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Sustainable Technologies
EVALUATION PROGRAM

Ontario

Partial Funding Provided
by Province of Ontario

TRIECA Conference (Thursday March 23, 2017 1:30 – 2 pm)

Development of an LID and Urban Water Balance Modeling Tool

Presenters:
Steve Auger, M.Sc., P.Eng., LSRCA
Chris Davidson, P.Eng., Golder Associates Ltd.

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Presentation Outline

- Direction and Evaluating Need
- LID Treatment Train Tool Overview
- Example - User Setup and Results
- Next Steps
- Q & A



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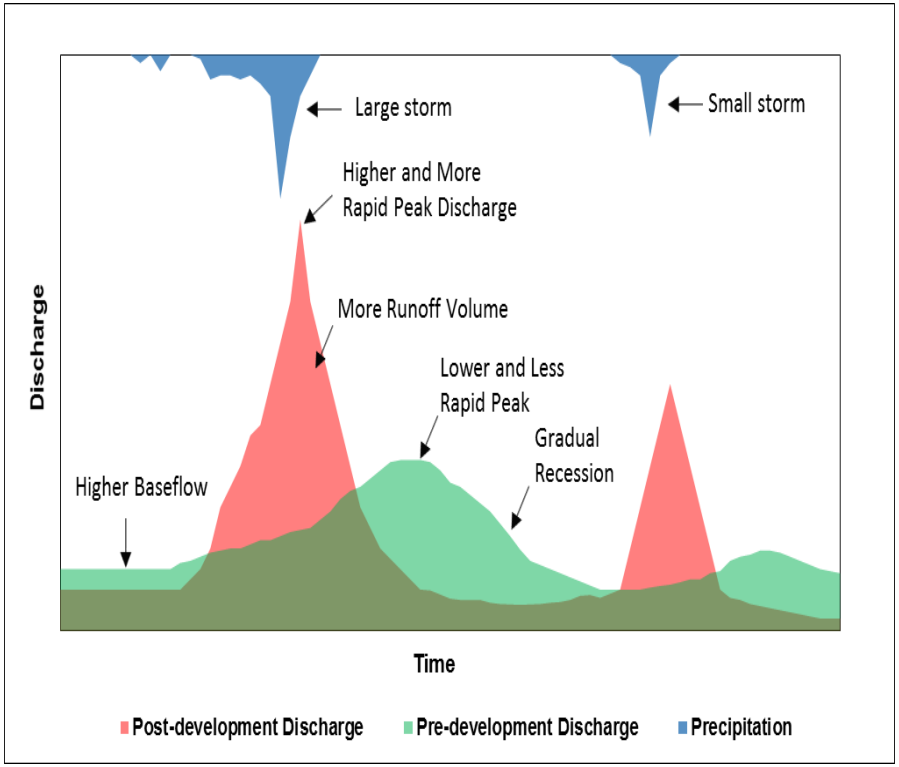
Direction

“Going forward, the Ministry expects that stormwater management plans…will employ LID in order to maintain the natural hydrologic cycle to the greatest extent possible.”

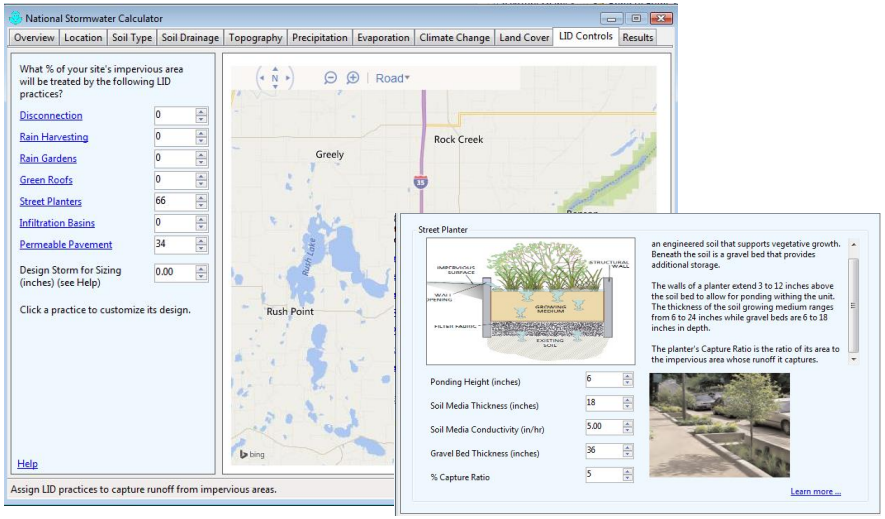
- Interpretation Bulletin from MOECC February 2015

Need For Tool

- Volume control
- Water quality
- Water balance



adapted from Schueler, 1987



EPA Stormwater Calculator

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Program Selection

- The BC Water Balance Model
- EPA-SWMM
- EPA National Stormwater Calculator
- HydroTrek
- WinSLAMM
- MIDS GUI Credit Calculator
- GSI-Calc

Program Comparison

	Short Listed Models			
Model Characteristic / Functionality	**Water Balance Model**	**EPA SWMM**	**HydroTrek**	**MIDS**
Hydrodynamic model type	N/A	One-dimensional	One-dimensional	N/A
Water quantity calculator	Yes	Yes	Yes	Yes
Water quality calculator	No	Yes	No	Yes
Continuous modeling	Yes	Yes	Yes	No
Single event modeling	No	Yes	Yes	No
Dynamic flow routing	No	Yes	No	N/A
Unsteady flow	N/A	Yes	Yes	N/A
Input complexity	Medium	High	Low	Low
# of LIDs represented	Low	Med	Med	Med
Input for LID practice/adaptability	Minimal	Detailed	Minimal	Minimal

Requirements

- Tailored to Ontario Climate & Geology
- Routing for Flows and Volumes
- Estimate Water Budget
- BMPs, End-of-Pipe, and Treatment Train
- User friendly GUI, Open-Source
- Generate Outputs for Local Targets

RFP

LID Treatment Train Tool for Ontario

Purpose:

A conceptual design tool to help developers, consultants, municipalities and landowners implement sustainable storm water management practices.

Capabilities:

Quantify runoff volumes reduction, pollutant load removal , and providing a preliminary pre and post development water budget evaluation by implementing Best Management Practices (BMPs) and Low Impact Development techniques.

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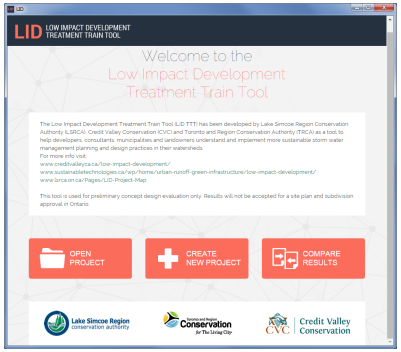
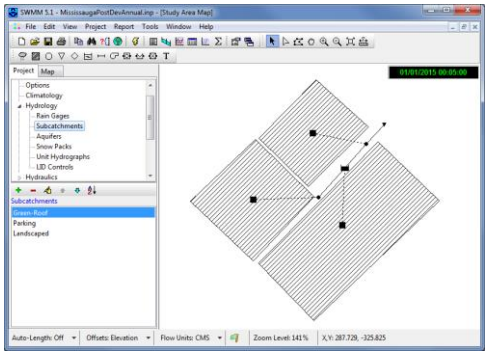
LID Tool Architecture

Input

.INP File





User

Tool (.JSON)

