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Install grate on Inlet 3 Remove vegetation from access route and blocking Inlet 2 and Inlet 3 Remediate erosion along bank of ditch inlet			$600		
6	Short-Term	Investigate animal dens in pond Investigate wet pond characteristics (large quantity of water in basin; see pond survey)	Algae present - no fencing around pond	Sediment removed, excess vegetation around inlets/outlets/spillways removed 2019	$520	$7,620	$8,753
	Medium-Term	Remediate erosion (rills on W & S banks) Repair rip rap (apply extra to Inlet 1 and Inlet 2 to mitigate pitting downstream)			$6,500		
	Long-Term	Install grate on Inlet 2 Remove excess vegetation found in some areas			$600		
7	Short-Term	Investigate wet pond characteristics (large quantity of water in basin; see pond survey)	Minor algae present (forebay and spillway)	Sediment removed, excess vegetation around inlets/outlets/spillways removed 2017	$520	$4,120	$4,733
	Medium-Term	Remove dense vegetation (especially dense around forebay)			$3,000		
	Long-Term	Install grate on Inlet 2 Remediate minor erosion and remove minor sediment build-up			$600		
8	Short-Term	Remove vegetation (tree, bush) and litter in front of Outlets 1a&b (high priority blockage)* Remove excess garbage near outlets Investigate wet pond characteristics (large quantity of water in basin; see pond survey)	Algae present	None	$1,300	$3,100	$3,561
	Medium-Term	Repair Inlet 1 (concrete cracked due to flows)			$0		
	Long-Term	Install grates on Inlet 1 and Outlets 1a&b			$1,800		
9	Short-Term	Remove graffiti on inlet headwalls Remove garbage from site (large quantity of bottles, trash and bags present; some partially blocking inlets and outlets)	None	None	$520	$520	$597
	Medium-Term	Remove sediment build-up in drainage channel near Inlet 2 Remediate blockage of Outlet 2 (dead leaves and litter)			$0		
	Long-Term	No maintenance recommended			$0		
10	Short-Term	Remove excess vegetation especially from hickenbottom (hickenbottom submerged - vegetation likely blocking flow) and Spillway 2 Remove shopping cart from pond Install new trespassing sign (faded) Investigate potential dumping on-site Investigate animal burrows Investigate wet pond characteristics (large quantity of water in basin; see pond survey)	Algae present	Sediment removed, excess vegetation around inlets/outlets/spillways removed 2020	$3,800	$3,800	$4,365
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Remediate erosion at Inlet 1			$0		
11	Short-Term	Remove excess cattails (pond features difficult to access/ inspect due to dense vegetation) Remove overgrown vegetation on spillway Investigate high water levels which are contributing to bank erosion (spillway also submerged and steady murky flows observed)* Investigate wet pond characteristics (large quantity of water in basin; see pond survey)	Algae present	Sediment removed, excess vegetation around inlets/outlets/spillways removed 2019	$3,520	$4,120	$4,733
	Medium-Term	Remove sediment build-up at Inlet 1			$0		
	Long-Term	Install grate on Inlet 1			$600		
12	Short-Term	No maintenance recommended	Algae present at Inlet 3, Inlet 1Inlet 2 and Outlet 1 do not have grates (however they are greater than 2 m in diameter)	None	$0	$0	$0
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Remove vegetation and litter from Inlet 1 and Inlet 3			$0		
13	Short-Term	Investigate wet pond characteristics (large quantity of water in basin; see pond survey) Investigate hickenbottom submergence (Outlet 1 may be blocked)	Grapevine may be killing trees along banks	None	$520	$520	$597
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Repair Inlet 1 (part of pipe broken) Remove vegetation and litter at inlets and outlets			$0		
14	Short-Term	No maintenance recommended	None	None	$0	$1,200	$1,378
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Install grates on Inlet 2 and Inlet 2 Remove excess vegetation			$1,200		
15	Short-Term	No maintenance recommended	None	None	$0	$0	$0
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Remove vegetation and litter			$0		
16	Short-Term	Investigate Inlet 1 functionality (Inlet 1 - from Pond 113 - is approximately 1 m below surrounding grade in a pit formation - water would need to pool before exiting area) Remove sediment and repair rip rap (Inlet 1 is 25% buried in mud)	None	None	$3,260	$3,860	$4,434
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Install grate on Inlet 1			$600		
17	Short-Term	Investigate Outlet 1 blockage (100% submerged; no flow to catchment/ dispersion chamber - chamber is dry) Investigate potential sheen at Inlet 1 Investigate wet pond characteristics (standing water in basin; see pond survey)	Algae present	Sediment removed, excess vegetation around inlets/outlets/spillways removed 2019	$520	$3,520	$4,043
	Medium-Term	Repair rip rap at Inlet 1 (rip rap has eroded and flow to pond is channelized)			$3,000		
	Long-Term	Remove slight sediment build-up at inlets			$0		
18	Short-Term	Investigate potential dumping of sand and other debris at Outlet 1 Remediate blockage at Outlet 1 (large amount of sediment below grate) Remove sediment build-up at Inlet 1	None	None	$2,630	$2,630	$3,021
	Medium-Term	No maintenance recommended			$0		

Pond ID	Duration	Description	Additional Comments	City Comments	Subtotal	Total (2014 dollars)	Total (2021 dollars)
	Long-Term	Repair minor erosion at Inlet 1			$0		
19	Short-Term	Install signage Investigate wet pond characteristics (large quantity of water in basin; see pond survey)	No fencing around pond (retains large volume of water)	None	$670	$1,270	$1,459
	Medium-Term	Remediate blockage at Outlet 1 (detritus and debris) Repair Outlet 1 cracks in headwall			$0		
	Long-Term	Install grate on Receiving Stream Inlet 1 Repair minor erosion at inlets, outlets and banks*			$600		
21	Short-Term	Investigate water quality of Receiving Stream Inlet 1 (brown murky water observed)	Algae present (Outlet 1)	None	$260	$520	$597
	Medium-Term	Monitor wet characteristics (standing water and cattails) Remove excess vegetation (including cattails) causing inlet/ outlet access issues			$260		
	Long-Term	No maintenance recommended			$0		
22	Short-Term	Remediate blockage at Inlet 1 (partially buried) Investigate wet pond characteristics (large quantity of water in basin; see pond survey)	Algae present (appears to be significant growth) Gate difficult to unlock	None	$3,520	$7,720	$8,868
