

Assessing the changes in hydrology through a simulation of stormwater management control alternatives

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Background

Issue 1: Ongoing erosion in Oshawa Creek

- Current method of providing extended detention is does not appear to help prevent erosion within Oshawa Creek
- Issue 2: Stacked versus overlapped extended detention storage in stormwater management (SWM) ponds (see Figure 1)
- CLOCA requires stacked storage volumes to protect the flood control volume from antecedent rainfall, but this results in larger pond volumes and footprints

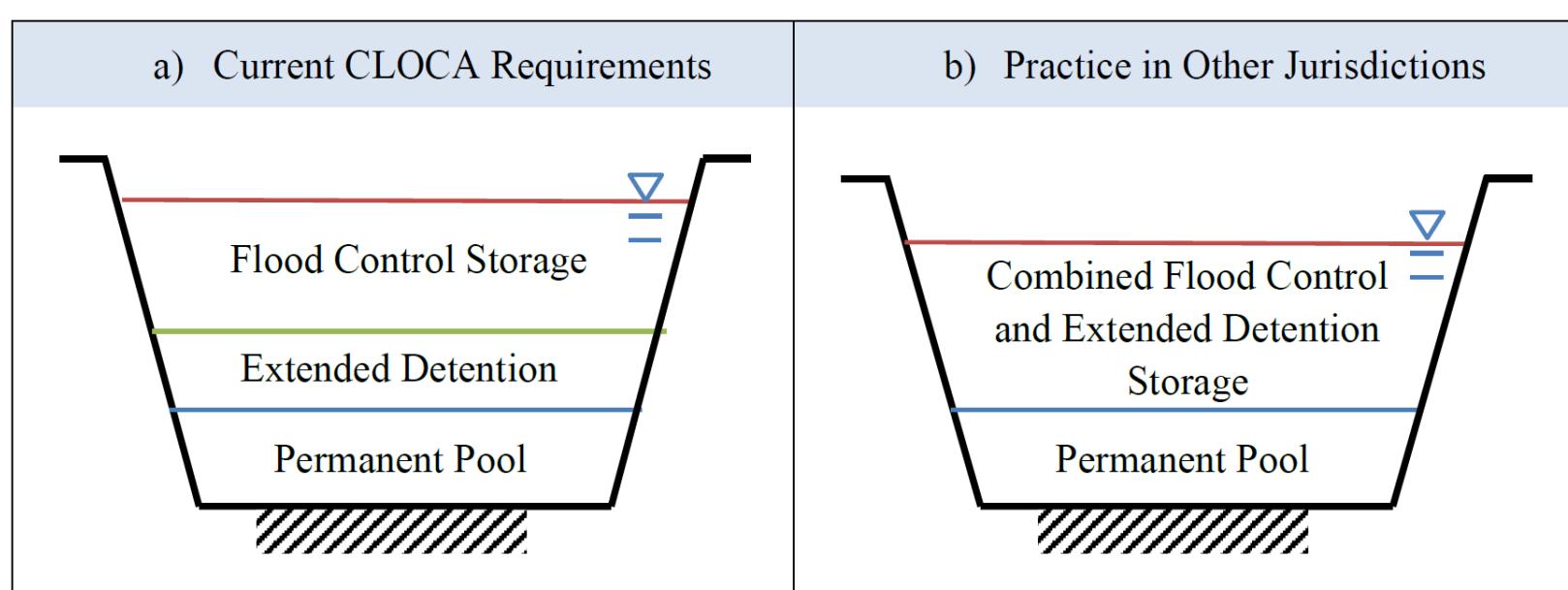


Figure 1: Ponds with Stacked and Overlapped Extended Detention and Flood Control Volumes

Study Objective

Quantify the performance of SWM facilities implemented at two catchments in preventing downstream channel erosion and protecting the availability of flood control storage from antecedent rainfall