EPA SWMM5

SVR, Water Budget & TSS & TP % Removal

.RPT File

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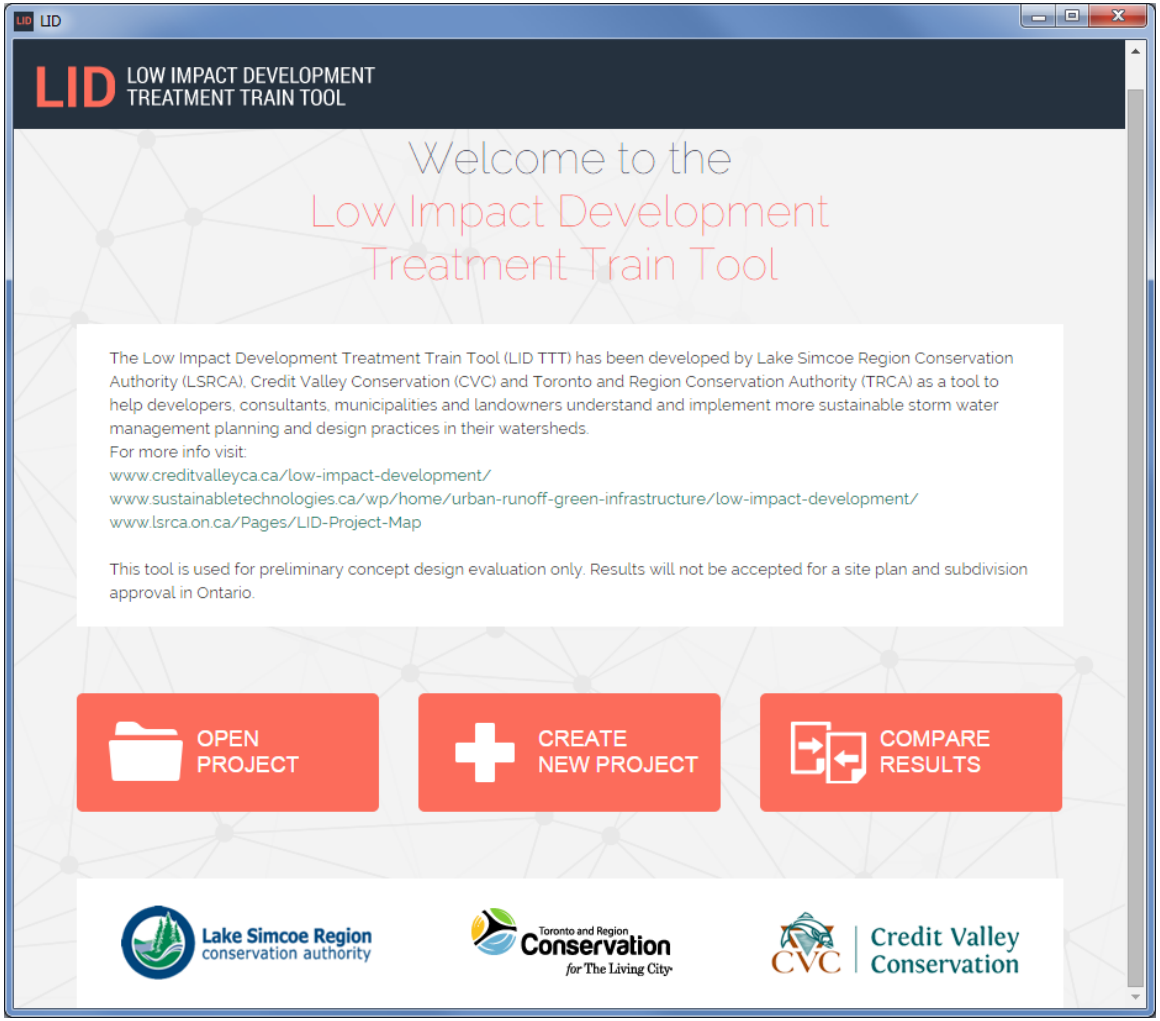
Minimum System Requirements

- Internet Access for Initial Download
- Windows OS (7, 8,10)
- 1 GHz and 1-2 GB RAM (32-bit or 64-bit)
- 200 MB available hard disk space
- Site Plan and Excel (Optional)

- Includes latest version of SWMM5 (5.1.010)
- No installation required (runs off .exe file)

Project Creation



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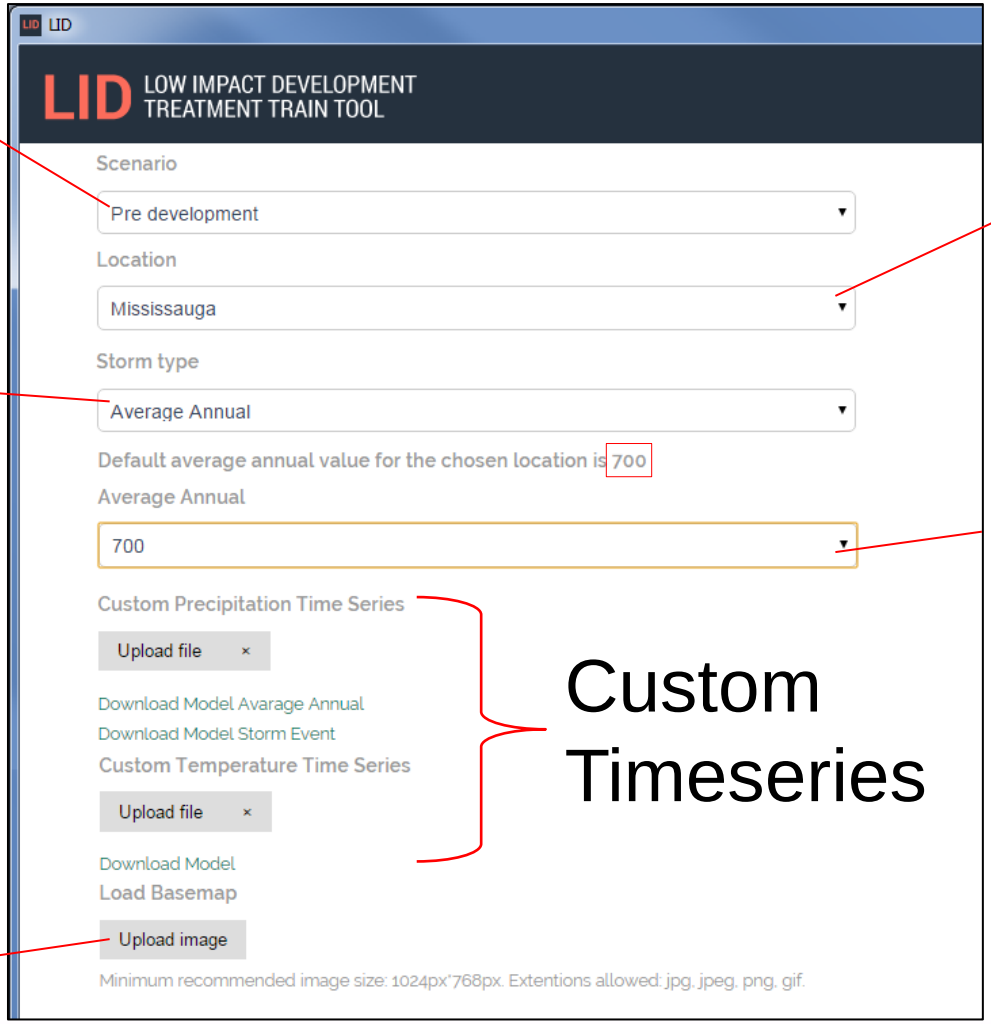
Project Creation

