

City of Edmonton's Kennedale Wetland

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WaterTech 2014





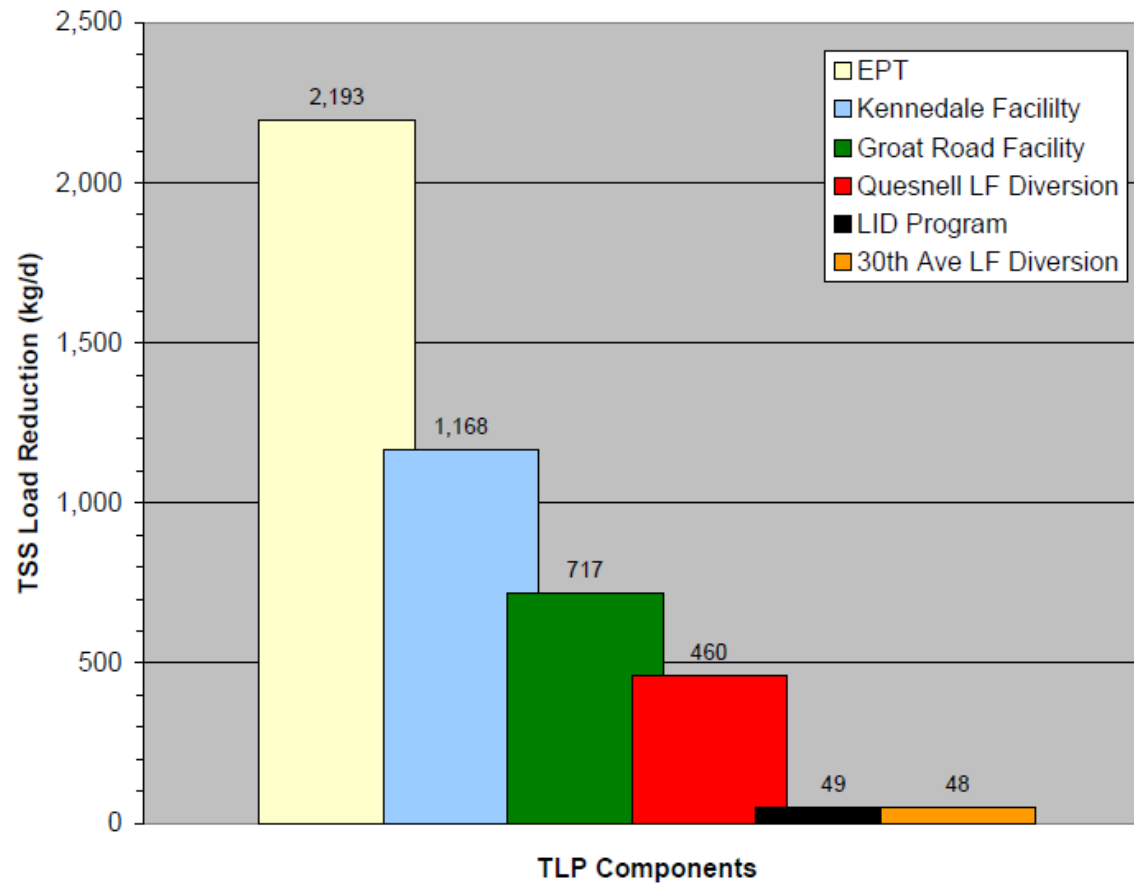
Background: City of Edmonton's Total Loading Plan

- The City's Total Loadings Plan (TLP) was submitted to Alberta Environment as required under the City's Approval-to-Operate in 2009.
- The goal of the TLP is to establish a framework to limit annual loadings of Total Suspended Solids (TSS) in the future to baseline levels.
- TSS is a key water quality parameter of the North Saskatchewan River.
- TSS is also a surrogate for other pollutants.
- TSS is key indicator of aquatic health in waterbodies affected by urban stormwater.
- TSS loading is expected to increase due to new urban land development.
- City of Edmonton started implementing approaches to reduce TSS such as the Kennedale Wetland.



City of Edmonton's Total Loading Plan

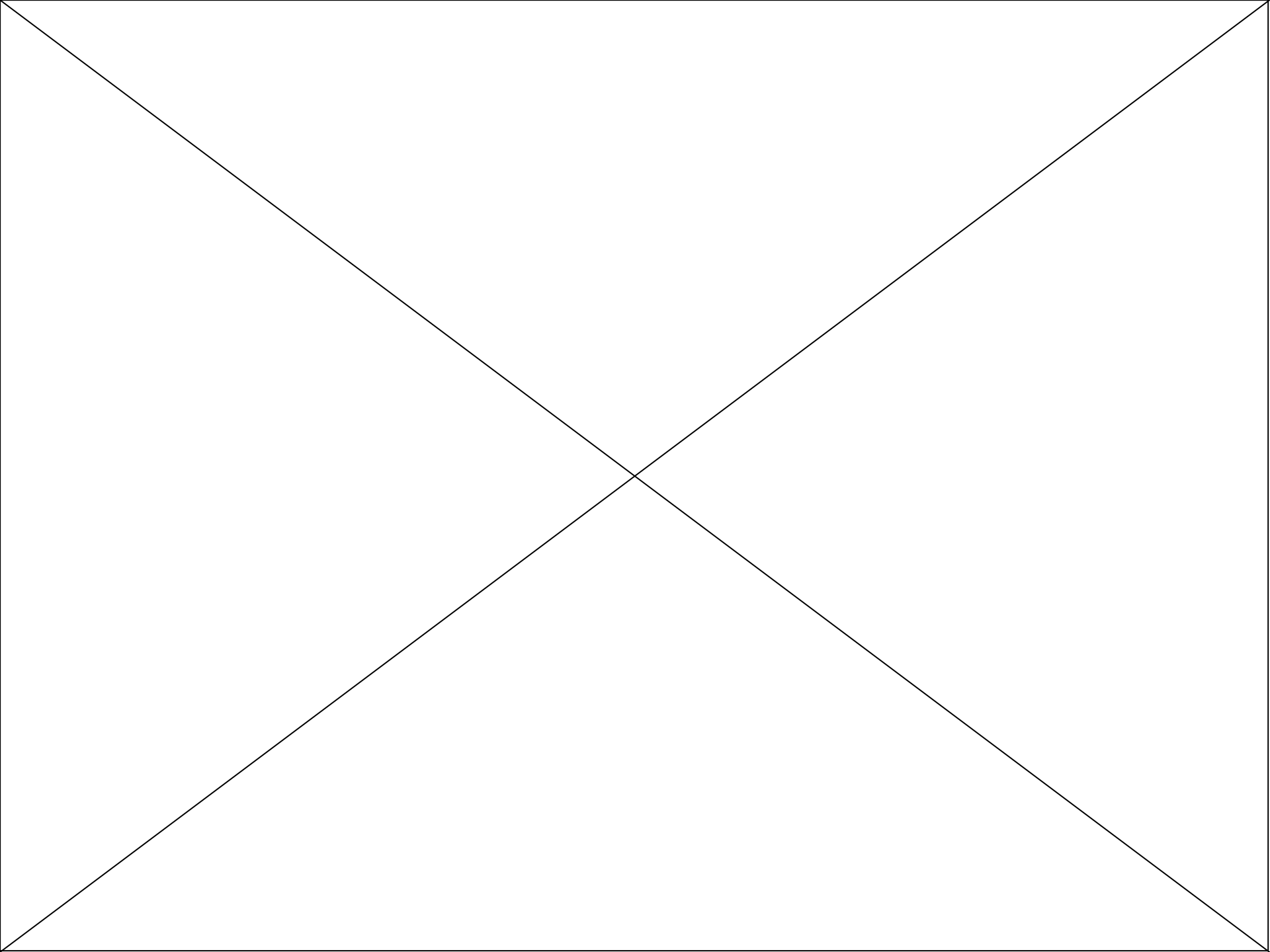
TSS Load Reduction in 2020





Kennedale Constructed Wetland

- \$7.5 M end-of-pipe treatment facility.
- 5 ha in size.
- Built from a former gravel pit.
- Real-time automated controls to control inflows and outflows.
- Awarded Federation of Canadian Municipalities Sustainable Community Award in the Water Category.