	Medium-Term	Remove excess vegetation (gate cannot open entirely with surrounding dense vegetation) and features difficult to find			$3,000		
	Long-Term	Install grates on Inlet 2 and Inlet 3 Remove minor sediment build-up at Outlet 1			$1,200		
23	Short-Term	No maintenance recommended	Algae present on rip rap and headwall of Inlet 1	None	$0	$600	$689
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Install grate on Inlet 1 Remove excess vegetation and fallen trees Remediate erosion at Inlet 1			$600		
24	Short-Term	Remove dense vegetation (difficult to access pond and locate pond features) Investigate pond access (can only access pond through dense vegetation; no road or trail to pond) Investigate potential dumping issues (near Inlet 1)	Algae present	None	$3,520	$4,120	$4,733
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Install grate at Inlet 1 Repair rip rap and remediate blockage/ structural issues at Inlet 1			$600		
25	Short-Term	Investigate potential dumping (grass clippings and brush at entrance gate) Investigate wet pond characteristics (large quantity of water in basin; see pond survey)	Algae present (minor at inlets and outlets)	None	$520	$1,120	$1,287
	Medium-Term	Repair fencing at Inlet 1 (hole in fence above pipe)			$0		
	Long-Term	Install grate on Inlet 2 Remove excess vegetation Remove minor sediment, remediate erosion and repair rip rap at various features			$600		
26	Short-Term	Remove excess cattails Install signage (dry pond but retaining large volumes of water) Investigate wet pond characteristics (large quantity of water in basin; but dry when pond survey attempted)	Pond access is difficult (need to walk approx. 1 km on a trail to reach pond; trail not accessible by truck)	None	$3,540	$7,140	$8,202
	Medium-Term	Repair rip rap at Inlet 1 (not enough rip rap present; water is ponding at base on inlet - 1 m wide and 30+ cm deep in some locations)			$3,000		
	Long-Term	Install grate on Inlet 1 Repair gabion stone near access entrance (gabion has washed out) Re-bolt grate to Outlet 1 Repair crack in Outlet 1 headwall			$600		
27	Short-Term	No maintenance recommended	Algae present (minor on rip rap)	None	$0	$3,860	$4,434
	Medium-Term	Monitor wet characteristics (standing water and cattails) Repair rip rap at Inlet 1 (add more to prevent channeling downstream of inlet)*			$3,260		
	Long-Term	Install grate on Inlet 1 Remove excess vegetation (lots of cattails)			$600		
28	Short-Term	No maintenance recommended	None	None	$0	$8,300	$9,534
	Medium-Term	Repair Inlet 4 headwall (cracked and sloughing into pond) Remediate erosion at Inlet 4 (pitting at inlet base may be contributing to structural issues) Remove excess vegetation (difficult to access perimeter of site and features)			$6,500		
	Long-Term	Install grates on Inlet 1, Inlet 4 and Outlet 2 Repair rip rap downstream of Inlet 1 Remove sediment build-up in front of Inlet 2 and Outlet 1 Repair headwall of Outlet 2			$1,800		
29	Short-Term	Investigate why forebay is wet but main cell is dry with aquatic vegetation	Pond has steep banks (difficult to walk around perimeter), Algae present (large quantity of algae in forebay; organic odour) Inlet from forebay standpipe could not be located during inspection	Sediment removed, excess vegetation around inlets/outlets/spillways removed 2019	$260	$2,060	$2,366
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Install grates on Inlet 1, Inlet 2 and Inlet 3 Repair grate of Inlet Receiving Stream 1 (grate stuck in open position) Remove medium-sized trees in front of Inlet 1 Repair erosion minor and remove sediment at various features			$1,800		
30	Short-Term	Repair major erosion at Outlet 2* Repair Outlet 2 rip rap (none currently present; may be contributing to erosion) Remove sediment from Outlet 2 DICB* Investigate animal dens in pond Investigate wet pond characteristics (large quantity of water in basin; see pond survey)	Algae present (approx. 80% of surface covered) Pond has steep banks on N side, Several bird houses erected within fenced area	None	$4,020	$9,920	$11,395
	Medium-Term	Repair rip at Inlet 2 (medium-heavy erosion downstream of inlet; pitting) Repair minor erosion and remove sediment downstream of Receiving Stream Inlet 1 (beginning to wash out fence)			$3,500		
	Long-Term	Install grates on Inlet 1, Inlet 2. Inlet 3 and Receiving Stream Inlet 1 Repair minor erosion at Inlet 1 and Inlet 3 Repair Inlet 2 (concrete splitting slightly at joint) Remove vegetation partially blocking features			$2,400		
31	Short-Term	Investigate access route (access trail built up after fence installation; cannot properly open gate; 0.6 m drop-off from trail to gate) Remove excess vegetation (spillway covered with fallen trees and overgrown vegetation; difficult to access features) Install pond signage	None	None	$3,280	$4,140	$4,756
	Medium-Term	Monitor wet characteristics (standing water and cattails) Remove sediment build-up at Inlet 1 (15-20 cm blocking inlet)			$260		
	Long-Term	Install grate on Inlet 1 Repair minor erosion and remove sediment at inlets/ outlets			$600		
32	Short-Term	No maintenance recommended	None	None	$0	$5,530	$6,352
	Medium-Term	Remove excess vegetation (shrubs around inlets and outlets)* Investigate pond use (residents manicuring pond)			$3,130		
	Long-Term	Install grates on Inlet 1, Inlet 2, Inlet 3 and Receiving Stream Inlet 1 Repair Receiving Stream Inlet 1 pipe Repair rip rap at Inlet 2 (dispersed) Remove minor garbage			$2,400		

Pond ID	Duration	Description	Additional Comments	City Comments	Subtotal	Total (2014 dollars)	Total (2021 dollars)
33	Short-Term	Investigate why pond footprint has expanded several metres since 2008 (trees are now submerged, outlets that are supposed to be on land are submerged) Investigate pond use (apparent trespassing - several alcohol bottles, misc. garbage) Repair rip rap at Inlet 1 (riprap from 2008 report not present/submerged, pit at foot of inlet is 2 feet deep) Remediate blockage at Outlet 1 (twigs and branches obstructing DCIB; twigs an branches obstructing culvert at receiving stream) and Receiving Stream Inlet 2 (50% blocked with twigs and organic debris) Repair rip rap at Receiving Stream Inlet 2 (geotextile is over top rip rap; heavy water flow is going under geotextile; sediment deposited on geotextile surface) Remove excess vegetation (difficult to access some features)	Algae present (in perimeter ditches)	None	$9,650	$10,250	$11,774