Scenario

Design Storm vs. Annual Average

Sitemap



Location

Timeseries

Custom Timeseries

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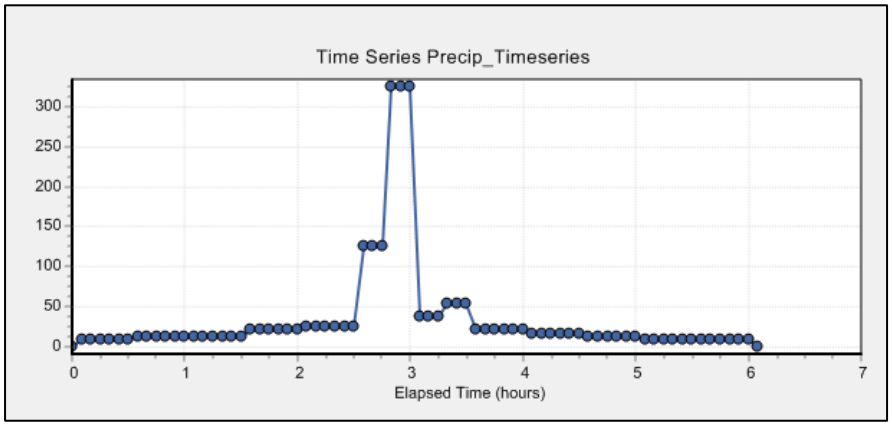
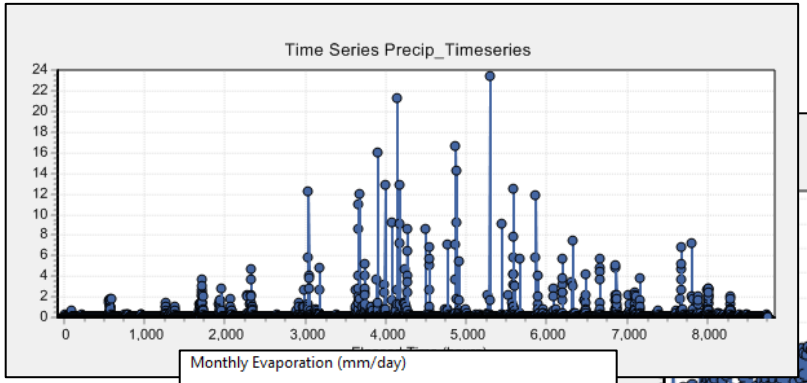
Project Creation

Design Storm



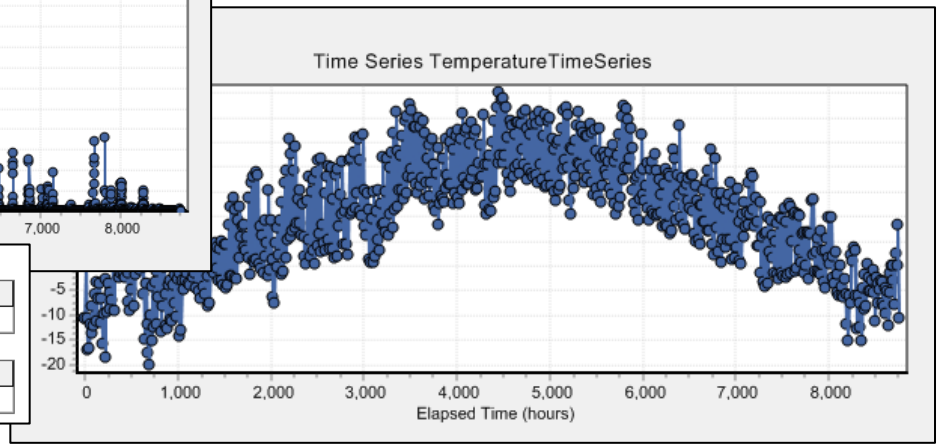
Average Annual



Monthly Evaporation (mm/day)

Jan	Feb	Mar	Apr	May	Jun
0.03	0.04	0.29	1.13	2.45	3.77

Jul	Aug	Sep	Oct	Nov	Dec
4.35	3.84	2.67	1.35	0.47	0.10



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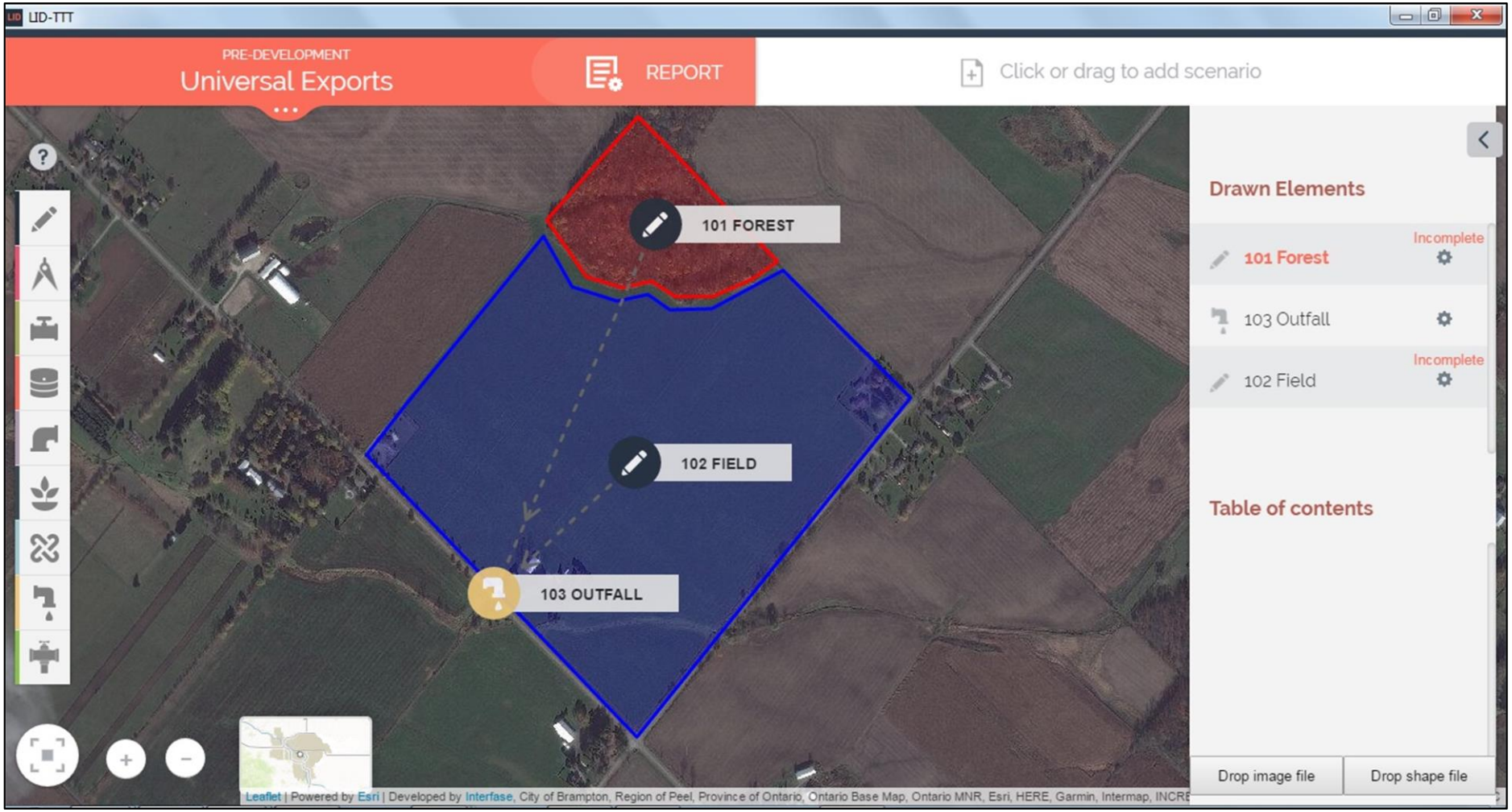
Step 1: Pre Development