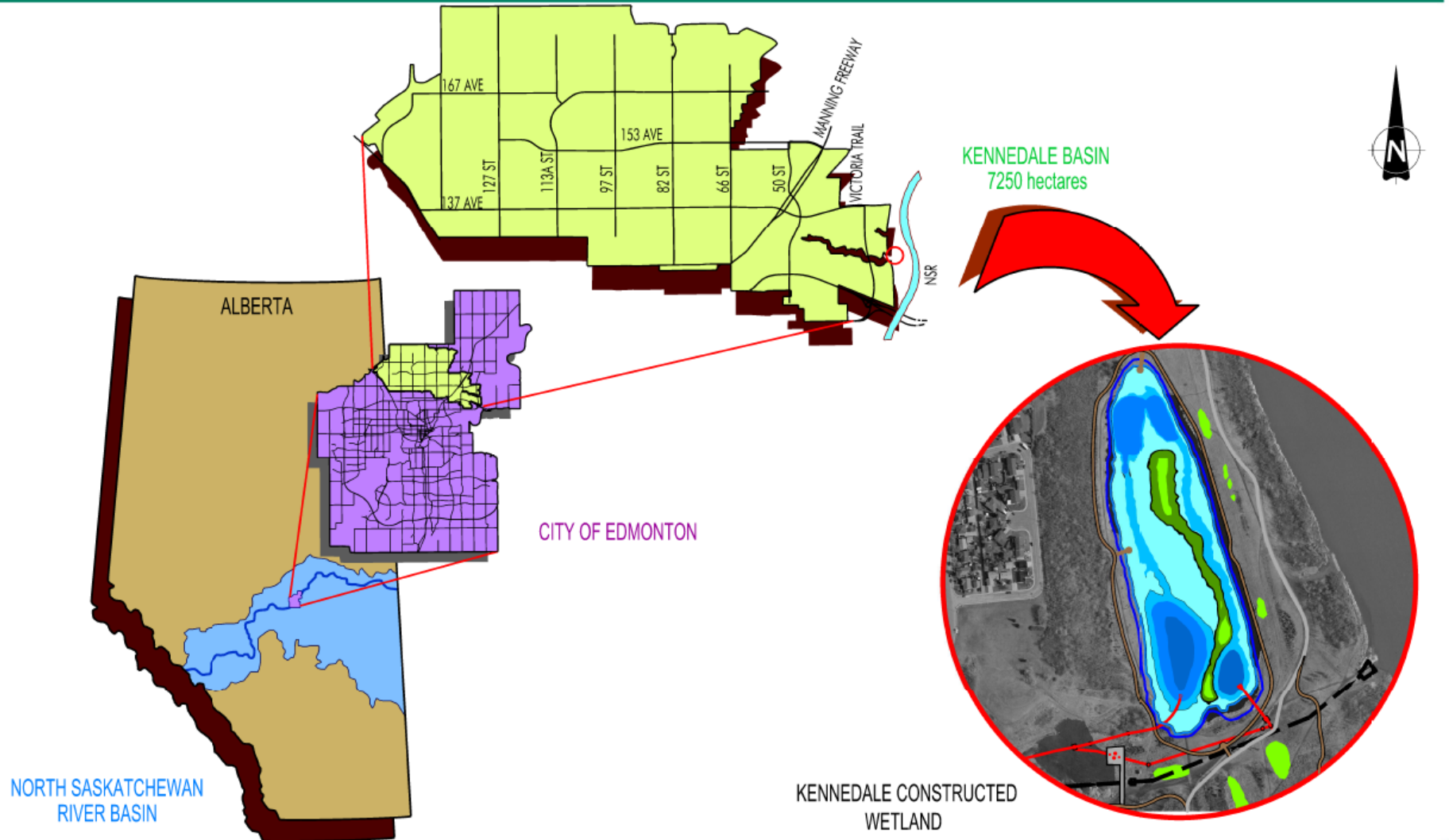


Kennedale Wetland Video

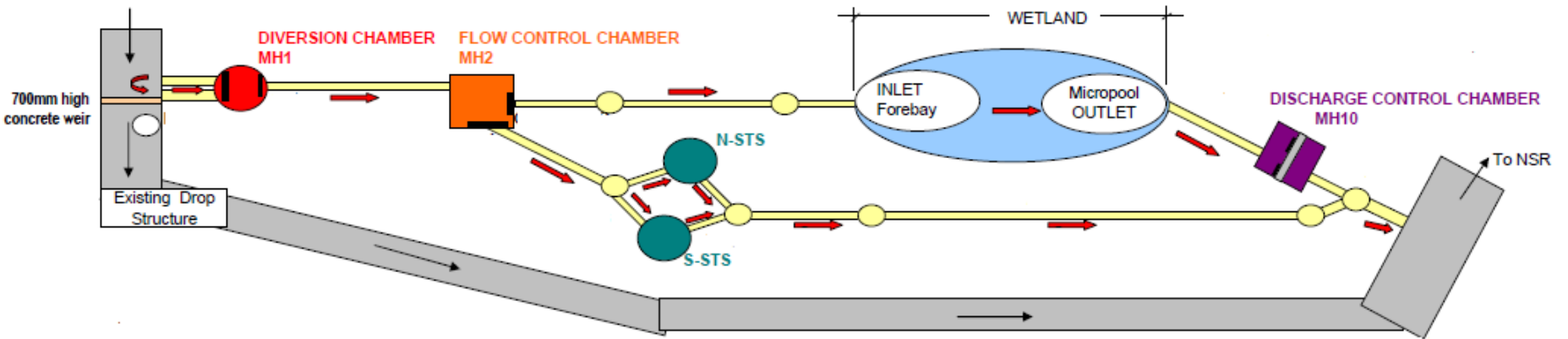
- https://www.youtube.com/watch?v=EKuqFTW1Zbs&feature=player_detailpage

