3[ND] ANNUAL MONITORING REPORT

FOR THE

LAKE BELLE VIEW RESTORATION PROJECT

BELLEVILLE, WISCONSIN

FEBRUARY 2014

PHOTO BY MONTGOMERY ASSOCIATES

PHOTO BY NES ECOLOGICAL SERVICES

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1 GENERAL

Summer of 2013 was the second full growing season of the post-construction restoration and mitigation activities of the Lake Belle View Restoration Project and the third year since construction completion in the spring of 2011. Vegetation management activities continued throughout the summer conducted by NES Ecological Services and monitoring of the progress of the restoration continued with a team of consultants hired by the Village of Belleville (Montgomery Associates, Agrecol Environmental Consulting and Eco-Resource Consulting). This summary report documents the various restoration and monitoring activities associated with the Lake Belle View Restoration Project.

2 VEGETATION MANAGEMENT

Vegetation Management Activities in 2013:

New Habitat Area and Berm:

- Cutting and spot herbicide treatment was implemented in June and July. Main target species were reed canary grass, thistles, burdock and sweet clover.
- Cutting, removal of seed head and spot herbicide treatment was implemented in August/September and into October of purple loosestrife, thistles and re-sprouts of sweet clover.

Emergent Zone

- Continued cattail control with focus on narrow-leaf and hybrid if easily distinguished from broad-leaf in September.

3 WETLAND/FLOODPLAIN FOREST RESTORATION

The wetland/floodplain forest restoration areas were evaluated for diversity, extent and dominance of native and invasive species, and the floristic quality of the species present in the restoration areas. This was done by Eco-Resource Consulting, LLC using meander surveys in summer and fall of 2013.

The ERC report found that of the 74 species found during the fall 2013 meander survey, 60% were native. This compares to 67 species with 48% native found in June, 2013. The estimated coverage by native species was approximately 65% in September compared to 52% in June. The FQI value increased from 10.6 to 14.7 and the qFQI increased from 11.5 to 18.2 during the two 2013 monitoring events.

The performance standards outlined in the Restoration and Mitigation plan for the Lake Belle View Restoration project by Montgomery Associates, 2010 calls for 80% total plant cover and 20% cover by native species. The monitoring results indicate that the project is still on the right track, easily meeting the performance standards for the second growing season.

The Army Corps of Engineers permit special condition 12 calls for a wetland delineation to determine the successful establishment of 11.6 acres of wetlands within the wetland habitat restoration area. This wetland delineation was delayed by 1 year and will be implemented by October 1, 2014. The establishment of native vegetation was delayed in the first year post construction and the 1st growing season experienced significant drought in 2012. However, the vegetation monitoring indicates that the intent of the project objectives of establishing a wetland hydrology and vegetation in the new habitat areas is still on track, just one year behind schedule compared to the schedule in the Montgomery Associates report from 2010. Since the soil profile is fill material with no native soil structure to indicate wetland conditions, and the wetland vegetation is in flux, the project team believes that an additional year of establishment of the native wetland vegetation will result in a more accurate representation of the actual wetland boundary that is naturally developing on the new habitat restoration area.

Next steps for the year 2014 (the third growing season) in the new habitat area restoration project will continue to follow the steps outlined in the Restoration and Mitigation plan for the Lake Belle View Restoration project by Montgomery Associates, 2010.

The following activities are anticipated for year 2014:

- Prescribed burn in both new habitat areas and existing wetland forested areas to prepare the areas for the seeding of climax species and tree seeding.
- Seeding of native forbs climax species as well as tree seeding for the ultimate establishment of wetland forest habitat;
- Continued vegetation management including the control of invasive and non-native species using mowing and spot herbicide treatment;
- Wetland delineation per the current Corps of Engineers Wetland Delineation Manual;
- Continued monitoring of the establishment of and diversity of native species.

4 LAKE LEVEL MONITORING

Continuous water level monitoring was continued in 2013. Water level loggers were installed in two location: by the control structure to Lake Belle View and immediately west of the separation berm as it connects to Community Park on the Sugar River impoundment upstream of the old Belleville Dam. The loggers were launched on April 22, as soon as ice had broken and continued throughout the year until November 25th.

The results of the monitoring can be seen in *Appendix C*. The graph shows daily mean water levels for the Lake and the River as well as the accumulative precipitation at the Dane County Regional Airport in Madison. The median water levels were 858.03 and 857.57 for the Lake and the River respectively. The Lake levels are within the +/- 0.5' range from the normal water level of 858 and within +/- 0.5' of the annual median stage of the Sugar River.

5 IN LAKE WATER QUALITY MONITORING

Establishment of in-lake rooted vegetation and fisheries in Lake Belle View continues as part of the whole restoration project efforts. Agrecol Environmental Consulting has conducted in-lake water quality monitoring program supported by the Village of Belleville and a Wisconsin DNR Lake Planning grant and facilitated the training and coordination of various volunteer monitoring activities. Attached in *Appendix C* is the final water quality monitoring report for the 2012 – 2013 monitoring effort sponsored by the Wisconsin DNR Planning Grant.

Results of water quality monitoring and biological surveys in 2012 and 2013 have indicated that common carp has survived the construction drawdown and are thriving in the newly formed Lake Belle View. Diminished water clarity, high nutrients and high chlorophyll a concentrations, coupled with a dearth of rooted aquatic plants, were symptoms of an unexpected common carp population in the lake. While the carp had undermined some of the goals for creating a clear off-channel lake, the project was nonetheless successful in diverting a massive watershed sediment and phosphorus load around the lake and providing a much appreciated urban lake for the community. The next focus of the lake restoration project is to control the excessive common carp population that will allow native fishes and aquatic plants to thrive in a floodplain lake; perhaps one of the most threatened water resources in Wisconsin. Our restoration targets include sustaining a diverse off-channel fish community, floating leaf and submersed macrophytes, phosphorus TSI of 54, chlorophyll TSI of 47 and a secchi TSI of 48.

6 Additional Restoration and Monitoring Activities

In addition to the restoration and monitoring activities discussed above, the Village of Belleville has also shown initiatives in implementing additional monitoring and restoration activities to increase the amenities of the newly restored lake. Below is some of the additional work being implemented:

- The Village is in cooperation with the DNR working on raising beetle as natural biocontrol for purple loosestrife infestation on the Sugar River side of the berm. This effort will hopefully reduce the continued threats of purple loosestrife infestation in the project area and improve biodiversity in the area.
- The Village continues to engage volunteer efforts to help with implementing various smaller projects to improve access and amenities in the project area. The Village is working with Operation Fresh Start, a local non-profit organization helping underprivileged youth ages 16 – 20 in finishing high school and training for self-sustaining employment, on various hands on activities, including building fishing peers and groomed trails in newly acquired Village properties west of the berm. Also, students from local elementary and high schools frequently go on field visits learning about the environment and natural resources in the area.
- Second annual LAKEFEST 2013 took place with continued success drawing attention to the project's success and bringing life and commerce to the Village business community.

Appendix A

Summer 2013 Monitoring Report for Lake Belle View Restoration Project

Fall 2013 Monitoring Report for Lake Belle View Restoration Project

SUMMER 2013

MONITORING REPORT

FOR

LAKE BELLE VIEW RESTORATION PROJECT

Prepared for:

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Introduction

Eco-Resource Consulting, LLC, conducted a field investigation of the native plant community restoration around Lake Belle View on June 27, 2013. The areas surveyed included the emergent aquatic bed, an area from two feet below water level to the shoreline (-2 to 0 feet elevation), the wet meadow, an area from the shoreline to two feet of elevation above the shoreline (0 to + 2 feet elevation), the wet mesic prairie, an area from two feet to five feet elevation above the shoreline (+2 to + 5 feet elevation) and the mesic prairie area greater than five feet of elevation above the shoreline (> 5 feet elevation). The original plan called for the emergent aquatic bed to occupy 9.4 acres of shallow water, the wet meadow, 11.1 acres of wetland; the wet prairie, 4.1 acres, and the mesic prairie 3.9 acres of upland (Figure 1). However because of heavy rains, causing high water conditions, before the sampling the emergent zone was increased in size and the wet meadow zone decreased in size.

The restoration area is composed of dredge spoils from the construction of Lake Belle View. The area was dredged during September 2010 and March 2011; grading activities were completed in November 2011. The emergent area was seeded in June 2011 and a dormant seeding using native plant seed appropriate to the community type was conducted in December 2011. Eco-Resource Consulting was assigned the task of evaluating the success of the restoration during the growing seasons from 2012 –2015 pursuant to State and Federal Permit conditions. This survey focuses on the plant species and communities the second year after seeding and compares them to the plant species and communities found in 2012.

Field Methods

To assess the vegetation, a meander survey of the entire restoration area was conducted. In addition, three straight-line transects were completed starting at the emergent zone, traveling through the wet meadow, the wet-mesic prairie, and into the mesic prairie at various locations. Two field personnel traveled along the meander survey path (Figure 2) and recorded all species encountered. The three straight-line transects across the four habitat zones were conducted to verify and confirm that each habitat zone segment accurately assigned species dominance in that zone. Table 1 provides the GPS starting and ending points for each transect.

Table 1. Starting and Ending GPS Points for Lake Belle View Sampling Transects

	Starting point	Ending point
Transect 1	N42.51.891, W-89.32.231	N42.51.912, W-89.32.238
Transect 2	N42.51.970, W-89.32.223	N42.51.988, W-89.32.214
Transect 3	N42.51.097, W-89.32.097	N42.51.949, W-89.32.075

Analysis

A species list was compiled within each habitat community type to measure plant species diversity and floristic quality. The species list (Table 2) is a compilation of species found in the three transects, the meander survey, and meander loops 1 and 2. Table 2 also compares the species found in this survey with those found in July 2012.

The 2009 survey (Montgomery and Associated, 2009) defined vegetative cover class as an estimated percent cover of a species in a habitat zone based on visual observation over the entire habitat zone. The table below provides the ranges of percent cover and the cover class value or ranking.

Vegetative Cover Classes

Cover Class	% Cover
1	1-10%
2	11-25%
3	26-50%
4	51-75%
5	76-90%
6	91-100%

The percent cover assigns every species observed a cover class rating of 1 to 6. A cover class rating of 6 indicates a species was found and was dominant or co-dominant in all three transects, and in the habitat zone as a whole. A cover rating of 1 indicates the species was found in low density throughout the habitat zone. Our estimates of cover class are also included in Tables 3-6 describing the plant communities in the four habitat types.

The Floristic Quality Assessment (FQA) was used to assess the floristic quality, following methodology developed by Swink and Wilhelm (1994). An FQA analysis was performed for each community type. This method is based on calculating an average Coefficient of Conservatism (C) and a Floristic Quality Index (FQI) for each community. A predetermined C value is assigned to each identifiable native plant species using locally appropriate values assigned by a panel of botanical experts (Bernthal, 2003). Each native species is assigned a C value which ranges from 0 to 10 and represents an estimated probability that a plant is likely to occur in a landscape relatively unaltered from what is believed to be a pre-settlement condition. A value for C of 0 is applied to a species that demonstrates little fidelity to any remnant natural community and to non-native species; whereas C of 10 is applied to plants that are almost always restricted to pre-settlement remnants. Values lower than 4 generally represent weedy species and values closer to 10 represent more "conservative", rare or disturbance intolerant species

(Swink and Wilhelm 1994). C values for each species that were assigned C values are included in Tables 2-6.

FQI values are calculated using the following formula:

FQI = Mean C(√N)

C= Coefficient of Conservatism

N= species richness (Identifiable Native & Non-native)

FQI has traditionally been calculated using C values and species richness of only native species. However, more recently, scientists are including the non-native species in the calculations, giving all non-native species a C value of "0". This is done because disregarding the non-native species can often give sites falsely elevated mean C and FQI values that do not reflect the presence or abundance of less desirable species, which influences the overall floristic quality of an area. This methodology better reflects the actual integrity of a site, rather than simply using native species for the FQI analysis, particularly in highly disturbed conditions dominated by non-native taxa.

FQI and mean C values were calculated using both natives only and all species, including non-natives. While FQI results must be carefully interpreted, especially in small sites or stands such as those surveyed which usually result in lower FQI values regardless of species composition. It is generally accepted that an FQI value of 35 and/or a mean C value of 4.0 indicates a site with very high floristic quality and integrity, while an FQI value of less than 20 and a mean C value of less than 2.5 indicates that the site is degraded (Swink and Wilhelm 1994) or in the case of a restoration a newly restored area or a restored area that has not reached its habitat potential.

In this survey a quantitative FQI (qFQI) was also calculated for each area using each species' estimated abundance in that stand as a weighting factor. For this calculation, the sum of the product of species abundances and mean C values is divided by the sum of the species abundances. The result is a weighted C value (qC) that is multiplied by the square root of species richness for the stand to give the qFQI. This calculation can result in an FQI value that more accurately takes into account species dominance, and thus floristic composition and quality, within the vegetation survey areas. The qC and qFQI results are also provided in Tables 3-6.

To determine the degree to which the species found in a restoration area are appropriate to the habitat type an analysis of the species present was done using the wetland indicator status of assigned species. For this calculation each species is assigned a regional wetland indicator status (from Bernthal, 2003). These indicator statuses are defined as follows: Obligate Wetland (OBL) species almost always occur under natural conditions in wetlands in the region specified (estimated probability 99%), Facultative Wetland (FACW) species typically occur in wetlands (estimated probability 67%-99%) but are occasionally found in non-wetlands, Facultative (FAC) species are equally likely to occur in wetlands or non-wetlands (estimated probability 34%-66%), Facultative Upland (FACU) species typically occur in non-wetlands (estimated probability 67%-99%) but are occasionally found in wetlands, and Upland (UPL) species almost always occur under natural conditions in non-wetlands (estimated probability 99%). Positive (+) or negative (-) signs are also used with the indicator statuses to further categorize the regional frequency of each species. A positive sign indicates a tendency toward the wetter end of the category, and a negative sign indicates a tendency toward the drier end. Tables 2-6 provide the wetland status of species with assigned values and positive (+) or negative (-) signs. However for the trends displayed in Table 8 the signs were not considered.

All these community characteristics are summarized in Table 8 and compared to similar values from the July 2012 survey.

Results

The flora of the whole restoration area consisted of 66 species (Table 2). Fifty-two percent of these species were non-native and only 7.6% had a C value greater than 4. This compares to 74 species found, 41% non-native, and 12% with a C value greater than 4 found in July 2012. This indicates that at this point in the restoration the flora consists of mainly weedy or non-native species and there is little difference or even a decline in the flora found in this survey. Some of these results could be due to the slightly earlier sampling this year than 2012, the late start to the growing season, and the loss of some "pioneer" plant species as the vegetation develops.

The emergent zone had the fewest species but the highest percentage of native species (Table 8). It also was most "true" to its habitat type with 98% of the species being obligate wetland species. Rice cut grass, coontail, and narrow-leaved cattails were the most common species (Table 3). The dominance of rice cut grass is probably due to the high water conditions that flooded some of the wet meadow areas and is found primarily in the shallow areas of the emergent zone. The paucity of plants in this zone is not surprising. Emergent plant communities generally have fewer species than many upland communities. Also any residual seed bank found in bottom sediments may have been removed by dredging. The Mean C and qC values for this area are 3.0 and 3.0. The FQI and qFQI are 11 and 10.4 (Table 8). These values are a very slight increase over July, 2012 values.

Although the wet meadow had the highest number of species in 2012, the species number dropped dramatically in 2013 to 19 species total with 12 native species and 7 non-native species (Table 8). This drop may be the result of flooding of some of the area in 2013 and the fact that this may have been the only area in 2012, a drought year, with adequate moisture for growth. Rice cut grass was still the dominant species with reed canary grass and black-eyed susan also common. The species present span an expected wetness gradient from obligate wetland species to facultative upland species (Table 8).

The Mean C, qC, FQI and qFQI all dropped when compared to July, 2012 values (Table 8).

Species number dropped slightly in the wet-mesic prairie when compared to July, 2012 values and the percentage of native species was 32% versus 39% in 2012. Likewise Mean C, qC, FQI and qFQI values also dropped slightly (Table 8). The habitat fidelity of species in this area was less confusing in this area than it was in 2012. The highest percentage of species was in the FACU category, which was not expected. Reed canary grass, black-eyed susan, and Kentucky blue grass were the dominant species (Table 5). This differs considerable from the 2012 survey when Pennsylvania smartweed and lamb's quarters were the dominant species. Species number for this area was 31 and Mean C and qC values are 1.1 and 1.0. FQI and qFQI values are 6.1 and 5.6 (Table 8).

Species number in the mesic prairie increased dramatically from 29 in July 2012 to 43, with 44% native species (Table 8). The highest percentage of the species was in the FAC category. The increase in species number may be due to much better moisture conditions this year when compared to 2012. Also there was much less "open" with all upland areas are nearly completely vegetated. Reed canary grass, black-eyed susan, and Kentucky blue grass were also the dominant species in this area rather than Pennsylvania smartweed and lamb's quarters as in 2012 (Table 6). FQI and qFQI values increased slightly over those in 2012 (Table 8).

The highest Mean C and FQI values, considering both native and total species, for all areas were 3.4 and 12. This is down slightly from 2012 values (Table 8). Many values were considerably lower than these numbers and don't approach the Mean C and FQI values of 4 and 35 considered by Swink and Wilhelm (1994) as areas with high floristic quality and integrity. Some areas, however, surpass the 2.5 Mean C, but fall below the FQI value of 20 which Swink and Wilhelm consider the area to be degraded or in this case needs considerably more time and work for the restoration to be successful.

In general, more of the restoration area is vegetatively covered, almost 100%, as compared to 2012. Many of the early invasive species such as the smartweeds are not present or have been drastically reduced in importance. However, the species that replaced them are either non-native species or species with low C values so the floristic quality of the area has decreased.

Table 7 is included as a continued record of the meander loops that were done in 2012. Generally speaking, the vegetation found was similar to that in the remainder of the restoration area and the species found there are included in Table 2. The tree and shrub vegetation seen in the lowland forest areas adjacent to the restoration were similar to those found in 2012 (Table A.1 in the summer 2012 report). Because the herbaceous layer was flooded, no species were recorded for this area.

Wildlife and other notes

Some of the more interesting wildlife observed were an American bald eagle, sandhill cranes, and great blue herons. Other wildlife observed included a variety of sparrows (mostly song sparrows), swallows (mostly tree swallows), red winged black birds, mourning doves, crows, dragonflies, and rabbits. Adult common carp were seen spawning in the shallow areas of the lake, which is not desirable. Water in the channel between restoration areas was approximately 16 inches higher than in 2012 and the water was extremely turbid because of recent heavy rains. This will make it difficult for some of the emergent species to survive and also floods the shallow areas of the wet-meadow.

Summary

The performance standard for the Lake Belle View restoration states that after two full growing seasons, seeded areas shall have 80% total plant cover and 20% cover by native species. This coverage standard was easily met by the June 2013 sampling. By species count, 48% were native species but this doesn’t take into account species coverage.

Although the restoration area is not very high quality, botanically speaking at this time, the results should not be discouraging. The restoration is new and has not gone through two complete growing seasons. Restored vegetation takes time and considerable effort to attain. This restoration needs additional weed control, especially with the amount of reed canary grass that is developing. Interseeding of desirable native plants is also recommended.

References

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Wetter, M.A., T.S. Cochrane, M.R. Black, H.H. Iltis, and P.E. Berry. 2001. Checklist of the Vascular Plants of Wisconsin. Technical Bulletin No. 192. Wisconsin Department of Natural Resources, Madison, Wisconsin. 258 pg.