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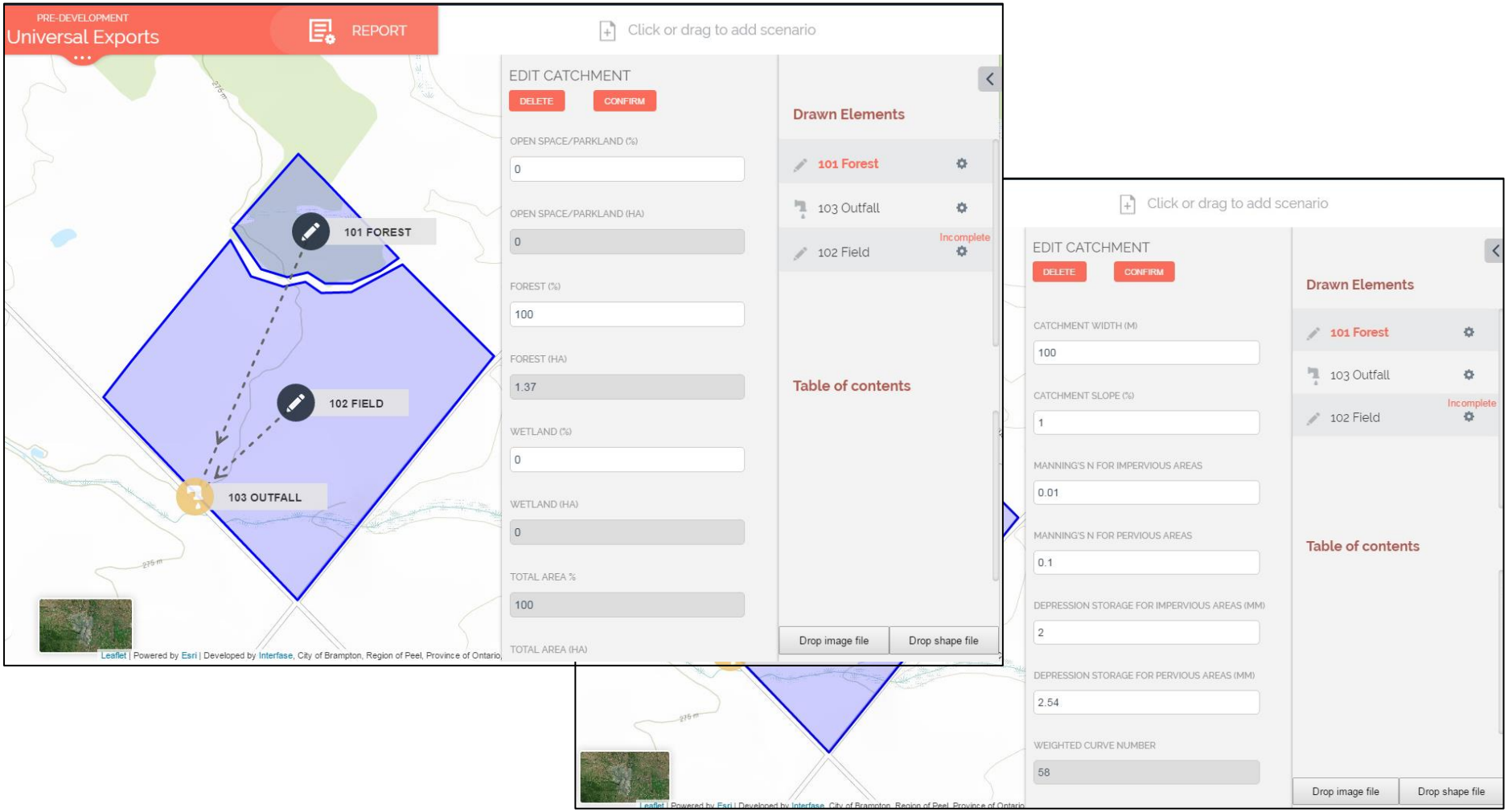
Step 1: Pre-Development



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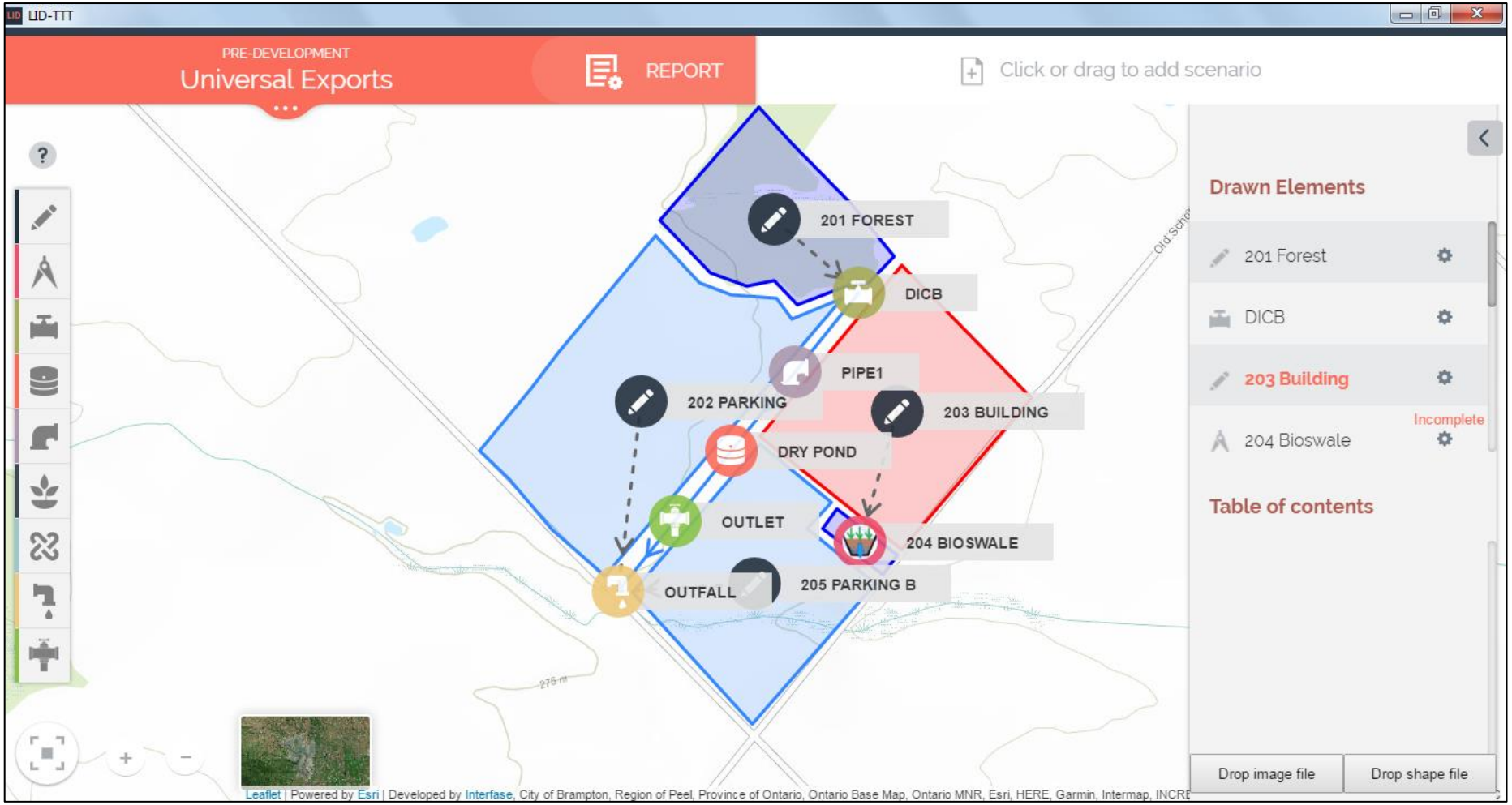
Default Event Mean Concentrations