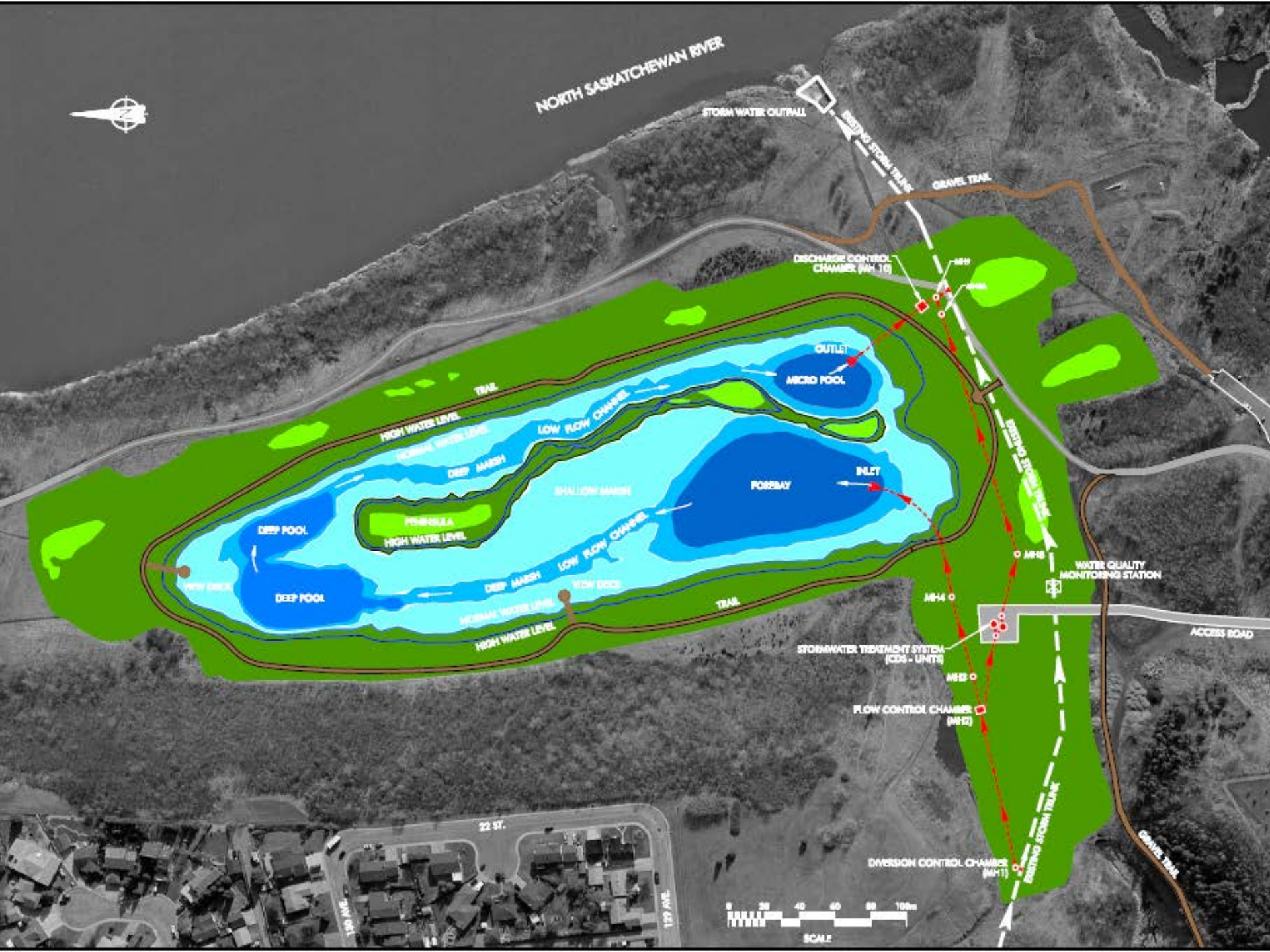


Kennedale Storm Basin and Wetland



Kennedale Wetland – Schematic Diagram







Kennedale Drainage – Pre-Construction



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Kennedale Drainage – Pre-Construction



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Kennedale Drainage – During Construction





Kennedale Drainage – During Construction





Kennedale Drainage – Post-Construction





Kennedale Drainage – Post-Construction



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Overview of the Kennedale Wetland Monitoring Program

- Program extended from 2010 – 2013
- Samples collected from upstream and downstream of the wetland during both wet (stormflow) and dry (baseflow) conditions throughout the open water period
- Automated samplers operational in 2011 and collected ~ 60 stormflow event samples a year
- Samples analyzed for TSS, chloride, TKN, ammonia, $\text{NO}_3 + \text{NO}_2$, TP, *E. coli* and chlorophyll *a*
- Metals and pesticides collected periodically
- Sediment accumulation measured in the forebay



Goal of the Kennedale Wetland Monitoring Program

- Goal was to determine efficiency of the Kennedale Wetland

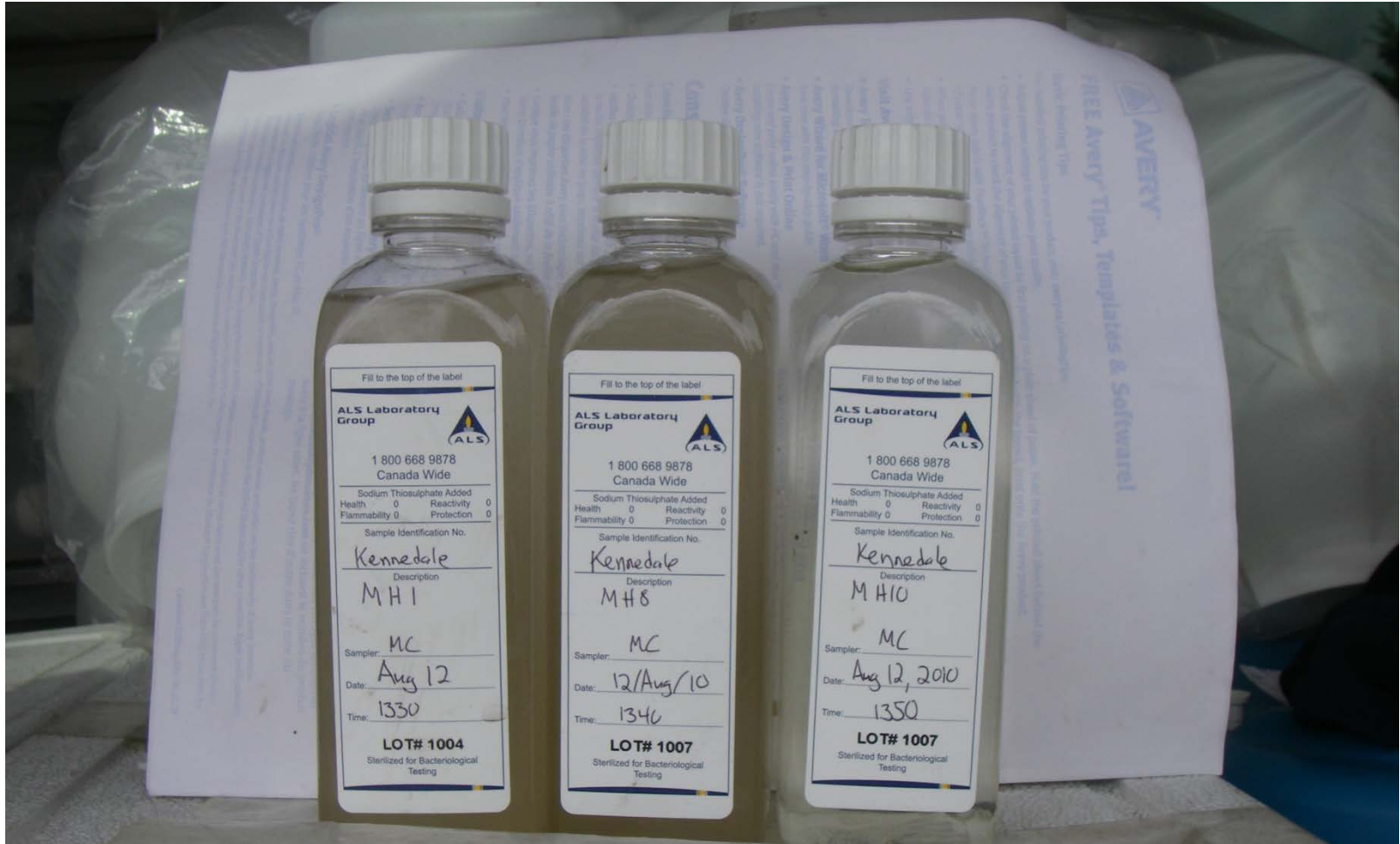
$$\text{Removal Efficiency} = \frac{\text{Mass}_{\text{in}} - \text{Mass}_{\text{out}}}{\text{Mass}_{\text{in}}} \times 100$$

- Challenge – flow measurements were not available for inflow

$$\text{Individual Event Efficiency} = \frac{\text{Concentration}_{\text{in}} - \text{Concentration}_{\text{out}}}{\text{Concentration}_{\text{in}}} \times 100$$



Did The Kennedale Wetland Work?