TABLES

Table 2. Belle View- June 27,2013 Species list[1,2,3] and Comparison With July, 2012 Species

			C of C value	Found 7/'12	Found 6/'13[3]
Abutilon theophrasti	velvet-leaf	FACU-	0	1	
Acer saccharinum	silver maple	FACW	2		1
Agropyron repens	quackgrass				1
Ajuga genevensis	blue bugle		0	1	
Alisma subcordatum	water-plantain	OBL	3	1	
Alopecurus carolinianus	foxtail	FACW	0	1	
Amaranthus retroflexus	pigweed	FACU+	0	1	1
Ambrosia artemisiifolia	common ragweed	FACU	0	1	1
Ambrosia trifida	giant ragweed	FAC+	0	1	
Arctium minus	burdock	FACU	0	1	
Asclepias incarnata	swamp milkweed	OBL	5	1	
Asparagus officinalis	asparagus	FACU	0	1	
Aster novae-angliae	New England aster	FACW	3		1
Aster sp.	aster			1	
Barbarea vulgaris	yellow rocket	FAC	0	1	1
Bidens frondosa	beggars tick	FACW	1	1	
Bromus inermis	smooth brome grass	FACU	0	1	
Carex lacustris	lake sedge	OBL	6	1	
Carex sp.	sedge			1	
Cerastium fontanum	mouse-ear chickweed	FACU			1
Ceratophyllum demersum	coontail	OBL	3	1	1
Chenopodium album	lamb's-quarters	FACU-	0	1	1
Cirsium arvense	Canada thistle	FACU			1
Cirsium vulgare	bull thistle	FACU-	0	1	1
Convolvulus arvensis	bindweed		0	1	1
Conyza canadensis	horseweed	FAC-	0	1	1
Cuscuta gronovii	dodder		4	1	
Cyperus esculentus	yellow nut sedge	FACW	0	1	
Dactylis glomerata	orchard grass	FACU			1
Daucus carota	Queen Anne's-lace		0	1	1
Decodon vericillatus	swamp loosestrife	OBL	7	1	
Echinacea pallida	purple coneflower		7	1	1
Echinochloa crusgalli	barnyard grass	FACW	0	1	
Echinocystis lobata	wild-cucumber	FACW	2		1
Eleocharis obtusa	blunt spike-rush	OBL	3	1	
Elodea canadensis	common waterweed	OBL	3	1	
Elymus canadensis	Canadian wild rye	FACU-	4	1	
Epilobium ciliatum	willow-herb	FACU	3		1
Erigeron annuus	daisy fleabane	FAC-	0	1	1
Eupatorium maculatum	joe-pye weed		4	1	
Eupatorium perfoliatum	boneset	FACW+	6	1	1
Festuca pratensis	rye grass	FACU-	0	1	
Glyceria borealis	mana grass	OBL	8	1	
Hordeum jubatum	sqirrel-tail grass	FAC+			1
Impatiens capensis	jewel weed	FACW	2	1	1
Iris virginica	blue flag	OBL	5	1	

Laportea canadensis	Canadian wood-nettle	FACW	4	1	
Leersia oryzoides	rice cut grass	OBL	3	1	1
Lemna minor	small duckweed	OBL	4	1	1
Lythrum salicaria	purple loosestrife	OBL	0	1	1
Matricaria discoidea	pineapple-weed	FACU			1
Medicago lupulina	black medic	FAC-			1
Medicago sativa	alfalfa				1
Melilotus alba	white sweet-clover	FAC			1
Melilotus altissima	yellow sweet-clover				1
Menispermum canadense	moonseed	FAC	5		1
Mentha arvensis	field mint	FACW	3	1	1
Monarda fistulosa	bee balm	FACU	3		1
Mollugo verticillata	carpetweed	FAC	0	1	
Nymphaea odorata	white water lily	OBL	6	1	1
Oenothera biennis	evening-primrose	FACU	1	1	
Phalaris arundinacea	Reed canary grass	FACW+	0	1	1
Phleum pratense	timothy	FACU			1
Plantago lanceolata	English plantain	FAC			1
Plantago major	common plantain	FAC+			1
Poa pratensis	Kentucky bluegrass	FAC	0	1	1
Polygonum hydropiper	water-pepper	OBL	0	1	1
Polygonum pensylvanicum	Pennsylvania smartweed	FACW+	1	1	1
Polygonum persicaria	lady's thumb	FACW	0	1	1
Populus deltoides	cottonwood	FAC+	2	1	
Potamogeton natans	floatingleaf pondweed	OBL	5	1	1
Potentilla simplex	common cinquefoil	FACU-	2	1	1
Rhamnus cathartica	common buckthorn	FACU			1
Rudbeckia hirta	black-eyed susan	FACU	4	1	1
Rumex crispus	curly dock	FAC+	0	1	1
Sagitarria latifolia	common arrowhead	OBL	3	1	
Salix nigra	willow	OBL	4	1	1
Schoenoplectus tabernaemontani	soft-stem bulrush	OBL	4	1	1
Scirpus atrovirens	dark-green bulrush	OBL	3	1	
Scirpus cyperinus	wool grass	OBL	4	1	1
Scirpus fluviatilis	river bulrush		0	1	1
Silene latifolia	white campion		0	1	
Solanum dulcamara	deadly nightshade	FAC	0	1	1
Solidago gigantea	giant goldenrod	FACW	3		1
Sonchus arvensis	sow-thistle	FAC-	0	1	1
Stuckenia pectinata	sago pondweed	OBL	3	1	1
Taraxacum officinale	dandelion	FACU	0	1	1
Thlaspi arvense	penny cress	FACU	0	1	1
Tragopogon pratensis	goats-beard				1
Trifolium pratense	red clover	FAC+	0	1	1
Trifolium repens	white clover	FAC+	0	1	1
Typha angustifolia	narrow-leaved cattail	OBL	0	1	1
Typha latifolia	broad-leaved cattail	OBL	1	1	1
Urtica dioica	Stinging nettle	FAC+	1	1	1
Verbascum thapsus	mullein			1	1

Verbena hastata	blue vervain	FACW+	3	1	1
Vitis riparia	river bank grape	FACW-	2		1
Total species				74	66
Non-native species				30	34
Percent non-native				41%	52%
Species C > 4				9	5
Percentage Species C > 4				12%	7.6%
Species in common	43				

1. Naming follows Wetter et al. 2001
2. Species in bold are non-native
3. Also includes species found in Meander Loops 1 and 2

Table 3. Lake Belleview- June 27, 2013					
Emergent Zone Vegetation			**Regional**		
		Cover	**wetland**		**Cover X**
Scientific Name [1,2]	**Common Name**	**Class '6/13**	**Indicator[3]**	**C of C[3]**	**C**
Leersia oryzoides	rice cut grass	4	OBL	3	12
Ceratophyllum demersum	coontail	3	OBL	3	9
Typha angustifolia	narrow-leaved cattail	3	OBL	0	0
Lemna minor	small duckweed	2	OBL	4	8
Potamogeton natans	floatingleaf pondweed	2	OBL	5	10
Typha latifolia	broad-leaved cattail	2	OBL	1	2
Epilobium ciliatum	willow-herb	1	FACU	3	3
Eupatorium perfoliatum	boneset	1	FACW+	6	6
Nymphaea odorata	white water lily	1	OBL	6	6
Schoenoplectus tabernaemontani	soft-stem bulrush	1	OBL	4	4
Scirpus cyperinus	wool grass	1	OBL	4	4
Stuckenia pectinata	sago pondweed	1	OBL	3	3
	Total cover	15	Total C	36	46
Total species	12		**Mean C**	3.00	
Native species	11		**Mean C**	3.27	
% Native	92%				
			FQI		
1. Naming follows Wetter et al., 2001		**Native**	12	**qC**	3
2. Species in bold are non-native		**Total**	11	**qFQI**	10.4
3. After Bernthal,2003					

Table 4. Lake Belleview- June 27, 2013					
Wet Meadow Zone Vegetation			**Regional**		
		Cover	**wetland**	**27-Jun**	**Cover X**
Scientific Name [1,2]	**Common Name**	**Class '6/13**	**Indicator[3]**	**C of C[3]**	**C '6/13**
Leersia oryzoides	rice cut grass	5	OBL	3	15
Rudbeckia hirta	black-eyed susan	3	FACU	4	12
Phalaris arundinacea	Reed canary grass	3	FACW+	0	0
Conyza canadensis	horseweed	3	FAC-	0	0
Verbena hastata	blue vervain	2	FACW+	3	6
Poa pratensis	Kentucky bluegrass	2	FAC	0	0
Typha angustifolia	narrow-leaved cattail	1	OBL		
Taraxacum officinale	dandelion	1	FACU	0	0
Scirpus cyperinus	wool grass	1	OBL	4	4
Salix nigra	willow	1	OBL	4	4
Rudbeckia hirta	black-eyed susan	1	FACU	4	4
Polygonum pensylvanicum	Pennsylvania smartweed	1	FACW+	1	1
Polygonum hydropiper	water-pepper	1	OBL	0	0
Lythrum salicaria	purple loosestrife	1	OBL	0	0
Impatiens capensis	jewel weed	1	FACW	2	2
Eupatorium perfoliatum	boneset	1	FACW+	6	6
Epilobium ciliatum	willow-herb	1	FACU	3	3
Cirsium arvense	Canada thistle	1	FACU		0
Ambrosia artemisiifolia	common ragweed	1	FACU	0	0
	Total Cover	**31**	**Total C**	34	57
Total species	19	**Mean C**	1.79		
Native species	13	**Mean C**	2.62		
% Native	65%				
			FQI		
1. Naming follows Wetter et al. 2001		**Native**	9.4	**qC**	1.8
2. Species in bold are non-native		**Total**	7.8	**qFQI**	7.8
3. After Bernthal,2003					

Table 5. Lake Belleview- June 27, 2013					
Wet-Mesic Prairie Vegetation			**Regional**		
		Cover	**wetland**		**Cover X**
Scientific Name [1,2]	**Common Name**	**Class '6/13**	**Indicator[3]**	**C of C[3]**	**C**
Conyza canadensis	horseweed	3	FAC-	0	0
Phalaris arundinacea	Reed canary grass	3	FACW+	0	0
Poa pratensis	Kentucky bluegrass	3	FAC	0	0
Rudbeckia hirta	black-eyed susan	3	FACU	4	12
Rumex crispus	curly dock	3	FAC+	0	0
Agropyron repens	quackgrass	2			0
Cirsium vulgare	bull thistle	2	FACU-	0	0
Epilobium ciliatum	willow-herb	2	FACU	3	6
Medicago lupulina	black medic	2	FAC-		0
Medicago sativa	alfalfa	2			0
Melilotus alba	white sweet-clover	2	FAC		0
Verbena hastata	blue vervain	2	FACW+	3	6
Arctium minus	burdock	1	FACU	0	0
Barbarea vulgaris	yellow rocket	1	FAC	0	0
Cirsium arvense	Canada thistle	1	FACU		0
Convolvulus arvensis	bindweed	1		0	0
Dactylis glomerata	orchard grass	1	FACU		0
Daucus carota	Queen Anne's-lace	1		0	0
Echinacea pallida	purple coneflower	1		7	7
Eupatorium perfoliatum	boneset	1	OBL	6	6
Leersia oryzoides	rice cut grass	1	OBL	3	3
Mentha arvensis	field mint	1	FACW	3	3
Phleum pratense	timothy	1	FACU		0
Polygonum persicaria	ladys thumb	1	FACW	0	0
Potentilla simplex	common cinquefoil	1	FACU-	2	2
Solidago gigantea	giant goldenrod	1	FACW	3	3
Sonchus arvensis	sow-thistle	1	FAC-	0	0
Taraxacum officinale	dandelion	1	FACU	0	0
Trifolium pratense	red clover	1	FAC+	0	0
Trifolium repens	white clover	1	FAC+	0	0
Verbascum thapsus	mullein	1		0	0
	Total Cover	48	Total C	34	48
Total species	31		**Mean C**	1.10	
Native species	10		**Mean C**	3.40	
% Native	32%				
			FQI		
1. Naming follows Wetter et al., 2001		**Native**	10.8	**qC**	1
2. Species in bold are non-native		**Total**	6.1	**qFQI**	5.6
3. After Bernthal,2003					

Table 6. Lake Belleview- June 27, 2013					
Mesic Prairie Vegetation			**Regional**		
		Cover	**wetland**		**Cover X**
Scientific Name [1,2]	**Common Name**	**Class '6/13**	**Indicator[3]**	**C of C[3]**	**C**
Conyza canadensis	horseweed	3	FAC-		0
Phalaris arundinacea	Reed canary grass	3	FACW+	0	0
Poa pratensis	Kentucky bluegrass	3	FAC	0	0
Rudbeckia hirta	black-eyed susan	3	FACU	4	12
Verbena hastata	blue vervain	3	FACW+	3	9
Chenopodium album	lamb's-quarters	2	FAC-	0	0
Medicago lupulina	black medic	2	FAC-		0
Medicago sativa	alfalfa	2			0
Rumex crispus	curly dock	2	FAC+	0	0
Amaranthus retroflexus	pigweed	1	FACU+	0	0
Ambrosia artemisiifolia	common ragweed	1	FACU	0	0
Aster novae-angliae	New England aster	1	FACW	3	3
Barbarea vulgaris	yellow rocket	1	FAC	0	0
Cerastium fontanum	mouse-ear chickweed	1	FACU		0
Convolvulus arvensis	bindweed	1			0
Daucus carota	Queen Anne's-lace	1		0	0
Echinacea pallida	purple coneflower	1		7	7
Echinocystis lobata	wild-cucumber	1	FACW	2	2
Epilobium ciliatum	willow-herb	1	FACU	3	3
Erigeron annuus	daisy fleabane	1	FAC-	0	0
Eupatorium perfoliatum	boneset	1	OBL	6	6
Hordeum jubatum	sqirrel-tail grass	1	FAC+		0
Leersia oryzoides	rice cut grass	1	OBL	3	3
Matricaria discoidea	pineapple-weed	1	FACU		0
Melilotus alba	white sweet-clover	1	FAC		0
Menispermum canadense	moonseed	1	FAC	5	5
Mentha arvensis	field mint	1	FACW	3	3
Modarda fistulosa	bee balm	1	FACU	3	3
Mollugo verticillata	carpetweed	1	FAC	0	0
Plantago major	common plantain	1	FAC+		0
Polygonum persicaria	lady's thumb	1	FACW	0	0
Potentilla simplex	common cinquefoil	1	FACU-	2	2
Solanum dulcamara	deadly nightshade	1	FAC	0	0
Solidago gigantea	giant goldenrod	1	FACW	3	3
Sonchus arvensis	sow-thistle	1	FAC-	0	0
Taraxacum officinale	dandelion	1	FACU	0	0
Thlaspi arvense	penny cress	1	FACU	0	0
Tragopogon pratensis	goats-beard	1			0
Trifolium pratense	red clover	1	FAC+		0
Trifolium repens	white clover	1	FAC+		0
Urtica dioica	Stinging nettle	1	FAC+	1	1
Verbascum thapsus	mullein	1		0	0
	Total Cover	56	Total C	48	62
Total species	43		**Mean C**	1.12	
Native species	19		**Mean C**	2.53	
% Native	44%				
			FQI		
1. Naming follows Wetter et al., 2001		**Native**	11	**qC**	1.1
2. Species in bold are non-native		**Total**	7.2	**qFQI**	7.2
3. After Bernthal,2003					

Table 7. Flora of Meander Loops, Lake Belleview, '6/27/2013			
Scientific Name [1,2]	**Common Name**	**Loop 1[a]**	**Loop 2[a]**
Acer saccharinum	silver maple		1
Ambrosia artemisiifolia	common ragweed	1	1
Arctium minus	burdock	1	1
Aster novae-angliae	New England Aster	1	3
Barbarea vulgaris	yellow rocket	1	1
Chenopodium album	lamb's-quarters	1	1
Cirsium arvense	canada thistle	1	1
Convolvulus arvensis	bindweed	1	1
Conyza canadensis	horseweed	1	1
Erigeron annuus	daisy fleabane	2	1
Impatiens capensis	orange touch-me-not (jewel weed)	1	1
Leersia oryzoides	rice cut grass	4	4
Lythrum salicaria	purple loosestrife	1	
Menispermum canadense	moonseed	1	
Mentha arvensis	field mint	1	2
Phalaris arundinacea	reed canary grass	4	2
Plantago major	common plantain	1	1
Poa pratensis	Kentucky bluegrass	2	2
Polygonum pensylvanicum	Pennsylvania smartweed	1	1
Rhamnus cathartica	common buckthorn	1	
Rudbeckia hirta	black-eyed susan	2	1
Rumex crispus	curly dock	2	2
Solanum dulcamara	deadly nightshade	1	1
Solidago gigantea	giant goldenrod	2	1
Sonchus oleraceus	sow thistle	1	1
Taraxacum officinale	common dandelion	1	1
Thlaspi arvense	penny cress	1	
Urtica dioica	stinging nettle	1	1
Verbascum thapsus	mullein	1	1
Verbena hastata	blue vervain	2	2
Vitis riparia	riverbank grape	1	
a. Indicates cover class			
1. Naming follows Wetter et al., 2001			
2. Species in bold are non-native			

Table 8. Comparison of Species Richness and Floral Quality Between Summer 2012 and Summer 2013.

Zone	Species Richness				Mean C		Percentage	Regional Wetland Indicator Status Percentage[1]								
	Native	Non-native	Total	Percentage native	Value all	Native	C value 4 or less	UPL	FACU	FAC	FACW	OBL	FQI native	FQI total	qC	qFQI
Emergent '7/12	12	2	14	86%	2.9	3.4	86%	0%	0%	0%	7%	93%	11.8	10.8	2.6	9.7
Emergent '6/13	11	1	12	92%	3.0	3.3	75%	0%	0%	1%	1%	98%	12	11	3.0	10.4
Wet Meadow '7/12	27	14	41	66%	2.1	3.2	83%	0%	7%	20%	24%	32%	16.5	13.4	1.9	12.2
Wet Meadow '6/13	12	7	19	63%	1.8	2.6	100%	0%	30%	15%	25%	30%	9.4	7.8	1.8	7.8
Wet-Mesic Prairie '7/12	14	22	36	39%	1.2	3.2	92%	0%	25%	25%	22%	14%	12.0	7.5	1.2	7.2
Wet-Mesic Prairie '6/13	10	21	31	32%	1.1	3.4	94%	0%	29%	19%	16%	6%	10.8	6.1	1.0	5.6
Mesic Prairie '7/12	14	15	29	48%	1.2	2.6	93%	0%	14%	14%	14%	21%	9.7	6.7	1.1	5.9
Mesic Prairie '6/13	19	24	43	44%	1.2	2.7	92%	0%	21%	42%	16%	5%	11	7.2	1.1	7.2

1. Percentage will not add up to 100% because all species in a zone were not given a wetland status

Main Map Projection: Dane County Coordinate System | Locator Map Not to Scale

DRAWN BY	CHECKED BY
DYL	SJH

MONTGOMERY ASSOCIATES:
RESOURCE SOLUTIONS, LLC
119 South Main Street | Cottage Grove, WI 53527
(608) 839-4422 | www.ma-rs.org

AS BUILT ELEVATIONS
HABITAT ZONES

Lake Belle View Lake Restoration
Village of Belleville
Dane County, WI

N
W E
S

0 150 300 Feet

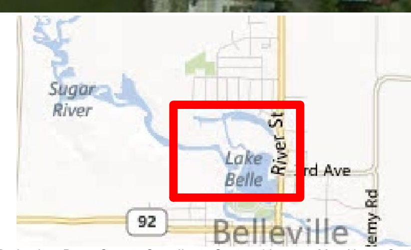
SCALE
1 inch = 300 feet

PROJECT NO.	DATE
1428-011	Sept 4, 2012

SHEET NO.
Figure 1

Legend

- Meander Survey
- Transect3
- Transect2
- Transect1



Main Map Projection: Dane County Coordinate System | Locator Map Not to Scale

Drawn by: Daniel Fuhs

Date: 7/18/2013

ECO-RESOURCE CONSULTING, LLC

Summer 2013 Meander Survey
Paths and Transects
Lake Belle View Lake Restoration
Village of Belleville
Dane County, WI

0 85 170 340 Feet

1 inch = 333 feet

Project Number: 11006

Figure 2 of 2

January, 2001

File or Docket Number

Wisconsin Department of Natural Resources

RAPID ASSESSMENT METHODOLOGY FOR EVALUATING WETLAND FUNCTIONAL VALUES

GENERAL INFORMATION

Name of Wetland/Owner:
Location: County ______________________; ¼, ¼, Section , Township , Range
Project Name:
Evaluator(s):
Date(s) of Site Visit(s):

Description of seasonality limitations of this inspection due to time of year of the evaluation and/or current hydrologic and climatologic conditions (e.g. after heavy rains, snow or ice cover, during drought year, during spring flood, during bird migration):

WETLAND DESCRIPTION

Wisconsin Wetlands Inventory classification:
Wetland Type: shallow open water, deep marsh, shallow marsh, seasonally flooded basin, bog, floodplain forest, alder thicket, sedge meadow, coniferous swamp, fen, wet meadow, shrub-carr, low prairie, hardwood swamp
Estimated size of wetland in acres:

SUMMARY OF FUNCTIONAL VALUES

Based on the results of the attached functional assessment, rate the significance of each of the functional values for the subject wetland and check the appropriate box. Complete the table as a summary.

FUNCTION	**SIGNIFICANCE**				
	Low	Medium	High	Exceptional	N/A
Floral Diversity					
Wildlife Habitat					
Fishery Habitat					
Flood/Stormwater Attenuation					
Water Quality Protection					
Shoreline Protection					
Groundwater					
Aesthetics/Recreation/Education					

List any Special Features/"Red Flags":

SITE DESCRIPTION

I. HYDROLOGIC SETTING

A. Describe the geomorphology of the wetland:

- ❑ Depressional (includes slopes, potholes, small lakes, kettles, etc.)
- ❑ Riverine
- ❑ Lake Fringe
- ❑ Extensive Peatland

B. **Y** **N** Has the wetland hydrology been altered by ditching, tiles, dams, culverts, well pumping, diversion of surface flow, or changes to runoff within the watershed (circle those that apply)?

C. **Y** **N** Does the wetland have an inlet, outlet, or both (circle those that apply)?

D. **Y** **N** Is there any field evidence of wetland hydrology such as buttressed tree trunks, adventitious roots, drift lines, water marks, water stained leaves, soil mottling/gleying, organic soils layer, or oxidized rhizospheres (circle those that apply)?

E. **Y** **N** Does the wetland have standing water, and if so what is the average depth in inches? _____" Approximately how much of the wetland is inundated? _____%

F. How is the hydroperiod (seasonal water level pattern) of the wetland classified?

- ❑ Permanently Flooded
- ❑ Seasonally Flooded (water absent at end of growing season)
- ❑ Saturated (surface water seldom present)
- ❑ Artificially Flooded
- ❑ Artificially Drained

G. **Y** **N** Is the wetland a navigable body of water or is a portion of the wetland below the ordinary high-water mark of a navigable water body? List any surface waters associated with the wetland or in proximity to the wetland (note approximate distance from the wetland and navigability determination). Note if there is a surface water connection to other wetlands.

II. VEGETATION

A. Identify the vegetation communities present and the dominant species.

	floating leaved community dominated by:
	submerged aquatic community dominated by:
	emergent community dominated by:
	shrub community dominated by:
	deciduous broad-leaved tree community dominated by:
	coniferous tree community dominated by:
	open sphagnum mat or bog
	sedge meadow/wet prairie community dominated by:
	other (explain)

B. Other plant species identified during site visit:

III. SOILS

A. NRCS Soil Map Classification: ____

B. Field description:

❑ Organic (histosol)? If so, is it a muck or a peat?

❑ Mineral soil?