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

Preliminary values

Step 2: Post-Development



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Step 2: Post-Development

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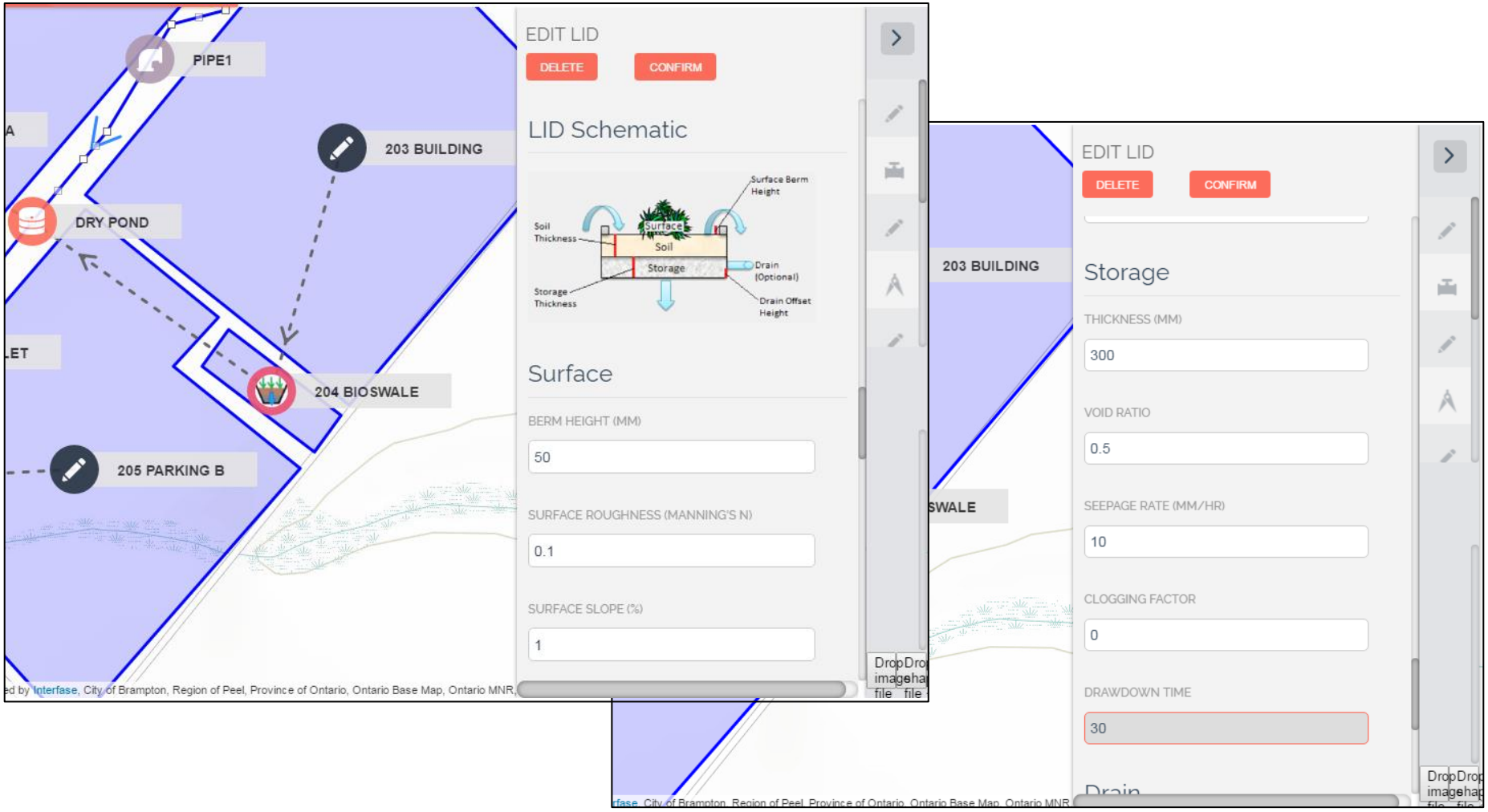
Step 3: Iterative LID Design



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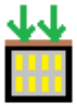
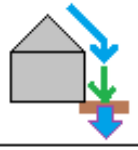
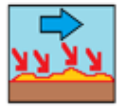
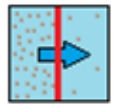
Step 3 (Cont.): Removal Efficiencies

LID	TSS Removal Efficiency %	TP Removal Efficiency %	Icon
Bioretention	75	25	
Green Roof	0	-45	
Infiltration / Exfiltration Systems	75	60	
Permeable Pavement	75	60	
Vegetated Filter Strips / Buffer Strips	30	20	
Enhanced Swale	40	25	

Storage	TSS Removal Efficiency %	TP Removal Efficiency %	Icon
Constructed Wetland	80	60	
Wet Retention Ponds	80	60	
Dry Detention Ponds	60	20	

Junction	TSS Removal Efficiency %	TP Removal Efficiency %	Icon
Specializaed Phosphorus Media Filter	75	70	
Sand or Media Filter	75	40	
Oil Grit Separator	50	0	

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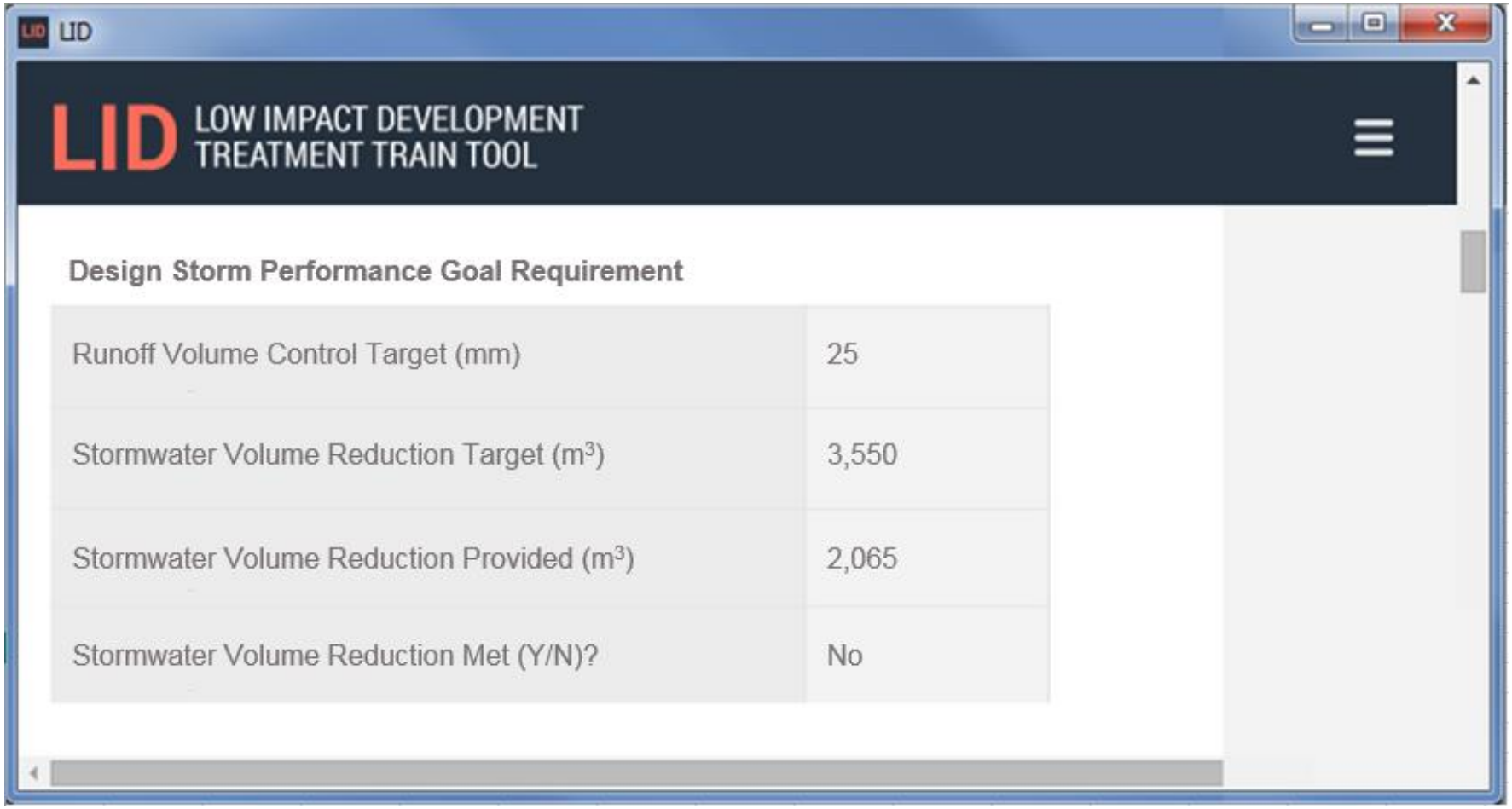
Tool Results – Runoff Volume Control Target