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Install grate on Inlet 1			$600		
34	Short-Term	Investigate access route (steep slope and dense vegetation) Remove excess vegetation (dense trees/ bushes/ shrubs making features difficult to access and blocking DICBs) Investigate wet pond characteristics (some standing water in basin and cattails present; see pond survey)	Algae present (in standing water)	None	$3,520	$4,120	$4,733
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Install grate on Inlet 1 Remove minor sediment build-up and repair rip rap at Inlet 1			$600		
35	Short-Term	Repair pond erosion (significant along banks and around Outlet 1) Repair silt fencing (in poor condition) Remediate blockage at Outlet 3 (grate is almost completely blocked; although high volume of water still flowing through) Investigate slight sheen near Outlet 1 (was also previously noted in City inspections)	Algae present, Murky water present due to high sediment volumes	None	$6,630	$7,230	$8,305
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Install grate on Inlet 2 Repair grate on Inlet 1			$600		
36	Short-Term	No maintenance recommended	Turtle nest identified near outlet structures (City/ CH2M HILL took necessary precautions)	None	$0	$10,100	$11,602
	Medium-Term	Remove excess vegetation Remediate blockage and erosion at Outlet 1* (vegetation in grate; pipe is below water level; sediment deposited) Repair erosion at Outlet 2* (erosion around standpipe and adjacent bank)			$9,500		
	Long-Term	Install grate on Inlet 1 Repair rip rap at Inlet 1 (minor pitting downstream)			$600		
37	Short-Term	Investigate high water levels (Inlet 2, Outlet 3 and Outlet 4 partially submerged) Remove blockage at Inlet 1 (partially blocked by garbage and debris) Remove blockage at Outlet 1* (almost completely blocked by branches and other debris)	Murky water	None	$3,520	$4,720	$5,422
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Install grates on Outlet 2 and Receiving Stream Inlet 1			$1,200		
38	Short-Term	Install pond signage Investigate wet pond characteristics (some standing water in basin and cattails present; see pond survey)	Pond has steep slopes - may be difficult bringing in equipment Several snakes identified during inspection, algae present (minor)	None	$670	$1,270	$1,459
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Install grate on Outlet 1 Remove excess vegetation Remove minor sediment build-up and repair erosion at various features			$600		
39	Short-Term	Remediate blockage at Outlet 2 (sediment accumulation; Outlet 2 is submerged) Remediate blockage at Inlet 1 (vegetation blocking) Remove garbage from pond (office chair, tennis balls, bags) Repair access gate (difficult to open and close) Investigate pond use (misc. garbage and dead branches dumped at perimeter of site from adjacent backyards) Investigate access route (steep banks)	Algae in pond (significant quantity; clumping and floating) Resident commented on significant mosquito population	None	$3,910	$4,510	$5,181
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Install grate on Outlet 2 Repair Inlet 1 (headwall cracked and rebar exposed) Remove dense vegetation from Outlet 1			$600		
40	Short-Term	Investigate pond use (hockey net and other sports equipment present; potted plants in pond)	None	None	$130	$3,130	$3,595
	Medium-Term	Remove excess vegetation (outlets blocked)*			$3,000		
	Long-Term	Repair loose grates on Outlet 2, Outlet 3 and Outlet 4			$0		
42	Short-Term	Investigate potential dumping Investigate sheen at Outlet 2	Algae present	None	$260	$1,460	$1,677
	Medium-Term	Repair Inlet 4 grate			$0		
	Long-Term	Install grates on Inlets 1 a&b Remediate blockage at Inlets 1 a&b (sediment, vegetation)			$1,200		
43	Short-Term	Investigate potential dumping	None	None	$130	$130	$149
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Repair erosion at Inlet 6 and Outlet 1 Repair minor blockage at Inlet 2 (two large rocks)			$0		
44	Short-Term	Remove filter sock from Inlet 1 (not impeding flow)	None	None	$130	$1,330	$1,528
	Medium-Term	Remediate blockage at Outlet 1 (excess vegetation and two trees growing between rip rap)			$0		
	Long-Term	Install grates on Inlet 1 and Outlet 1 Repair bolt on grate of Outlet 3 Remove minor sedimentation at features			$1,200		
45	Short-Term	No maintenance recommended	None	None	$0	$5,400	$6,203
	Medium-Term	Remove blockage at Inlet 1 (vegetation in CSP and around inlet)			$3,000		
	Long-Term	Install grates on Inlet 1, Outlet 2 and Outlets 6 a&b Remediate minor blockages (sedimentation, vegetation, grass clippings)			$2,400		
46	Short-Term	No maintenance recommended	None	None	$0	$2,400	$2,757
	Medium-Term	Remediate blockage (sedimentation, vegetation)			$0		
	Long-Term	Install grates on Inlets 1 a&b, Inlet 2 and Outlet 1			$2,400		
47	Short-Term	No maintenance recommended	None	None	$0	$600	$689
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Install grate on Inlet 1 Remove vegetation (lush grass in front of features) Remove garbage			$600		

Pond ID	Duration	Description	Additional Comments	City Comments	Subtotal	Total (2014 dollars)	Total (2021 dollars)
48	Short-Term	No maintenance recommended	None	None	$0	$4,200	$4,824
	Medium-Term	Remediate blockage at Inlet 1 (approx. 50%; bank is eroding into inlet; vegetation in grate) Remediate blockage at Inlet 2 (approx. 50% blocked by sediment) Repair rip rap at Inlet 2 (sparse)			$3,000		
	Long-Term	Install grates on Outlets 3 a&b Repair Outlet 3 a (pipe slightly crushed) Remove high grass in front of Outlets 3 a&b			$1,200		
50	Short-Term	Repair blockage at Inlet3 (50% of pipe is full of sediment) Repair Inlet 4 (large crack in headwall, portion is beginning to separate from structure)	Couch located in underpass (Inlet 1) Algae present (in standing water)	None	$6,000	$7,460	$8,569
	Medium-Term	Monitor wet characteristics (standing water and cattails) Remove sediment and garbage in Inlet 1 (underpass)			$260		
	Long-Term	Install grates on Inlet 1 and Inlet 2 Repair minor erosion and remove minor sediment build-up Remove vegetation			$1,200		
53	Short-Term	Investigate potential pond sheen (forebay) Install signage	Algae present (significant growth) No fencing around pond	None	$280	$3,880	$4,457