- Mottling, gleying, sulfidic materials, iron or manganese concretions, organic streaking (circle those that apply)
- Soil Description: ____
- Depth of mottling/gleying: ____
- Depth of A Horizon: ____
- Munsell Color of matrix and mottles
  - -Matrix below the A horizon (10"depth): ______________________________
  - -Mottles: ____

V. SURROUNDING LAND USES

A. What is the estimated area of the wetland watershed in acres? ____________

B. What are the surrounding land uses?

LAND-USE	ESTIMATED % OF WETLAND WATERSHED
Developed (Industrial/Commercial/Residential)	
Agricultural/cropland	
Agricultural/grazing	
Forested	
Grassed recreation areas/parks	
Old field	
Highways or roads	
Other (specify)	

VI. SITE SKETCH

FUNCTIONAL ASSESSMENT

The following assessment requires the evaluator to examine site conditions that provide evidence that a given functional value is present and to assess the significance of the wetland to perform those functions. Positive answers to questions indicate the presence of factors important for the function. The questions are not definitive and are only provided to guide the evaluation. After completing each section, the evaluator should consider the factors observed and use best professional judgement to rate the significance. The ratings should be recorded on page 1 of the assessment.

SPECIAL FEATURES/"RED FLAGS"

1. (Y) **N** Is the wetland in or adjacent to an area of special natural resource interest (NR 103.04, Wis. Adm. Code)? If so, check those that apply:

- ❑ Cold water community as defined in s. NR 102.04(3)(b), Wis. Adm. Code, including trout streams, their tributaries, and trout lakes
- ❑ Lakes Michigan and Superior and the Mississippi River
- ❑ State or federal designated wild and scenic river
- ❑ Designated state riverway
- ❑ Designated state scenic urban waterway
- ❑ Environmentally sensitive area or environmental corridor identified in an area-wide water quality management plan, special area management plan, special wetland inventory study, or an advanced delineation and identification study
- ❑ Calcareous fen
- ❑ State park, forest, trail or recreation area
- ❑ State and federal fish and wildlife refuges and fish and wildlife management areas
- ❑ State or federal designated wilderness area
- ❑ Designated or dedicated state natural area
- ❑ Wild rice water listed in ch. NR 19.09, Wis. Adm. Code
- ❑ Surface water identified as an outstanding or exceptional resource water in ch. NR 102, Wis. Adm. Code

2. (Y) **N** According to the Natural Heritage Inventory (Bureau of Endangered Resources) or direct observations, are there any rare, endangered, or threatened plant or animal species in, near, or using the wetland or adjacent lands? If so, list the species of concern:

3. **Y** (N) Is the project located in an area that requires a State Coastal Zone Management Plan consistency determination?

Floral Diversity

1. (Y) **N** Does the wetland support a variety of native plant species (i.e. not a monotypic stand of cattail or giant reed grass and/or not dominated by exotic species such as reed canary grass, brome grass, buckthorn, purple loosestrife, etc.)?

2. (Y) **N** Is the wetland plant community regionally scarce or rare?

Wildlife and Fishery Habitat

1. List any species observed, evidenced (e.g. tracks, scat, nest/burrow, calls), or expected to utilize the wetland:

2. **Y N** Does the wetland contain a number of diverse vegetative cover types and a high degree of interspersion of those vegetation types?

3. **Y N** Is the estimated ratio of open water to cover between 30 and 70 percent? What is the estimated ratio? ______%

4. **Y N** Does the surrounding upland habitat likely support a variety of animal species?

5. **Y N** Is the wetland part of or associated with a wildlife corridor or designated environmental corridor?

6. **Y N** Is the surrounding habitat and/or the wetland itself a large tract of undeveloped land important for wildlife that requires large home ranges (e.g. bear, woodland passerines)?

7. **Y N** Is the surrounding habitat and/or the wetland itself a relatively large tract of undeveloped land within an urbanized environment that is important for wildlife?

8. **Y N** Are there other wetland areas near the subject wetland that may be important to wildlife?

9. **Y N** Is the wetland contiguous with a permanent waterbody or periodically inundated for sufficient periods of time to provide spawning/nursery habitat for fish?

10. **Y N** Can the wetland provide significant food base for fish and wildlife (e.g. insects, crustaceans, voles, forage fish, amphibians, reptiles, shrews, wild rice, wild celery, duckweed, pondweeds, watermeal, bulrushes, bur reeds, arrowhead, smartweeds, millets...)?

11. **Y N** Is the wetland located in a priority watershed/township as identified in the Upper Mississippi and Great Lakes Joint Venture of the North American Waterfowl Management Plan?

12. **Y N** Is the wetland providing habitat that is scarce to the region?

Flood and Stormwater Storage/Attenuation

1. **Y N** Are there steep slopes, large impervious areas, moderate slopes with row cropping, or areas with severe overgrazing within the watershed (circle those that apply)?

2. **Y N** Does the wetland significantly reduce run-off velocity due to its size, configuration, braided flow patterns, or vegetation type and density?

3. **Y N** Does the wetland show evidence of flashy water level responses to storm events (debris marks, erosion lines, stormwater inputs, channelized inflow)?

4. **Y N** Is there a natural feature or human-made structure impeding drainage from the wetland that causes backwater conditions?

5. **Y** **N** Considering the size of the wetland area in relation to the size of its watershed, at any time during the year is water likely to reach the wetland's storage capacity (i.e. the level of easily observable wetland vegetation)? [For some cases where greater documentation is required, one should determine if the wetland has capacity to hold 25% of the run-off from a 2 year-24 hour storm event.]

6. **Y** **N** Considering the location of the wetland in relation to the associated surface water watershed, is the wetland important for attenuating or storing flood or stormwater peaks (i.e. is the wetland located in the mid or lower reaches of the watershed)?

Water Quality Protection

1. **Y** **N** Does the wetland receive overland flow or direct discharge of stormwater as a primary source of water (circle that which applies)?

2. **Y** **N** Do the surrounding land uses have the potential to deliver significant nutrient and/or sediment loads to the wetland?

3. **Y** **N** Based on your answers to the flood/stormwater section above, does the wetland perform significant flood/stormwater attenuation (residence time to allow settling)?

4. **Y** **N** Does the wetland have significant vegetative density to decrease water energy and allow settling of suspended materials?

5. **Y** **N** Is the position of the wetland in the landscape such that run-off is held or filtered before entering a surface water?

6. **Y** **N** Are algal blooms, heavy macrophyte growth, or other signs of excess nutrient loading to the wetland apparent (or historically reported)?

Shoreline Protection

1. **Y** **N** Is the wetland in a lake fringe or riverine setting? If NO, STOP and enter "not applicable" for this function. If YES, then answer the applicable questions.

2. **Y** **N** Is the shoreline exposed to constant wave action caused by long wind fetch or boat traffic?

3. **Y** **N** Is the shoreline and shallow littoral zone vegetated with submerged or emergent vegetation in the swash zone that decrease wave energy or perennial wetland species that form dense root mats and/or species that have strong stems that are resistant to erosive forces?

4. **Y** **N** Is the stream bank prone to erosion due to unstable soils, land uses, or ice floes?

5. **Y** **N** Is the stream bank vegetated with densely rooted shrubs that provide upper bank stability?

Groundwater Recharge and Discharge

1. **Y** **N** Related to discharge, are there observable (or reported) springs located in the wetland, physical indicators of springs such as marl soil, or vegetation indicators such as watercress or marsh marigold present that tend to indicate the presence of groundwater springs?

2. **Y** **N** Related to discharge, may the wetland contribute to the maintenance of base flow in a stream?

3. **Y** **N** Related to recharge, is the wetland located on or near a groundwater divide (e.g. a topographic high)?

Aesthetics/Recreation/Education and Science

1. Y N Is the wetland visible from any of the following kinds of vantage points: roads, public lands, houses, and/or businesses? (Circle all that apply.)

2. Y N Is the wetland in or near any population centers?

3. Y N Is any part of the wetland is in public or conservation ownership?

4. Y N Does the public have direct access to the wetland from public roads or waterways? (Circle those that apply.)

5. Is the wetland itself relatively free of obvious human influences, such as:

   a. Y N Buildings?
   b. Y N Roads?
   c. Y N Other structures?
   d. Y N Trash?
   e. Y N Pollution?
   f. Y N Filling?
   g. Y N Dredging/draining?
   h. Y N Domination by non-native vegetation?

6. Is the surrounding viewshed relatively free of obvious human influences, such as:
   a. Y N Buildings?
   b. Y N Roads?
   c. Y N Other structures?

7. Y N Is the wetland organized into a variety of visibly separate areas of similar vegetation, color, and/or texture (including areas of open water)?

8. Y N Does the wetland add to the variety of visibly separate areas of similar vegetation, color, and/or texture (including areas of open water) within the landscape as a whole?

9. Does the wetland encourage exploration because any of the following factors are present:
   a. Y N Long views within the wetland?
   b. Y N Long views in the viewshed adjacent to the wetland?
   c. Y N Convoluted edges within and/or around the wetland border?
   d. Y N The wetland provides a different (and perhaps more natural/complex) kind of environment from the surrounding land covers?

10. Y N Is the wetland currently being used for (or does it have the potential to be used for) the following recreational activities? (Check all that apply.)

ACTIVITY	CURRENT USE	POTENTIAL USE
Nature study/photography		
Hiking/biking/skiing		
Hunting/fishing/trapping		
Boating/canoeing		
Food harvesting		
Others (list)		

11. Y N Is the wetland currently being used, and/or does it have the potential for use for educational or scientific study purposes (circle that which applies)?

Fall 2013

MONITORING REPORT

FOR

LAKE BELLE VIEW RESTORATION PROJECT

Prepared for:

The Village of Belleville
Belleville, Wisconsin

Prepared by:

Eco-Resource Consulting, LLC
409 Concord Drive
Oregon, WI 53575

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Introduction

Eco-Resource Consulting, LLC (ERC), conducted a field investigation of the native plant community restoration around Lake Belle View on September 24, 2013. The areas surveyed included the emergent aquatic bed, an area from two feet below water level to the shoreline (-2 to 0 feet elevation), the wet meadow, an area from the shoreline to two feet of elevation above the shoreline (0 to + 2 feet elevation), the wet mesic prairie, an area from two feet to five feet elevation above the shoreline (+2 to + 5 feet elevation) and the mesic prairie area greater than five feet of elevation above the shoreline (> 5 feet elevation). The original plan called for the emergent aquatic bed to occupy 9.4 acres of shallow water, the wet meadow, 11.1 acres of wetland; the wet-mesic prairie, 4.1 acres, and the mesic prairie 3.9 acres of upland (Figure 1). Dry conditions during mid-to-late summer caused water levels to recede after high water conditions in spring and early summer, changing some of acreage estimates from the original plan.

The restoration area is composed of dredge spoils from the construction of Lake Belle View. The area was dredged during September 2010 and March 2011; grading activities were completed in November 2011. The emergent area was seeded in June 2011 and a dormant seeding using native plant seed appropriate to the community type was conducted in December 2011. Eco-Resource Consulting was assigned the task of evaluating the success of the restoration during the growing seasons from 2012 – 2015 pursuant to State and Federal Permit conditions. This survey focuses on the plant species and communities the second year after seeding.

Field Methods

To assess the vegetation, a meander survey of the entire restoration area was conducted. Two field personnel traveled along the meander survey path (Figure 2) and recorded all species encountered and gave each species a cover rating (explained under analysis).

Analysis

The species coverage (Table 1) is a compilation of species found along the meander survey in all habitat types including loops 1 and 2. Table 1 also compares the species found in the fall 2013 survey with those found in the June 2013 survey.

The 2009 survey (Montgomery and Associated, 2009) defined vegetative cover class as an estimated percent cover of a species based on visual observation. The table below provides the ranges of percent cover and the cover class value or ranking.

Vegetative Cover Classes

Cover Class	% Cover
1	1-10%
2	11-25%
3	26-50%
4	51-75%
5	76-90%
6	91-100%

The percent cover assigns every species observed a cover class rating of 1 to 6. A cover class rating of 6 indicates a species was found and was dominant or co-dominant. A cover rating of 1 indicates the species was found in low density. Our estimates of cover class are included in Table 1.

The Floristic Quality Assessment (FQA) was used to assess the floristic quality, following methodology developed by Swink and Wilhelm (1994). This method is based on calculating an average Coefficient of Conservatism (C) and a Floristic Quality Index (FQI). A predetermined C value is assigned to each identifiable native plant species using locally appropriate values assigned by a panel of botanical experts (Bernthal, 2003). Each native species is assigned a C value which ranges from 0 to 10 and represents an estimated probability that a plant is likely to occur in a landscape relatively unaltered from what is believed to be a pre-settlement condition. A value for C of 0 is applied to a species that demonstrates little fidelity to any remnant natural community and to non-native species, whereas C of 10 is applied to plants that are almost always restricted to pre-settlement remnants. Values lower than 4 generally represent weedy species and values closer to 10 represent more "conservative", rare or disturbance intolerant species (Swink and Wilhelm 1994). C values for each species that were assigned C values are included in Table 1.

FQI values are calculated using the following formula:

FQI = Mean C(√N)

C= Coefficient of Conservatism

N= species richness (Identifiable Native & Non-native)

FQI has traditionally been calculated using C values and species richness of only native species. However, more recently, scientists are including the non-native species in the calculations, giving all non-native species a C value of "0". This is done because disregarding the non-native species can often give sites falsely elevated mean C and FQI values that do not reflect the presence or abundance of less desirable species, which influences the overall floristic quality of an area. This methodology better reflects the actual integrity of a site, rather than simply using native species for the FQI analysis, particularly in highly disturbed conditions dominated by non-native taxa.

FQI and mean C values were calculated using both natives only and all species, including non-natives. While FQI results must be carefully interpreted, especially in small sites or stands such as those surveyed, which usually result in lower FQI values regardless of species composition. It is generally accepted that an FQI value of 35 and/or a mean C value of 4.0 indicates a site with very high floristic quality and integrity, while an FQI value of less than 20 and a mean C value of less than 2.5 indicates that the site is degraded (Swink and Wilhelm 1994) or in the case of a restoration a newly restored area or a restored area that has not reached its habitat potential.

In this report, a quantitative FQI (qFQI) was also calculated for each area using each species' estimated abundance in that stand as a weighting factor. For this calculation, the sum of the product of species abundances and C values is divided by the sum of the species abundances. The result is a weighted C value (qC) that is multiplied by the square root of species richness for the stand to give the qFQI. This calculation can result in an FQI value that more accurately takes into account species dominance, and thus floristic composition and quality, within the vegetation survey areas. The qC and qFQI results are provided in Tables 1.

Because the original performance standards prescribe certain percentages of native plant cover at designated intervals after restoration begins, an additional metric is included in this report (Montgomery and Associates, 2010). This metric is the relative cover of native species in each habitat type. The relative cover is calculated by adding the cover classes of native species and dividing by the sum of all cover classes for each habitat type. The results are expressed as a percentage (Table 1). The performance standards for the restoration do not require that any mean C or FQI values be met.

Results and Discussion

The flora of the restoration area consisted of 74 species (Table 1). Sixty percent of these species were native. This compares to 67 species with 48% native found in June, 2013. The coverage by native species was approximately 65% in September versus 52% in June (Table 1). The FQI value increased from 10.6 to 14.7, and the qFQI increased from 11.5 to 18.2 during the two 2013 monitoring events.

The performance standard for the Lake Belle View restoration states that after two full growing seasons, seeded areas shall have 80% total plant cover and 20% cover by native species. This cover standard was easily met by the September 2013 sampling as virtually all of the restoration had vegetative coverage. By species count, 60% were native species and native species coverage was 65%.

Wildlife and other notes

During the field investigation, there was a variety of wildlife observed. The majority of the wildlife observed were birds and included: Double Crested Cormorant (*Phalacrocorax auritus*), Canadian Geese (*Branta canadensis*), Mourning Dove (*Zenaida macroura*), Red-tailed Hawk (*Buteo jamaicensis*), Killdeer (*Charadrius vociferus*), American Crow (*Corvus brachyrhynchos*), Sedge Wren (*Cistothorus platensis*), Black-capped Chickadees (*Poecile atricapillus*), Red-winged Blackbird (*Agelaius phoeniceus*), American Robin (*Turdus migratorius*), Common Yellowthroat (*Geothlypis trichas*), Great Blue Heron (*Ardea herodias*), Mallard duck (*Anas platyrhynchos*), Pectoral Sandpiper (*Calidris melanotos*), Belted Kingfisher (*Megaceryle alcyon*), and various Sparrows. There were several insect species observed during the investigation that included: Bumble Bee (*Bombus sp.*), Monarch Butterfly (*Danaus plexippus*), Potato Leaf Hopper (*Empoasca fabae*), Crickets, Grasshoppers, Moths, Dragonfly, and Mosquitoes. One observed reptile was a Painted Turtle (*Chrysemys picta bellii*).

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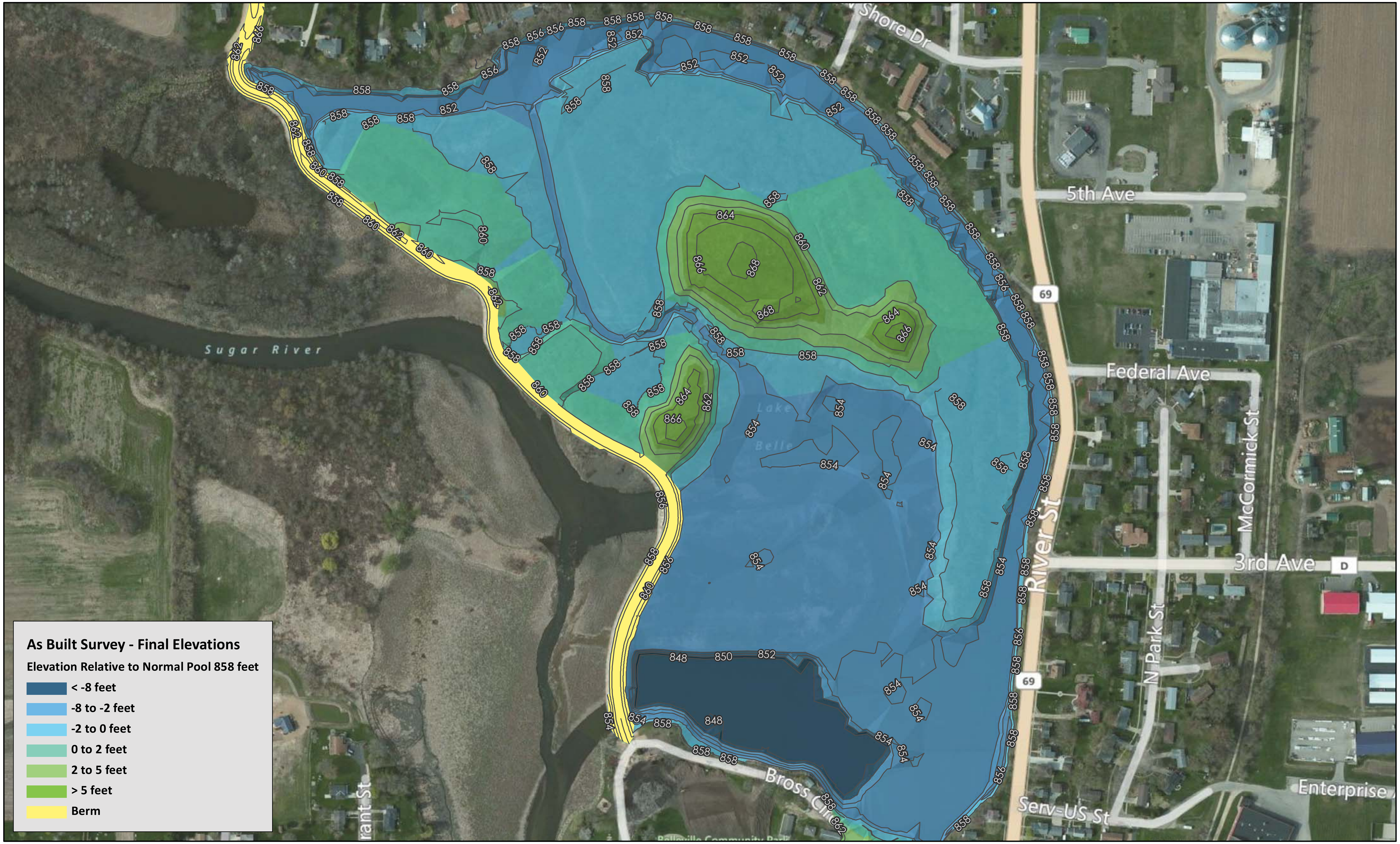
Swink, F. and G. Wilhelm. 1994. *Plants of the Chicago Region*, 4^{th} edition. The Indiana Academy of Science. 921 pg.

Wetter, M.A., T.S. Cochrane, M.R. Black, H.H. Iltis, and P.E. Berry. 2001. Checklist of the Vascular Plants of Wisconsin. Technical Bulletin No. 192. Wisconsin Department of Natural Resources, Madison, Wisconsin. 258 pg.