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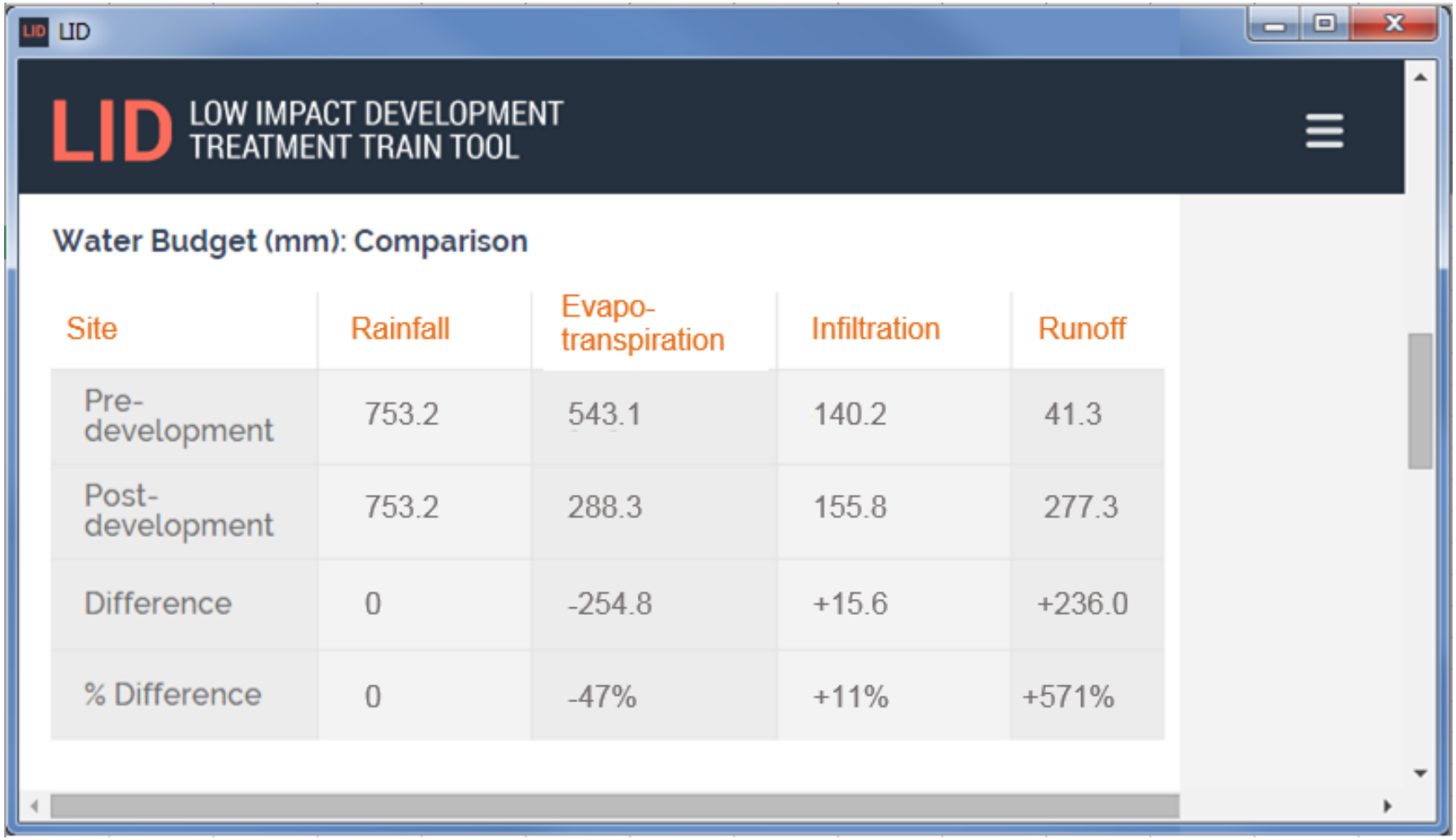
Tool Results – Water Budget Comparison



Site	Rainfall	Evapo-transpiration	Infiltration	Runoff
Pre-development	753.2	543.1	140.2	41.3
Post-development	753.2	288.3	155.8	277.3
Difference	0	-254.8	+15.6	+236.0
% Difference	0	-47%	+11%	+571%

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Tool Results – Post Dev. TSS Loading

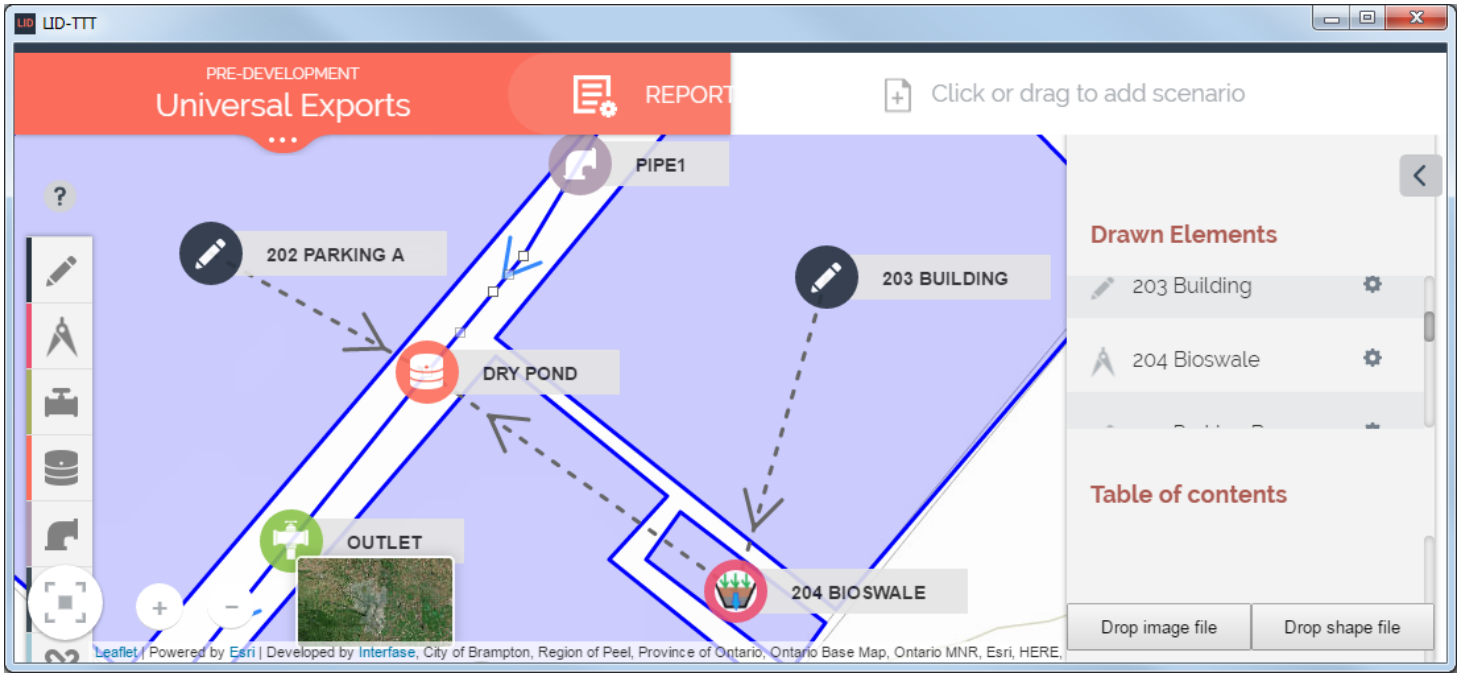
Feature (Removal%)	LID Type	% Removal	Incomming			Peak Outflow (m^3/s)	Outgoing		
			Total Flow (m^3)	Concentration (mg/L)	Total Load (kg)		Total Flow (m^3)	Concentration (mg/L)	Total Load (mg/L)
201 Forest			-	-	-	0.010	130	55	7
DICB			130	55	7	0.006	130	55	7
Pipe1			130	55	7	0.006	130	55	7
203 Building			-	-	-	0.160	17,060	8	136
204 Bioswale (75%)	Bioswale	75%	18,568	10	182	0.040	650	2	2
202 Parking A			-	-	-	0.220	22,990	81	1,867
Dry Pond (60%)	Dry Detention Pond	60%	23,770	79	1,876	0.030	20,768	32	655
Outlet 1			20,768	32	655	0.030	20,768	32	655
205 Parking B			-	-	-	0.180	18,440	81	1,497
Outfall_1			39,380	55	2,153	0.187	-	-	-

