



2013 Annual Wetland Monitoring Report

for the

Platte West Water Production Facilities Project



METROPOLITAN
UTILITIES DISTRICT

Project No. 60787

January 2014

2013 Annual Wetland Monitoring Report

for the

Platte West Water Production Facilities Project

prepared for

**Metropolitan Utilities District
Omaha, Nebraska**

January 2014

Project No. 60787

prepared by

**Burns & McDonnell Engineering Company, Inc.
Kansas City, Missouri**

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EXECUTIVE SUMMARY

The Metropolitan Utilities District (District), Omaha, Nebraska, was issued a Section 404 Individual Permit (Permit) on May 16, 2003, from the U.S. Army Corps of Engineers, Omaha District (Corps), for the Platte West Water Production Facilities Project (Project) (U.S. Army Corps of Engineers 2003). As part of the terms and conditions included in the Corps Section 404 Permit, the wetlands located in the well fields and projected cones of depression must be monitored to determine the extent of any impacts to wetlands that may take place as a result of Project operation. To comply with this condition, a Wetland Monitoring Plan was prepared and approved in 2005 and is now being implemented (Burns & McDonnell 2005a).

As part of the Wetland Monitoring Plan, vegetation monitoring of the wetlands in the well fields was conducted in June and September 2013 to characterize major wetland and upland plant communities and the variation between them. This sampling effort represents the fourth year of monitoring during operation of the water treatment plant. Vegetation sampling took place in sample plots along permanent transects and gradsects established in each wetland ecosystem. Data obtained during 2013 has been analyzed and compared to baseline data and the results are discussed in this annual report and included in Appendix I.

In 2013, the Level 2 Decreased Annual Wetland Monitoring protocol was initiated with the understanding that data analysis would be completed following the spring monitoring effort at which point a determination would be made regarding the next step in monitoring. This analysis was completed and submitted to the District and the Corps prior to the fall monitoring effort. The analysis prompted the recommendation to perform an additional monitoring effort at two of the three PEM wetlands (W-25 and W-100) in September 2013. W-68 remained within normal ranges and it was decided that an additional monitoring effort in 2013 was unnecessary at that wetland.

As a result of the conditions observed in the wetlands discussed in this report, it is recommended that wetland monitoring efforts in 2014 continue without changes to the methodology at wetlands W-68 in Douglas County and W-25 in Saunders County. Level 2 decreased monitoring is conducted once annually at these wetlands and will continue to rotate between the June and September sampling seasons. Since 2013 vegetation monitoring was originally scheduled for June, wetland monitoring will be conducted in September 2014 at these wetlands.

Additionally, it is recommended that the monitoring intensity at W-100 be increased to Level 1 Decreased Monitoring with monitoring efforts scheduled for both spring and fall in 2013. W-100 differs from the other monitored wetlands described in this report in that it is underlain by a sandy layer rather than a thick clay layer. Additionally, W-100 is located much farther from the Platte River and, therefore, is not as directly tied to the river water elevation compared to W-68 and, to a lesser extent, W-25. If the mean weighted average (WA_M) value and other vegetative indices at W-100 continue to show statistically significant changes, the level of monitoring intensity at W-100 may continue to be increased or an impact may be occurring which will be discussed with the District and the Corps.

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1.0 INTRODUCTION

The Metropolitan Utilities District (District), Omaha, Nebraska, was issued a Section 404 Individual Permit (Permit) on May 16, 2003, from the U.S. Army Corps of Engineers, Omaha District (Corps), for the Platte West Water Production Facilities Project (Project) (U.S. Army Corps of Engineers 2003). As part of the terms and conditions included in the Corps Section 404 Permit, the wetlands located in the well fields and projected cones of depression must be monitored to determine the extent of any impacts to wetlands that may take place as a result of Project operation. To comply with this condition, a Wetland Monitoring Plan was prepared and approved in 2005 and is now being implemented (Burns & McDonnell 2005a).

As stated in Permit Condition 37: “The purpose of the monitoring is to identify any changes in the existing or future wetlands or aquatic sites impacted as a result of project development and operation.” Both temporary and permanent impacts to wetlands are expected to result from the construction and operation of the Project, which is located in Douglas and Saunders Counties, Nebraska. The 2005 Wetland Monitoring Plan presents a systematic, multi-tiered approach to monitor wetlands within the Douglas County and Saunders County well fields and their associated cones of depression to evaluate any impact due to the operation of the Project.

