**Green Lake - County Hwy K Marsh**

**Restoration Project – 2015**

**WBIC: 146100**

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**Purpose:**

The County Hwy K Marsh (K Marsh or Marsh) is located in the Southwest corner of Big Green Lake in Green Lake County, Wisconsin (Latitude: 43.7734, Longitude: -89.0530; PLSS Coordinates T15N R12E). CTH K Marsh is approximately 268 acres in size with 3 major tributaries: Spring, Roy, and Wuerches Creeks. The system is called a “Marsh” but it really is a 1-4 foot deep bay off of Green Lake that is connected via a 10 foot deep by 17 foot wide channel. Currently, the K Marsh is in a turbid algal state with no submersed aquatic plant community.

The CTH K Marsh is a major loading source of phosphorus Big Green Lake, namely from internal loading and upstream sediment contributions. The USGS has an automated sampler that samples the outlet of the K Marsh to Big Green Lake. For 2014, the average discharge total phosphorus concentrations were 0.19 mg/l and the maximum level sampled was 0.56 mg/l. The internal loading of the system is exacerbated by a pervasive population of carp within the marsh which prevents the establishment of rooted vegetation and re-suspends phosphorus-laden lake-bed sediment. A carp barrier installed at the Southwest Inlet (County Hwy K) in 2011 was initially not successful at reducing carp numbers. Modifications were made to the carp barrier in the spring of 2014. Data provided by the WDNR suggested that the spacing of the bars on the carp gate were too wide and reproductive age fish were able to pass through the bars into the marsh. It is believed, by DNR Fishery Staff, that the recent modifications will greatly reduce the number of carp that can access the marsh in future years. In addition to a properly functioning carp gate, the Green Lake Sanitary District has hired commercial harvesters to remove carp from the County K Marsh in 2013 and 2014. Each year, 100,000 lbs of carp were removed from the Marsh.

Through funds obtained by NRCS and WDNR grants, millions of dollars are being spent on BMP’s in the Big Green Lake watershed. Multiple BMP projects have been done on the tributaries to the County K Marsh (Roy and Wuerches Creeks) reducing the amount of total phosphorus and sediment reaching the marsh. With a properly functioning carp gate in place and a reduction in sediment delivery from tributaries it is now time to establish a native plant community in the marsh to help tie up phosphorus before it reaches Big Green Lake proper.

A watershed model by Panuska (1999) estimated that the Southwest Inlet (County K Marsh) was the second greatest source of total phosphorus loading to Green Lake, contributing 13% the annual load. Silver Creek, the highest loading source, was estimated to contribute 44% of the total phosphorus load, though renovations to the Ripon Wastewater Treatment Facility and other upstream BMPs have likely decreased the percentage loading of Silver Creek and therefore increased the percentage loading of the Southwest Inlet (Dale Robertson, 2014, personal communication).

The Silver Creek Estuary is very similar to the K Marsh in that it was in a turbid algal state until similar restorative efforts were made as proposed here. In a study by Simonson (1984), the total phosphorus levels were sampled at both the inlet to the Estuary along with the outlet to Big Green Lake over three years (1972, 1977, and 1983). It was determined that the phosphorus concentrations were lowered by 65% when the Estuary was fully vegetated as compared to when it had no plants.

Establishing native aquatic vegetation in the County Hwy K marsh is a high priority. No one single action in the entire Big Green Lake watershed can reduce phosphorus loading to the lake as much as establishing an aquatic plant community within the marsh, capable of filtering sediment and phosphorus before it reaches Big Green Lake. The restoration of the K Marsh has the potential to greatly reduce the phosphorus loading to Big Green Lake.

**Objective:**

With the recent improvements to the tributary streams, re-construction of the carp gate and physical removal of carp it is likely that the plant community will start to recover within the next 1-2 years. The Green Lake Sanitary District and the Green Lake Association have pledged $35,000 - $40,000 to purchase and plant native submersed aquatic plants. The main rationale for doing these plantings is to give the native species a better chance to compete against Eurasian water milfoil and curly leaf pondweed that could dominate the system without native competition.

The objectives of the study are as follows:

1. Determine when conditions are right for the reestablishment of an aquatic plant community within the County K Marsh.
2. Monitor the County K Marsh with a full point intercept plant survey and our restoration enclosures. Once a plant response is observed, money from the Green Lake Sanitary District and Green Lake Association will be used to purchase large amounts of aquatic plant propagules to ensure native plants get established before EWM and CLP take over.
3. If it is determined that our enclosures, that prevent carp interactions, are the only areas that support aquatic plant growth it may be necessary to target carp (commercial and/or rotenone) prior to a large scale aquatic plant planting.

**Methods:**

The proposed project attempts to isolate potential factors contributing to existing conditions of limited plant viability: (1) bottom-sediment disruption from wind, (2) bottom-sediment disruption from carp, and/or (3) reduced light penetration from high turbidity. Given that the condition of the existing seed bank is unknown, the project will also consider the success of propagule-planted versus seed bank generated treatments. Results will be used to better inform future, larger-scale restoration initiatives.

Each treatment will consist of a 4’x4’ enclosure made of various materials, depending on the treatment (summarized below). Enclosures will be sited at a water depth of 1.5’ to 2’ on the west side of the marsh. Treatments will be repeated with and without hand-planted propagules to determine any benefit of an extensive planting effort versus the viability of any existing seed bank.

Treatment 1 will include two enclosures made using Snow Fence, to provide a physical barrier to carp while still allowing for wind disturbance. One of the enclosures will be treated with native aquatic plant propagules and one will not, to determine the extent of the existing seed bank.

Treatment 2 will include two enclosures made using a Polypropylene mesh fabric, to provide a physical barrier to carp and moderate protection from wind and water disturbances reducing turbidity. Again, one enclosure will be treated with native propagules and one will not.

Treatment 3 will include two areas the same size as the enclosures but will have no barrier of any kind. One of the areas will be treated with native propagules and one will not.

**Monitoring:**

The enclosures will be installed in early May on the west side of the marsh (prevailing wind direction). Once enclosures are installed, propagules will be planted in one enclosure for each treatment. Enclosures will be inspected 2-3 times monthly and a measure of percent viability will be made at each inspection as well as a stem count of live plants. Dissolved oxygen, secchi temperature, conductivity and pH will be assessed during each inspection using a Professional Plus YSI meter.

**Budget:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Item** | **#** | **Price per** | **Total** |
| LTE Salary | 250 | 13.51 | 3377.5 |
| Supplies |  |  | 554.88 |
| Mileage | 1230 | 0.72 | 885.6 |
| Meals | 30 | 5 | 150 |
| Lab Costs |  |  |  |
|  |  | Total | 4967.98 |

Table 1: Total budget for County K Marsh Restoration Project

|  |  |  |  |
| --- | --- | --- | --- |
| **Item** | **#** | **Price per** | **Total** |
| 6ft steel fence posts | 24 | 3.07 | 73.68 |
| Snow-guard fence |  | 30 | 30 |
| Polypropylene mesh fabric | 20 | 3.56/ft | 71.2 |
| Aquatic plant propagules  (Sago pondweed & Wild Celery) | 100 |  | 100 |
| Batteries |  |  | 20 |
| Boat Gas |  |  | 100 |
| Rope |  |  | 10 |
| Miscellaneous Supplies |  |  | 150 |
|  |  | Total | 554.88 |

Table 2: Supplies for County K Marsh Restoration Project