Table 1:Lake Belle View Species Coverage, 2013 [1,2]					
			C of C value	Cover 6/13	Cover 9/13
Acer negundo	box elder	FACW_	0		1
Acer saccharinum	silver maple	FACW	2	1	1
Agropyron repens	quackgrass			1	1
Alopecurus carolinianus	foxtail	FACW	0		1
Amaranthus retroflexus	pigweed	FACU+	0	1	
Ambrosia artemisiifolia	common ragweed	FACU	0	2	1
Andropogon gerardii	big blue-stem	FAC-	4		1
Arctium minus	burdock	FACU	0	1	1
Aster laevis	smooth blue aster		6		3
Aster novae-angliae	New England aster	FACW	3	2	1
Aster lanceolatus	marsh aster		4		2
Aster sp.	aster			1	1
Barbarea vulgaris	yellow rocket	FAC	0	3	1
Bidens frondosa	beggars tick	FACW	1		1
Bromus inermis	smooth brome grass	FACU	0		1
Cerastium fontanum	mouse-ear chickweed	FACU		1	
Ceratophyllum demersum	coontail	OBL	3	3	2
Chenopodium album	lamb's-quarters	FACU-	0	2	1
Cirsium arvense	Canada thistle	FACU		2	2
Cirsium vulgare	bull thistle	FACU-	0	2	1
Convolvulus arvensis	bindweed		0	2	
Conyza canadensis	horseweed	FAC-	0	3	2
Cornus stolonifera	red osier dogwood	FACW	3		1
Craetaegus sp.	hawthorn				1
Dactylis glomerata	orchard grass	FACU		1	
Daucus carota	Queen Anne's-lace		0	1	
Echinacea pallida	purple coneflower		7	1	
Echinochloa crusgalli	barnyard grass	FACW	0		1
Echinocystis lobata	wild-cucumber	FACW	2	1	1
Elymus canadensis	Canadian wild rye	FACU-	4		1
Elymus virginicus	Virginia wild rye	FACW-	6		4
Epilobium coloratum	cinnamon willow-herb	OBL	3	2	
Erigeron annuus	daisy fleabane	FAC-	0	2	1
Eupatorium perfoliatum	boneset	FACW+	6	2	1
Festuca pratensis	rye grass	FACU-	0		1
Fraxinus pennsylvanica	green ash	FACW	2		1
Glyceria borealis	mana grass	OBL	8		1
Helenium autumnale.	common sneezeweed	FACW+	4		3
Hordeum jubatum.	sqirrel-tail grass	FAC+		1	1
Impatiens capensis	jewel weed	FACW	2	1	1
Laportea canadensis	Canadian wood-nettle	FACW	4		1
Leersia oryzoides	rice cut grass	OBL	3	4	4
Lemna minor	small duckweed	OBL	4	2	2
Lythrum salicaria	purple loosestrife	OBL	0	1	1
Matricaria discoidea	pineapple-weed	FACU		1	
Medicago lupulina	black medic	FAC-		2	1
Medicago sativa	alfalfa			2	1
Melilotus alba	white sweet-clover	FAC		2	
Melilotus altissima	yellow sweet-clover				
Menispermum canadense	moonseed	FAC	5	1	
Mentha arvensis	field mint	FACW	3	2	1
Modarda fistulosa	bee balm	FACU	3	1	1
Mollugo verticillata	carpetweed	FAC	0		1
Nymphaea odorata	white water lily	OBL	6	1	
Oenothera biennis	evening-primrose	FACU	1		1
Panicum virgatum	switch grass	FAC+	4		1

Phalaris arundinacea	Reed canary grass	FACW+	0	3	2
Phleum pratense	timothy	FACU		1	1
Plantago lanceolata	English plantain	FAC		1	1
Plantago major	common plantain	FAC+		1	1
Poa palustris	marsh bluegrass	FACW	5		3
Poa pratensis	Kentucky bluegrass	FAC	0	2	1
Polygonum hydropiper	water-pepper	OBL	0	1	
Polygonum pensylvanicum	Pennsylvania smartweed	FACW+	1	1	1
Polygonum persicaria	lady's thumb	FACW	0	1	1
Polygonum sagittatum	arrow-leaved tear-thumb	OBL	6		1
Populus deltoides	cottonwood	FAC+	2		1
Potamogeton natans	floatingleaf pondweed	OBL	5	2	1
Potentilla simplex	common cinquefoil	FACU-	2	1	
Rhamnus cathartica	common buckthorn	FACU		1	1
Rudbeckia hirta	black-eyed susan	FACU	4	3	2
Rumex crispus	curly dock	FAC+	0	2	1
Salix nigra	willow	OBL	4	1	1
Schoenoplectus tabernaemontani	soft-stem bulrush	OBL	4	1	1
Scirpus cyperinus	wool grass	OBL	4	1	1
Scirpus fluviatilis	river bulrush		0	1	1
Solanum dulcamara	deadly nightshade	FAC	0	1	1
Solidago canadensis	common goldenrod	FACU	1		2
Solidago gigantea	giant goldenrod	FACW	3	1	2
Sonchus arvensis	sow-thistle	FAC-	0	1	1
Stuckenia pectinata	sago pondweed	OBL	3	1	1
Taraxacum officinale	dandelion	FACU	0	1	1
Thlaspi arvense	penny cress	FACU	0	1	
Tragopogon pratensis	goats-beard			1	
Trifolium pratense	red clover	FAC+	0	1	1
Trifolium repens	white clover	FAC+	0	1	1
Typha angustifolia	narrow-leaved cattail	OBL	0	3	3
Typha latifolia	broad-leaved cattail	OBL	1	2	
Urtica dioica	Stinging nettle	FAC+	1	1	1
Verbascum thapsus	mullein			1	1
Verbena hastata	blue vervain	FACW+	3	3	3
Vitis riparia	river bank grape	FACW-	2	1	1
				102	100
	Total species			67	75
	Native species			32	45
	Percent Native			48%	60%
	Total C			89	130
	Mean C-all			1.3	1.7
	Mean C-native			2.8	2.9
	FQI-all			10.6	14.7
	FQI-native			15.8	19.5
	qC			1.4	2.1
	qFQI			11.5	18.2
	Total Cover			102	100
	Native Cover			53	65
	Percent Native Cover			52%	65%
1. Naming follows Wetter et al. 2001					
2. Species in bold are non-native					



Main Map Projection: Dane County Coordinate System | Locator Map Not to Scale

DRAWN BY	CHECKED BY
DYL	SJH

MONTGOMERY ASSOCIATES: RESOURCE SOLUTIONS, LLC

119 South Main Street | Cottage Grove, WI 53527

(608) 839-4422 | www.ma-rs.org

AS BUILT ELEVATIONS HABITAT ZONES

Lake Belle View Lake Restoration

Village of Belleville

Dane County, WI

N
W E
S

0 150 300 Feet

SCALE

1 inch = 300 feet

PROJECT NO.	DATE
1428-011	Sept 4, 2012

SHEET NO.

Figure 1

Drawn by: Daniel Fuhs | Date: 7/18/2013

ERC
ECO-RESOURCE CONSULTING, LLC

Summer 2013 Meander Survey
Paths and Transects
Lake Belle View Lake Restoration
Village of Belleville
Dane County, WI

0 85 170 340 Feet

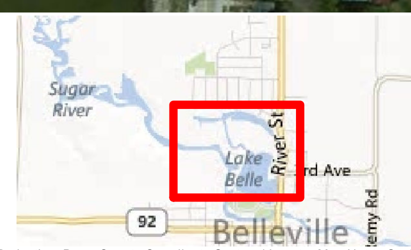
1 inch = 333 feet

Project Number: 11006

Figure 2 of 2

Legend

- Meander Survey
- Transect3
- Transect2
- Transect1



Main Map Projection: Dane County Coordinate System | Locator Map Not to Scale

Legend

Meander Survey

Drawn By: Daniel Fuhs

Date: 9/24/2013

Project Number: 11006

Figure 2

ERC

ECO-RESOURCE CONSULTING, LLC

409 Concord Dr. Oregon, WI 53575

www.eco-resource.net

Fall 2013 Meander Survey
Lake Belle View Lake Restoration
Village of Belleville
Dane County, WI

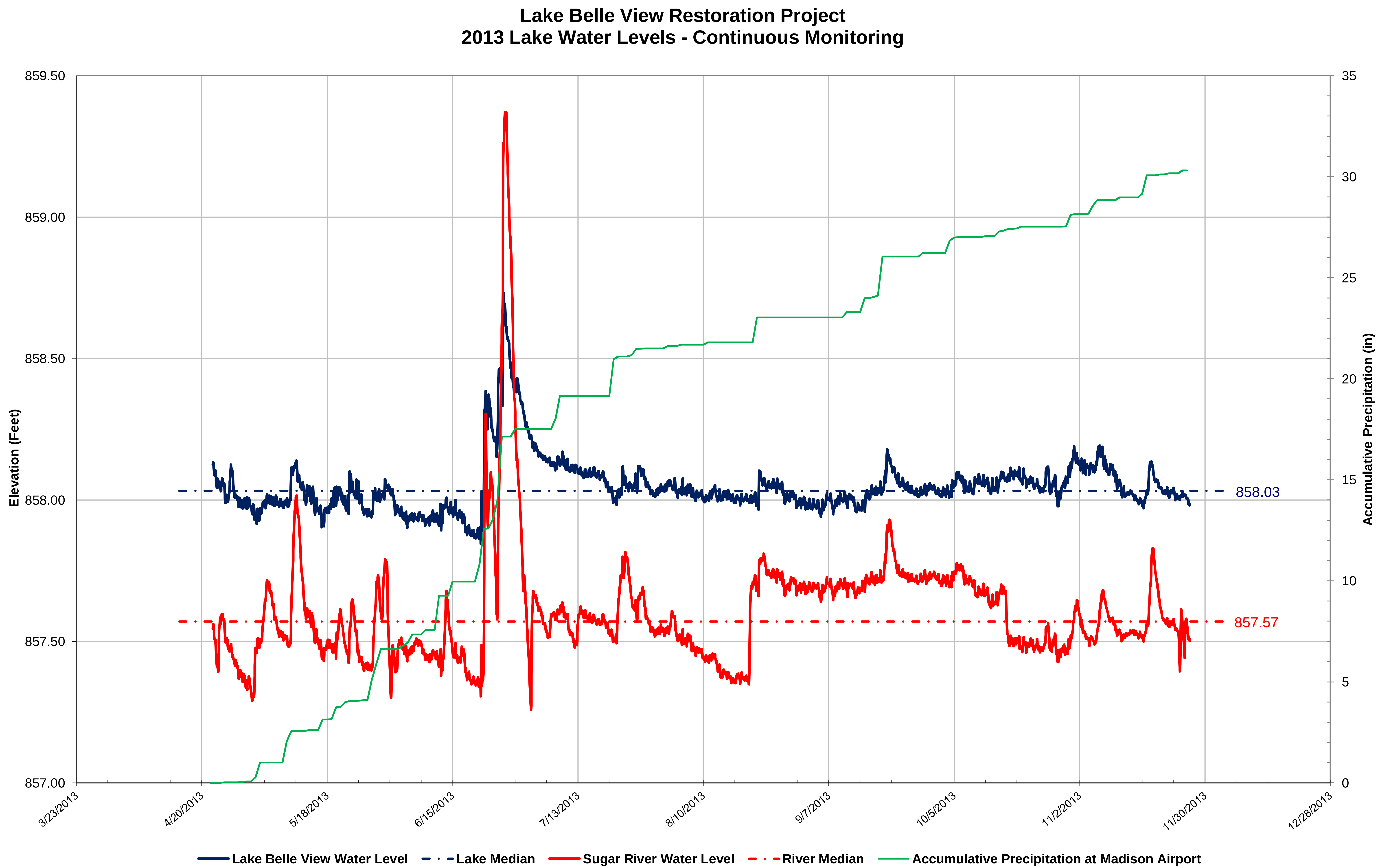
0 150 300 600 Feet

1 inch = 333 feet

N
W E
S

APPENDIX B

2013 LAKE WATER LEVELS – CONTINUOUS MONITORING - MARS


Lake Belle View Restoration Project
2013 Lake Water Levels - Continuous Monitoring
Elevation (Feet)
Accumulative Precipitation (in)
859.50
859.00
858.50
858.00
857.50
857.00
35
30
25
20
15
10
5
0
858.03
857.57
3/23/2013
4/20/2013
5/18/2013
6/15/2013
7/13/2013
8/10/2013
9/7/2013
10/5/2013
11/2/2013
11/30/2013
12/28/2013
Lake Belle View Water Level
Lake Median
Sugar River Water Level
River Median
Accumulative Precipitation at Madison Airport

APPENDIX C

LAKE BELLE VIEW RESTORATION – TWO YEAR EVALUATION

DECEMBER 2013

Lake Belle View Restoration Project

Two Year Evaluation

Prepared by David W. Marshall and Richard Wedepohl

Village of Belleville

Agrecol Environmental Consulting LLC

Montgomery Associates Resources Solutions LLC

Large-scale Lake Planning Grant Report

December 2013

Summary

Results of water quality monitoring and biological surveys in 2012 and 2013 demonstrated that common carp had survived the construction drawdown and are thriving in the newly formed Lake Belle View. Poor water clarity, high nutrients and high chlorophyll a concentrations, coupled with a dearth of rooted aquatic plants, were symptoms of an unexpected common carp population in the lake. While the carp had undermined some of the goals for creating a clear off-channel lake, the project was nonetheless successful in diverting a massive watershed sediment and phosphorus load around the lake and providing a much appreciated urban lake for the community. The next focus of the lake restoration project is to control the excessive common carp population that will allow native fishes and aquatic plants to thrive in a floodplain lake; perhaps one of the most threatened water resources in Wisconsin. Our restoration targets include sustaining a diverse off-channel fish community, floating leaf and submersed macrophytes, phosphorus TSI of 54, chlorophyll TSI of 47 and a secchi TSI of 48.

Introduction

Until recently, Lake Belle View was a 90 acre impoundment that was formed in 1920 by the construction of a mill dam. The millpond was severely degraded due to loss of storage capacity, very poor water quality, and very poor habitat due to prolific densities of common carp. It drained a massive 172 square miles (watershed area to lake area ratio of 1100:1) of predominantly intensive agricultural lands along with rapid urban expansion. Although the Sugar River is classified as an Exceptional Resource Water (ERW), it continues to transport enough sediment and phosphorus loads to make inline millpond management unfeasible. It displayed typical problems associated with shallow nutrient rich impoundments, including complete loss of storage capacity. Recreational use was rare and the fishery was dominated by common carp. The Village of Belleville, Wisconsin had proposed various millpond dredging projects over the last 30 years. The proposals were rejected because of high costs, projected poor water quality and short term effectiveness due to projected rapid sedimentation from a massive agricultural watershed.

A watershed diversion project was completed in 2011 and involved the construction of a berm that separates the new off-channel lake from the river. The berm provides access to restored wetland areas and serves as a biking and hiking trail that connects the north part of the Village to its southern business district. To meet federal and local floodplain regulations, the separation berm was designed to prevent river water intrusion under normal flow events (up to the estimated 50 year event). To minimize costs and to expand the floodplain forest wetland, the lakes open water area is reduced in size, with sediment borrowed from lake dredging being used to restore the wetland system.

The lake was designed to mimic natural oxbows that had declined along the river due to floodplain aggradation. The new 40 acre lake has its own water level control system. Twenty-nine fish species were stocked in the lake to provide a diverse fishery that mimics natural oxbow lakes. Aquatic plants stocked in the lake included white water lily, wild celery, Chara and long-leaf pondweed. The new wetland areas, comprised of 27 acres of deepwater wetland habitat, 11.5 acres of emergent wetland, and 11.6 acres of floodplain forest wetlands, provide numerous functional values and educational opportunities. The lake and surrounding floodplain forest provide habitat for the American Bald Eagle and the Prothonotary Warbler. The restoration of the floodplain forest habitat and water quality improvements is expected to provide benefits associated with increased habitat for these species.

The new off-channel lake was expected to display significant water quality and ecological improvements and function as a model for off-channel lake management. This project was conducted to determine if goals of the restoration were achieved and document environmental conditions as a response to the watershed diversion.

Methods

Lake water quality sampling as conducted on a monthly basis from June through September in 2012 and 2013 and through the ice in February of both years. Sampling stations included the deep hole near the park and in the channel. The channel was monitored since it intercepts most of the local watershed runoff.

A YSI Model 52 meter will be used to measure dissolved oxygen and temperature. A YSI Model 63 meter will be used to measure pH and specific conductivity. Calibration of the instruments followed manufacturer recommendations including the 2 point calibration for pH. Growing season secchi transparency measurements were taken in the lake.

Paired testing of the Sugar River and Lake Belle View included use of a 120 cm transparency tube and turbidity measurements using a Hach Model 2100P meter. Nutrient samples were collected and submitted to the State Lab of Hygiene Inorganic Chemistry Unit. The chlorophyll a, phosphorus and secchi data were converted to Trophic State Index (TSI).

Local watershed areas were delineated along with major land uses. Annual phosphorus loading rates were estimated using WILMS and similar models. Nearshore fish population sampling was conducted with a towed single probe DC electroshocker. All specimens were immediately released after field identification and enumeration except where immature specimens required further review. The fish surveys were designed to sample populations of nongame species and juvenile stages of sportfish. The surveys were conducted to assess distribution of fishes that inhabit nearshore areas within floodplain habitats. The surveys were also designed to detect potential common carp reproduction that could threaten the ecosystem.

Since the near shore surveys do not evaluate growth rates, size distribution or population densities of sport fish populations, the WDNR conducted a boom shocking survey to evaluate the sport fish population.

Qualitative biological surveys included birds, furbearer, and herptile sight and sound observations. Watershed boundaries and land uses were delineated along with predicted phosphorus loading to the lake. Storm sewers were identified and storm events monitored. A point intercept macrophyte survey was conducted as a replication of a survey performed prior to lake construction on June 15, 2009. Volunteers also provided non-scientific creel survey notes.

Findings

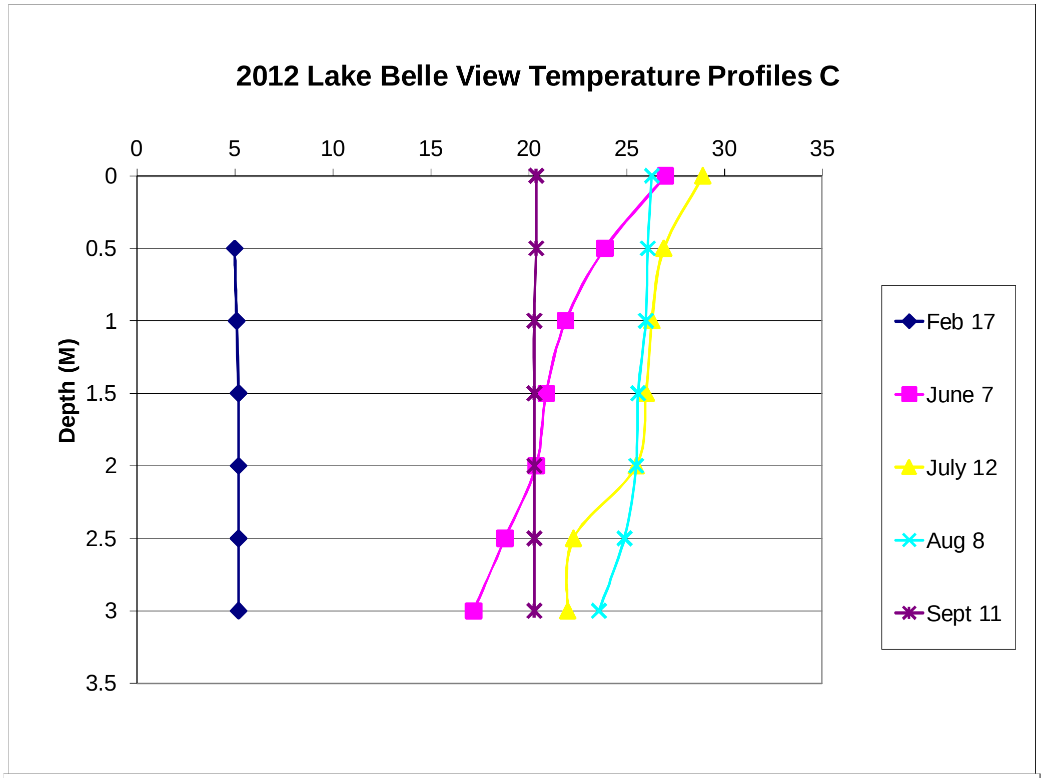
Although the watershed diversion project successfully established an off-channel lake with a berm that bypasses the 172 square mile watershed, the water quality and project goals were tempered by an unexpected population of common carp (*Cyprinus carpio*) in Lake Belle View that likely over-wintered in a shallow pond during the early 2011 construction drawdown. The majority of carp in the lake are now 14 inches long or smaller, indicating that the drawdown refuge likely held mostly young of year carp.

Limnology

The vertical profile data for temperature, dissolved oxygen, pH and specific conductance appear in Figures 1 - 4. One issue of concern during the planning phase of the project was the potential for winterkill conditions. The dissolved oxygen profiles in Figure 2 demonstrated adequate dissolved oxygen levels in the lake but anoxia did occur seasonally near the bottom. In Figure 1, modest thermal stratification was limited to June in both years and reflected mixing in the shallow lake. Therefore, the low oxygen levels near the bottom did not reflect stratification but rather light and photosynthesis limitation. Consistent with decreasing dissolved oxygen levels with depth, pH measurements also declined with depth (Figure 3). Specific conductance levels were typically in the range of 500 – 600 uS/cm except in February of 2013 when levels reached 700 uS/cm, suggesting chloride runoff from street salt applications.