Wetlands selected for monitoring were chosen from those identified during the delineations conducted in the well fields (Burns & McDonnell 2004) and in the cones of depression (Burns & McDonnell 2005b). Monitoring of wetlands in accordance with the Wetland Monitoring Plan was initiated in June 2005. Annual monitoring reports, characterizing each year’s monitoring effort (2005 through 2007) and culminating in the *Baseline Wetland Monitoring Report*, were submitted for each year of baseline monitoring (Burns & McDonnell 2006a, 2007a, 2008, 2009). Monitoring through spring of 2008 was conducted to characterize the baseline conditions of the wetlands prior to initiation of Project operation. The Project began producing water for municipal use during the summer of 2008; therefore, the monitoring efforts from fall 2008 through the present are considered operational.

This report summarizes the 2013 monitoring efforts and provides some comparisons to the baseline and operational conditions.

* * * * *

2.0 SAMPLING METHODOLOGY

The goal of monitoring wetlands within the Douglas County and Saunders County well fields and associated cones of depression is to evaluate the impact that operation of the Project may have on the existing wetlands. To accomplish this goal, a wetland monitoring approach consisting of a systematic, multi-tiered vegetation sampling procedure has been developed, approved, and implemented. In developing this vegetation sampling procedure, numerous literature sources and references were reviewed. Several discussions with personnel from the Corps and the District occurred during the preparation of this plan and the synthesis of the approach. Key references and sources used included:

- 1987 Corps and 1989 Federal wetland delineation manuals (Environmental Laboratory 1987 and Federal Interagency Committee for Wetland Delineation 1989)
- performance standards for wetland creation and restoration (Streever 1999 and Environmental Law Institute 2004)
- vegetation sampling and analysis methodologies (U.S. Environmental Protection Agency 2002 and Tiner 1999)
- wetland mitigation guidelines (Taylor and Krueger 1997)

Wetland monitoring, as stated above and described in the following paragraphs, began during Project construction in 2005, prior to initiation of Project operation. Monitoring will continue until the Corps agrees that any impacts to wetlands as a result of Project operation are either completely mitigated for or are not likely to occur. If the results of the monitoring program indicate that no wetland impacts are occurring, long-term monitoring can either be decreased or stopped, in accordance with the thresholds analysis discussed in Section 4.0 Thresholds. If the results of the monitoring indicate effects are occurring to wetlands that have not been previously mitigated, discussions with the Corps will be initiated to determine what additional mitigation may be required.

2.1 WETLAND MONITORING IN THE WELL FIELDS

The types of data that were collected, the methods used, and the analyses completed during the wetland monitoring process in the well fields are described in the paragraphs that follow.

2.1.1 Vegetation Sampling

Vegetation was sampled in selected wetlands in the two well fields to characterize the major wetland and adjacent upland plant communities and the variation between them. Wetlands where vegetative change was most likely to be detected first were selected for vegetation sampling; these wetlands are referred to

as “primary” wetlands. In past years, vegetation sampling in these primary wetlands occurred twice each year, in mid-June and in late September. In 2011, the monitoring intensity decreased from Level 1 (monitoring of palustrine emergent (PEM) wetlands twice yearly) to Level 2 (monitoring of PEM wetlands once yearly) based on the data collected during monitoring to date. Level 2 Decreased Monitoring continued initially in 2013 with the yearly monitoring effort taking place in June. It was discussed and approved during the annual late-winter meeting between Corps, District, and Burns & McDonnell personnel that following the June 2013 monitoring effort, an analysis would be conducted to determine the potential need to increase the level of effort at the wetlands showing a significant decrease in wetness in 2012 (W-25 and W-100). This analysis was conducted in August 2013 and it was determined that fall monitoring was warranted at W-25 and W-100 in 2013, effectively increasing the monitoring effort to Level 1 for these two wetlands only. The discussion of threshold levels in Section 4.0 details the criteria for a switch between monitoring levels and the procedures followed at each level.