Did The Kennedale Wetland Work?





Did The Kennedale Wetland Work?



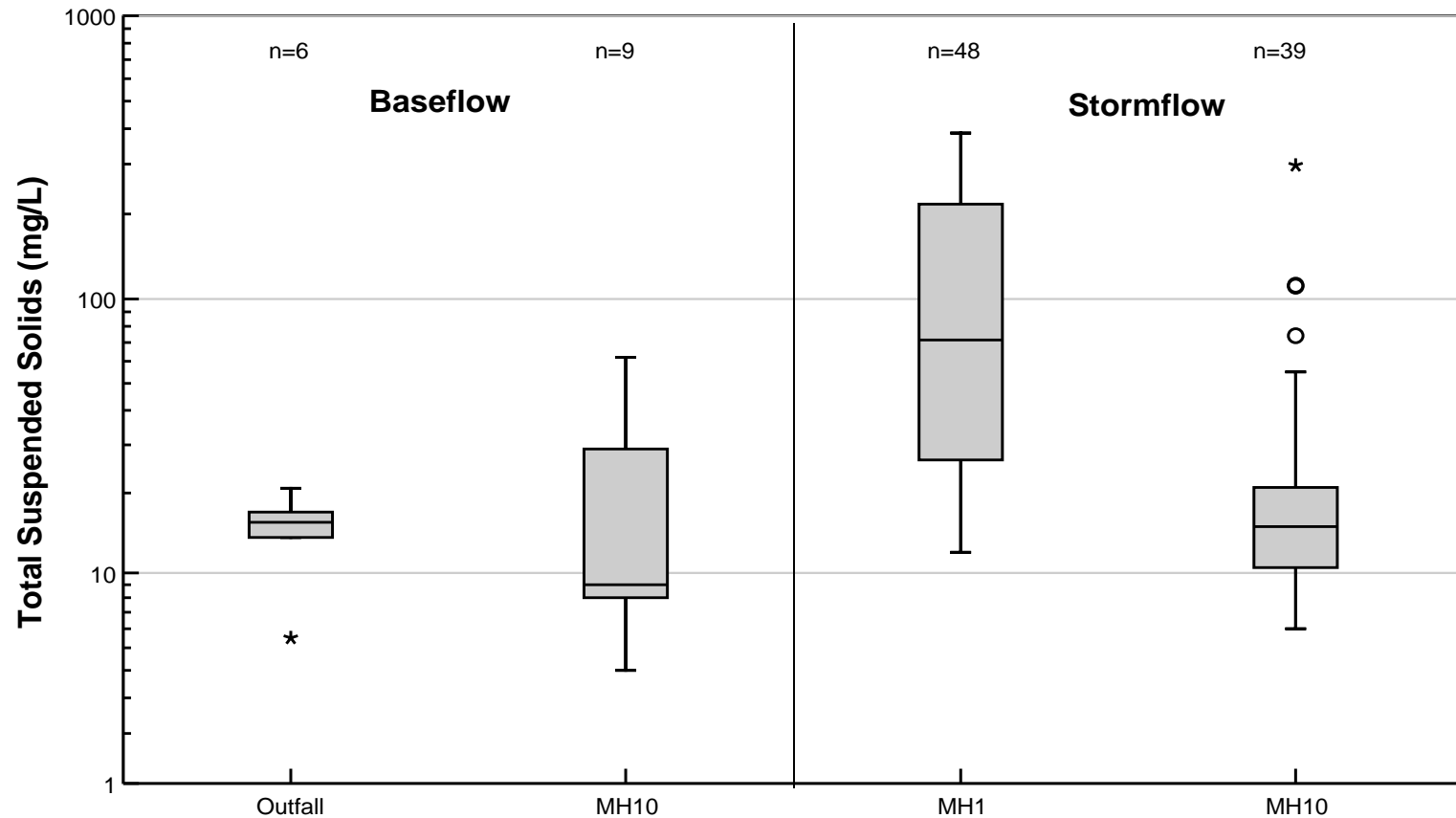
Forebay



Outlet Pool



Results: Total Suspended Solids



- Annual removal efficiency during stormflow conditions: 70 to 88%

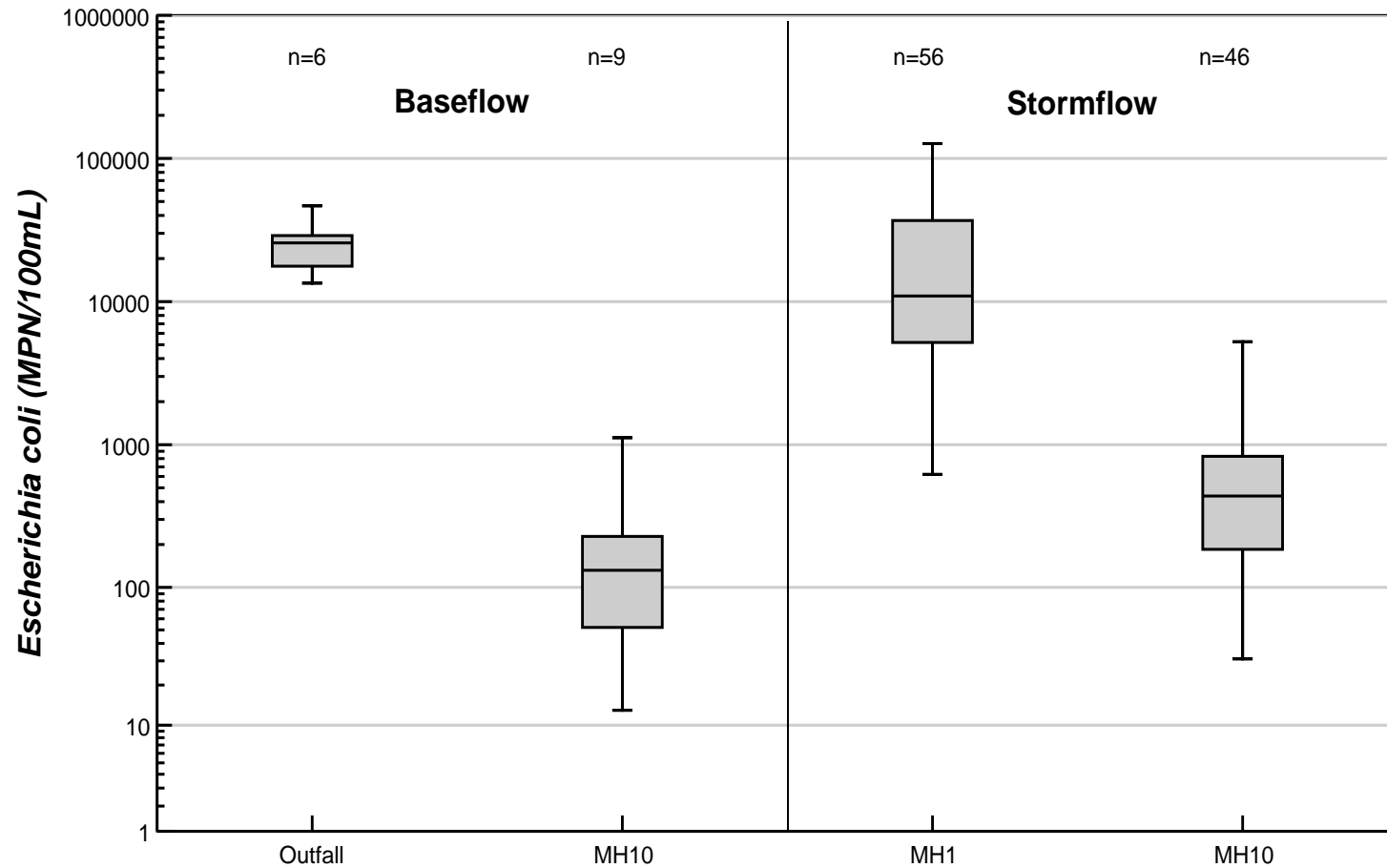


Results: Total Suspended Solids

- Objective of the Kennedale Wetland was to remove 1,100 kg/d of TSS.
- Due to incomplete flow data, assumptions had to be made to address this objective.
- The Kennedale Wetland removes ~ 1,100 kg/d of TSS during the open water period due to the prevalence of wet conditions.
- Relatively little TSS removal during dry conditions, and presumably during winter.



