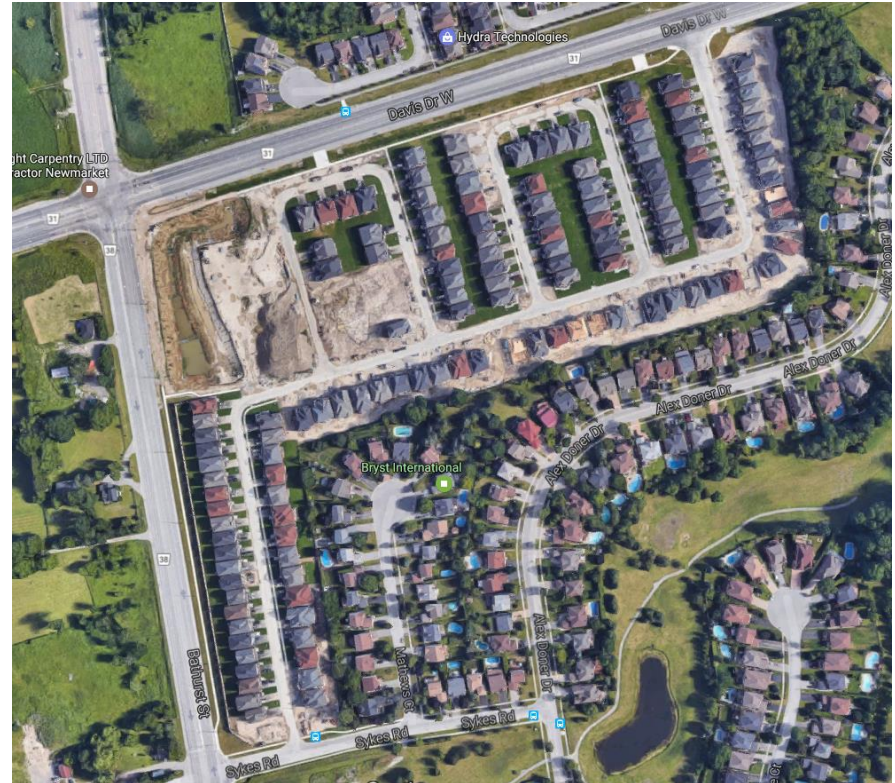


LID Treatment Train Tool

What does it do?



Justification

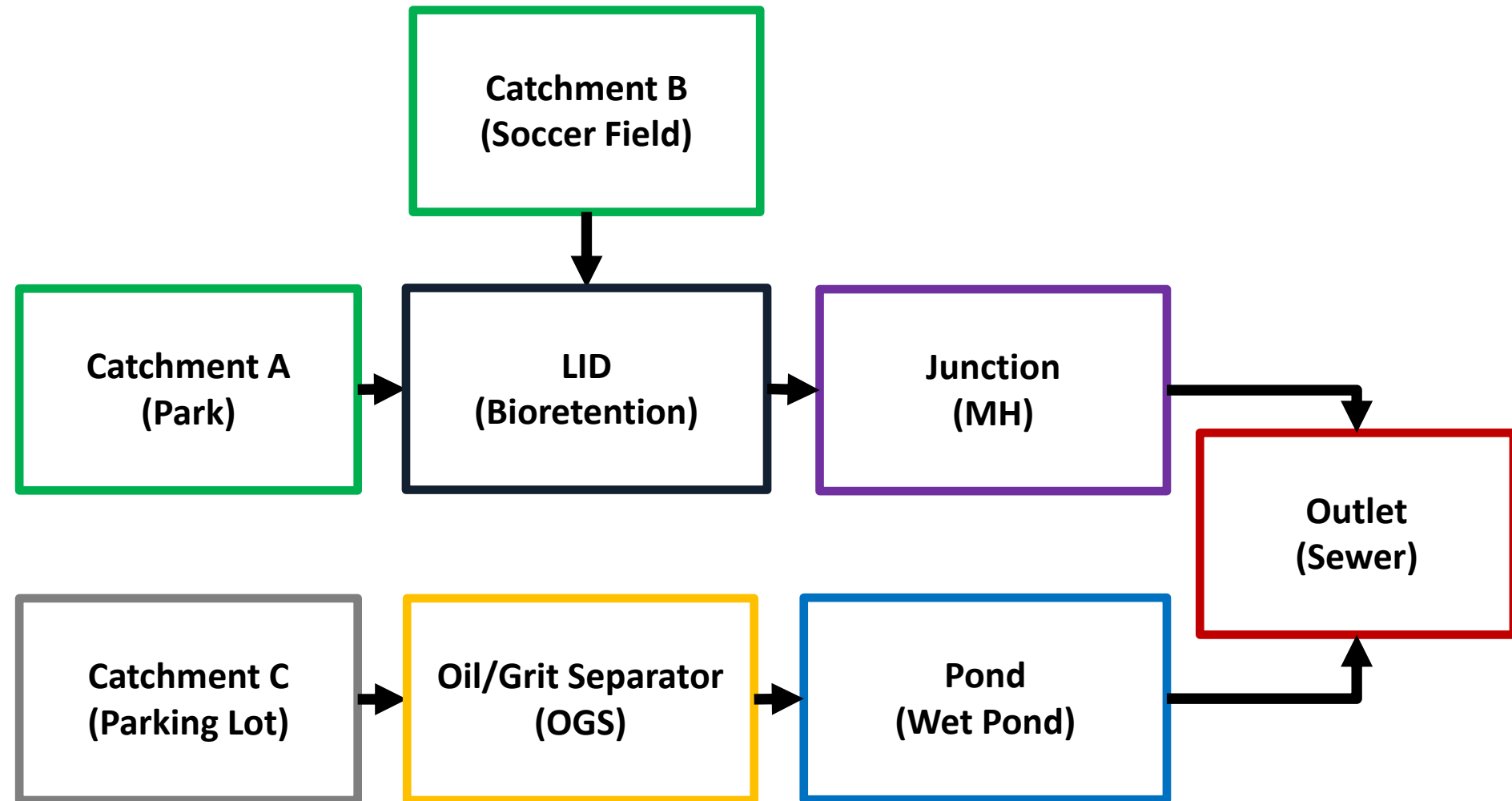
- Need: MOECC's direction – LIDs a requirement
- Why: Is site able to meet the targets – quick (relatively) answer
- Help: LID feature design help comes with the tool, which would, in future, be linked to the MOECC's "LID SWM Guidance Manual" and CVC/TRCA/LSRCA's "LID SWM Planning and Design Guide LID Planning and Design Guide"
- How: using easy to use interface backed by powerful EPA-SWWM 5 engine
- Consistency in reviewing process – conceptual/planning design stage
- Effort not wasted: Export to SWMM5 for detailed design