Lake Belle View (millpond) prior to restoration and watershed diversion berm

Figure 1: Lake Belle View Temperature Profiles



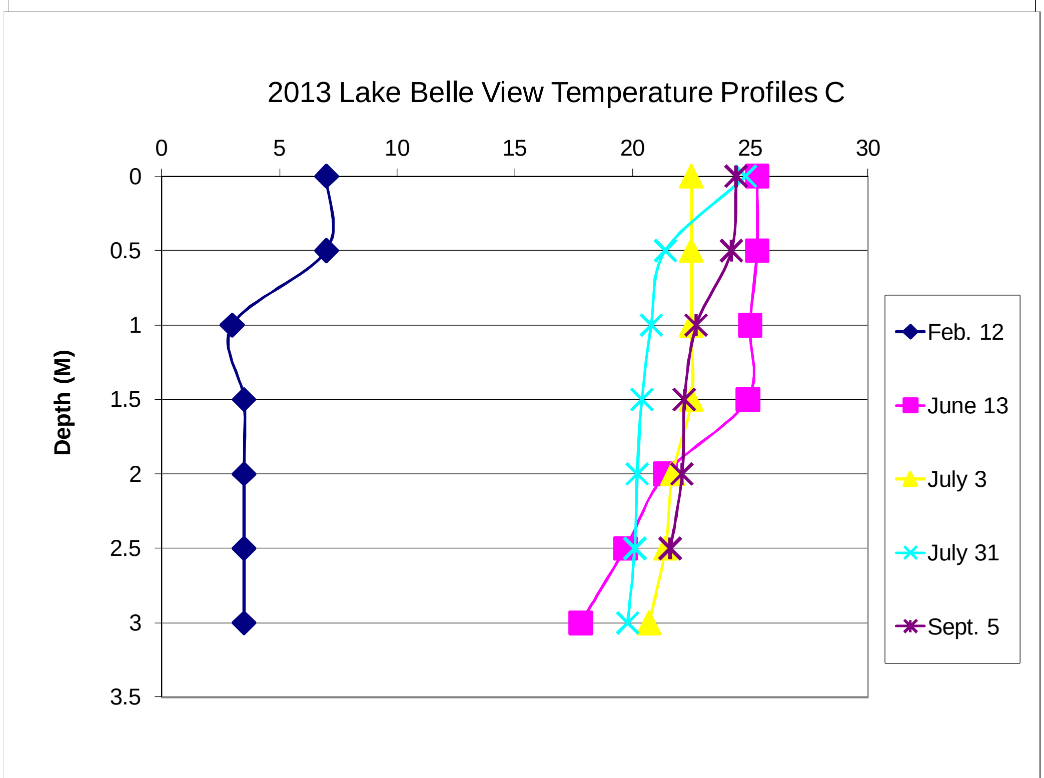


Figure 2: Lake Belle View Dissolved Oxygen Profiles

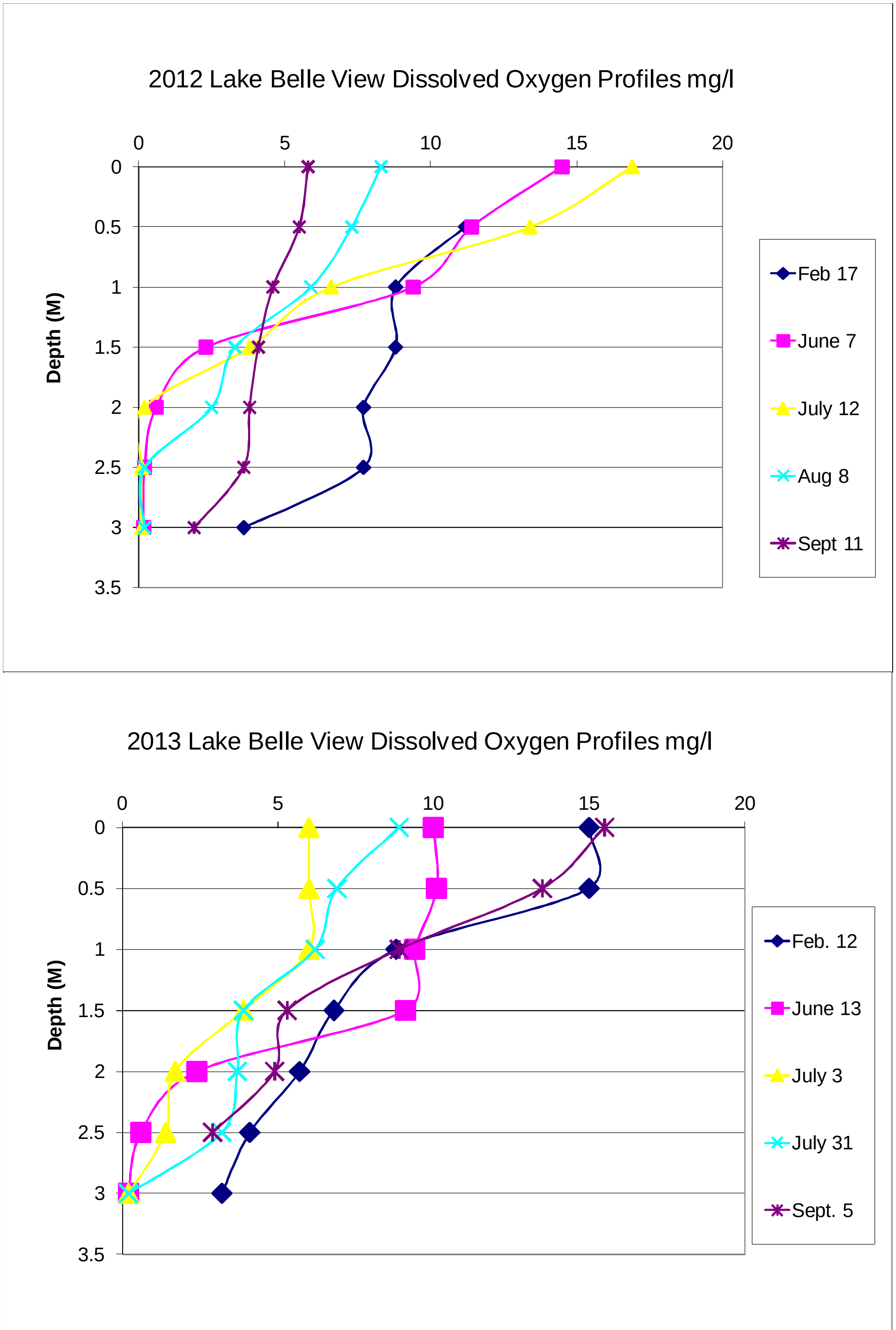
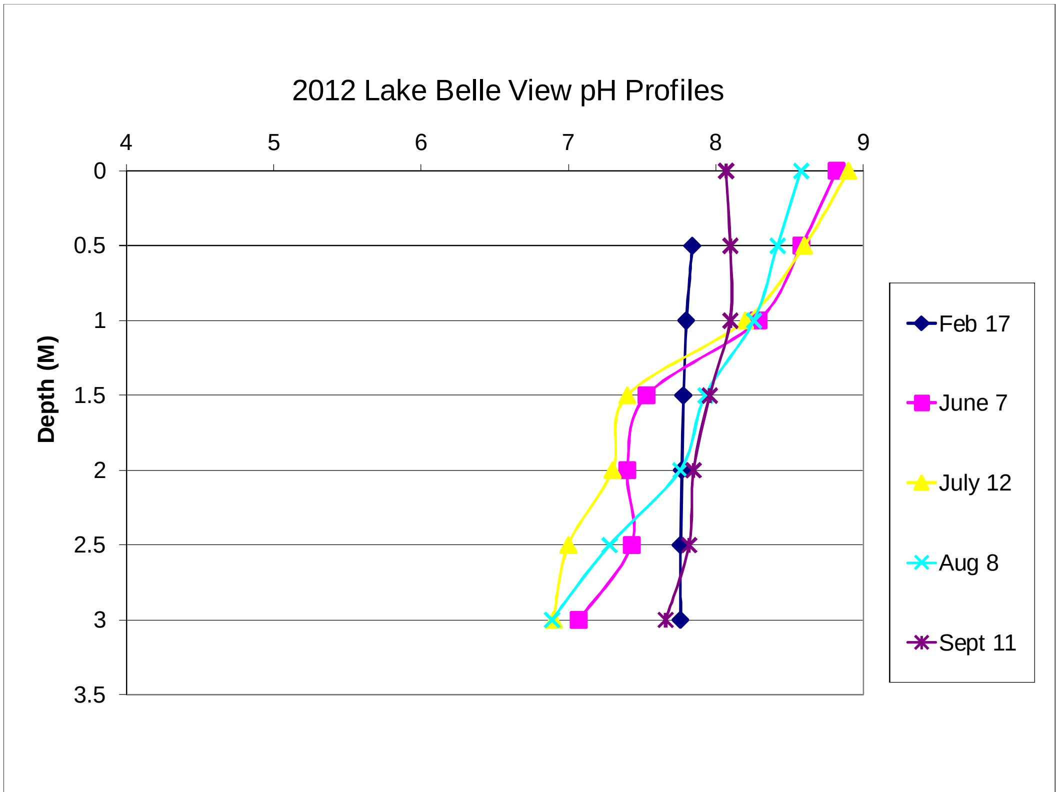


Figure 3: Lake Belle View pH Profiles



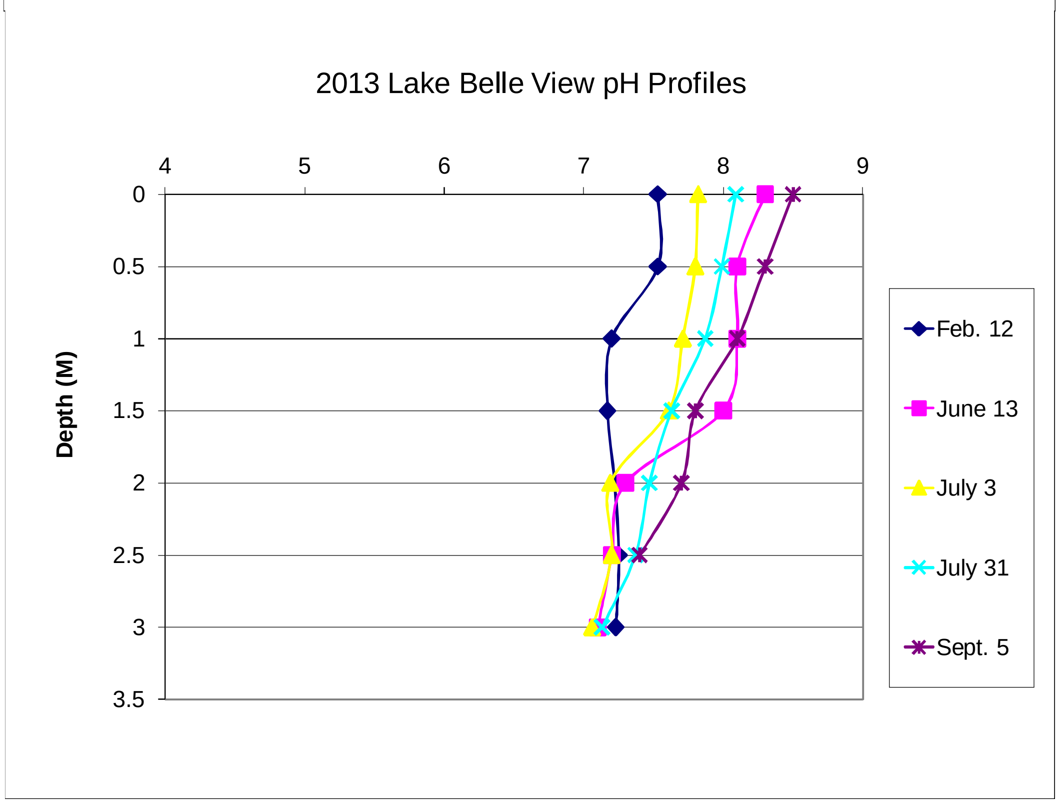
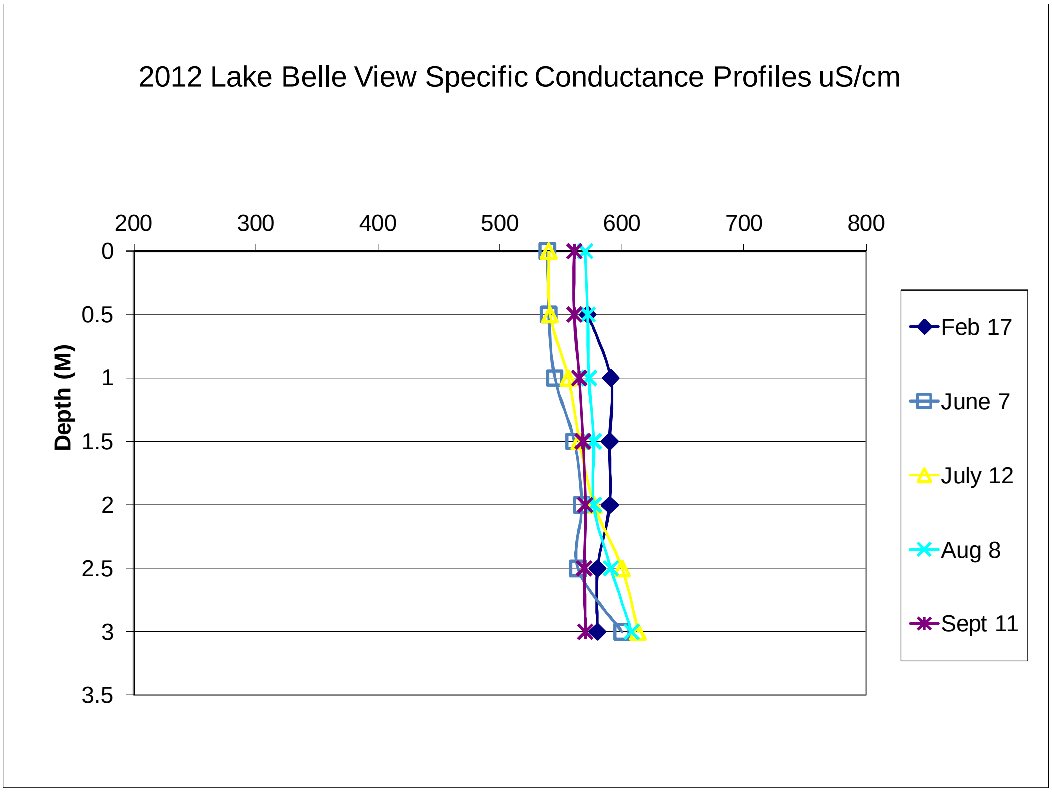
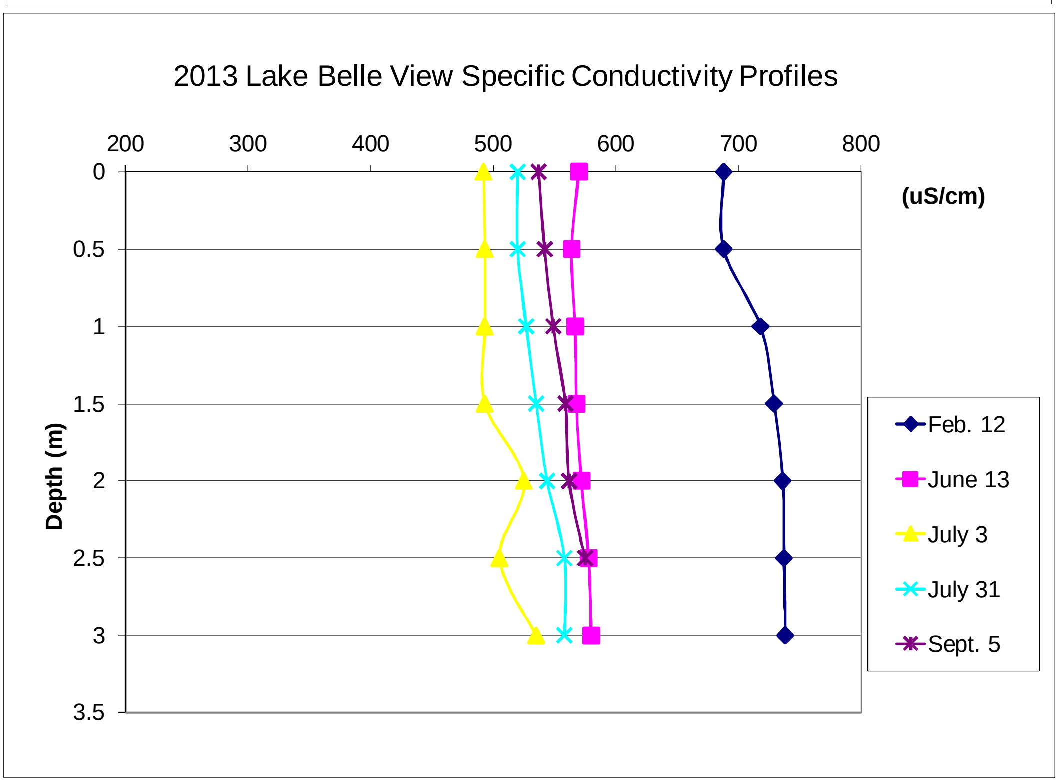


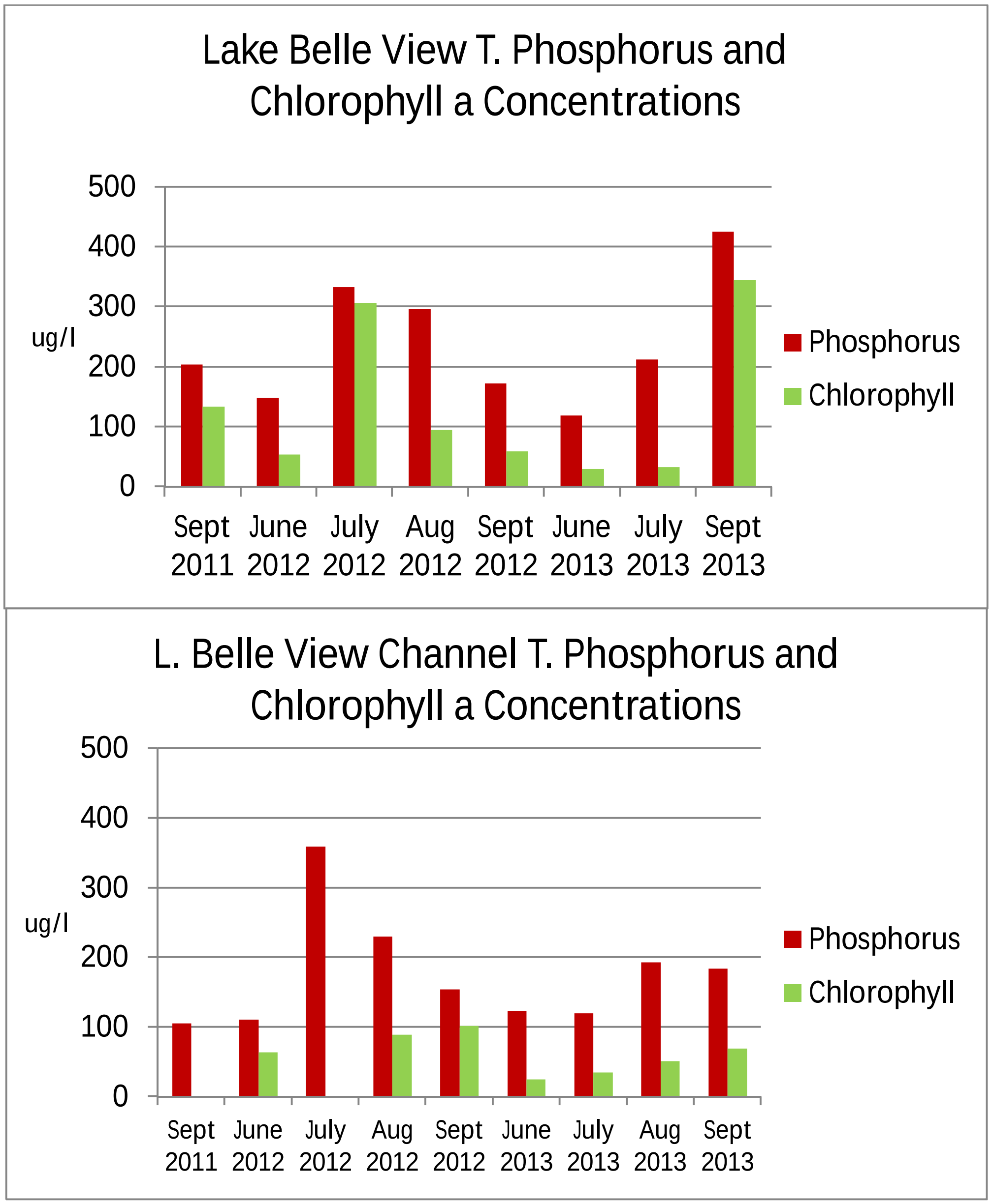
Figure 4: Lake Belle View Specific Conductance Profiles





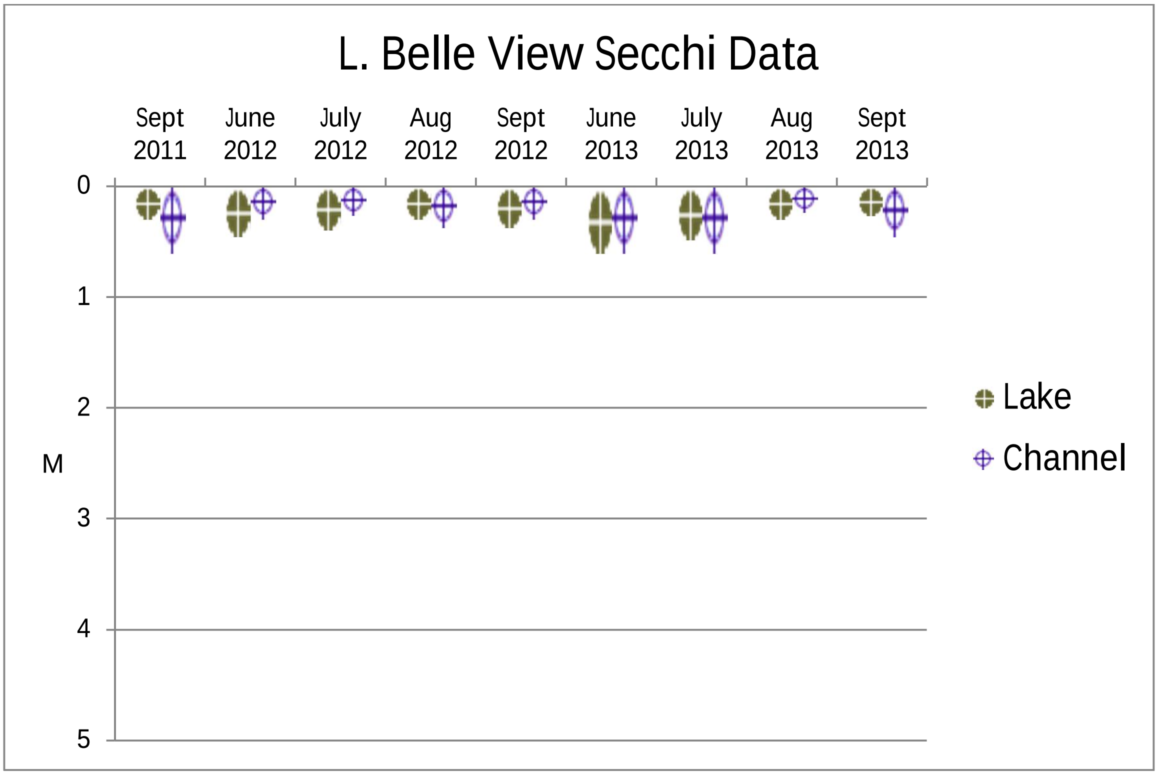
Paired samples at the deep hole and channel indicated that eutrophic conditions prevailed at both locations. Slightly lower nitrogen, phosphorus and chlorophyll concentrations were found in the channel, indicating that surface runoff from the local watershed was not likely a major problem. Detectable nitrates in the channel likely reflected groundwater inputs. High phosphorus concentrations were found throughout 2012 and 2013 and coincided with high chlorophyll a concentrations (Figure 5) and poor water clarity (Figure 6).