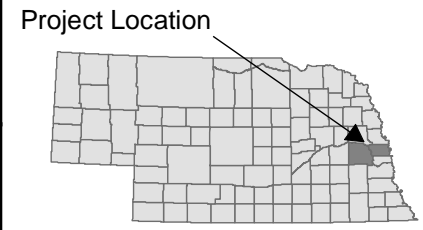
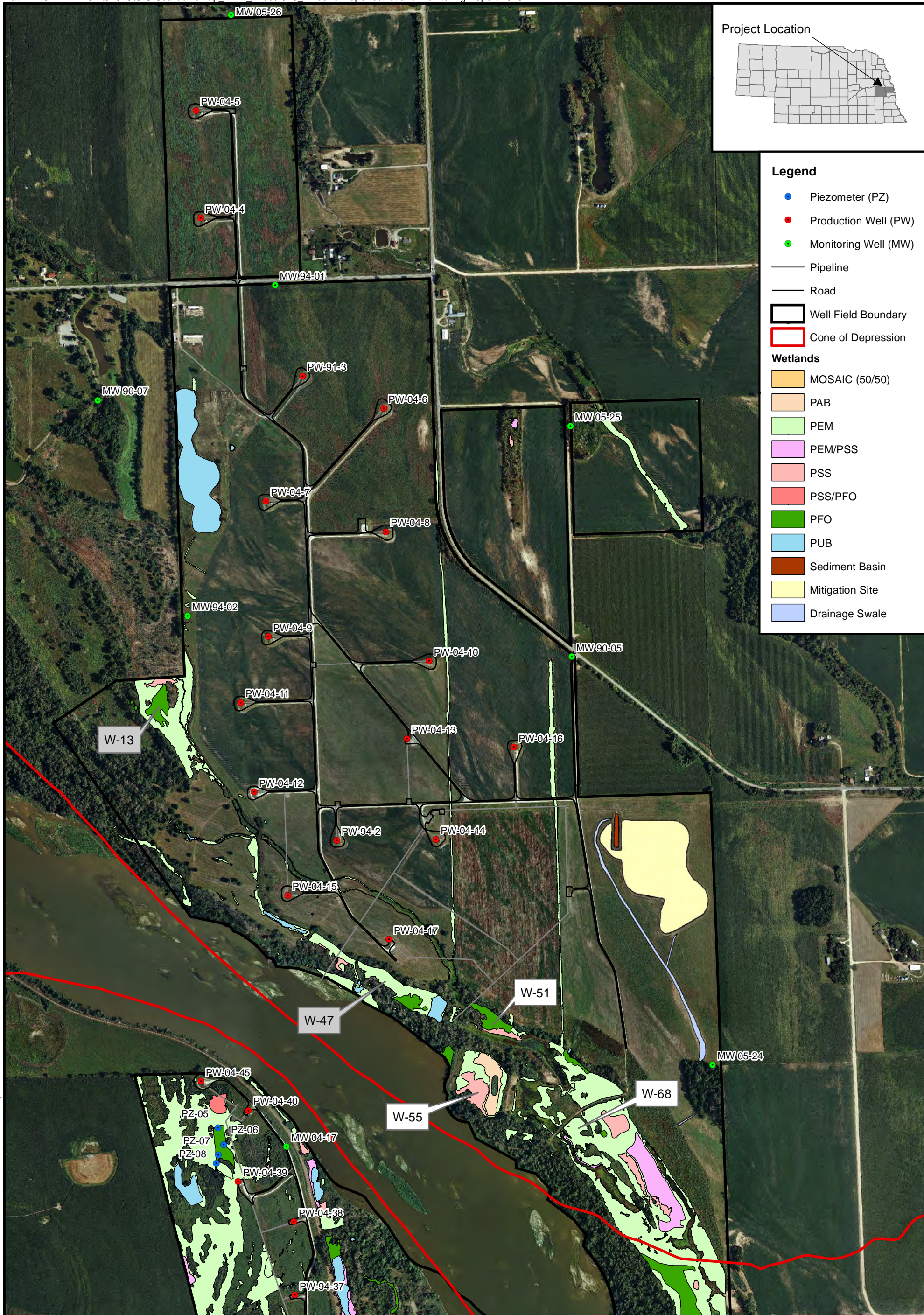
If Project operation-induced impacts to wetland vegetation are observed and documented in any of the primary wetlands, the monitoring of nearby secondary wetlands will be initiated. The monitoring of the secondary wetlands, in addition to the primary wetlands, will help determine if the observed impact is localized and confined to the primary wetland, or is spreading to the adjacent or surrounding wetlands. The primary and secondary wetlands that are being or will be monitored in the Douglas County and Saunders County well fields are shown in Figures 2-1 and 2-2. The wetlands in the Saunders County well field are monitored more extensively than wetlands in the Douglas County well field due to the presence of the 95-acre Wet Meadow in Saunders County. However, the proposed monitoring plan is flexible and can be adjusted to meet specific identified needs for monitoring if they develop.