Modelling Scenarios

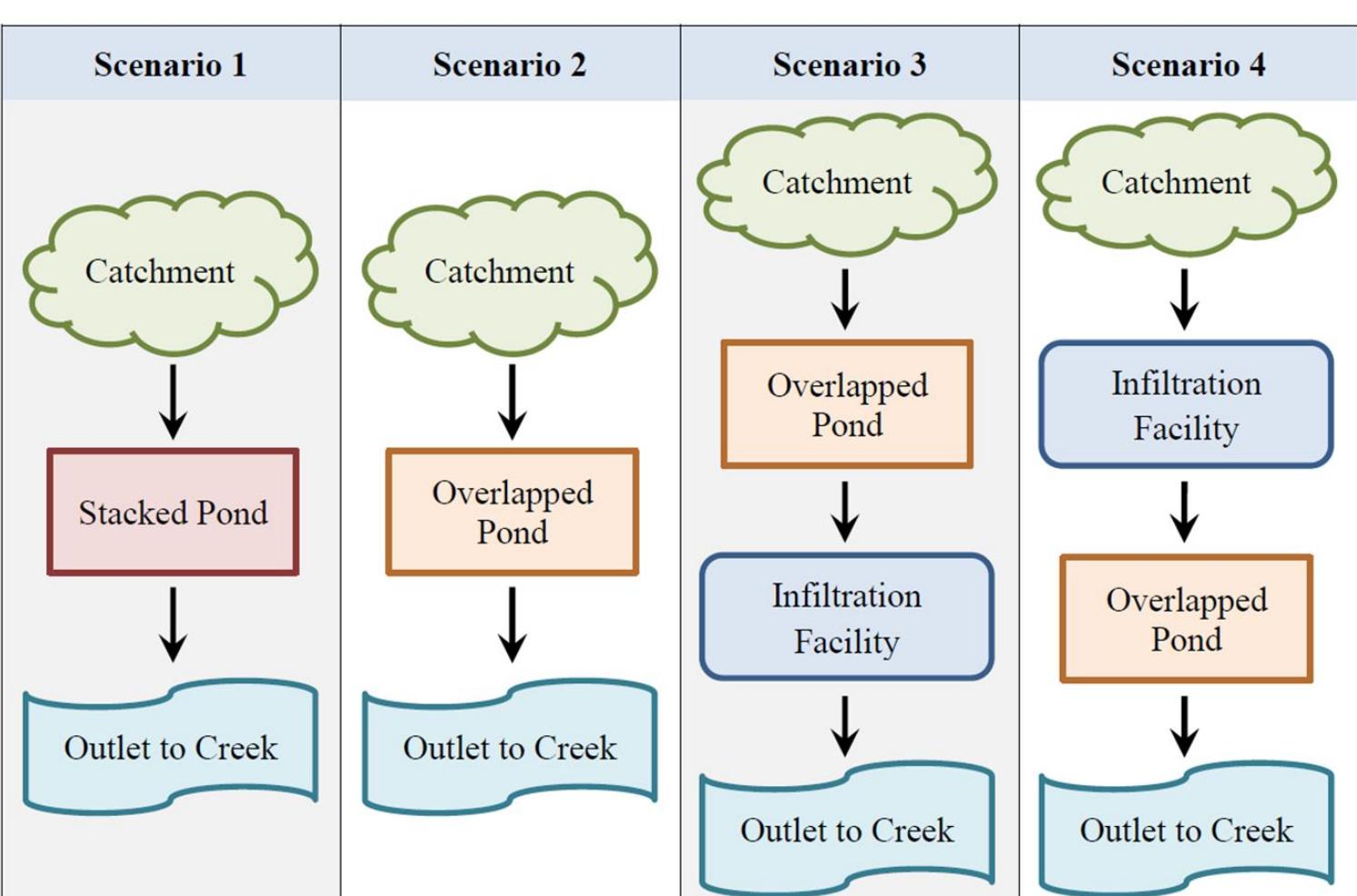


Figure 2:
Schematic of
Stormwater
Management
Control
Scenarios
Evaluated

Metrics and Results

AVERAGE DETENTION TIME (ADT)

- ADT measures of the average amount of time that a particle of water remains within the SWM facility
- Scenario 3 provides the best results as runoff from small events can generally be retained on site
- Stacked ponds perform marginally better than overlapped ponds

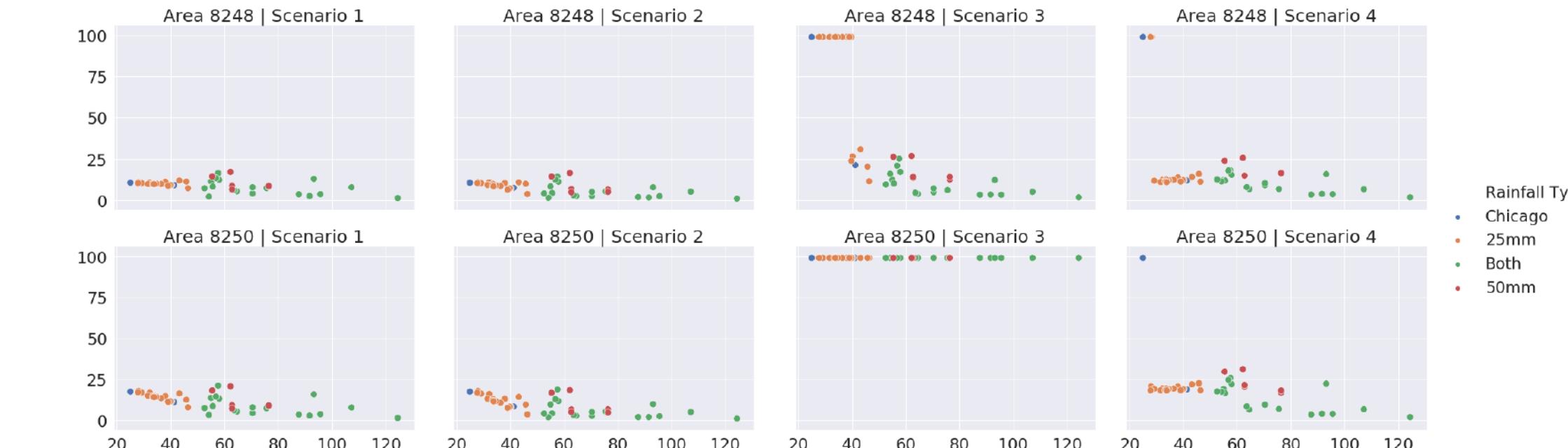


Figure 3: Results of Average Detention Time

POND AVAILABILITY

- Percentage of the pond's available volume 6 hours after meeting the rainfall selection criteria, calculated for each catchment
- Stacked ponds protect flood control volumes better than overlapped ponds, but infiltrating upstream of the pond provides the best improvement



Figure 4: Results of Pond Availability

EROSION INDEX

- Measures the combined impact the duration and the flow rate exceeding a threshold value: $EI = \sum(V - V_c) \Delta t$ (MOE, 2003)
- Infiltration-based scenarios present marginally better improvement rates
- Improvements are quickly overshadowed by the lack of control in other areas of the watershed



Figure 5: Change in Erosion Index from Uncontrolled Conditions

Conclusions and Recommendations

- Incorporating volume reduction measures generally improve results of all metrics most significantly
- To make a significant impact on the hydrology of the watershed to prevent downstream erosion from low to medium volume rainfall events, volume reduction targets should be set and implemented at the watershed level

Acknowledgements

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