	Medium-Term	Repair erosion at Inlet 1 (more rip rap may be required; some erosion of banks) Repair grate on Inlet 1 (locked but pushed out)			$0		
	Long-Term	Install grates on Inlets 2 a-c and Outlets 1 a-c Remediate minor blockages, remove minor sediment build-up, repair minor structural deficiencies Remove minor garbage and debris			$3,600		
54	Short-Term	Remediate pond erosion (significant along banks) Investigate pond sheen (visible in some areas) Investigate potential dumping (soil)	Algae present (significant growth)	None	$3,760	$6,760	$7,765
	Medium-Term	Repair gabion stone Repair spillway (liner visible)			$3,000		
	Long-Term	Remove minor sediment build-up (Inlet 1, Inlet 2) Remove minor garbage and debris (Inlet 2, Outlet 1) Sedimentation (1): debris and sediment accumulation in pipe; Inlet			$0		
56	Short-Term	No maintenance recommended	Algae present (forebay)	None	$0	$600	$689
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Install grate on Inlet 1 Remove garbage and debris			$600		
57	Short-Term	Replace pond signage (weathered) Investigate pond use (lawn cuttings and debris dumped throughout pond)	Algae present (Inlet 3; associated organic odour)	None	$280	$880	$1,011
	Medium-Term	Repair rip rap at Inlet 1 (sparse; causing erosion) Remediate blockage at Inlet 2 (leaves and debris)			$0		
	Long-Term	Install grate on Outlet 1 Repair grate at Inlet 1 (open position) Remediate some minor erosion and sediment build-up Remove vegetation around features			$600		
59	Short-Term	No maintenance recommended	Algae present (Outlet 1 rip rap)	None	$0	$600	$689
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Install grate on Outlet 1 Remove excess vegetation Remove minor garbage			$600		
60	Short-Term	Remediate blockage at Inlet 2 (50% submerged)	Access may be difficult for machinery (pooling water, soft sediment and cattails) Murky water (likely due to heavy rainfall)	None	$3,000	$3,860	$4,434
	Medium-Term	Monitor wet characteristics (standing water and cattails) Remove excess cattails			$260		
	Long-Term	Install grate on Inlet 1 Repair grate on Inlet 2 (grate broken off; pipe chipped too)			$600		
61	Short-Term	Investigate potential dumping (grass clippings and debris throughout pond)	None	None	$130	$130	$149
	Medium-Term	Remove excess vegetation (difficult to access features) Remediate blockage at Outlet 2 (vegetation and debris)			$0		
	Long-Term	Remediate blockage at Inlet 1 (grass clippings and litter)			$0		
62	Short-Term	No maintenance recommended	Organic sheen near Outlet 5, Water quality at outlets is not clear	None	$0	$2,400	$2,757
	Medium-Term	Remove excess vegetation (difficult to access features)			$0		
	Long-Term	Install grates on Inlet 4 a&b and Outlets 1 a&b Repair Outlet 5 grate (plate loose) Remove minor sediment build-up Repair minor rip rap issues			$2,400		
63	Short-Term	No maintenance recommended	None	None	$0	$1,200	$1,378
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Install grates on Inlets 1 a&b Repair bolts on grates of Outlet 1 and Outlet 2 Repair concrete chipping at Outlet 1 Remove vegetation and sediment build-up partially blocking features Remove minor garbage and debris			$1,200		
64	Short-Term	Investigate sheen (present at several outlets)	Murky water	None	$130	$1,330	$1,528
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Install grates on Inlets 4 a&b Remove sediment from Inlet 1 rip rap Remove garbage			$1,200		
65	Short-Term	No maintenance recommended	Evidence of algae growth on rip rap	None	$0	$1,460	$1,677
	Medium-Term	Monitor wet characteristics (standing water and cattails) Remediate blockage at Inlet 1 (boulders; excess veg) Repair rip rap at Inlet 1 (mix of boulders and pebbles) and Inlet 3 (large pit 1 m x 1.5 m, 20 cm deep in some areas) Repair erosion at Inlet 3* (banks eroding) Remove dense vegetation and sedimentation around features			$260		
	Long-Term	Install grates on Outlets 7 a&b Repair various cracks in DICBs Remove tree limb and 1.5m metal rod shoved through grate of Outlet 4 Remove plywood in Outlet 7 b			$1,200		
66	Short-Term	No maintenance recommended	None	None	$0	$0	$0
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Remove vegetation			$0		
68	Short-Term	No maintenance recommended	Access may be difficult for machinery (soft sediment and cattails) Algae present, Murky water	None	$0	$3,860	$4,434
	Medium-Term	Monitor wet characteristics (standing water and cattails) Remove excess vegetation (dense cattails) Secure grates on Inlet 1, Outlet 3, Outlet 4 and Outlet 5 (loose)			$3,260		
	Long-Term	Install grate on Inlet 2 Remove garbage			$600		

Pond ID	Duration	Description	Additional Comments	City Comments	Subtotal	Total (2014 dollars)	Total (2021 dollars)
69	Short-Term	Investigate wet pond characteristics (ponded water in one area and dense cattails present; see pond survey)	Difficult to access Inlet 1 (steep bank with boulders) Algae at Inlet 1, Couch at other end of Outlet 1 Graffiti in culvert (Outlet 1)	None	$260	$3,860	$4,434
	Medium-Term	Repair rip rap at Inlet 1 (rip rap on sides of inlet but not directly in front; resulting in pool of water several meters wide in front of Inlet 1) Remediate blockage at Inlet 1 (rags and litter caught in grate)			$3,000		
	Long-Term	Install grate on Inlet 2 Remove sediment build-up and grey washout material at various features Repair Outlet 1 (cracks in headwall)			$600		
70	Short-Term	Remove various garbage on-site: beer bottles and cans, signs, litter, frame of desk	None	None	$390	$390	$448
	Medium-Term	Repair rip rap of spillway* (geotextile exposed) and Inlet 2 (geotextile exposed in some areas; looks like rip rap has sunk compared to 2008)			$0		
	Long-Term	Repair grate on Outlet 1 (loose)			$0		
71	Short-Term	Investigate potential dumping (garbage and potted soil)	Algae present (on rip rap) Murky water	None	$130	$390	$448
	Medium-Term	Monitor wet characteristics (ponded water and cattails)			$260		
	Long-Term	Repair grates on Outlet 2 and Outlet 5 (loose) Remove vegetation			$0		
72	Short-Term	Investigate pond use (children may be playing here - loose grates and tree limbs/ branches in outlets) Investigate potential dumping (concrete dumped at Inlet 1; rags, towels, foam tube, etc.)	Green murky water at Outlet 5	None	$260	$860	$988
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Install grate on Outlet 7 Repair grates on Outlet 1, Outlet 3 and Outlet 5 (bent/ loose plates) Remove minor sediment build-up at various features			$600		