Figure 5: Lake Belle View Total Phosphorus and Chlorophyll a Concentrations\



Mean Concentrations: Lake T.P. = 0.24 mg/l and Channel T.P. = 0.18 mg/l, Lake T.N. = 2.56 mg/l and Channel T.N. = 2.20 mg/l, Lake Chlorophyll a = 132 ug/l and Channel Chlorophyll a = 62 ug/l.

Figure 6: Lake Belle View Secchi Data



Transformed to Trophic State Index (TSI), both secchi and phosphorus TSI values typically exceeded chlorophyll values and indicated turbidity related to carp disturbances (Figure 7). The very poor water clarity reflected a combination of phytoplankton and sediment related turbidity due to carp. In all cases, the trophic states related to the three measures reflected highly eutrophic conditions. Nitrogen data are presented in Figure 8. Phosphorus concentrations were relatively high compared with nitrogen concentrations and nutrient limitation was often indeterminate or nitrogen limited in the lake and phosphorus limited just twice in the channel (Figure 9).

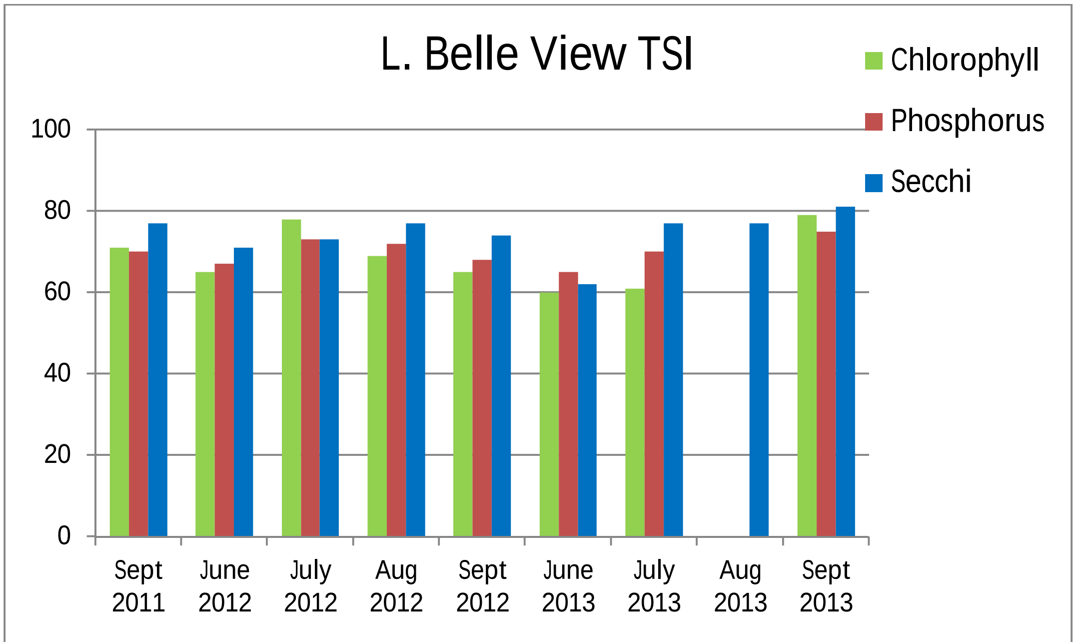
Clear water was another anticipated benefit of the watershed diversion project since the berm diverts approximately 172 square miles of agricultural and urban watershed. To assess effects of the diversion on water clarity, paired turbidity samples and 120 cm transparency tube measurements were recorded from the lake and river. As the data indicates, the common carp population in the lake significantly reduced water clarity as turbidities were significantly higher in the lake and secchi tube measurements significantly lower (Figures 10 and 11). Specific conductance levels in the river were significantly higher in the river and reflected a larger source of road salt and chlorides and other ions linked to point source discharges (Figure 12).

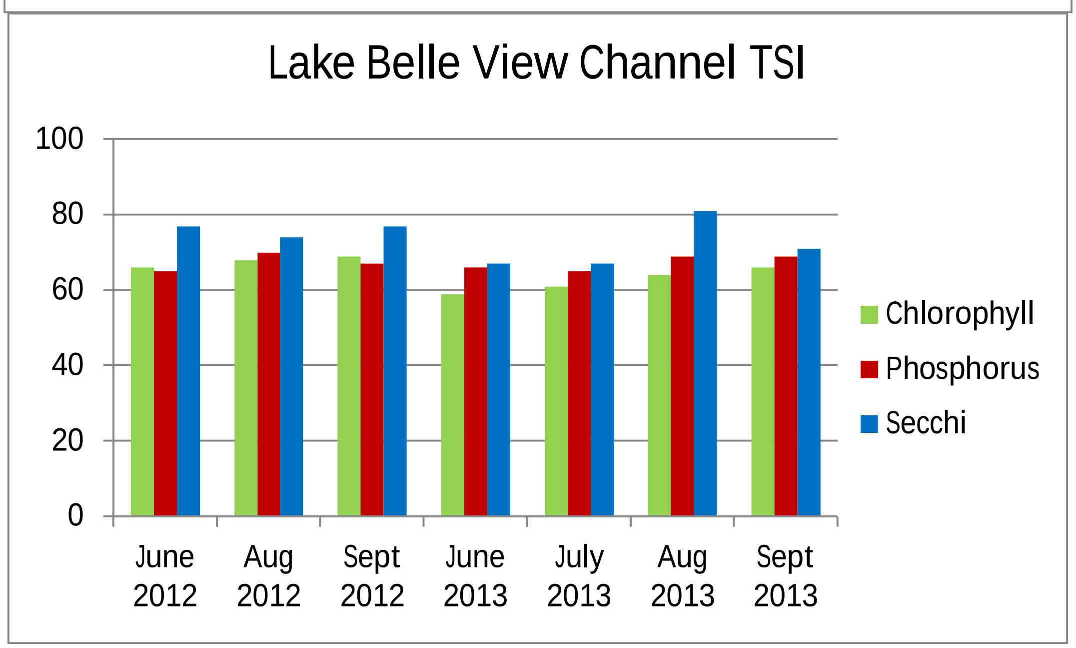
Biological

As part of the restoration, thirty fish species were introduced into newly constructed Lake Belle View including hatchery sportfish and Sugar River predator and nongame species. Nearshore electroshocking surveys were conducted in 2012 and 2013 to assess the status of the native fish.

Based on two nearshore electroshocking surveys conducted in September 2012, eight native fish species were collected along with the first confirmation that common carp had survived the construction drawdown. Another nearshore electroshocking survey was performed in May 2013 with six native species collected (Figures 13 and 14). The nearshore shocking did not reveal information concerning the status of most native fish species that were stocked in the lake, however an abundance of bluegills (*Lepomis macrochirus*) and green sunfish (*L. cyanellus*) indicate potential predation on common carp eggs and fry.

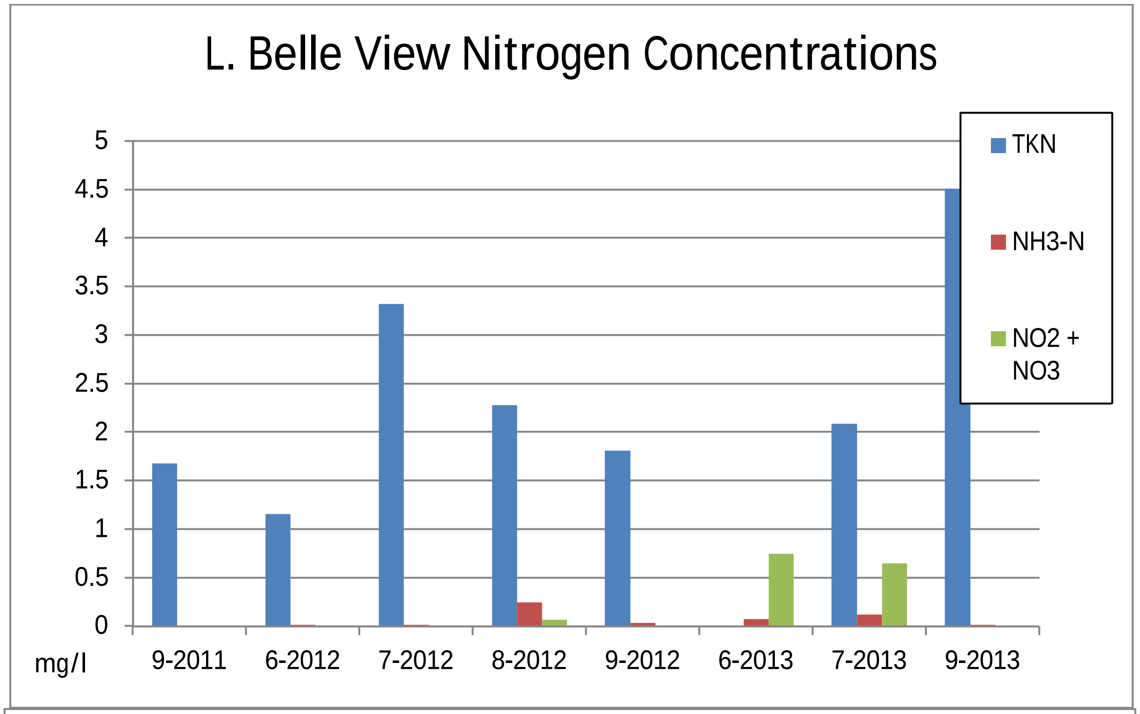
Figures 7: Lake Belle View TSI





(TSI 50 – 70 – eutrophic and > 70 = hypereutrophic)

Figure 8: Lake Belle View Nitrogen Concentrations



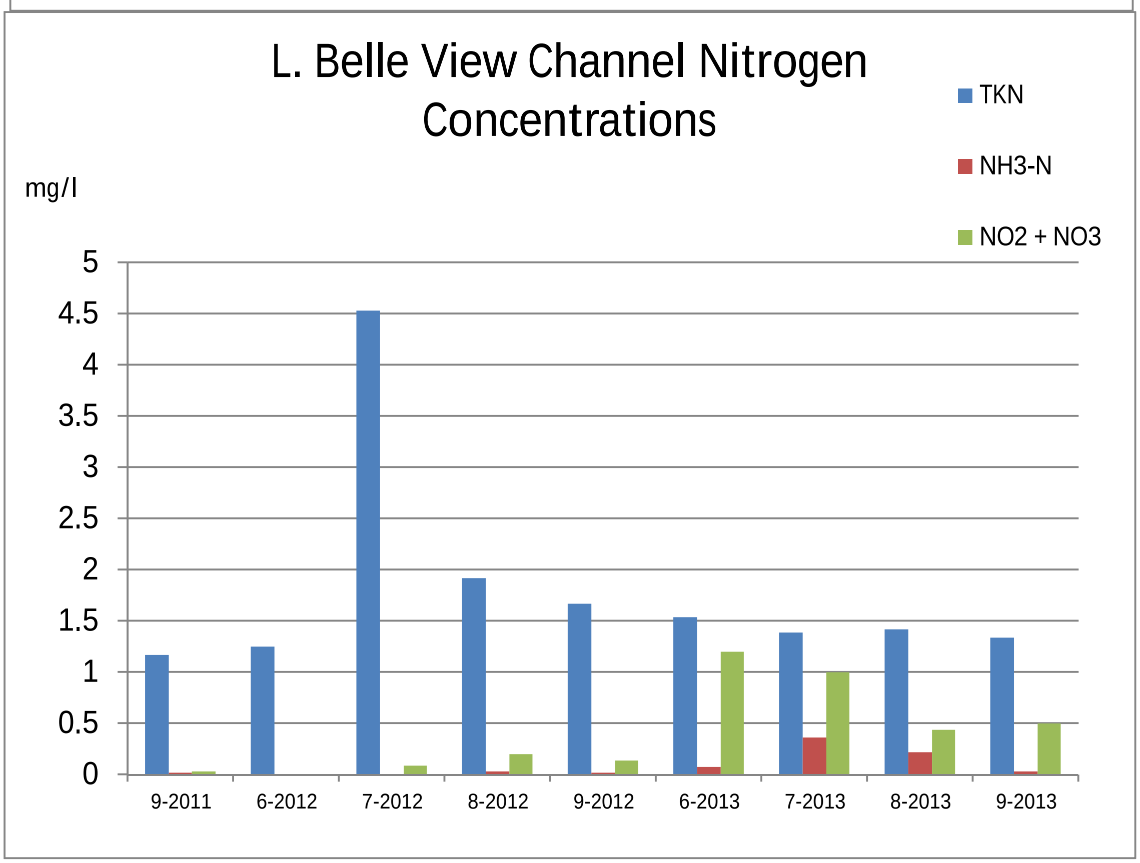
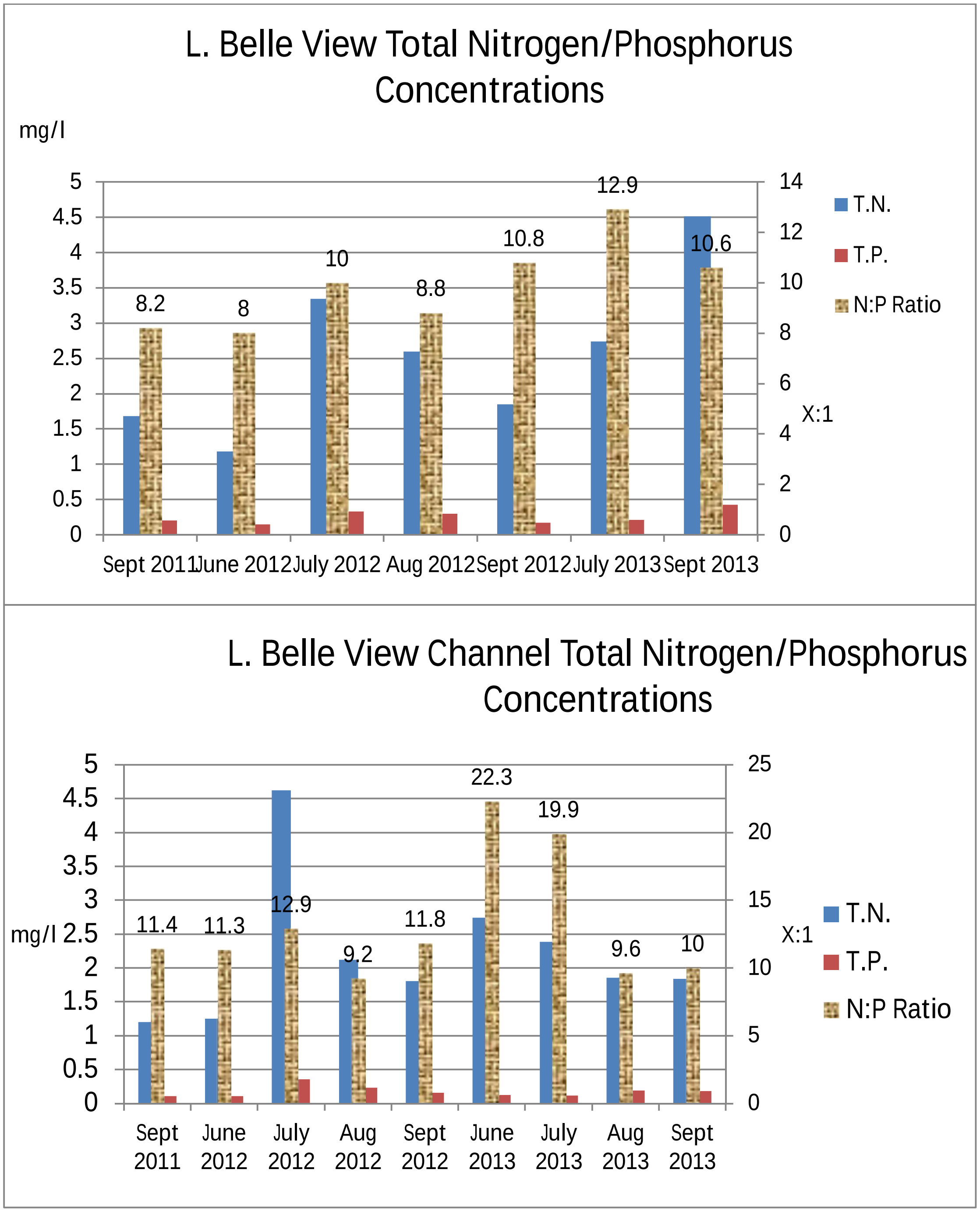
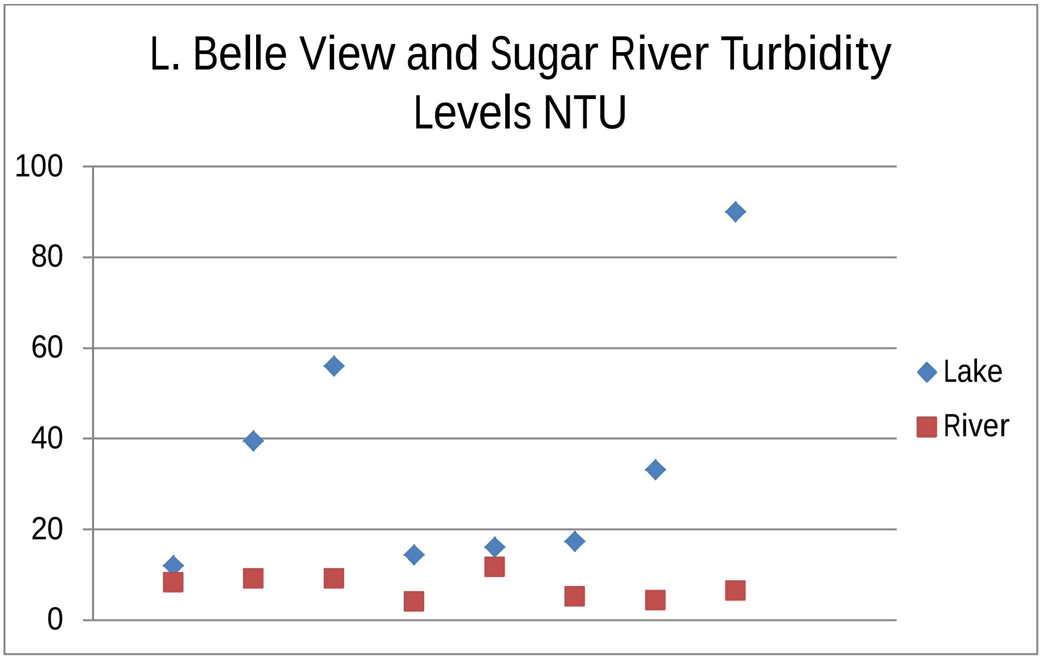


Figure 9: Lake Belle View N:P Ratios



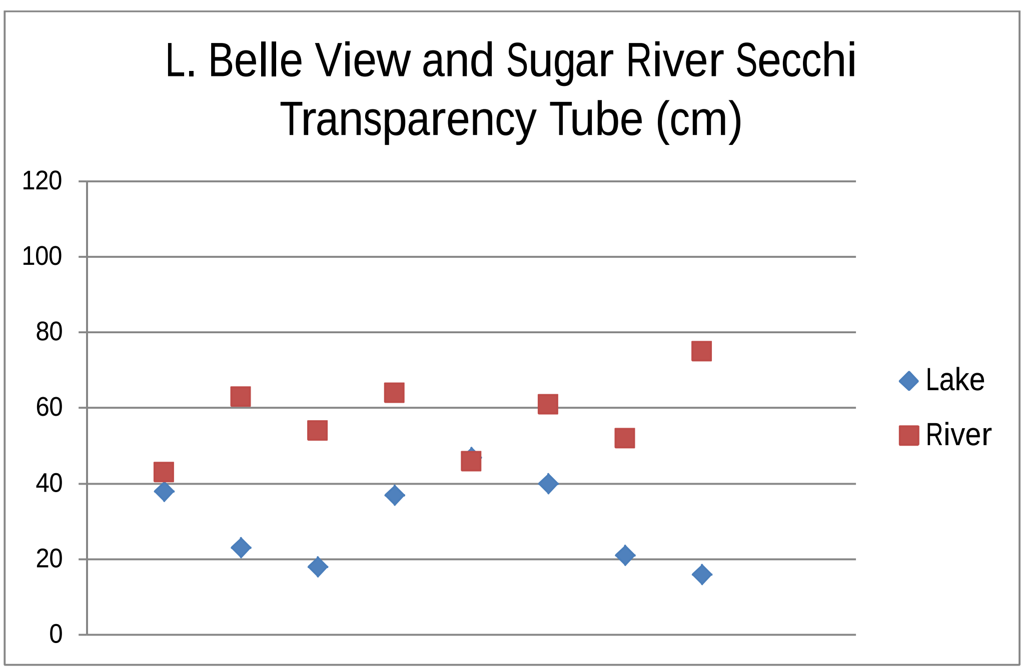
(< 10:1 indicated N limitation, 10:1 – 15:1 indeterminate, >15:1 = P limitation)