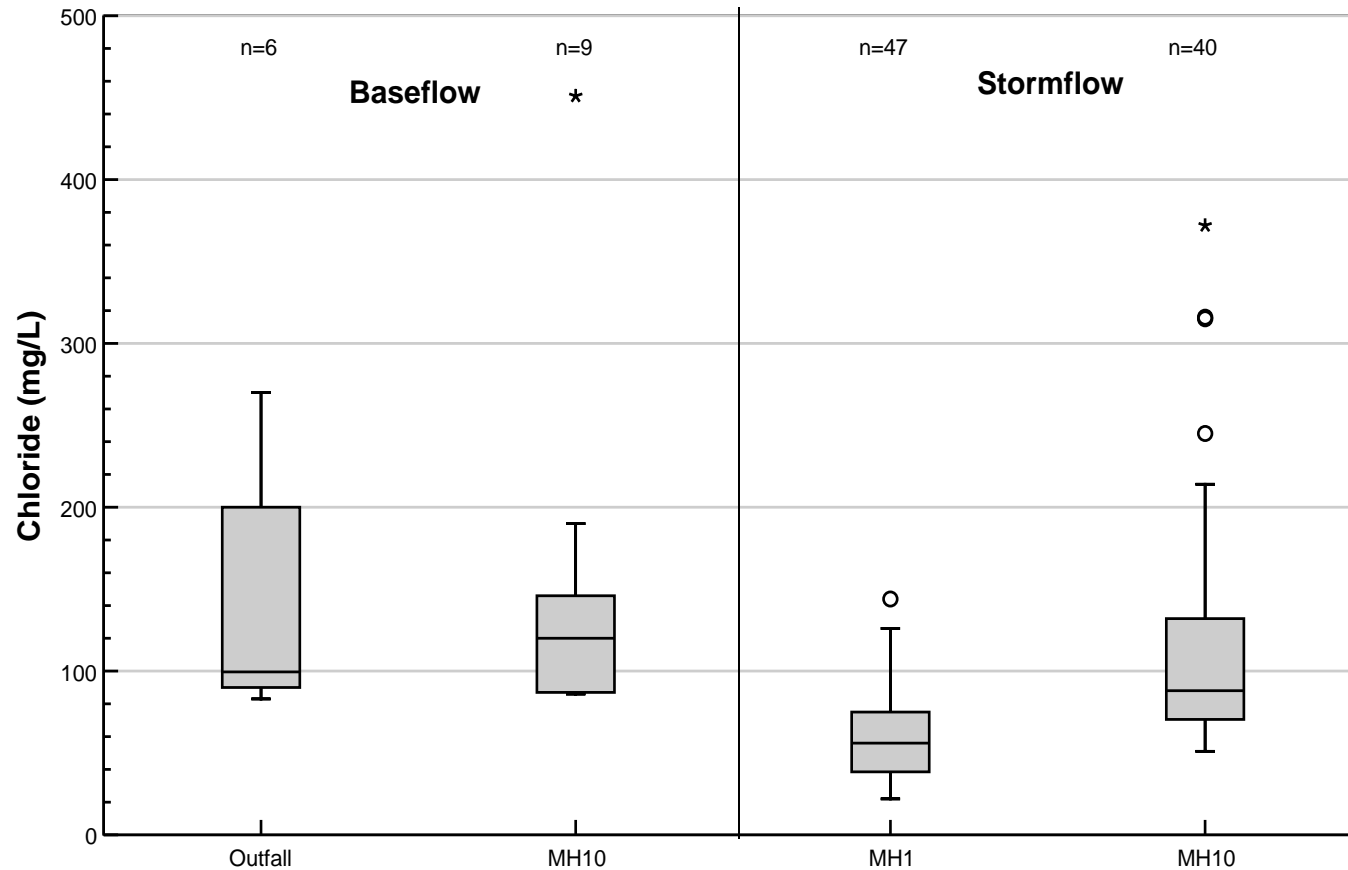
Results: *E. coli*



- Annual removal efficiency during stormflow conditions: 90 to 95%



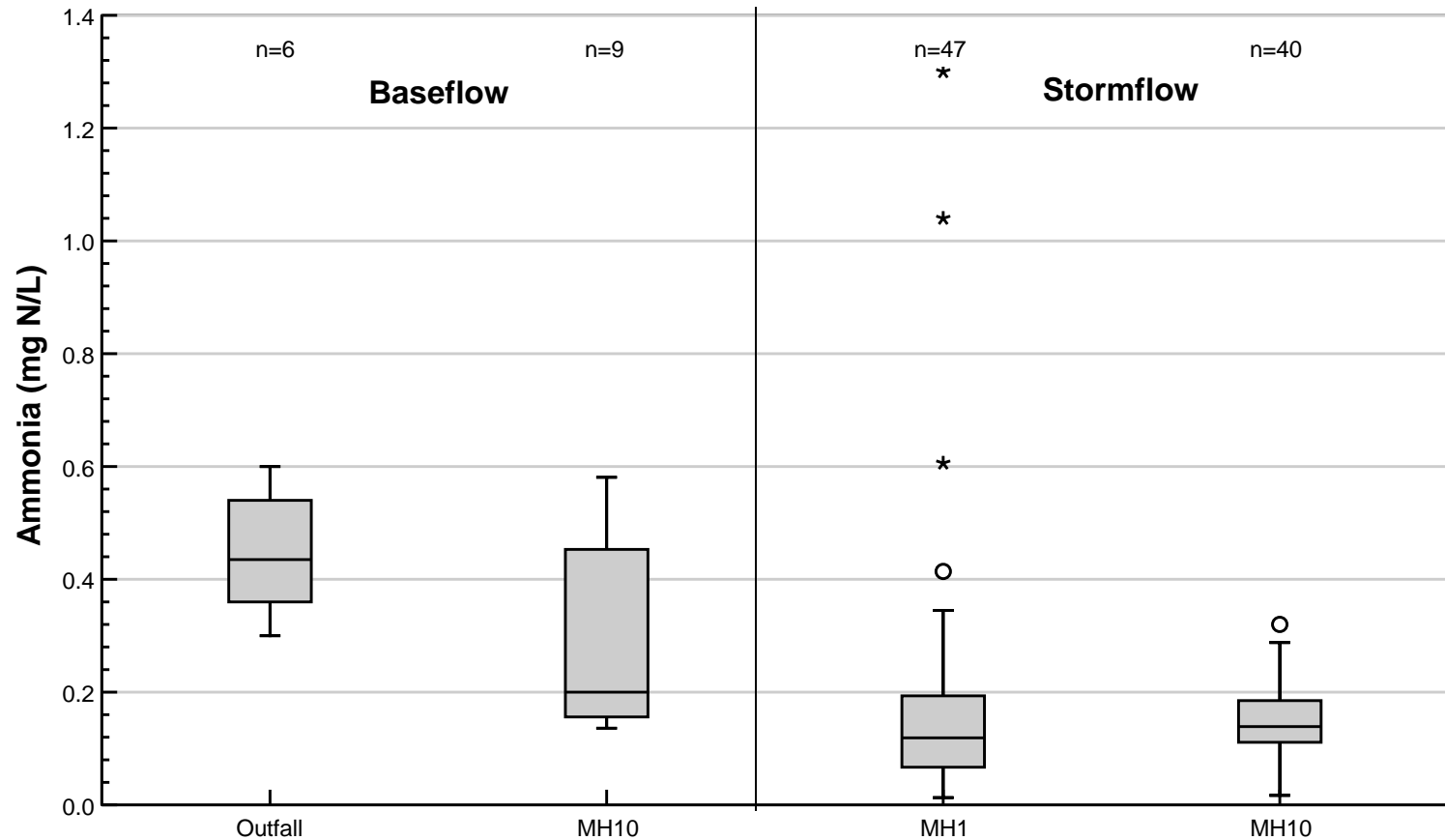
Results: Chloride



- Annual removal efficiency during stormflow conditions: - 90 to - 313%



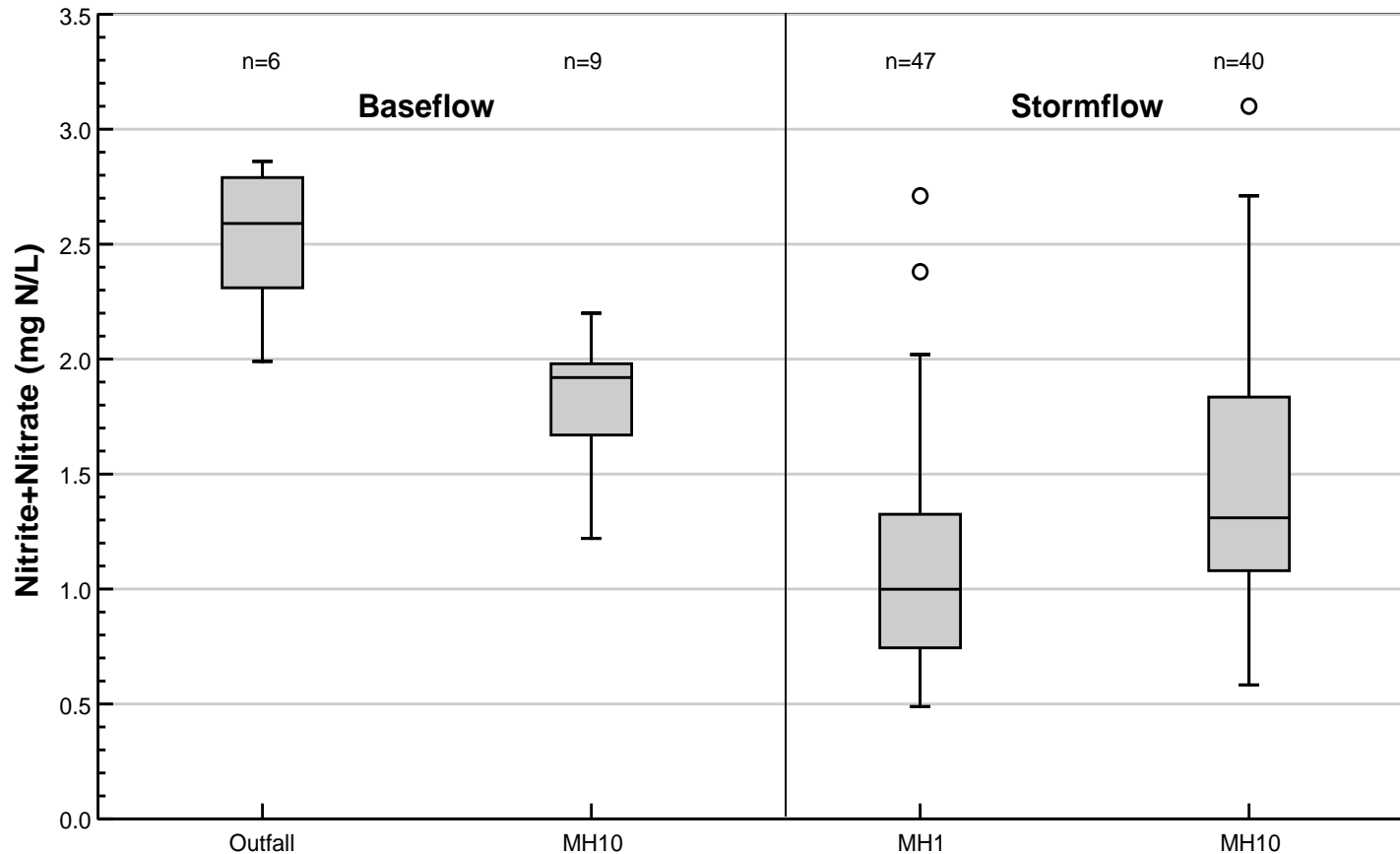
Results: Ammonia



- Annual removal efficiency during stormflow conditions: - 30 to - 147% *



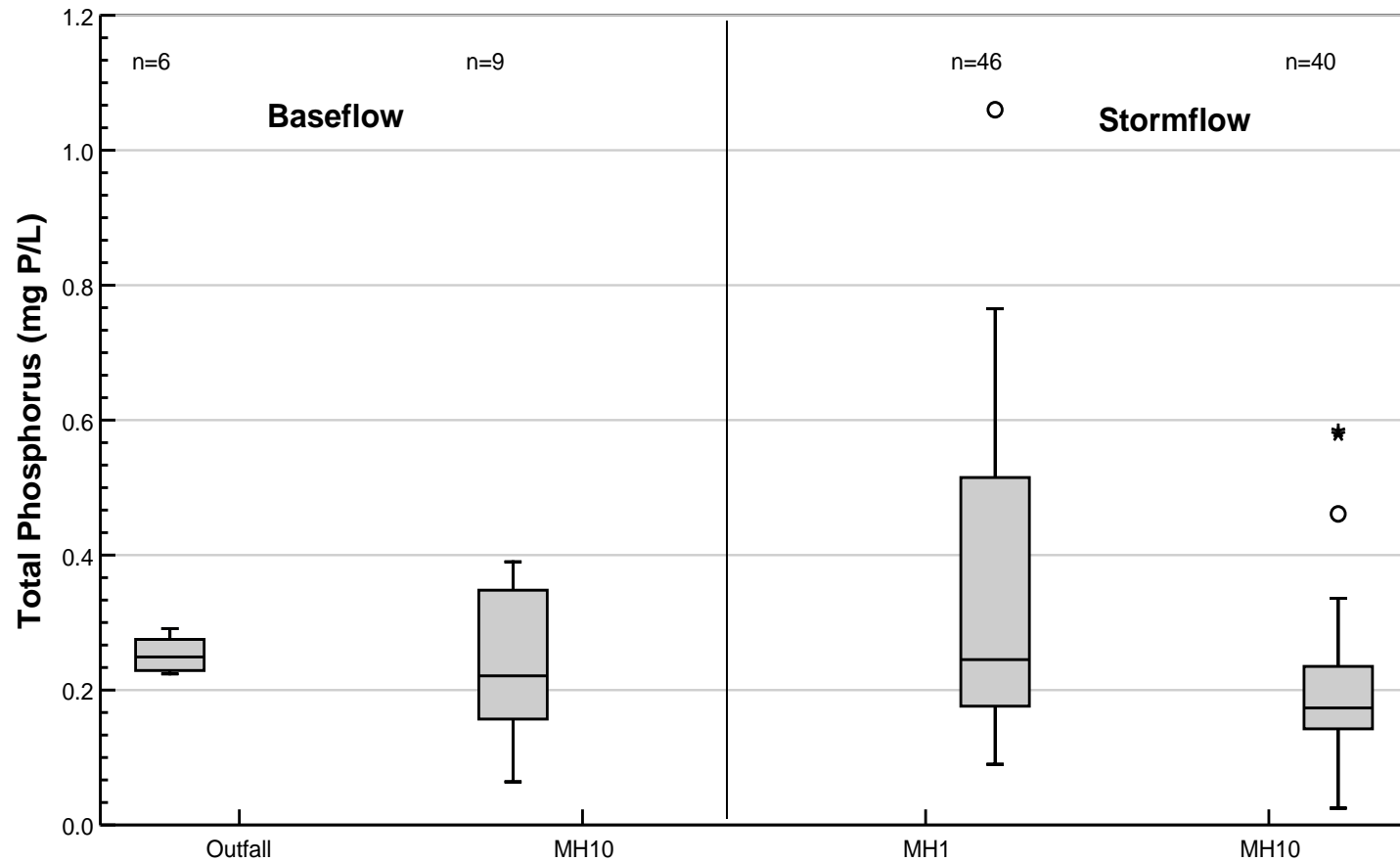
Results: NO₃+NO₂