73	Short-Term	No maintenance recommended	Turbid water in some locations No fencing around forebay	Sediment removed, excess vegetation around inlets/outlets/spillways removed 2019	$0	$0	$0
	Medium-Term	Remove bush and vegetation near Inlet 1 - difficult to access			$0		
	Long-Term	Remove long vegetation at various features			$0		
74	Short-Term	Investigate potential dumping (debris and soil) Investigate wet pond characteristics (forebay holds water; see pond survey)	Algae present (minor), No fencing around Cell 1 (holding water)	None	$520	$520	$597
	Medium-Term	Repair crack in spillway Repair rip rap at Outlet 2* (geotextile exposed)			$0		
	Long-Term	Remediate blockage at Inlet 1 (garbage, sedimentation) and Inlet 2 (sedimentation) Repair Inlet 1 (minor concrete erosion)			$0		
75	Short-Term	Investigate wet pond characteristics (forebay holds water; see pond survey)	None	Sediment removed, excess vegetation around inlets/outlets/spillways removed 2017	$520	$1,120	$1,287
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Install grate on Inlet 2 Remove excess cattails			$600		
76	Short-Term	Investigate wet pond characteristics (forebay holds water; see pond survey) Investigate pond use (residents manicuring S side of pond, dumping yard waste and articles of encroachment - barbques, etc.) Investigate discharge from receiving stream inlet 2 (slimy appearance and organic odour)	Algae present (significant growth)	Sediment removed, excess vegetation around inlets/outlets/spillways removed 2019	$780	$4,380	$5,031
	Medium-Term	Remediate blockage of receiving steam inlet 1 (50% blocked by sediment and vegetation)			$3000		
	Long-Term	Install grade on inlet 1 remove cattails and excessive vegetation (N side mostly) repair inlet 1 (concrete slightly eroded)			$600		
78	Short-Term	Repair rip rap at Inlet 1 *(rip rap eroded exposing geotextile) and Inlet 5* (rip rap eroded exposing geotextile; channel created due to erosion) Investigate pond use (residents manicuring lawn)	None	None	$3130	$3,130	$3,595
	Medium-Term	Remediate blockages at Inlet 1 (vegetation, debris in inlet bars), Inlets 3 a&b (30% blocked with sediment) and outlets 7 a&b (20% blocked with sediment)			$0		
	Long-Term	Remediate various minor blockages and erosion issues, repair grates on outlet 1 and outlet 2 (plates loose)			$0		
79	Short-Term	No maintenance recommended	algae present (covering 40% of pond) access route has tall grasses burs and thistles	None	$0	$1,800	$2,068
	Medium-Term	remediate blockage at outlet 1 and outlet 2 (heavy vegetation on grating) remove access vegetation			$0		
	Long-Term	install grates on inlet 1, receiving stream inlet 1 and receiving stream inlet 2, remove minor sediemtn build-up and remediate erosion			$1800		
80	Short-Term	No maintenance recommended	Murky water	None	$0	$0	$0
	Medium-Term	remediate blockage at inlet 2 (litter and vegeatation) remediate receiving stream inlet (PVC pipe is buried in the infiltration ditch)			$0		
	Long-Term	repair grates on inlet 1 and inlet 2 (loose), remove vegetation, remove minor sedimentation			$0		
81	Short-Term	No maintenance recommended	None	None	$0	$0	$0
	Medium-Term	remove vegetation			$0		
	Long-Term	No maintenance recommended			$0		
83	Short-Term	Investigate potential sheen near Inlet 1 (possibly from road runoff) Investigate pond use (hockey nets)	Murky water in pond; downstream of pond is clear	None	$130	$1,330	$1,528
	Medium-Term	Remove excess aquatic vegetation (especially near spillway)			$0		
	Long-Term	Install grates on Inlets 1 a&b Remove garbage			$1,200		
84	Short-Term	No maintenance recommended	None	None	$0	$600	$689
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Install grate on Inlet 2 Remove vegetation			$600		
85	Short-Term	Investigate access route (steep bank and standing water)	None	None	$130	$130	$149
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Repair Inlet 1 (chipping) Remediate blockage at Outlet 1 (debris)* Remove vegetation			$0		
86	Short-Term	Investigate potential sheen (forebay)	Algae present (signficant growth)	None	$130	$730	$839
	Medium-Term	Remediate blockage at Inlet 3 (partially blocked by garbage and debris)			$0		
	Long-Term	Install grate on Inlet 3 Repair grate on Inlet 2 (partially broken off) Remediate minor erosion along banks Remove sediment build-up at inlets			$600		
87	Short-Term	Investigate pond use (hose running from adjacent construction site and banks are eroding; pond has sedimentation and high turbidity) Remediate erosion* Remove sediment build-up at various features	Algae present (minor)	None	$3,760	$3,760	$4,319
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Remove vegetation*			$0		

Pond ID	Duration	Description	Additional Comments	City Comments	Subtotal	Total (2014 dollars)	Total (2021 dollars)
88	Short-Term	No maintenance recommended	Algae present	Sediment removed, excess vegetation around inlets/outlets/spillways removed 2019	$0	$3,000	$3,446
	Medium-Term	Remediate blockage at Receiving Stream Inlet 1 (40% buried)			$3,000		
	Long-Term	Remove sediment build-up at Inlet 1 Remove medium-sized vegetation Repair grate on Inlet 1 (half open) Remove garbage			$0		
89	Short-Term	Install pond signage	None	None	$150	$150	$172
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Remediate minor blockages (rock build-up, sedimentation, vegetation) Remediate minor erosion Repair Outlet 1 and Outlet 5 (pipe chipped) Remove garbage Remove vegetation			$0		
90	Short-Term	No maintenance recommended	None	None	$0	$0	$0
	Medium-Term	Remediate erosion at Inlet 6 (30 cm divot at mouth of inlet) Remediate blockage at Outlet 4 (sediment build-up)			$0		
	Long-Term	Remediate minor blockages Remediate minor erosion Repair minor chips in pipes			$0		
91	Short-Term	Investigate potential dumping (Outlet 4 could not be located due to dumping of soil from adjacent property) Remove dumped soil from Outlet 4 Repair grates on Outlet 5 and Outlet 6 (DICBs 3 ft deep and have loose plates) Install pond signage (due to standing water) Remove small dead animal at Outlet 5 Investigate animal burrows	W side of pond difficult to access due to vegetation Algae present	None	$3,430	$3,430	$3,940
	Medium-Term	Remove excess cattails Remediate blockage at Inlet 1 a (plastic sheeting blocking) Repair rip rap at Inlets 1 a&b (lacking)			$0		