Stormwater Management Criteria

- Erosion Control
- Runoff reduction (new criteria)
- Peak flow control (Flood control)
- Water balance
- Water quality

Formula Example



Runoff Volume Control (Retention)

LEGEND

- Flow

Catchment B

- 40,000 m³/yr Rainfall

Rainfall = 107,000 m³/yr
Runoff = 33,000 m³/yr
Retained = 74,000 m³/yr

Catchment A

- 30,000 m³/yr Rainfall

LID

- 2,000 m³/yr Rainfall

Junction

- 0 m³/yr Rainfall

Outlet

- 33,000 m³/yr Outflow

Catchment C

- 35,000 m³/yr Rainfall

OGS

- 0 m³/yr Rainfall

Pond

- 0 m³/yr
- Rainfall

Rainfall and Outflow

[SUBCATCHMENTS]			
Name	Rain Gage	outlet	Area
Catchment-A	Rain_Gauge	LID	3.54
Catchment-B	Rain_Gauge	LID	4.72
Catchmebt-C	Rain_Gauge	OGS	4.13
LID	Rain_Gauge	Junction	0.24

***** Subcatchment Runoff Summary *****				
Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm
Catchment-A	847.60	0.00	84.76	480.31
Catchment-B	847.60	0.00	42.38	381.42
Catchmebt-C	847.60	0.00	24.22	0
LID	847.60	7207.11	254.28	8899.80

***** outfall Loading Summary *****				
outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total volume 10^6 ltr
outlet	8.29	0.017	0.400	33.000
DummyOutfall	0.18	0.000	0.000	0.004
System	4.24	0.017	0.400	40.673

Catchments

- 107,000 m³/yr
Rainfall

Outlet

- 33,000 m³/yr
Outflow

Annual Runoff Volume Control (Treated/Captured)

LEGEND

- **Untreated** (bypassed)
- **Treated** (filtrated)
- **Runoff reduction** (infiltrated/evapotranspired)

Catchment B

- 20,000 m³/yr
- 0 m³/yr

Catchment A

- 10,000 m³/yr
- 0 m³/yr

LID

- 1,000 m³/yr
- 7,000 m³/yr
- 22,000 m³/yr

Junction

- 8,000 m³/yr
- 0 m³/yr
- 0 m³/yr

Catchment C

- 30,000 m³/yr
- 0 m³/yr

OGS

- 0 m³/yr
- 30,000 m³/yr
- 0 m³/yr

Pond

- 0 m³/yr
- 25,000 m³/yr
- 5,000 m³/yr

Outlet (Site)

- 1,000 m³/yr
- 32,000 m³/yr
- 27,000 m³/yr

Runoff Volume Control (Treated/Captured)