- Annual removal efficiency during stormflow conditions: - 9 to - 62%



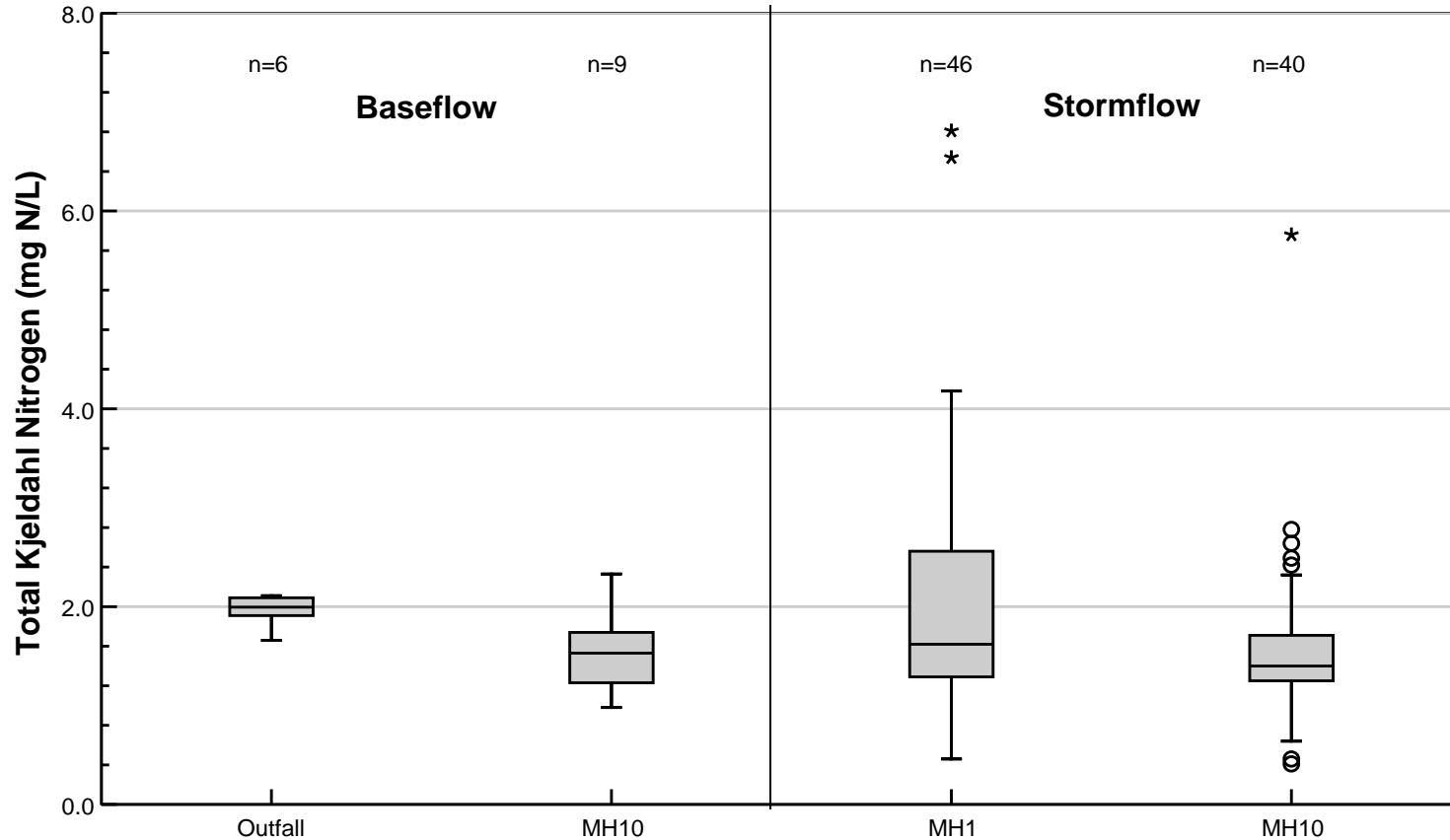
Results: TP



- Annual removal efficiency during stormflow conditions: - 155 to 30%



Results: TKN



- Annual removal efficiency during stormflow conditions: - 26 to 32%

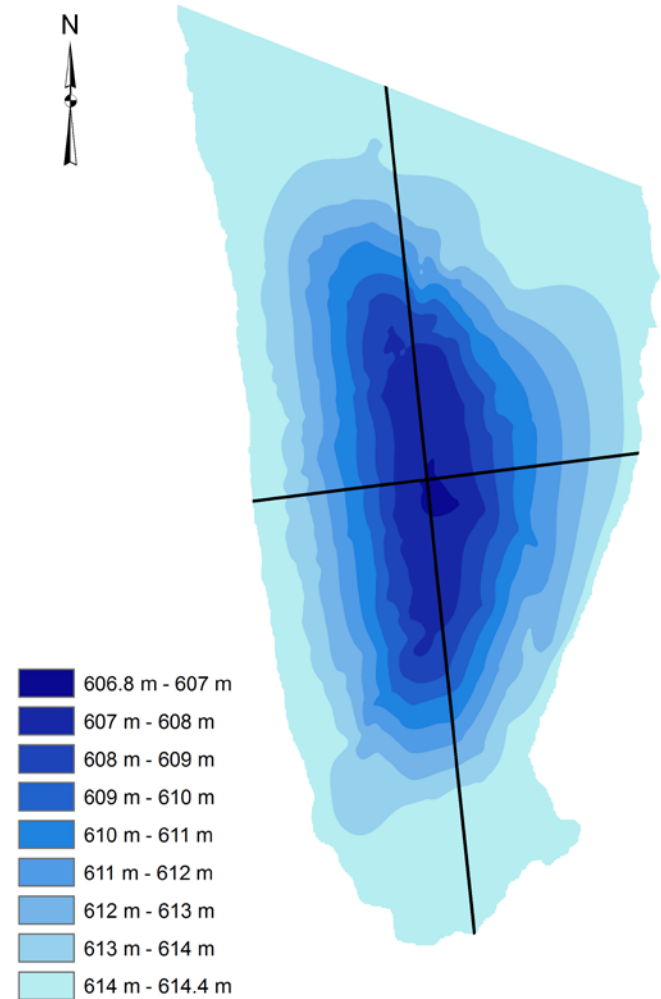
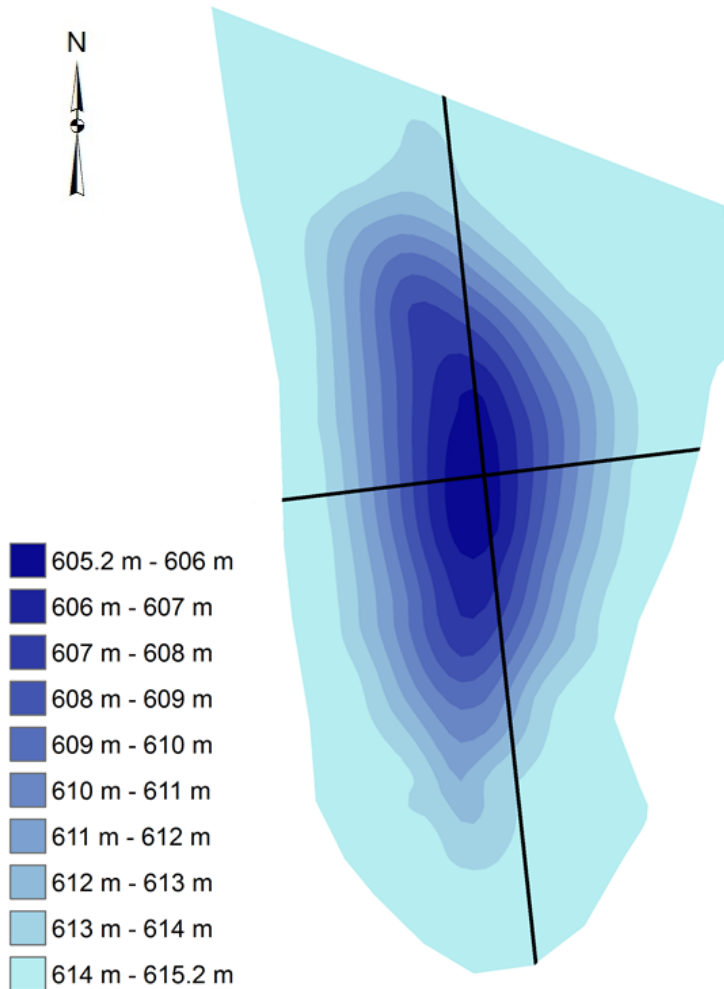


Summary of Removal Efficiencies

Parameter	2010	2011	2012	2013
	Average Removal Efficiency	Average Removal Efficiency	Average Removal Efficiency	Average Removal Efficiency