	Long-Term	Repair grates on Outlet 1 and Outlet 3 (loose) Remediate minor erosion and remove minor sediment build-up			$0		
92	Short-Term	Remove garbage (significant amount)	None	None	$390	$1,590	$1,826
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Install grates on Outlet 1 and Outlet 2 Remediate minor erosion			$1,200		
93	Short-Term	Remediate blockage at Outlet 1 (completely covered with vegetation but can hear water flowing still)	No fencing around pond	Sediment removed, excess vegetation around inlets/outlets/spillways removed 2020	$3,000	$3,000	$3,446
	Medium-Term	Remove excess cattails around forebay			$0		
	Long-Term	Install grate on Inlet 5 Remediate minor blockages Remove minor sediment build-up Remove garbage			$0		
94	Short-Term	No maintenance recommended	Algae present (floating)	None	$0	$0	$0
	Medium-Term	Remove vegetation			$0		
	Long-Term	Remove garbage			$0		
96	Short-Term	Remove dense vegetation (including cattails; features difficult to find and contributing to blockages)	None	None	$3,000	$3,000	$3,446
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Remove minor sediment build-up Remove garbage			$0		
98	Short-Term	No maintenance recommended	Murky water	None	$0	$0	$0
	Medium-Term	Remediate blockage at Outlet 2 (fallen branches and vegetation)			$0		
	Long-Term	Install grate on Inlets 2 a&b and Outlets 3 a&b Remove vegetation Remediate minor blockages Remove garbage			$0		
99	Short-Term	No maintenance recommended	Algae present and murky water	None	$0	$600	$689
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Install grate on Outlet 2 Remediate minor erosion Remove minor sediment build-up Remove vegetation			$600		
100	Short-Term	No maintenance recommended	Murky water in forebay	None	$0	$0	$0
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Remediate minor blockages Remove minor sediment build-up* Remove garbage			$0		
101	Short-Term	Investigate dry pond characteristics (basin is dry and not wet; see pond survey)	Algae present (in standing water)	None	$520	$3,520	$4,043
	Medium-Term	Repair rip rap at Inlet 1 (geotextile exposed)			$3,000		
	Long-Term	Remove garbage			$0		
102	Short-Term	No maintenance recommended	Algae present (in standing water)	None	$0	$0	$0
	Medium-Term	Remediate erosion along W and S banks			$0		
	Long-Term	Install grate on Inlet 1 Remove garbage			$0		
104	Short-Term	Remediate erosion along banks near Inlet 1, Inlet 2 and Inlet 3 (add rip rap) Install pond signage	Algae present (minor) in cloudy water	None	$3,650	$3,650	$4,193
	Medium-Term	Remediate blockage at Inlet 1 (partially blocked by garbage and debris)			$0		
	Long-Term	Repair grates on Inlet 1 and Inlet 3 (detached); lock grate on Inlet 2 Remove vegetation Remove minor sediment build-up Remediate minor blockages Remove garbage			$0		
107	Short-Term	Remediate blockage at Inlet 1 (50% blocked by fine mud-like sediment; approx. 20 cm deep)	White frothy water at Inlet 1; slight organic odour Algae present (Receiving Stream Inlet 1), No fencing around pond	None	$3,000	$3,600	$4,135
	Medium-Term	Remove excess vegetation at Receiving Stream Inlet 1 Repair erosion at Receiving Stream Inlet 1			$0		
	Long-Term	Install grate on Receiving Stream Inlet 1 Remediate minor blockage at Inlet 2 (vegetation and bush)			$600		
109	Short-Term	Install sign Investigate potential blockage of Outlet 1 (could not be located; potentially submerged)	None	None	$410	$410	$471
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Remove garbage			$0		

Pond ID	Duration	Description	Additional Comments	City Comments	Subtotal	Total (2014 dollars)	Total (2021 dollars)
111	Short-Term	Install signage Remove excess cattails Remove tire in pond Investigate adjacent construction activities (heavy sediment)	Heavy sedimentation - see sediment surveys Algae present (perimeter of pond), Water entering pond is slightly turbid; pond is murky No fence around pond	None	$670	$1,270	$1,459
	Medium-Term	Repair rip rap at Inlet 1 and Inlet 2 (sparse) Remove sediment build-up at Inlet 1 and Inlet 2 (likely from adjacent construction activity; 5+ cm in some areas)			$0		
	Long-Term	Install grate on Receiving Stream Inlet 1 Remediate blockage at Inlet 2 (vegetation) Remediate erosion at Receiving Stream Inlet 1 (lack of rip rap)			$600		
112	Short-Term	No maintenance recommended	None	None	$0	$0	$0
	Medium-Term	No maintenance recommended			$0		
	Long-Term	Remove garbage			$0		
114	Short-Term	Install more signage (only one present for large footprint) Repair grate on Outlet 3 (large DICB; grate not bolted)	Algae present (perimeter), Aquatic vegetation present under water surface Heavy flows being received by sump structure No fencing around pond	None	$280	$3,280	$3,768
	Medium-Term	Remediate blockage at Outlet 2 (vegetation blocking grate but outlet pipe still functioning)			$3,000		
	Long-Term	Remove cattails Repair minor erosion at Inlet 1 Repair superficial cracks in Receiving Stream Inlet 1 concrete			$0		
115	Short-Term	Install signage Remove sediment build-up at Inlet 1 (several cm thick; forebay turbid) and at Inlet 2 (fine sediment accumulation; close to standpipe) Repair lid on Outlet 1 (lid does not lock)	Turbid water in forebay (Inlet 2 is bringing in water with high turbidity) Algae present (slight growth at Receiving Stream Inlets 1 a-d), No fencing around pond	None	$2,780	$2,780	$3,193
	Medium-Term	Remediate erosion of forebay (banks not vegetated yet - newly constructed area) Repair rip rap at Inlet 2 (heavy flows have caused pitting; add more rip rap)			$0		
	Long-Term	Install grates on Inlet 2, Receiving Stream Inlets 1a-d and Receiving Stream Inlet 2 Repair grate on Outlet 2 (unlocked)			$0		
117	Short-Term	Remove tire in creek	Several dogs off-leash on property, Algae present (at Creek Overpass Inlet and Outlet)	None	$260	$7,460	$8,569
	Medium-Term	Remediate river stone at Creek Overpass Inlet (flow is going around river stone instead of designed flow path; may erode banks) Remove sediment build-up at Creek Overpass Inlet (coarse grain sediment accumulating near overpass; several cm in some areas) Repair erosion downstream of Creek Overpass Outlet (pitting approx. 2 m downstream; at least 75 cm deep) Inspect after each storm event to ensure proper function			$6,000		
	Long-Term	Install grates on Creek Overpass Inlet and Outlet Remove sediment build-up at Creek Overpass Outlet (coarse grain)			$1,200		