Vegetation sampling methods used vary depending on the type of wetland vegetation being sampled. These differences in methodologies are described in the following sections.

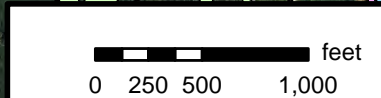
2.1.1.1 Palustrine Emergent Wetlands

The vegetation in a PEM wetland is normally comprised of herbaceous plant species. However, seedlings of woody plants less than one meter tall may also be included in the PEM wetland vegetation.

Herbaceous plant species were sampled using gradient-oriented transects, or “gradsects”. A gradsect is defined as a transect that is placed perpendicular to the baseline transect along the ecotone gradient. The ecotone is the distinct area where one plant community changes or intergrades into another separate, distinct plant community. Sampling units are located in the center of each vegetation community and at each ecotone. The sampling unit consists of five, three-foot-diameter



- Legend**
- Piezometer (PZ)
 - Production Well (PW)
 - Monitoring Well (MW)
 - Pipeline
 - Road
 - ▭ Well Field Boundary
 - ▭ Cone of Depression
- Wetlands**
- MOSAIC (50/50)
 - PAB
 - PEM
 - PEM/PSS
 - PSS
 - PSS/PFO
 - PFO
 - PUB
 - Sediment Basin
 - Mitigation Site
 - Drainage Swale