Catchment Runoff = 100% Untreated

Catchment B

- 20,000 m³/yr
- 0 m³/yr

LID Performance Summary

Subcatchment	LID Control	Total Inflow mm	Evap Loss mm	Infil Loss mm	Surface Outflow mm	Drain outflow mm
LID	LID	13561.60	1271.40	8899.80	423.80	2966.60
DummyCatchment	DummyLID	847.60	0.00	0.00	747.60	0.00

LID

- 1,000 m³/yr
- 7,000 m³/yr

Pond/OGS = 100% Treated
(minus any Losses)

Pond

- 0 m³/yr
- 25,000 m³/yr

OGS

- 0 m³/yr
- 30,000 m³/yr

Water Balance

LID

- 2,000 m³/yr Rainfall

Catchment B

- 10,000 m³/yr
- 10,000 m³/yr
- (20,000 m³/yr)

Evap. = 38,000 m³/yr
Infil. = 36,000 m³/yr
Run. = 33,000 m³/yr

LEGEND

- Evapotranspiration
- Infiltration
- Runoff

Catchment A

- 15,000 m³/yr
- 5,000 m³/yr
- (10,000 m³/yr)

LID

- 3,000 m³/yr
- 21,000 m³/yr
- (8,000 m³/yr)

Junction

- 0 m³/yr
- 0 m³/yr
- (8,000 m³/yr)

Outlet

- 0 m³/yr
- 0 m³/yr
- 33,000 m³/yr

Catchment C

- 5,000 m³/yr
- 0 m³/yr
- (30,000 m³/yr)

OGS

- 0 m³/yr
- 0 m³/yr
- (30,000 m³/yr)

Pond

- 5,000 m³/yr
- 0 m³/yr
- (25,000 m³/yr)

Water Balance

Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm
Catchment-A	847.60	0.00	84.76	480.31
Catchment-B	847.60	0.00	42.38	381.42
Catchment-C	847.60	0.00	24.22	0
LID	847.60	7207.11	254.28	8899.80

LID Performance Summary

Subcatchment	LID Control	Total Inflow mm	Evap Loss mm	Infil Loss mm	Surface outflow mm	Drain outflow mm
LID	LID	13561.60	271.40	8899.80	423.80	2966.60

Storage Volume Summary

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss
Pond	0.000	0	17	0

Groundwater Summary

Subcatchment	Total Infil mm	Total Evap mm	Total Lower Seepage mm	Total Lateral outflow mm	Maximum Lateral outflow CMS
Catchment-A	480.31	339.04	141.27	0.00	0.00
Catchment-B	381.42	169.52	211.90	0.00	0.00
Catchment-C	0.00	0.00	0.00	0.00	0.00

Outfall Loading Summary

outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
outlet	8.29	0.017	0.400	33.000

ET = 38,000 m³/yr
Infil. = 36,000 m³/yr
Run. = 33,000 m³/yr

Peak Flows

LEGEND

- Peak Flow Rate

Catchment B

- $0.18 \text{ m}^3/\text{s}$

Catchment A

- $0.15 \text{ m}^3/\text{s}$

LID

- $0.02 \text{ m}^3/\text{s}$

Junction

- $0.02 \text{ m}^3/\text{s}$

Outlet

- $0.06 \text{ m}^3/\text{s}$

Catchment C

- $0.65 \text{ m}^3/\text{s}$

OGS

- $0.65 \text{ m}^3/\text{s}$

Pond

- $0.05 \text{ m}^3/\text{s}$

Peak Flows

Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10 ⁶ ltr	Peak Runoff CMS	Runoff Coeff
Catchment-A	847.60	0.00	84.76	480.31	282.53	10.00	0.15	0.333
Catchment-B	847.60	0.00	42.38	381.42	423.80	20.00	0.18	0.500
Catchment-C	847.60	0.00	24.22	0	726.51	30.00	0.65	0.857
LID	847.60	7207.11	254.28	8899.80	3390.40	8.00	0.02	0.765
Dummycatchment	847.60	0.00	0.00	0.00	747.60	0.00	0.00	0.882

Catchment A

- 0.1 LID
- 0.02 m³/s

Node Inflow Summary

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow volume 10 ⁶ ltr	Total Inflow volume 10 ⁶ ltr
OGS	JUNCTION	0.261	0.650	220 17:00	25.9	30.0
Junction2	JUNCTION	0.000	0.060	220 17:00	0	33.0
Junction	JUNCTION	0.157	0.020	203 08:05	14.8	8.0
GroundwaterNode	JUNCTION	0.000	0.000	0 00:00	0	0
outfallcalcTrigger	JUNCTION	0.000	0.000	0 00:00	0	0
outlet	OUTFALL	0.000	0.060	220 17:00	0	33.0
DummyOutfall	OUTFALL	0.000	0.000	220 16:14	0	0.00433
Pond	STORAGE	0.000	0.650	220 17:00	0	25.0
DummyStorage	STORAGE	0.000	0.000	220 16:40	0.000748	0.000748