Appendix B: Preliminary Cost Estimates for SWM Facility Works

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SWM Pond #	Costs (2021 Canadian dollars)															
	Additional Studies						Maintenance Costs			Sediment Removal	Quantity Control Retrofit Feasibility Study	Retrofit				
	Revise Classification	Topographic/ Bathymetric Survey	Modelling	EMC Monitoring	Maintenance Inspection	Total Additional Studies	Maintenance from 2014	2021 Maintenance	Total Maintenance			Hydrogeological Study	EIS and Wetland Hydrology Study	Permitting	Design and Construction	Total Retrofit Cost
1	$0	-	-	-	-	**$0**	-	$11,800	**$11,800**	**-**	-	-	-	-	-	**-**
2	$0	$10,000	$10,000	-	-	**$20,000**	$4,500	-	**$4,500**	**-**	$25,000	$35,000	-	$8,000	$815,040	**$859,000**
3	$0	$10,000	$10,000	-	-	**$20,000**	$11,600	-	**$11,600**	**$320,519**	$25,000	$35,000	-	$8,000	$2,651,040	**$2,695,000**
4	$0	$10,000	$10,000	-	-	**$20,000**	-	-	**-**	**-**	$25,000	-	-	-	-	**-**
5	$0	$10,000	$10,000	-	-	**$20,000**	$700	$11,800	**$11,800**	**-**	-	-	-	-	-	**-**
6	$0	$10,000	$10,000	-	-	**$20,000**	$8,800	$11,800	**$11,800**	**-**	-	-	-	-	-	**-**
7	$0	$10,000	$10,000	-	-	**$20,000**	$4,800	-	**$4,800**	**-**	$25,000	$35,000	-	$8,000	$2,610,720	**$2,654,000**
8	$0	$10,000	$10,000	-	-	**$20,000**	$3,600	$11,800	**$11,800**	**-**	$25,000	-	-	-	-	**-**
9	-	$10,000	$10,000	-	-	**$20,000**	$600	$11,800	**$11,800**	**-**	$25,000	$35,000	-	$8,000	$3,872,160	**$3,916,000**
10	$0	$10,000	$10,000	-	-	**$20,000**	$4,400	-	**$4,400**	**-**	$25,000	$35,000	-	$8,000	$3,088,800	**$3,132,000**
11	$0	$10,000	$10,000	-	-	**$20,000**	$4,800	-	**$4,800**	**-**	$25,000	$35,000	-	$8,000	$1,291,680	**$1,335,000**
12	$0	$10,000	-	-	-	**$10,000**	$0	$11,800	**$11,800**	**-**	-	-	-	-	-	**-**
13	$0	$10,000	$10,000	-	-	**$20,000**	$600	$11,800	**$11,800**	**-**	$25,000	-	-	-	-	**-**
14	$0	$10,000	$10,000	-	-	**$20,000**	$1,400	$11,800	**$11,800**	**-**	-	-	-	-	-	**-**
15	-	$10,000	$10,000	$5,000	-	**$25,000**	-	-	**-**	**-**	-	-	-	-	-	**-**
16	$0	$10,000	-	-	-	**$10,000**	$4,500	-	**$4,500**	**-**	-	-	-	-	-	**-**
17	$0	$10,000	$10,000	-	-	**$20,000**	$4,100	$11,800	**$11,800**	**-**	-	-	-	-	-	**-**
18	-	$10,000	$10,000	-	-	**$20,000**	$3,100	$11,800	**$11,800**	**-**	$25,000	$35,000	-	$8,000	$3,176,640	**$3,220,000**
19	$0	$10,000	$10,000	-	-	**$20,000**	$1,500	$11,800	**$11,800**	**-**	$25,000	-	-	-	-	**-**
20	$0	$10,000	$10,000	$5,000	-	**$25,000**	-	-	**-**	**-**	$25,000	$35,000	$45,000	$15,000	$2,554,560	**$2,650,000**
21	-	$10,000	$10,000	-	-	**$20,000**	$600	$11,800	**$11,800**	**-**	$25,000	$35,000	$45,000	$15,000	$2,011,680	**$2,107,000**
22	$0	$10,000	$10,000	-	-	**$20,000**	$8,900	-	**$8,900**	**$166,545**	$25,000	$35,000		$8,000	$2,652,480	**$2,696,000**
23	-	$10,000	$10,000	-	-	**$20,000**	$700	$11,800	**$11,800**	**-**	$25,000	$35,000	$45,000	$15,000	$420,000	**$515,000**
24	$0	$10,000	$10,000	-	-	**$20,000**	$4,800	$11,800	**$11,800**	**-**	-	-	-	-	-	**-**
25	$0	$10,000	$10,000	-	-	**$20,000**	$1,300	-	**$1,300**	**-**	-	$35,000	-	$8,000	$3,108,960	**$3,152,000**
26	$0	$10,000	$10,000	-	-	**$20,000**	$8,300	-	**$8,300**	**-**	-	$35,000	-	$8,000	$420,000	**$463,000**
27	-	$10,000	$10,000	$5,000	-	**$25,000**	$4,500	$11,800	**$11,800**	**-**	-	$35,000	-	$8,000	$643,680	**$687,000**
28	-	$10,000	$10,000	$5,000	-	**$25,000**	$9,600	-	**$9,600**	**-**	-	-	-	-	-	**-**
29	-	-	-	-	-	**$0**	$2,400	$11,800	**$11,800**	**-**	-	-	-	-	-	**-**
30	-	$10,000	-	-	-	**$10,000**	$11,400	$11,800	**$17,500**	**-**	-	-	-	-	-	**-**
31	-	$10,000	$10,000	-	-	**$20,000**	$4,800	$11,800	**$16,600**	**-**	-	-	-	-	-	**-**
32	-	$10,000	$10,000	-	-	**$20,000**	$6,400	$11,800	**$15,000**	**-**	$25,000	$35,000	$45,000	$15,000	$607,680	**$703,000**
33	-	$10,000	$10,000	-	-	**$20,000**	$11,800	-	**$11,800**	**-**	-	$35,000	$45,000	$15,000	$444,960	**$540,000**
34	-	$10,000	$10,000	-	-	**$20,000**	$4,800	$11,800	**$11,800**	**-**	-	$35,000	$45,000	$15,000	$420,000	**$515,000**
35	-	$10,000	$10,000	$5,000	-	**$25,000**	$8,400	-	**$8,400**	**$241,766**	-	$35,000	-	$8,000	$2,200,320	**$2,244,000**
36	-	$10,000	$10,000	$5,000	-	**$25,000**	$11,700	-	**$11,700**	**$111,104**	-	$35,000	-	$8,000	$3,628,800	**$3,672,000**
37	-	$10,000	$10,000	$5,000	-	**$25,000**	$5,500	-	**$5,500**	**$123,320**	-	$35,000	-	$8,000	$1,316,160	**$1,360,000**
38	-	$10,000	$10,000	-	-	**$20,000**	$1,500	$11,800	**$11,800**	**-**	-	$35,000	-	$8,000	$4,487,040	**$4,531,000**
39	-	$10,000	$10,000	-	-	**$20,000**	$5,200	-	**$5,200**	**-**	-	$35,000	-	$8,000	$420,000	**$463,000**
40	-	$10,000	-	-	-	**$10,000**	$3,600	-	**$3,600**	**-**	-	-	-	-	-	**-**
41	-	$10,000	-	-	-	**$10,000**	-	-	**-**	**-**	-	-	-	-	-	**-**
42	-	$10,000	-	-	-	**$10,000**	$1,700	-	**$1,700**	**-**	-	-	-	-	-	**-**

SWM Pond #	Costs (2021 Canadian dollars)															
	Additional Studies						Maintenance Costs			Sediment Removal	Quantity Control Retrofit Feasibility Study	Retrofit				
	Revise Classification	Topographic/ Bathymetric Survey	Modelling	EMC Monitoring	Maintenance Inspection	Total Additional Studies	Maintenance from 2014	2021 Maintenance	Total Maintenance			Hydrogeological Study	EIS and Wetland Hydrology Study	Permitting	Design and Construction	Total Retrofit Cost
43	-	$10,000	-	-	-	**$10,000**	$200	-	**$200**	**-**	-	-	-	-	-	**-**
44	-	$10,000	$10,000	$5,000	-	**$25,000**	$1,600	-	**$1,600**	**-**	-	-	-	-	-	**-**
45	-	$10,000	$10,000	$5,000	-	**$25,000**	$6,300	-	**$6,300**	**-**	-	-	-	-	-	**-**
46	-	$10,000	$10,000	$5,000	-	**$25,000**	$2,800	-	**$2,800**	**-**	-	-	-	-	-	**-**
47	-	$10,000	$10,000	$5,000	-	**$25,000**	$700	-	**$700**	**-**	-	-	-	-	-	**-**
48	-	$10,000	$10,000	$5,000	-	**$25,000**	$4,900	-	**$4,900**	**-**	-	-	-	-	-	**-**
49	-	$10,000	-	-	-	**$10,000**	-	-	**-**	**-**	-	-	-	-	-	**-**
50	-	$10,000	-	-	-	**$10,000**	$8,600	-	**$8,600**	**-**	-	-	-	-	-	**-**
53	$0	$10,000	$10,000	-	-	**$20,000**	$4,500	-	**$4,500**	**$212,450**	$25,000	$35,000	$45,000	$15,000	$5,411,520	**$5,507,000**
54	-	$10,000	$10,000	-	-	**$20,000**	$7,800	-	**$7,800**	**-**	-	$35,000	-	$8,000	$420,000	**$463,000**
55	-	$10,000	$10,000	$5,000	-	**$25,000**	-	-	**-**	**-**	$25,000	$35,000	-	$8,000	$1,408,320	**$1,452,000**
56	-	$10,000	$10,000	$5,000	-	**$25,000**	$700	-	**$700**	**-**	$25,000	$35,000	$45,000	$15,000	$420,000	**$515,000**