W-55 Primary Wetland W-47 Secondary Wetland

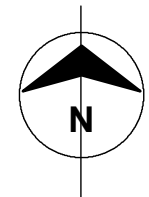
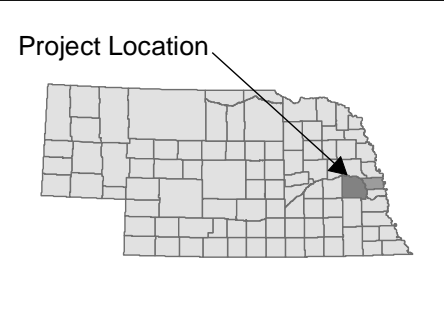
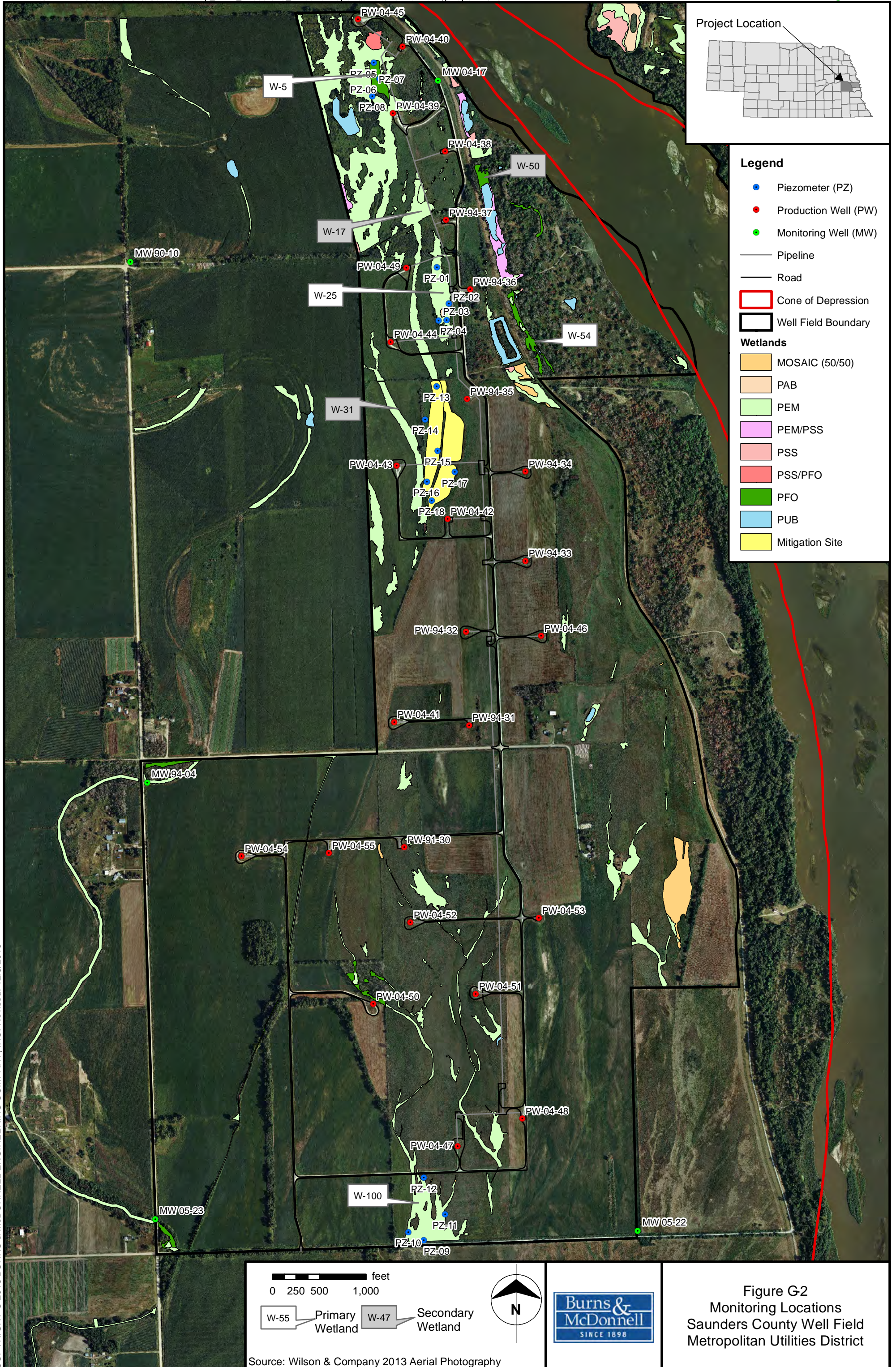


Figure 2-1
Monitoring Locations
Douglas County Well Field
Metropolitan Utilities District

Source: Wilson & Company 2013 Aerial Photography



Legend

- Piezometer (PZ)
- Production Well (PW)
- Monitoring Well (MW)
- Pipeline
- Road
- ▭ Cone of Depression
- ▭ Well Field Boundary

Wetlands

- MOSAIC (50/50)
- PAB
- PEM
- PEM/PSS
- PSS
- PSS/PFO
- PFO
- PUB
- Mitigation Site

0 250 500 1,000 feet

W-55 Primary Wetland W-47 Secondary Wetland

Burns & McDonnell
SINCE 1898

Figure G-2
Monitoring Locations
Saunders County Well Field
Metropolitan Utilities District

Source: Wilson & Company 2013 Aerial Photography

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circular sample plots placed along the gradsect. Three baseline transects with between two and seven gradsects have been placed in each PEM wetland.

Vegetation and wetland monitoring in the PEM wetlands began in 2005. During the first sampling period in June 2005, each permanent transect, gradsect, and sample plot was located and recorded using a global positioning system (GPS; Trimble® Pro XRS sub-meter GPS unit). The beginning and end of each transect and gradsect were permanently marked in each wetland using two-foot sections of 3/8-inch or 1/2 inch re-bar, painted orange and flagged. These permanent markers also serve as photograph stations. A photographic record is being maintained for each sampling period at each gradsect and transect. This photographic record will provide a repetitive visual record of the wetland vegetation monitoring during seasons and over years.