Junction

- 0 Pond
- OGS
- 0.65 m³/s

Water Quality Calculations

$$EMC_{Out} \text{ (mg/L)} = EMC_{In} \text{ (mg/L)} * (1 - \text{Removal Efficiency})$$

$$Load_{In} \text{ (kg)} = (Flow_{In} \text{ (m}^3\text{)} * EMC_{In} \text{ (mg/L)}) / 1000$$

$$Load_{Out} \text{ (kg)} = (Flow_{Out} \text{ (m}^3\text{)} * EMC_{Out} \text{ (mg/L)}) / 1000$$

Overview of TSS Predictions

LEGEND

- TSS Concentration
- Flow
- TSS Load

Catchment B

- 29 mg/L
- 20,000 m³/yr
- 580 kg/yr

Catchment A

- 29 mg/L
- 10,000 m³/yr
- 290 kg/yr

LID

- 7.25 mg/L (75%)
- 8,000 m³/yr
- 58 kg/yr

Junction

- 7.25 mg/L
- 8,000 m³/yr
- 58 kg/yr

Outlet

- 8.12 mg/L
- 33,000 m³/yr
- 268 kg/yr

Catchment C

- 84 mg/L
- 30,000 m³/yr
- 2,520 kg/yr

OGS

- 42 mg/L (50%)
- 30,000 m³/yr
- 1,260 kg/yr

Pond

- 8.4 mg/L (80%)
- 25,000 m³/yr
- 210 kg/yr

Generating – TSS Outflow Loads

Subcatchment Runoff Summary

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm
Catchment-A	847.60	0.00	84.76	480.31	282.53
Catchment-B	847.60	0.00	42.38	381.42	423.80
Catchmebt-C	847.60	0.00	24.22	0	726.51
LID	847.60	7207.11	254.28	8899.80	3390.40

[SUBCATCHMENTS]

Name	Rain Gauge	Outlet	Area
Catchment-A	Rain_Gauge	LID	3.54
Catchment-B	Rain_Gauge	LID	4.72
Catchmebt-C	Rain_Gauge	OGS	4.13
LID	Rain_Gauge	Junction	0.24
DummyCatchment	Rain_Gauge	DummyStorage	0.0001

Base Table of Runoff Concentrations

Land Use	TSS in/out (EMC) (mg/L)	TP in/out (EMC) (mg/L)
Paved surface	84	0.16
Roof	8	0.05
Landscaped Area	70	0.12
Row Crop	100	0.20
Open Space/Parkland	29	0.20
Forest	55	0.20
Wetland	38.5	0.10

Catchment A

- 29 mg/L
- 10,000 m³/yr
- 290 kg/yr

Catchment B

- 29 mg/L
- 20,000 m³/yr
- 580 kg/yr

Catchment C

- 84 mg/L
- 30,000 m³/yr
- 2,520 kg/yr

Removal – TSS

Node Inflow Summary

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10 ⁶ ltr	Total Inflow Volume 10 ⁶ ltr	Flow Balance Error Percent
OGS	JUNCTION	0.261	0.261	220 17:00	25.9	30.0	-0.004
Junction2	JUNCTION	0.000	0.400	220 17:00	0	33.0	-0.043
Junction	JUNCTION	0.157	0.157	203 08:05	14.8	8.0	0.019
GroundwaterNode	JUNCTION	0.000	0.000	0 00:00	0	0	0.000
OutfallCalcTrigger	JUNCTION	0.000	0.000	0 00:00	0	0	0.000
Outlet	OUTFALL	0.000	0.400	220 17:00	0	33.0	0.000
DummyOutfall	OUTFALL	0.000	0.000	220 16:14	0	0.00433	0.000
Pond	STORAGE	0.000	0.260	220 17:00	0	25.0	-0.016
DummyStorage	STORAGE	0.000	0.000	220 16:40	0.000748	0.000748	-83.674

OGS

- 42 mg/L (50%)
- 30,000 m³/yr
- 1,260 kg/yr

LID

- 7.25 mg/L (75%)
- 8,000 m³/yr
- 58 kg/yr

Pond

- 8.4 mg/L (80%)
- 25,000 m³/yr
- 210 kg/yr

LID/Best Management Practices (BMP) Removal Efficiencies

LID	TSS Removal Efficiency %	TP Removal Efficiency % ³
Oil grit Separator	50	0
Bioretention	75	25
Wet Pond	80	60

Questions?