57	-	$10,000	$10,000	-	-	**$20,000**	$1,100	-	**$1,100**	**-**	$25,000	$35,000	$45,000	$15,000	$1,795,200	**$1,891,000**
58	-	$10,000	$10,000	$5,000	-	**$25,000**	-	-	**-**	**-**	$25,000	$35,000	$45,000	$15,000	$1,364,400	**$1,460,000**
59	-	$10,000	$10,000	$5,000	-	**$25,000**	$700	-	**$700**	**-**	$25,000	$35,000	$45,000	$15,000	included with Pond 58	**$95,000**
60	-	$10,000	$10,000	-	-	**$20,000**	$4,500	-	**$4,500**	**-**	$25,000	$35,000	$45,000	$15,000	$420,000	**$515,000**
61	-	$10,000	$10,000	-	-	**$20,000**	$200	-	**$200**	**-**	$25,000	$35,000	$45,000	$15,000	$420,000	**$515,000**
62	-	$10,000	-	-	-	**$10,000**	$2,800	-	**$2,800**	**-**	-	-	-	-	-	**-**
63	-	$10,000	-	-	-	**$10,000**	$1,400	-	**$1,400**	**-**	-	-	-	-	-	**-**
64	-	$10,000	-	-	-	**$10,000**	$1,600	-	**$1,600**	**-**	-	-	-	-	-	**-**
65	-	$10,000	-	-	-	**$10,000**	$1,700	-	**$1,700**	**-**	-	-	-	-	-	**-**
66	-	$10,000	$10,000	$5,000	-	**$25,000**	$0	-	**-**	**-**	-	-	-	-	-	**-**
67	-	$10,000	-	-	-	**$10,000**	-	-	**-**	**-**	-	-	-	-	-	**-**
68	-	$10,000	-	-	-	**$10,000**	$4,500	-	**$4,500**	**-**	-	-	-	-	-	**-**
69	-	$10,000	$10,000	$5,000	-	**$25,000**	$4,500	-	**$4,500**	**-**	-	$35,000	-	$8,000	$852,480	**$896,000**
70	-	$10,000	$10,000	$5,000	-	**$25,000**	$500	-	**$500**	**-**	-	-	-	-	-	**-**
71	-	$10,000	$10,000	$5,000	-	**$25,000**	$500	-	**$500**	**-**	-	-	-	-	-	**-**
72	-	$10,000	$10,000	$5,000	-	**$25,000**	$1,000	-	**$1,000**	**-**	-	-	-	-	-	**-**
73	$0	$10,000	$10,000	$5,000	-	**$25,000**	$0	-	**-**	**-**	-	$35,000	-	$8,000	$420,000	**$463,000**
74	$0	$10,000	$10,000	$5,000	-	**$25,000**	$600	$11,800	**$11,800**	**$94,474**	-	-	-	-	-	**-**
75	$0	$10,000	$10,000	$5,000	-	**$25,000**	$1,300	$11,800	**$11,800**	**-**	-	$35,000	-	$8,000	$420,000	**$463,000**
76	$0	-	-	-	-	**$0**	$5,100	$11,800	**$11,800**	**-**	-	-	-	-	-	**-**
77	-	$10,000	$10,000	$5,000	-	**$25,000**	-	-	**-**	**-**	-	-	-	-	-	**-**
78	-	$10,000	-	-	-	**$10,000**	$3,600	-	**$3,600**	**-**	-	-	-	-	-	**-**
79	$0	$10,000	$10,000	-	-	**$20,000**	$2,100	-	**$2,100**	**-**	-	$35,000	-	$8,000	$476,640	**$520,000**
80	-	$10,000	-	-	-	**$10,000**	$0	$11,800	**$11,800**	**-**	-	-	-	-	-	**-**
81	$0	$10,000	-	-	-	**$10,000**	$0	-	**-**	**-**	-	-	-	-	-	**-**

SWM Pond #	Costs (2021 Canadian dollars)															
	Additional Studies						Maintenance Costs			Sediment Removal	Quantity Control Retrofit Feasibility Study	Retrofit				
	Revise Classification	Topographic/ Bathymetric Survey	Modelling	EMC Monitoring	Maintenance Inspection	Total Additional Studies	Maintenance from 2014	2021 Maintenance	Total Maintenance			Hydrogeological Study	EIS and Wetland Hydrology Study	Permitting	Design and Construction	Total Retrofit Cost
82	-	$10,000	$10,000	$5,000	-	**$25,000**	-	-	**-**	**-**	-	$35,000	-	$8,000	$5,264,640	**$5,308,000**
83	-	$10,000	$10,000	$5,000	-	**$25,000**	$1,600	-	**$1,600**	**-**	-	-	-	-	-	**-**
84	-	$10,000	-	-	-	**$10,000**	$700	-	**$700**	**-**	-	-	-	-	-	**-**
85	-	$10,000	-	-	-	**$10,000**	$200	-	**$200**	**-**	-	-	-	-	-	**-**
86	-	$10,000	$10,000	$5,000	-	**$25,000**	$900	-	**$900**	**-**	-	$35,000	-	$8,000	$718,560	**$762,000**
87	-	$10,000	$10,000	$5,000	-	**$25,000**	$4,400	-	**$4,400**	**$62,266**	-	$35,000	-	$8,000	$420,000	**$463,000**
88	-	$10,000	$10,000	$5,000	-	**$25,000**	$3,500	-	**$3,500**	**-**	-	-	-	-	-	**-**
89	-	$10,000	-	-	-	**$10,000**	$200	-	**$200**	**-**	-	-	-	-	-	**-**
90	-	$10,000	-	-	-	**$10,000**	$0	-	**-**	**-**	-	-	-	-	-	**-**
91	-	$10,000	-	-	-	**$10,000**	$4,000	-	**$4,000**	**-**	-	-	-	-	-	**-**
92	-	$10,000	-	-	-	**$10,000**	$1,900	-	**$1,900**	**-**	-	-	-	-	-	**-**
93	-	$10,000	$10,000	$5,000	-	**$25,000**	$3,500	-	**$3,500**	**-**	-	-	-	-	-	**-**
94	-	$10,000	-	-	-	**$10,000**	$0	-	**-**	**-**	-	-	-	-	-	**-**
95	-	$10,000	-	-	-	**$10,000**	-	-	**-**	**-**	-	-	-	-	-	**-**
96	-	$10,000	$10,000	-	-	**$20,000**	$3,500	$11,800	**$11,800**	**-**	-	$35,000	-	$8,000	$420,000	**$463,000**
97	-	$10,000	-	-	-	**$10,000**	-	-	**-**	**-**	-	-	-	-	-	**-**
98	-	$10,000	-	-	-	**$10,000**	$0	$11,800	**$11,800**	**-**	-	-	-	-	-	**-**
99	-	$10,000	$10,000	$5,000	-	**$25,000**	$700	-	**$700**	**-**	-	$35,000	-	$8,000	$1,097,280	**$1,141,000**
100	$0	$10,000	$10,000	-	-	**$20,000**	$0	-	**-**	**-**	$25,000	$35,000	$45,000	$15,000	$3,414,240	**$3,510,000**
101	$0	$10,000	$10,000	-	-	**$20,000**	$4,100	-	**$4,100**	**-**	$25,000	$35,000	$45,000	$15,000	$420,000	**$515,000**
102	-	$10,000	-	-	-	**$10,000**	$0	-	**-**	**-**	-	-	-	-	-	**-**
103	-	$10,000	$10,000	-	-	**$20,000**	-	$11,800	**$11,800**	**-**	-	$35,000	-	$8,000	$531,360	**$575,000**
104	$0	$10,000	-	-	-	**$10,000**	$4,200	$11,800	**$11,800**	**-**	-	-	-	-	-	**-**
105	$0	$10,000	$10,000	-	-	**$20,000**	-	-	**-**	**-**	-	$35,000	-	$8,000	$420,000	**$463,000**
106	-	$10,000	$10,000	-	-	**$20,000**	-	-	**-**	**-**	-	$35,000	-	$8,000	$4,075,200	**$4,119,000**
107	$0	$10,000	-	-	-	**$10,000**	$4,200	-	**$4,200**	**$167,112**	-	-	-	-	-	**-**
108	$0	$10,000	$10,000	-	-	**$20,000**	-	-	**-**	**-**	-	$35,000	-	$8,000	$495,360	**$539,000**
109	$0	$10,000	$10,000	-	-	**$20,000**	$500	-	**$500**	**$44,771**	-	$35,000	-	$8,000	$986,400	**$1,030,000**
110	-	$10,000	-	-	-	**$10,000**	-	-	**-**	**-**	-	-	-	-	-	**-**
111	-	$10,000	$10,000	$5,000	-	**$25,000**	$1,500	-	**$1,500**	**$41,723**	-	$35,000	-	$8,000	$420,000	**$463,000**
112	$0	$10,000	-	-	-	**$10,000**	$0	-	**-**	**-**	-	-	-	-	-	**-**
113	$0	$10,000	-	-	-	**$10,000**	-	-	**-**	**-**	-	-	-	-	-	**-**
114	$0	$10,000	-	-	-	**$10,000**	$3,800	-	**$3,800**	**-**	-	-	-	-	-	**-**
115	-	$10,000	-	-	-	**$10,000**	$3,200	-	**$3,200**	**-**	-	-	-	-	-	**-**
116	$0	$10,000	-	-	-	**$10,000**	-	$11,800	**$11,800**	**-**	-	-	-	-	-	**-**
117	-	$10,000	-	-	-	**$10,000**	$8,600	$11,800	**$11,800**	**-**	-	-	-	-	-	**-**
118/119	$0	$10,000	-	-	-	**$10,000**	-	-	**-**	**-**	-	-	-	-	-	**-**
120	$0	$10,000	-	-	-	**$10,000**	-	-	**-**	**-**	-	-	-	-	-	**-**
121	$0	$10,000	$10,000	-	-	**$20,000**	-	-	**-**	**-**	-	-	-	-	-	**-**
122	-	$10,000	-	-	-	**$10,000**	-	-	**-**	**-**	-	-	-	-	-	**-**
123	$0	-	-	-	-	**$0**	-	-	**-**	**-**	-	-	-	-	-	**-**
126	-	-	-	-	-	**$0**	-	-	**-**	**-**	-	-	-	-	-	**-**
127	$0	$10,000	-	-	$500	**$10,500**	-	-	**$11,800**	**-**	$25,000	$35,000	-	$8,000	-	**-**
128	$0	$10,000	-	-	$500	**$10,500**	-	-	**-**	**-**	-	-	-	-	-	**-**
129	$0	$10,000	-	-	$500	**$10,500**	-	-	**-**	**-**	-	-	-	-	-	**-**