Figure 10: Lake Belle View and Sugar River Turbidity Levels (NTU)



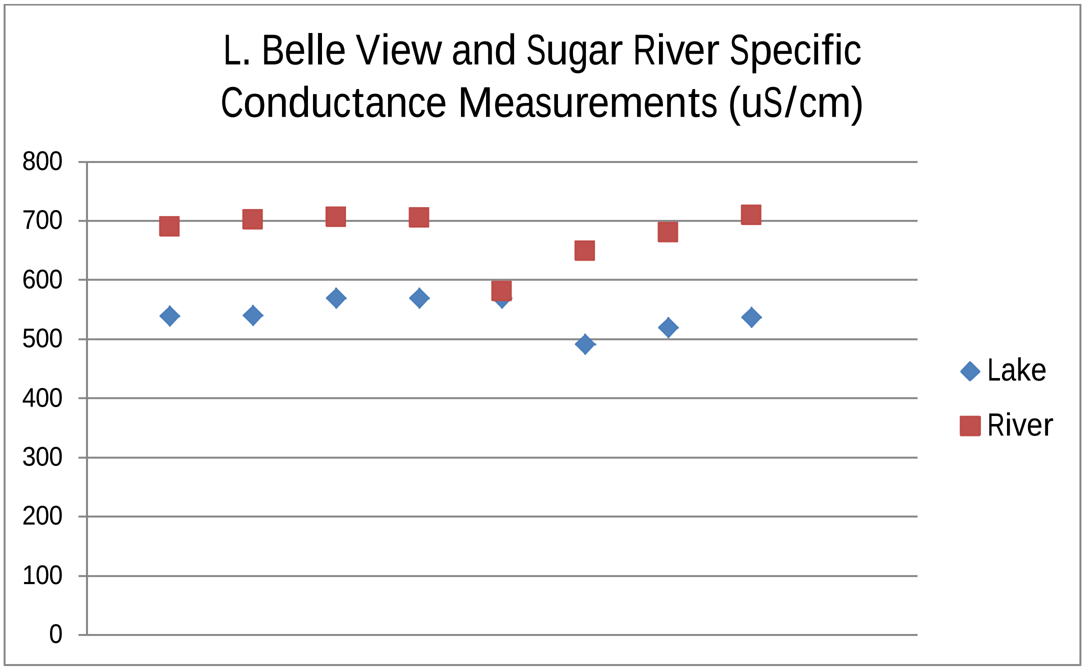
(June, July, Aug., Sept. 2012 and June, July, Aug., Sept. 2013)

Figure 11: Lake Belle View and Sugar River Secchi Tube Transparency Measurements (cm)



(June, July, Aug., Sept. 2012 and June, July, Aug., Sept. 2013)

Figure 12: Lake Belle View and Sugar River Specific Conductance Levels (uS/cm)



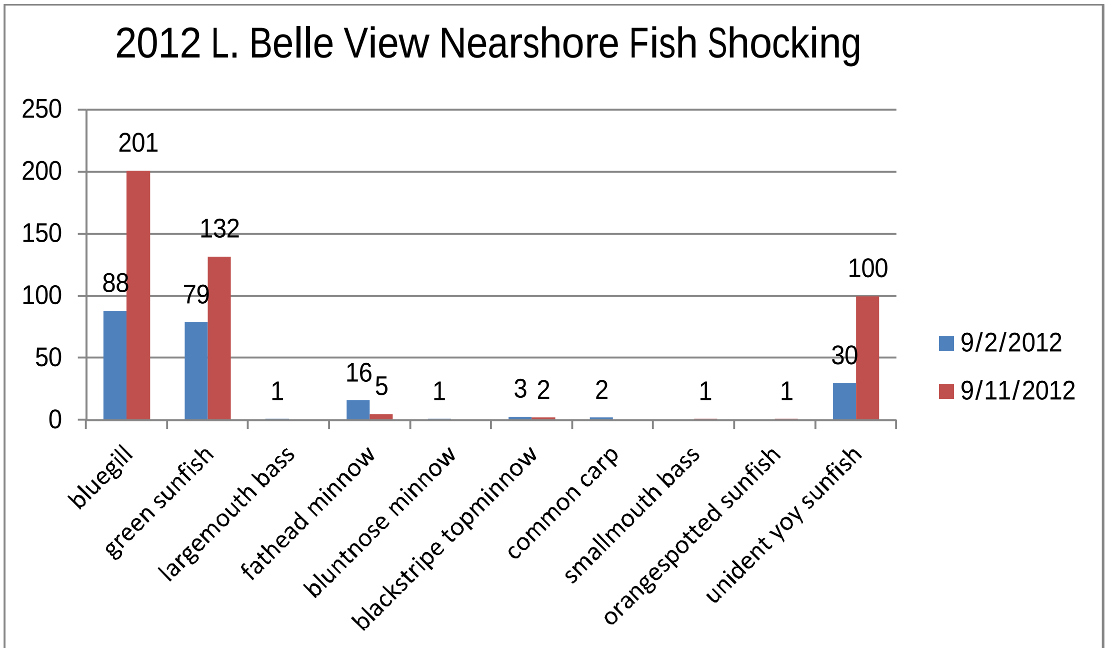
(June, July, Aug., Sept. 2012 and June, July, Aug., Sept. 2013)

While common carp were not collected during the 2013 nearshore electroshocking survey, numerous common carp catches had been reported by anglers and several were seined along the north end of the lake. Senior citizens and kids visited the lake occasionally in 2012 and 2013, reporting abundant catches of bluegills (*Lepomis macrochirus*). We also noted that the anglers had lumped in green sunfish (*Lepomis cyanellus*) as bluegills. Kids also mentioned catching occasional common carp (*Cyprinus carpio*) between 10 and 14 inches long as well as a few smallmouth bass (*Micropterus dolomieu*). On September 11, 2012, four volunteers also participated in a hook and line catch per unit effort survey designed to harvest common carp. After 7.3 hours of angling, two black bullheads (*Ameiurus melas*) and one common carp were harvested. A more detailed creel survey was not performed due to a few issues. First, the unexpected common carp population and habitat destruction had negatively affected the fish restoration effort. Secondly, anglers were discouraged from harvesting native fishes until the populations became established in the lake and therefore only catch and release anglers demonstrated an interest in fishing the new lake.

Prior to the lake restoration project, a point intercept survey of the former millpond demonstrated that few rooted plants existed and were limited to very low densities of sago pondweed (*Potamogeton pectinatus*) with a frequency of only 18.2%. Benthic filamentous algae (Cyanobacteria) dominated at that time with a frequency of 72.7%. In 2013, no macrophytes were found at the established point intercept sites. The updated surveys demonstrated that the common carp population had severely impacted the plant community restoration effort with just small patches of white water lilies (*Nymphaea odorata*), long-leaf pondweed (*P. nodosus*), arrowhead (*Sagittaria latifolia*) and sago pondweed occurring along the south, west and north nearshore areas of the lake.

Lacking macrophyte suppression, planktonic algae contributed to the poor water clarity of the lake in 2012 and 2013. In 2013, microscopic analysis revealed that Cyanobacteria dominated the lake phytoplankton. Table 1 lists the species identified by Gina LaLiberte with WDNR ISS.

Figure 13: Lake Belle View Nearshore Fish Shocking Results



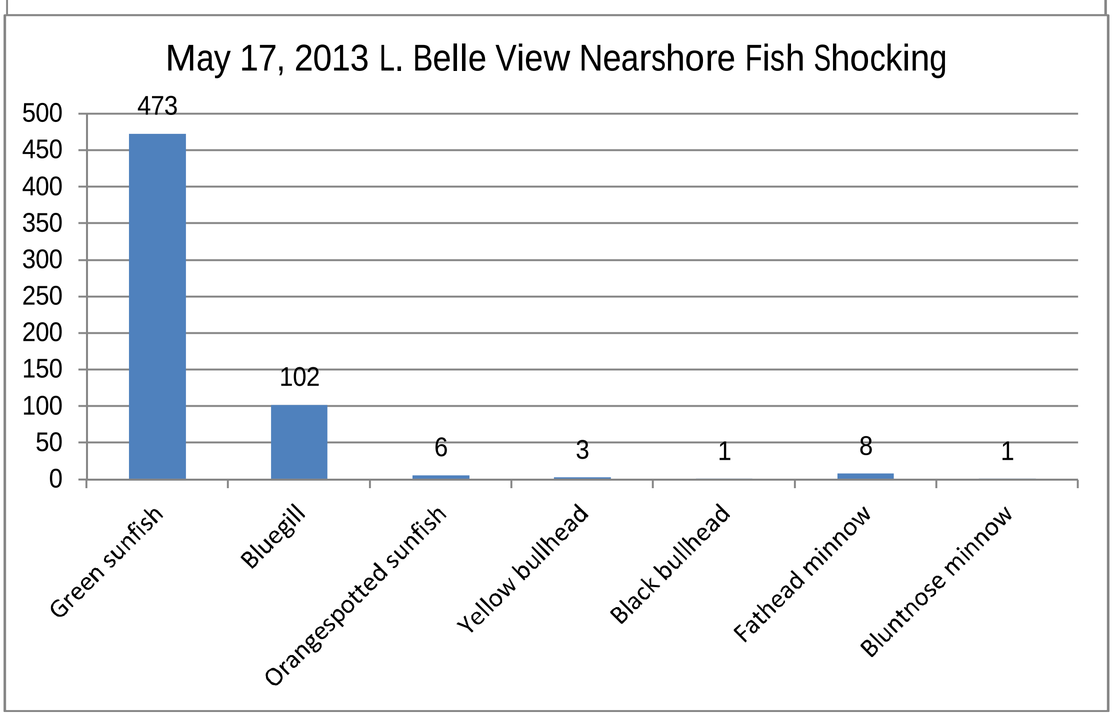


Figure 14: Estimated Numbers of Green Sunfish and Bluegills per Shoreline Mile

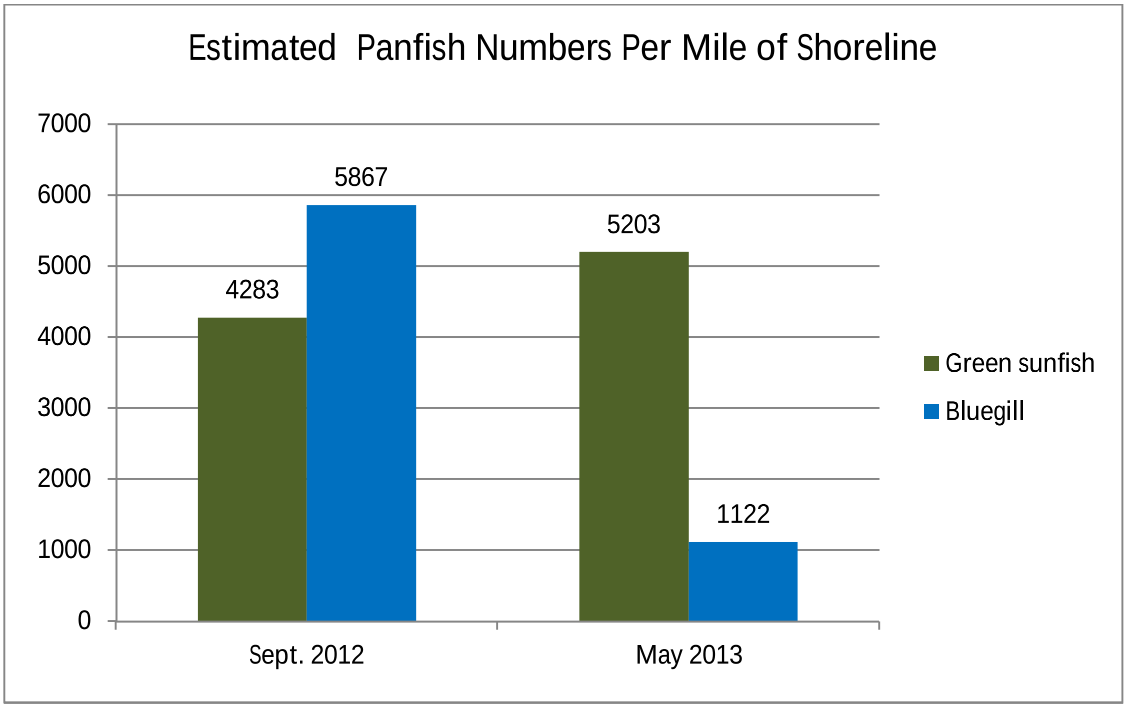


Table 1: Lake Belle View Phytoplankton Population (Aug. 15, 2013)

Species	Cell Count / ml
Chlamydomona	255
Chlorella	6,785
Cosmarium	28
Cryptomonas	653
Cyclotella	369
Euglena	85
Microcystis aeroginosa	13,597
Oocystis	738
Scenedesmus	227
Stephanodiscus	85

Watershed Area, Land Uses and Estimate WILMS Annual Phosphorus Loading

The watershed diversion berm changed the lake catchment area from 172 square miles of mostly agriculture and urbanization to just 161 acres of residential (109 acres), light industrial (27 acres) and row crop (25 acres). The catchment area and phosphorus loading changes represented approximately 99.9% reductions. Figure 15 displays reductions in both catchment area and WILMS estimated annual phosphorus loads.

Event Monitoring Results

Grab samples of storm water runoff into Lake Belleville were collected during the summer of 2012. Very few rainfall events occurred given the extensive drought experienced during this time period. However the pollutant concentrations from the rain events collected in August and September of 2012 were on the low side of those that would typically be expected from urban runoff (Table 2).

Table 2: Event Monitoring Results

8/9/12 Total Rainfall = 0.6"

River St. Grab:	BOD = 14.9 mg/l	TSS = 74 mg/l	
Kari St. Grab:	BOD = 15.9 mg/l	TSS = 50 mg/l	

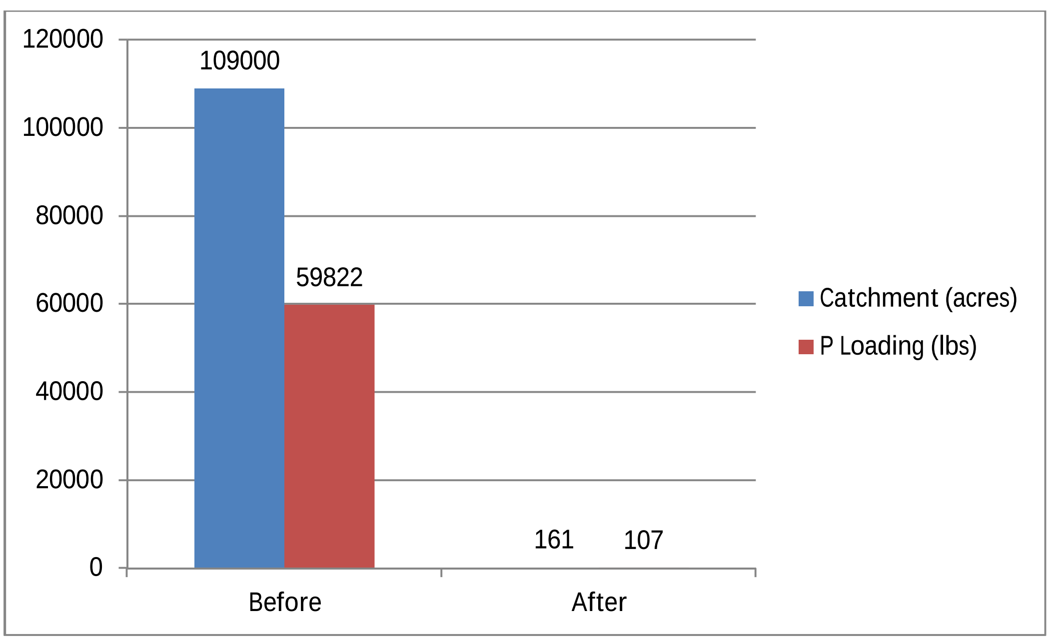
8/15/12 Total Rainfall = 1.2"

River St. Grab:	BOD = 9.6 mg/l	TSS = 14 mg/l	TP = 0.21 mg/l
Kari St. Grab:	BOD = 14.1 mg/l	TSS = 206 mg/l	TP = 0.25 mg/l

9/25/2012 Total Rainfall = 1.0"

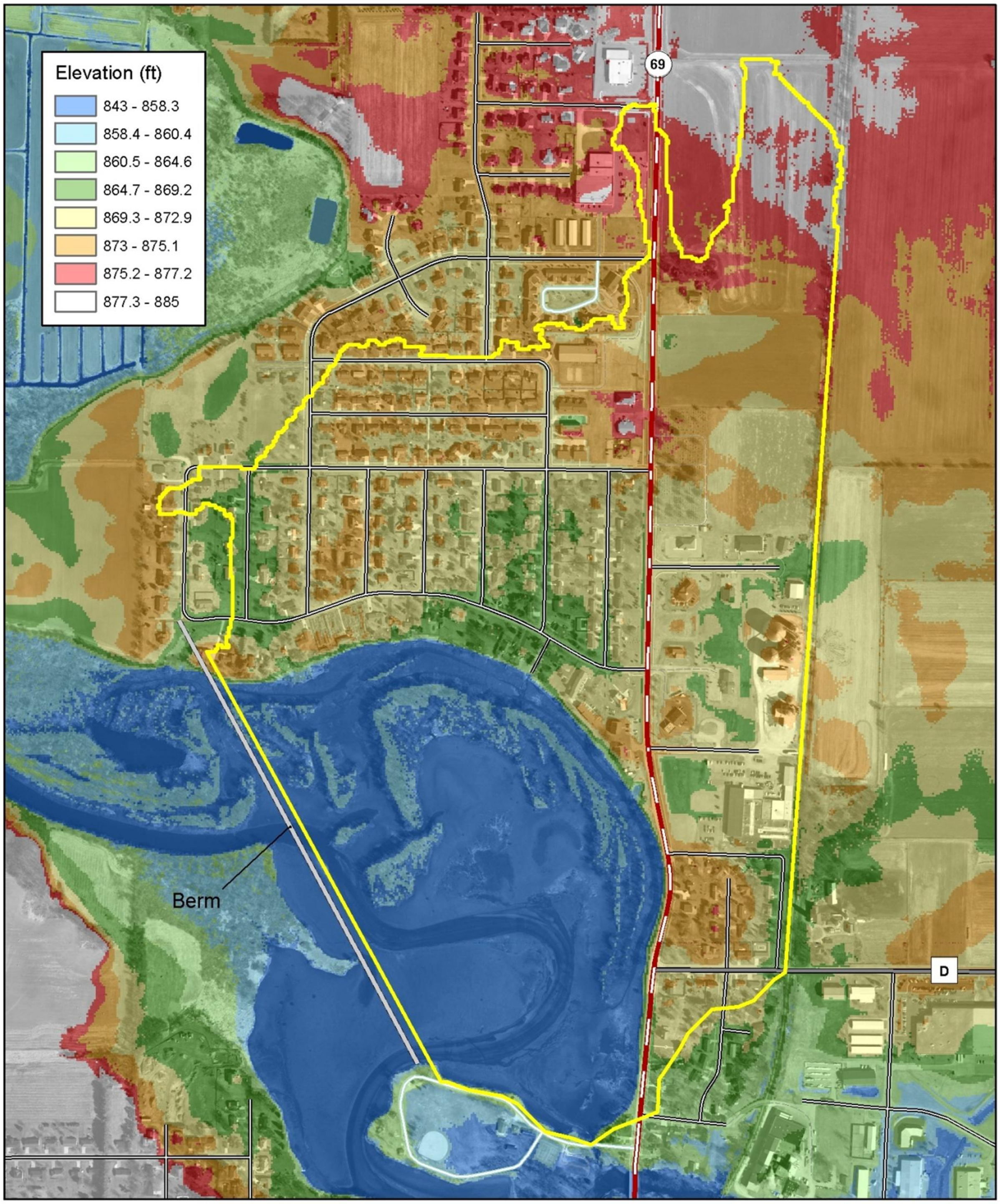
River St. Grab:	BOD = 7.4 mg/l	TSS = 27 mg/l	TP = 0.23 mg/l
Kari St. Grab:	BOD = 5.2 mg/l	TSS = 7 mg/l	TP = 0.11 mg/l

Figure 15: Changes in L. Belle View Catchment Area and Estimated Annual Phosphorus Loads



Lake Belle View Watershed Area

Watershed area (~180 acres without lake) was delineated using 10' cell size DEM (2009) with manual adjustment. Map created November 2013 by Dane Co. LWRD.



Projected TSI Targets

If the abundant common carp in Lake Belle View can be eliminated or significantly reduced, water quality conditions will likely improve. To establish realistic water quality targets, we looked at water quality data from 13 Lower Wisconsin River shallow macrophyte dominated floodplain lakes that were sampled from 2008-10. If the carp can be controlled, then macrophytes should expand significantly and suppress phytoplankton. Shallow productive floodplain lakes typically have higher phosphorus TSI compared with chlorophyll a and secchi due to phytoplankton suppression. Based on the median TSI results from the 13 Lower Wisconsin River floodplain lakes, the data suggest that phosphorus, chlorophyll a and secchi TSI targets of 54, 47 and 49 respectively are realistic for weedy shallow off channel lakes.