Tool Results – Post Dev. TP Loading

Feature (Removal%)	LID Type	% Removal	Incomming			Peak Outflow (m^3/s)	Outgoing		
			Total Flow (m^3)	Concentration (mg/L)	Total Load (kg)		Total Flow (m^3)	Concentration (mg/L)	Total Load (mg/L)
201 Forest			-	-	-	0.010	130	0.20	0.03
DICB			130	0.20	0.03	0.006	130	0.20	0.03
Pipe1			130	0.20	0.03	0.006	130	0.20	0.03
203 Building			-	-	-	0.160	17,060	0.05	0.85
204 Bioswale (25%)	Bioswale	25%	18,568	0.05	0.93	0.040	650	0.04	0.02
202 Parking A			-	-	-	0.220	22,990	0.15	3.49
Dry Pond (20%)	Dry Detention Pond	20%	23,770	0.15	3.54	0.030	20,768	0.12	2.48
Outlet 1			20,768	0.12	2.48	0.030	20,768	0.12	2.48
205 Parking B			-	-	-	0.180	18,440	0.15	2.80
Outfall_1			39,380	0.13	5.28	0.187	-	-	-

Tool Results – LID/BMP Summary

BMP	Drawdown Time (hrs)	Effective I/P Ratio	Flow			TSS			TP		
			Flow In (m3)	Flow Out (m3)	Actual % Reduction	Load In (kg)	Load Out (kg)	Actual % Reduction	Load In (kg)	Load Out (kg)	Actual % Reduction
Bioswale	30	12.3	18,568	650	96%	182	2	99%	0.93	0.02	97%
Dry-Pond	-	-	23,770	20,768	13%	1,876	655	65%	3.54	2.48	30%



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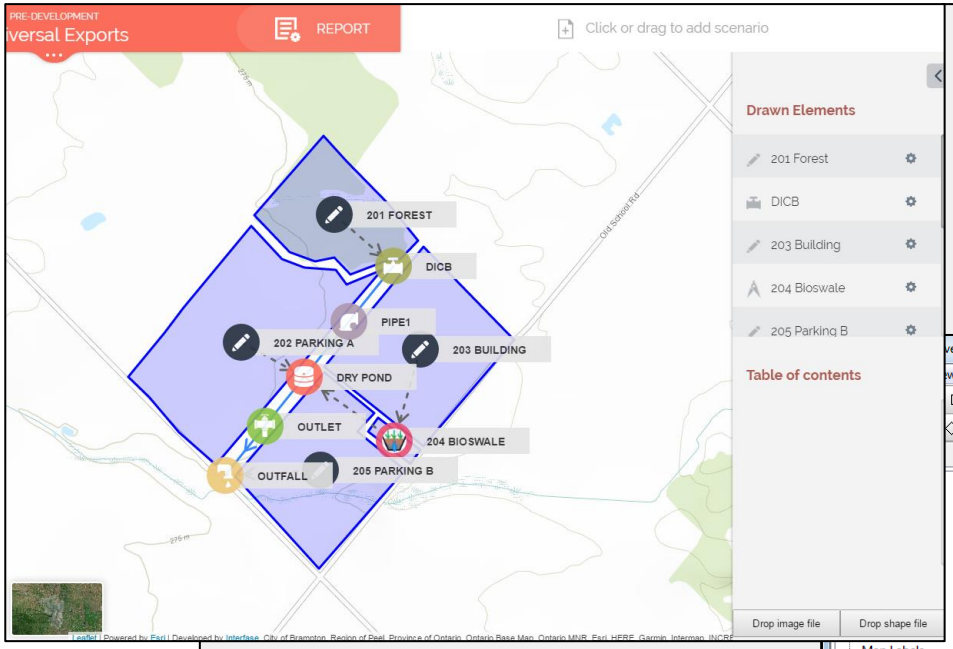
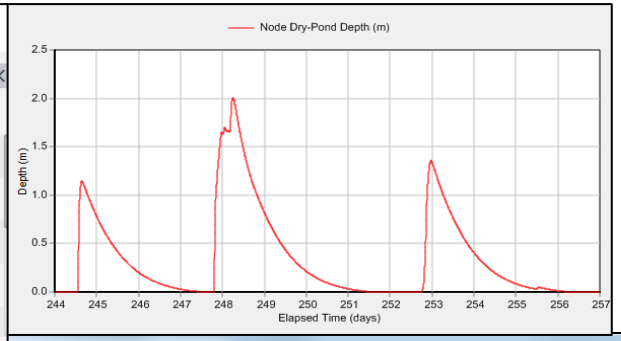
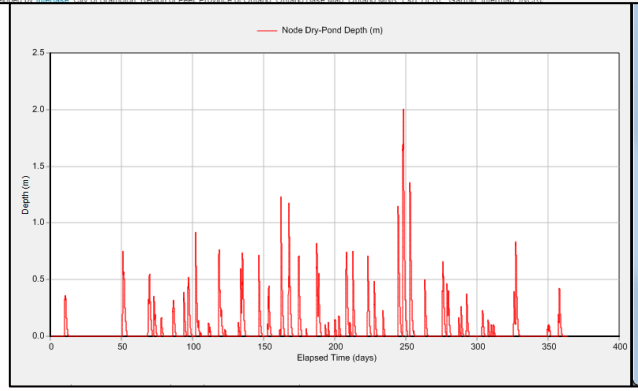
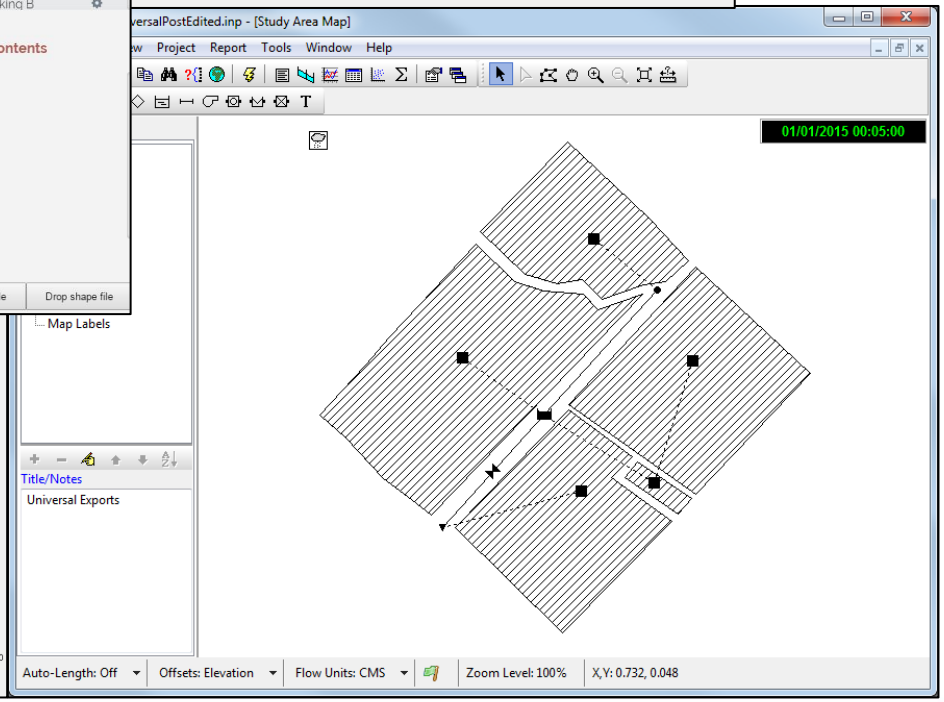
Tool in SWMM5