<u>Sink</u>				
TSS	74	88	80	70
<i>E. coli</i>	82	95	90	92
<u>Source</u>				
Chloride	-313	-90	-99	-115
Ammonia	-30 *	-55 *	-147 *	-74 *
NO ₃ +NO ₂	-23 *	-14 *	-9	-62
<u>Sink/Source?</u>				
TKN	-26 *	32	-0.3 *	11
TP	-155	30	-35 *	18

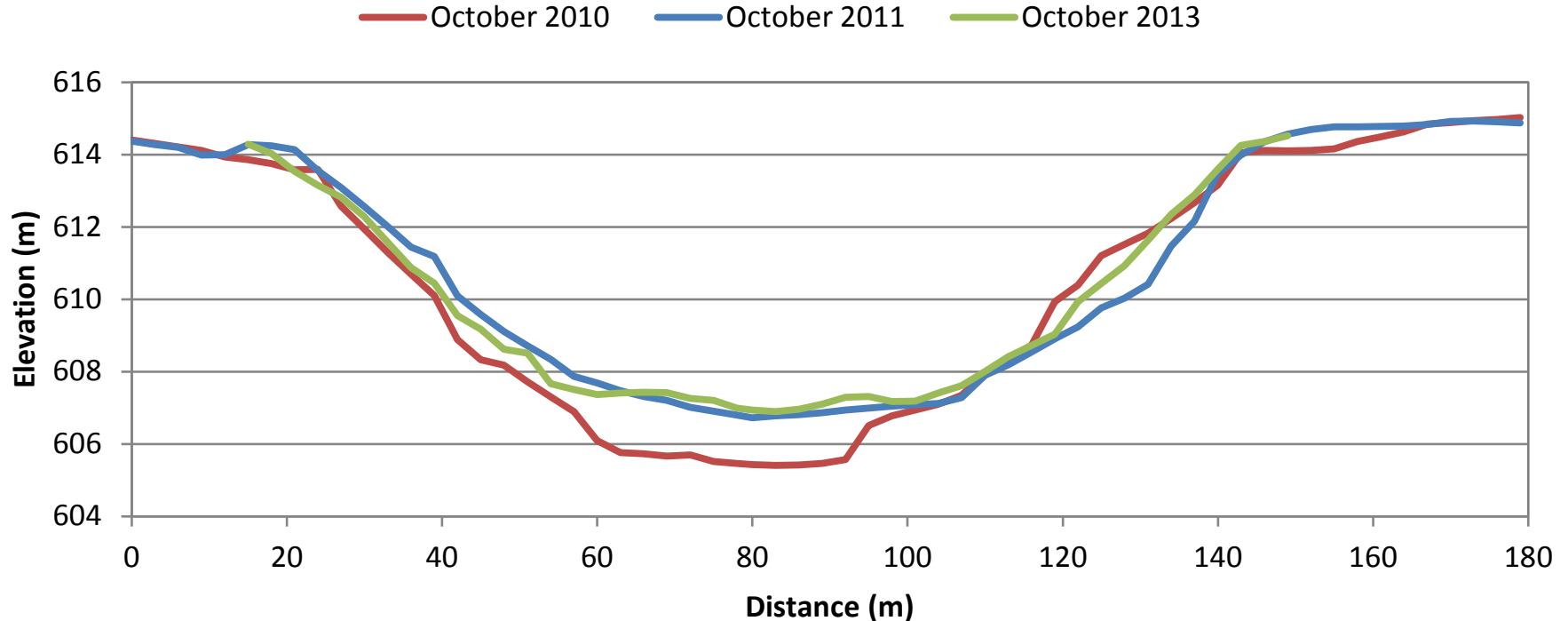


Bathymetric Survey of the Forebay





Forebay Sediment Accumulation



- 1.4 m of sediment accumulation between 2010 and 2011
- 0.3 m of sediment accumulation between 2011 and 2013



Sediment Accumulation in the Forebay





Summary

- Kennedale Wetland effectively removes TSS and *E. coli* from stormwater.
- The Kennedale Wetland met the objectives of removing 1,100 kg/d of TSS established in the City's Total Loadings Plan.
- The Kennedale Wetland has little or no effect on other parameters (i.e., chloride, nutrients).
- Relatively little inter-annual variation, and Wetland still appears fully operational 4 years after construction.
- The Kennedale Wetland is a successful end-of-pipe treatment facility.