Government Institutional Analysis

The Village of Belleville has adopted a comprehensive stormwater management ordinance based on Dane County's model. Chapter 450 of Belleville's ordinance describes their required stormwater management and erosion control requirements. This ordinance controls building construction, grading, and controls required for development within the new lake's watershed. In addition the village has a stormwater utility which they use for financing various stormwater control systems.

In the new lake's watershed, future development in the industrial park area would be controlled through additional stormwater basins. For new developments, the ordinance requires retention of soil particles greater than five microns on the site (80% reduction) resulting from a one year, twenty four hour storm even, according to approved procedures and assuming no sediment re-suspension.

For redevelopment resulting in exposed surface parking lots and associated traffic areas, design practice to retain soil particles greater than 20 microns on the entire site are required.

Discussion and Conclusion

By spring of 2011, the hydrologic budget analysis accurately predicted that local groundwater flow was sufficient to sustain the lake water level. At this early stage in the restoration, a stable ecosystem had not been established and a major Hydrodictyon (*Hydrodictyon reticulatum)* bloom had covered a significant area of the lake. Thanks to rapid response from Dane County Department of Land and Water Resources, a mechanical harvester removed most of the nuisance. Greater ecosystem stability was predicted later that year as native macrophytes and fish populations were planted in the lake. However, the ecosystem instability continues due to an unexpected common carp population. Efforts to eliminate or reduce the carp can result in significant water quality and ecosystem improvements. However, even with the carp, the project has been a major success given the recreational opportunities associated with this project including hiking, swimming, paddling and wildlife viewing. The restored off-channel Lake Belle View offers significant improvements compared to the former highly degraded millpond. And panfish populations, as potential carp egg/fry eaters, have successfully expanded in the new lake and are numerous.

Recommendations

1. Hire commercial fisherman to significantly reduce the common carp population.

2. Continue to monitor lake water quality and native fish populations to determine responses to the carp eradication efforts.

3. Continue to assess stormwater runoff within the Lake Belle View catchment.

Lake Belle View Deep Hole Profiles Data

D.O.	2/17/2012	6/7/2012	7/12/2012	8/8/2012	9/11/2012
0		14.5	16.9	8.3	5.8
0.5	11.2	11.4	13.4	7.3	5.5
1	8.8	9.4	6.6	5.9	4.6
1.5	8.8	2.3	3.8	3.3	4.1
2	7.7	0.6	0.2	2.5	3.8
2.5	7.7	0.2	0.1	0.2	3.6
3	3.6	0.17	0.1	0.2	1.9
D.O.	2/12/2013	6/13/2013	7/3/2013	7/31/2013	9/5/2013
0	15	10	6	8.9	15.5
0.5	15	10.1	6	6.9	13.5
1	8.8	9.4	6	6.2	8.9
1.5	6.8	9.1	3.9	3.9	5.3
2	5.7	2.4	1.7	3.7	4.9
2.5	4.1	0.6	1.4	3.2	2.9
3	3.2	0.2	0.2	0.2	
Temp C	2/17/2012	6/7/2012	7/12/2012	8/8/2012	9/11/2012
0		27	28.9	26.3	20.4
0.5	5	23.9	26.9	26.1	20.4
1	5.1	21.9	26.3	26	20.3
1.5	5.2	20.9	26	25.6	20.3
2	5.2	20.4	25.5	25.5	20.3
2.5	5.2	18.8	22.3	24.9	20.3
3	5.2	17.2	22	23.6	20.3
Temp.	2/12/2013	6/13/2013	7/3/2013	7/31/2013	9/5/2013
0	7	25.3	22.5	24.8	24.4
0.5	7	25.3	22.5	21.4	24.2
1	3	25	22.5	20.8	22.7
1.5	3.5	24.9	22.5	20.4	22.2
2	3.5	21.4	21.7	20.2	22.1
2.5	3.5	19.7	21.4	20.1	21.6
3	3.5	17.8	20.7	19.8	

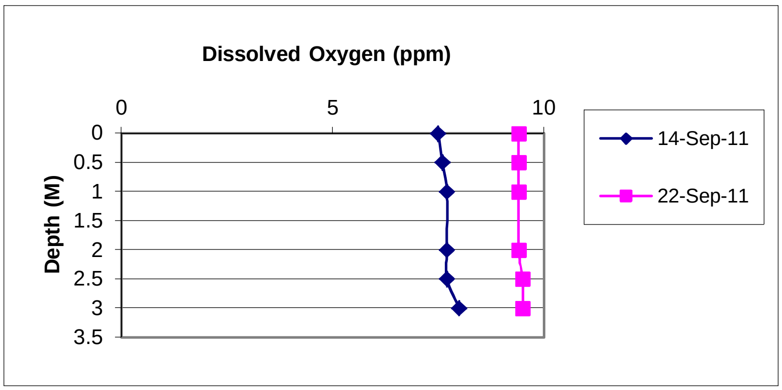
pH	2/17/2012	6/7/2012	7/12/2012	8/8/2012	9/11/2012
0		8.82	8.9	8.58	8.07
0.5	7.84	8.58	8.6	8.42	8.1
1	7.8	8.29	8.2	8.26	8.1
1.5	7.78	7.53	7.4	7.93	7.96
2	7.77	7.4	7.3	7.76	7.85
2.5	7.76	7.43	7	7.28	7.82
3	7.76	7.07	6.9	6.89	7.66

Column1	Column2	Column3	Column4	Column5	Column6
pH	2/12/2013	6/13/2013	7/3/2013	7/31/2013	9/5/2013
0	7.53	8.3	7.82	8.09	8.5
0.5	7.53	8.1	7.8	7.99	8.3
1	7.2	8.1	7.71	7.87	8.1
1.5	7.17	8	7.61	7.63	7.8
2	7.22	7.3	7.19	7.47	7.7
2.5	7.25	7.2	7.2	7.37	7.4
3	7.23	7.1	7.06	7.13	
Sp. Cond.	2/17/2012	6/7/2012	7/12/2012	8/8/2012	9/11/2012
0		539	540	570	561
0.5	572	540	541	572	561
1	591	545	556	573	565
1.5	590	561	565	577	568
2	590	567	577	577	570
2.5	580	564	600	591	569
3	580	600	613	608	570
Sp Cond	2/12/2013	6/13/2013	7/3/2013	7/31/2013	9/5/2013
0	688	570	492	520	537
0.5	688	564	493	520	542
1	718	567	493	527	549
1.5	729	568	493	535	559
2	736	572	525	544	562
2.5	737	578	505	558	575
3	738	580	535	558	

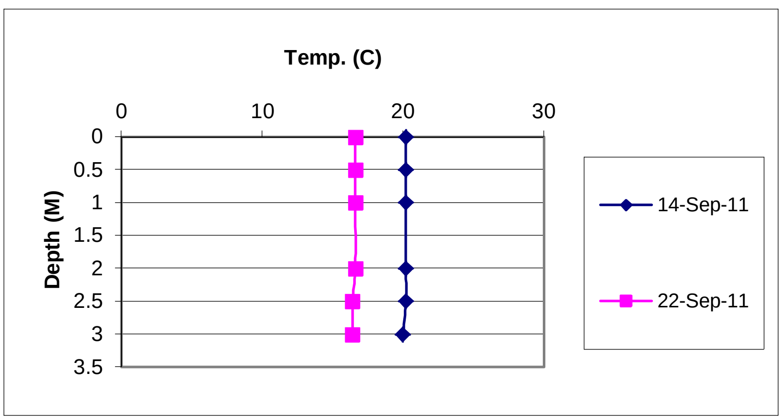
	Secchi (M)							
	June 2012	July 2012	Aug 2012	Sept 2012	June 2013	July 2013	Aug 2013	Sept 2013
Lake	0.46	0.4	0.3	0.38	0.61	0.49	0.3	0.27
Channel	0.3	0.27	0.38	0.3	0.61	0.61	0.24	0.46

2011 Lake Belle View Water Quality Monitoring Summary (Field Data)

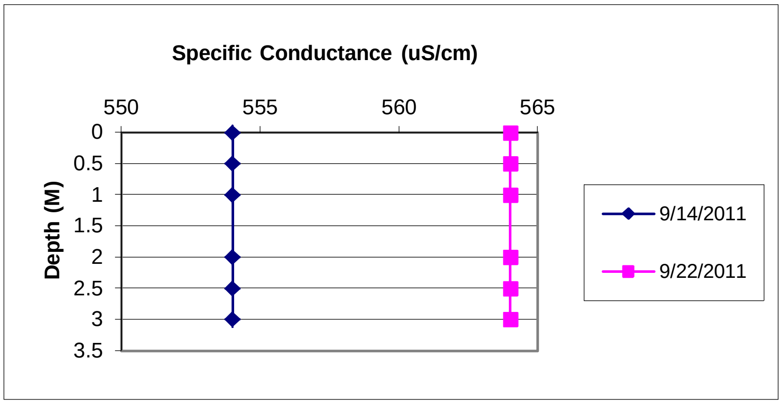
Dissolved oxygen levels remained above the water quality criterion level of 5 mg/l throughout the water column on September 14 and 22.

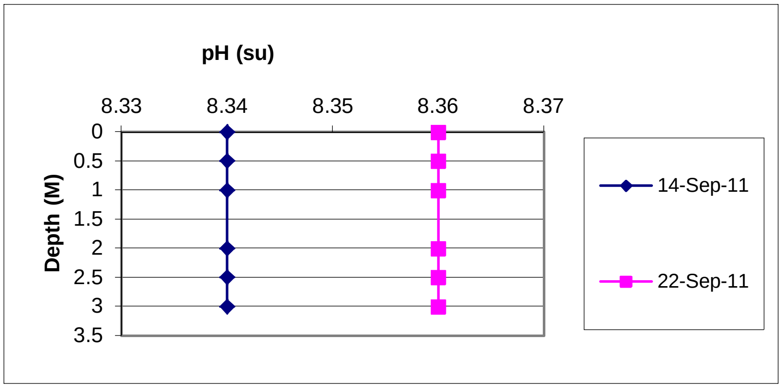


Vertical temperature levels indicated that the lake was well mixed in September.



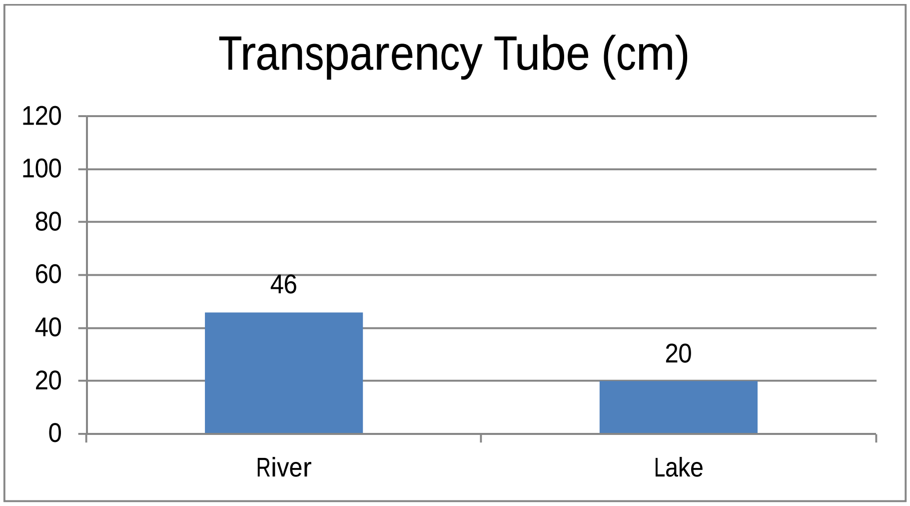
Specific conductance and pH mirrored the mixed water column as well.

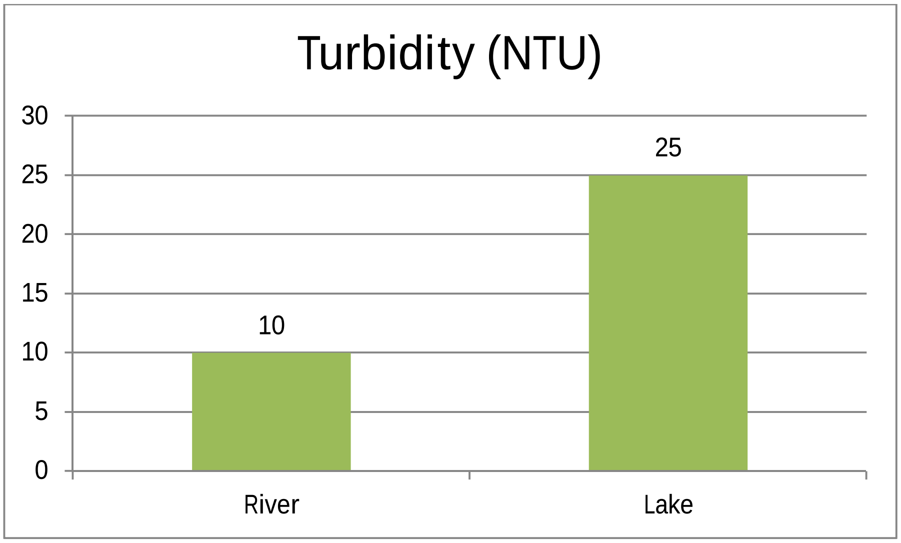




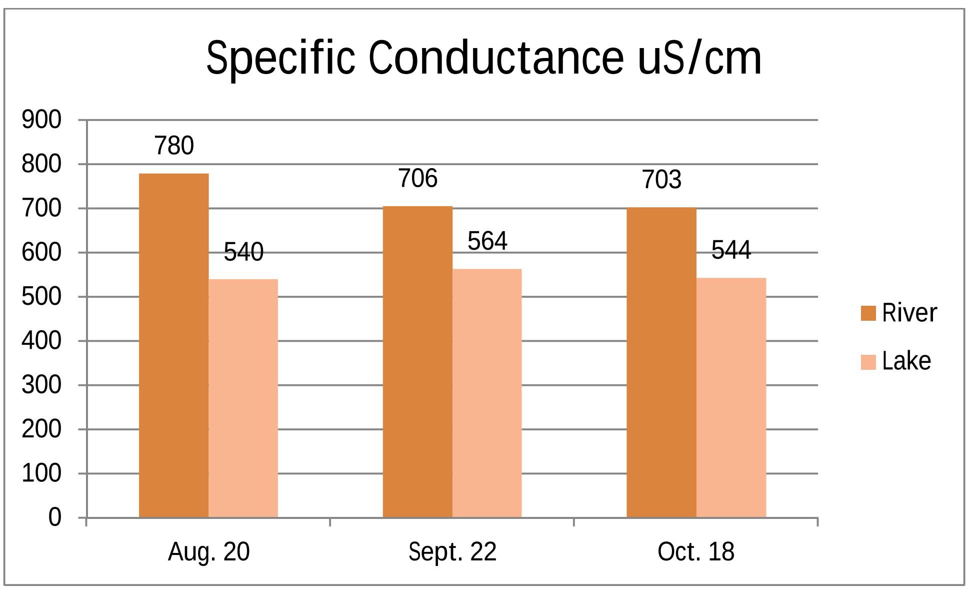
Wind and lack of aquatic vegetative cover over the sediment resulted in turbid conditions based on secchi measurements of 1' (0.31 M) on September 14 and 1.2' (0.37 M) on September 22.

Unlike the summer months, the river water clarity was better in September than in the lake due to the factors mentioned above.

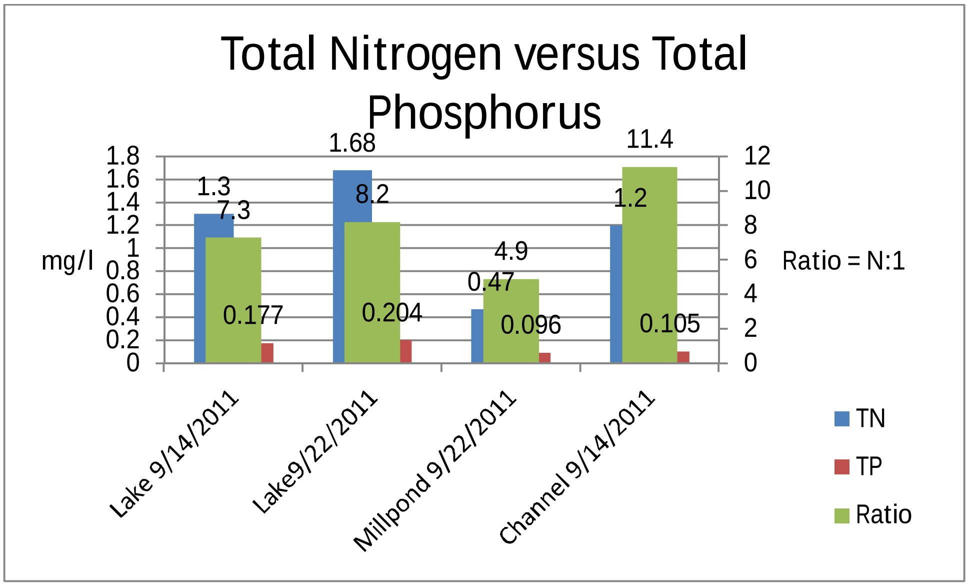




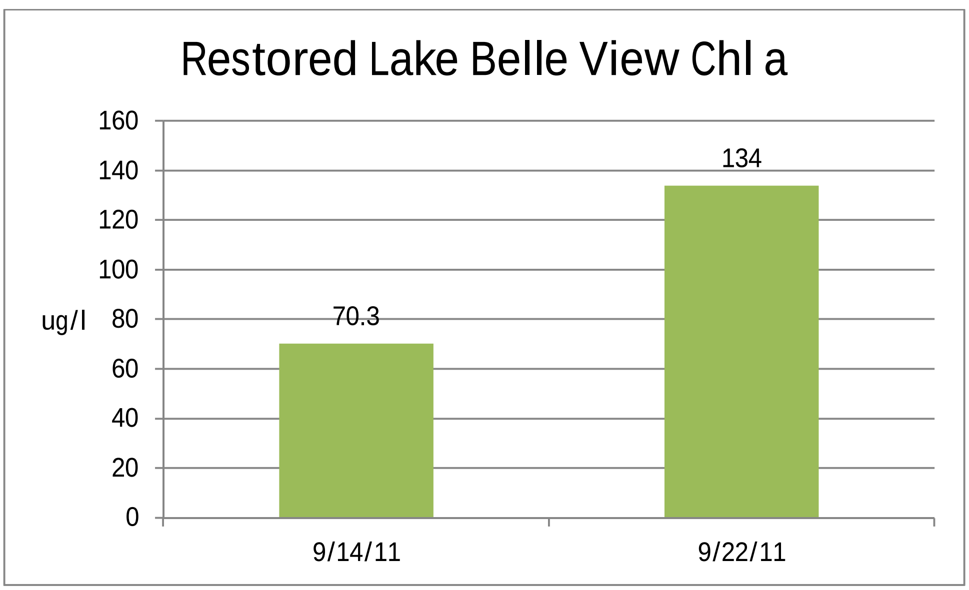
The specific conductance levels in the river were significantly higher than measured in the lake and reflect higher total dissolved solids discharged from the Mt. Horeb wastewater treatment plant to the West Branch Sugar River and Madison Metropolitan Sewerage District discharge to Badger Mill Creek. The levels found in the lake are more typical of groundwater and surface water that drain limestone topographies and therefore reflect better water quality.



2011 State Lab of Hygiene Sample Results



This graph compares total phosphorus with total nitrogen data. Phosphorus concentrations were very high and relatively high in comparison with total nitrogen. In three of four samples, the total nitrogen to total phosphorus ratio was less than 10:1. This occurs in only about 10% of Wisconsin lakes and indicates nitrogen limitation. Given the disturbance conditions that we observed soon after the lake had been constructed, these results likely will not reflect water quality once aquatic vegetation becomes well established in the lake. For that reason, the secchi, total phosphorus and chlorophyll a samples were not converted to Trophic State Index (TSI) and will not likely reflect typical growing season conditions.



Consistent with total phosphorus levels, chlorophyll a concentrations were very high. While water clarity was very low based on secchi depths, the turbid conditions primarily reflected suspended filamentous algae due to wind currents. The high phosphorus and chlorophyll concentrations and poor water clarity likely reflected temporary disturbance conditions that will change/improve once rooted vegetation becomes established in the lake.

Lake Belle View Field Data

Temp C				9/22/2011	River	Lake	Units
Depth (m)	9/14/2011	9/22/2011		Trans tube	46	20	cm
0	20.2	16.6		Turb	10	25	NTU
-0.5	20.2	16.6		pH	8.35	8.36	s.u.
-1	20.2	16.6		Cond.	706	564	uS/cm
-2	20.2	16.5					
-2.5	20.2	16.4			9/14/2011	9/22/2011	
-3	20	16.4		secchi	0.31	0.37	(m)
D.O. mg/l							
Depth (m)	9/14/2011	9/22/2011					
0	7.5	9.4					
-0.5	7.5	9.4					
-1	7.6	9.4					
-2	7.7	9.4					
-2.5	7.7	9.5					
-3	8	9.5					
pH s.u.							
Depth (m)	9/14/2011	9/22/2011					
0	8.34	8.36					
-0.5	8.34	8.36					
-1	8.34	8.36					
-2	8.34	8.36					
-2.5	8.34	8.36					
-3	8.34	8.36					
Cond. uS/cm							
Depth (m)	9/14/2011	9/22/2011					
0	554	564					
-0.5	554	564					
-1	554	564					
-2	554	564					
-2.5	554	564					
-3	554	564					