Investigating N Levels in a Stream

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Introduction

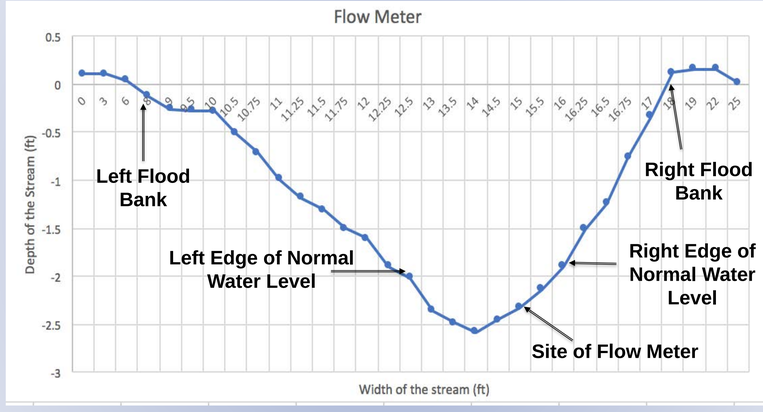
- **Eutrophication can occur in waterways due to N runoff from agriculture and industry sources**
- **Removing N from the stream after it already entered is the strategy highlighted**
- **ISCO automatic grab water samplers are used to collect samples up and down stream**
- **A flow meter is placed in the stream to collect changing water depths**
- **The difference in the levels from upstream from downstream will show the stream's natural ability to remove the extra nitrogen**
- **Plant mass could remove 40-70% of nitrogen depending on aquatic plant life and flow rates[1]**
- **The targeted stream will later go through a restoration process and post-restoration monitoring**

Stream Site: Alumni Creak

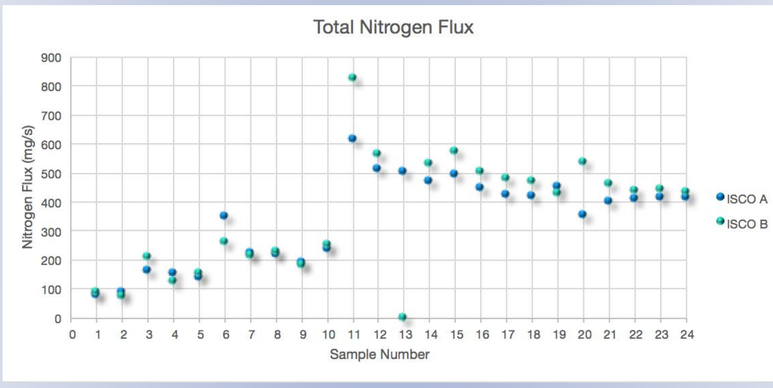
Methods

- **ISCO B was placed up stream, while ISCO A was placed down stream**
- **A flow meter was placed down stream from ISCO A but up stream from ISCO B**
- **The ISCOs collected approximately 500 mL samples every 7 hours for two weeks**
- **Samples were filtered to removed sediment and then 10 mL samples were collected**
- **The nitrogen concentrations of the 10 mL samples were determined using SEAL analysis**
- **Finally using data collected from surveying and Manning's equation nitrogen load was determined at sites A and B**

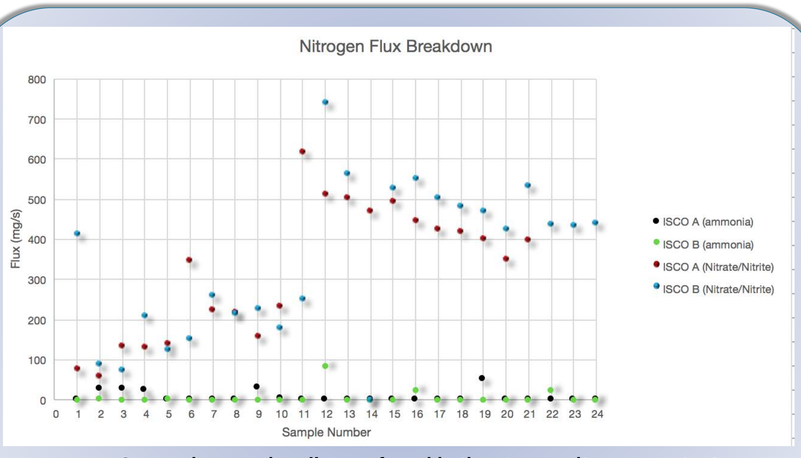
Results



This graph shows the bank used for this stream in Manning's equation.



The upstream ISCO (B) samples often had a higher nitrogen flux compared to the downstream ISCO (A) samples.



Ammonia occasionally was found in the stream nitrogen content.

Discussion

- **Manning's equation is used to find the flow rate.**

MANNING'S EQUATION

$$Q = vA = \frac{\left(\left(\frac{1.49}{n}\right) A^{5/3} \sqrt{S_f}\right)}{P^{2/3}}$$

- ***n = n-coefficient***
- ***A =cross-sectional area***
- ***S_f = friction/bed slope***
- ***P = wetted perimeter***

- **Manning's equation found the volume of water flowing through the stream over an amount of time**
- **n-coefficient was found on the storm water manual for Lexington-Fayette County to be 0.045 for streams in this area[2]**
- **S_f was estimated due to the flat area surrounding the stream to be 0.008 ft./ft.**
- **The left flood bank to the deepest part of the stream was treated as a right triangle**
- **The right flood bank to the deepest part of the stream was treated as a second right triangle**
- **The areas of these right triangles found were summed to find the cross-sectional area (A)**
- **The hypotenuse of the same triangles were used to find the wetted perimeter (P)**
- **The upstream samples often had a higher nitrogen flux compared to the downstream samples, showing that the stream has a natural ability to remove nitrogen**
- **The load of total N for ISCO A was ~190kg and for ISCO B it was ~206kg over a two week period**
- **The load was calculated using Riemann sum estimation**
- **The main source of nitrogen pollution was caused by nitrate and nitrite as opposed to ammonia**

Conclusion

- **The percent removed was calculated to be 7.97% from ISCO B to ISCO A**
- **The percent removed was significantly lower than the 40-70% ideal removal**
- **This low percentage could be caused by high flow rates, low biomass, and/or nitrogen rich soil[1]**
- **The current construction next to the alumni creek site could also attribute to the low percentage**
- **The nitrogen amounts in the stream are too high for the stream to naturally remove and is in need of restoration**

Citations

1. Birgand, François, Skaggs, R Wayne, Chescheir, George M, & Gilliam, J Wendell. (2007). *Nitrogen.* Removal in Streams of Agricultural Catchments - A Literature Review. Critical Reviews in *Environmental Science and Technology, 37,* 381-388. 10.1080/10643380600966426
2. Lexington-Fayette Urban County Government. (2009). *Stormwater Manual.* Retrieved from https://next.lexingtonky.gov/sites/default/files/2016-07/Stormwater%20Manual%202009%20%28updated%29_0.pdf

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