Nutrient Loading into Wapato Lake from Park Sheet Flow

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History/Location

Wapato Lake is a glacially formed lake located on the east side of Tacoma just off of the I-5 corridor. (figure #1) Wapato Lake has been used primarily for recreational use throughout its history it has been a place of rest and relaxation for many of Tacoma's citizens for over 75 years. Now Wapato Lake is closed to any fishing or swimming due to the high amount of nutrients that have caused the urban lake to become eutrophic

Figure #1

Abstract

Nutrients are required for lakes productivity, however an excess of nutrients can lead to eutrophication and loss of recreational access for the public. Wapato Lake in Tacoma, Washington has been severely impaired by an overload of nutrients from storm water and other sources resulting in eutrophication and lake closures. This study examines nutrient fluxes from sheet flow of the surrounding Wapato Park, where pet waste, waterfowl and fertilizer use may be significant sources. Samples of sheet flow were collected from locations around the lake during storms in 2010-2011 and total phosphorus and total nitrogen were measured. This data will be used to construct a comprehensive nutrient model for the future management of Wapato Lake.

Hypothesis

To verify if nutrient loads from park sheet overland flow and the waterfowl population at Wapato lake are playing a major role in causing the lake to become eutrophic and unsuitable for recreation.

Methods

Figure #2

PVC collectors were used to catch overland flow samples during heavy rain periods. testing for nutrients such as phosphorus and minerals, like lead and arsenic. (Fig. #2)

The collection sites (figure #3) were placed in areas where the flow of water was heavy into the lake, including the boathouse gutters that directly drain into the lake. (The boathouse is the primary resting spot for the seagulls)

The test used for the nutrients was the (Kjedahl) method: **TK, TKN, NH_3, NO_3/NO_2 •OPO_4**

Figure #3

Results

Initial results suggest that sheet flow may be a significant source of phosphorus to Wapato Lake. Additional samples will be collected in the fall with greater coverage of the area contributing to Wapato Lake. (figure #4)

Figure #4

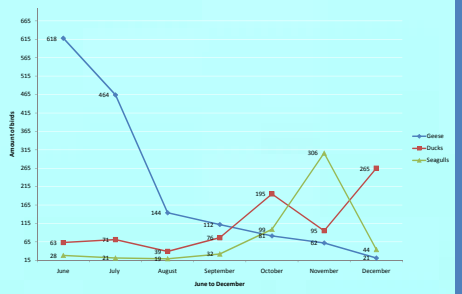
Nutrients from Overland Sheet Flow in (mg/l)	Pipe #2 2/25 /10	Pipe #3 2/25 /10	Pipe #4 2/25 /10	Pipe #2 4/5 /10	Pipe #4 4/5 /10	Pipe #2 5/20 /10	Pipe #3 5/20 /10	Pipe #4 5/20 /10	Pipe #1 10/24/10	Pipe #2 10/24 /10	Pipe #4 10/24 /10	Pipe #5 10/24 /10
Ammonia									0.3	0.26		0.23
Ortho Phosphate	.0686	.0324	.0821	.0275	.0317				.0182	.0234	.0083	.0203
Total Phosphorus	2.53	4.3	1.53	1.15	0.117	2.47		0.53	0.194	1.02	1.76	0.232
Nitrate /Nitrite									.0182	.0357		0.007
TKN	1.23	4.32	0.802	8.04	1.68	6.57		2.14	1.14	5.06	1.43	1.03
TSS							314	39.2				

The data results are also showing that waterfowl could play a role in increasing nutrients in the lakes due to the amounts of fecal matter that is getting washed in by the introduction of seagulls to the area and the increased number of geese the lake is seeing. (figure #5)

Figure #5

Nutrients from Overland Flow in (mg/l)	Boathouse West 2/23/10	Boathouse East 2/23/10	Boathouse West 4/5/10	Boathouse West 5/20/10	Boathouse East 5/20/10	Boathouse West 10/23/10	Boathouse East 10/24/10
Ammonia			14	7.69	7.47		
Ortho Phosphate	23.5	11.6				6.96	0.255
Total Phosphorus	28.3	13.85				11.3	0.427
Nitrate/Nitrite						0.0666	0.0085
TKN	316	352				134	4.08
Turbidity	23.3	7.52	16.3				

Waterfowl counts from June-December of 2010



Conclusion

Initial results show a large release of phosphorus from North basin sediments, while phosphorus in South basin sediments appears relatively immobile. Overland sheet flow may be an important contributor to phosphorus loading in the lake with waterfowl being a significant component. Water column data show much higher concentrations of phosphorus in the North basin during summer months due to higher organic matter leading to anoxia. During winter months storm water inputs appear to be the dominant contributor to both basins leading to spikes of phosphorus in the South basin. These results will be used to construct a nutrient model for Wapato Lake and will inform management recommendations once data collection is complete at the end of 2010.

Future work

The future work on Wapato Lake will be specifically done by the city of Tacoma and Metro Parks as they collaborate from our studies and there's to find a resolve for the problems. New park drawings have been submitted to show possible improvements of the lake. As for UW –Tacoma's involvement we will continue to do our volunteer monitoring of the lake that was approved by the City of Tacoma, to watch for any changes to the lake as well as possible increases in the waterfowl populations.

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