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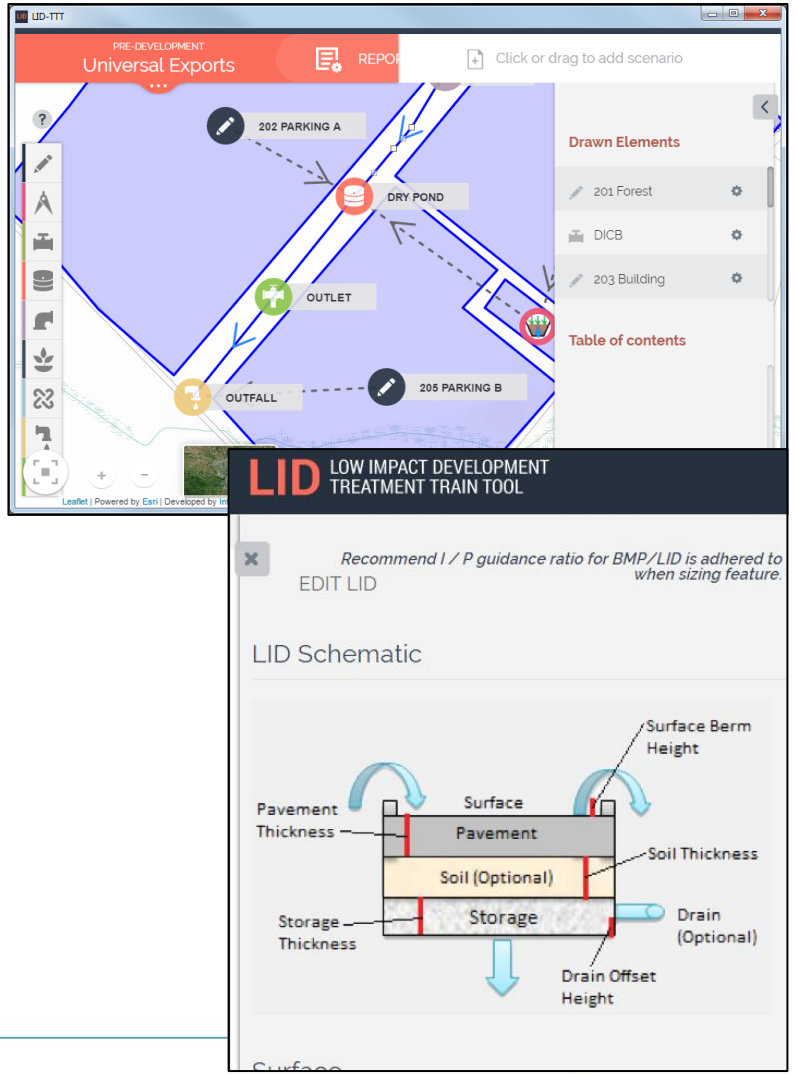
Next Steps Planned

Sustainable Technologies
EVALUATION PROGRAM

- Version 1.0 Scheduled for completion at end of April



- Training Workshops:
  - Lake Simcoe Watershed June, 2017
  - Toronto and Region Watershed September, 2017
  - Credit Valley Watershed October or November 2017

- STEP – Technical Support

Golder Associates

Acknowledgements

GTA Conservation Authority Project Team:

- Yuestas David, Wilfred Ho, Tim van Seters (TRCA)
- Amanjot Singh, Sakshi Saini (CVC)

Golder Associates Team:

- Melanie Kennedy, Kevin MacKenzie, Bob Murdoch, Massimo Draggan, Ruggero Bonora

Other Contributors:

- Rob Baldwin, Ken Cheney, Peng Du, Tom Hogenbirk,

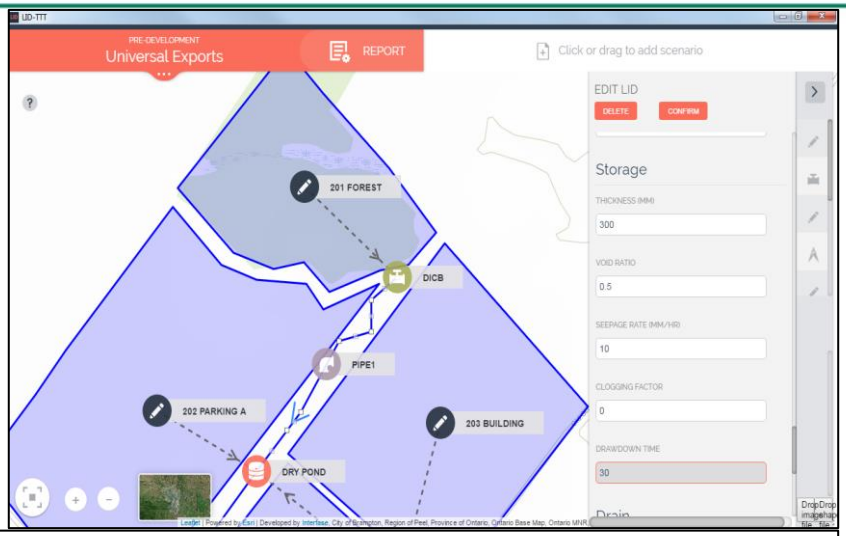
Ben Longstaff, Phil Thase, Mike Walters (LSRCA)

- Sameer Dhalla, Dan Hipple, Jason Tam (TRCA/STEP)
- Ghassan Sabour, Saleh Sebti, Christine Zimmer (CVC)
- John Antoszek, Tim Krsul, Sabrina Ternier (MOECC)

Partial Funding Provided by Province of Ontario

Thank You - Questions ?

Sustainable Technologies
EVALUATION PROGRAM



LID	TSS Removal Efficiency %	TP Removal Efficiency %	Icon
Bioretention	75	25	
Green Roof	0	-45	
Infiltration / Exfiltration Systems	75	60	
Permeable Pavement	75	60	
Vegetated Filter Strips / Buffer Strips	30	20	
Enhanced Swale	40	25	

INCOMMING				OUTGOING		
Total Flow (m3)	Concentration (mg/L)	Total Load (kg)	Peak Outflow (m3/s)	Total Flow (m3)	Concentration (mg/L)	Total Load (kg)
-	-	-	0.010	130	55	7
130	55	7	0.006	130	55	7
130	55	7	0.006	130	55	7
-	-	-	0.160	17,060	8	136
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