Vegetation and plant species data that were collected during the PEM wetland vegetation monitoring effort include the identification, to species when possible, of each plant located within the three-foot diameter sample plot. The percent cover for each plant species occurring in a sample plot was estimated using a modified Daubenmire cover-class method. In this methodology, percent canopy cover is visually estimated for each plant species either rooted within or extending into each three-foot diameter plot. The plant species is placed into one of a series of cover classes using the estimated percent canopy cover. These classes are based on the mid-point of canopy coverage per the modified Daubenmire canopy cover method shown in Table 2-1 (Daubenmire 1959; Bailey and Poulton 1968).

Table 2-1: Modified Daubenmire Cover Class Scale							
Cover Class	1	2	3	4	5	6	7
Range (%)	0-1	1-5	5-25	25-50	50-75	75-95	95-100
Midpoint (%)	0.5	3.0	15.0	37.5	62.5	85.0	97.5

A cover class was also estimated for the non-vegetated area in the three-foot diameter plot because sample plots are often not completely vegetated. Non-vegetated areas can include bare soil, rocky surface, open water, or litter. Quantifying the bare area provides an indication of the potential for additional vegetation in the sample plot. Even with bare area in a plot, the total cover of vegetation may be greater than 100 percent, because plants often overlap in a plot.

If standing water is present within the sample plot, the water depth (in inches) at the center of each plot will be recorded. The percentage of the plot that is inundated will also be estimated and assigned a cover class value that is recorded on the data entry forms.

2.1.2 False-color Infrared (CIR) Aerial Photography

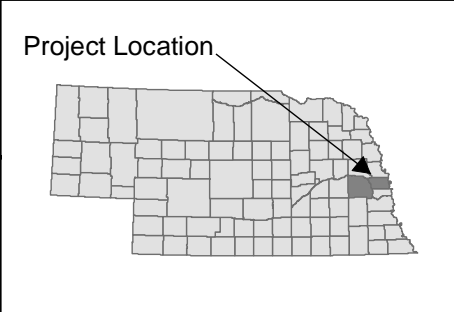
False-color infrared (CIR) aerial photography was initially taken in 2005 and was obtained annually through 2009. In accordance with the reduced monitoring intensity level, as described in Section 4.0 Thresholds, CIR aerial photography is currently obtained every-other year. Prior to 2013, CIR photography was obtained in 2011. In accordance with the current schedule, CIR photography was again obtained in 2013. The CIR photographic coverage typically includes both well fields and the associated cones of depression in Douglas and Saunders Counties. The annual CIR aerial photography is used to monitor the overall size, shape and condition of the wetlands and different types of vegetation occurring in the well fields over time.

2.2 WETLAND MONITORING IN THE CONES OF DEPRESSION

The Douglas County and Saunders County well fields are owned in fee title by the District. As a result, access to the well fields for vegetation and groundwater monitoring is available at all times. The land surrounding or adjacent to the well fields is projected to potentially experience some groundwater drawdown during Project operation. Groundwater modeling is conducted annually to incorporate data collected from the monitoring and production wells (HDR 2013). The groundwater model is able to predict the area of land surrounding the well fields that is expected to experience a one-foot drawdown of local groundwater during project operation. These areas are designated as “cones of depression” and are larger than the well fields. The originally modeled cones of depression are included in Figures 2-3 and 2-4.

The land outside the well fields but within the cones of depression is not owned by the District. As such, seasonal and annual access to that portion of the cones of depression for consistent wetland monitoring cannot be assured. Therefore, the monitoring methodology for the wetlands within the cones of depression, but outside of the District-owned well fields is based on the interpretation and comparison of the CIR aerial photography. The CIR aerial photography for the cones of depression will be obtained per the methods described in Section 2.1.2 above for the wetland monitoring in the well fields.

A total of eight wetlands in the cones of depression have been selected for secondary monitoring from those that were delineated (Burns & McDonnell 2005b; Figures 2-3 and 2-4). Six of these eight wetlands are emergent wetlands (W-9, W-514, and W-519 in Douglas County and W-306, W-321, and W-700 in Saunders County), one is a PFO/PEM wetland complex (W-5 in Douglas County), and one is a PFO wetland (W-8 in Douglas County). More emergent wetlands are being monitored than other types of wetlands due to the fact that more emergent wetlands were delineated in the cones of depression than any other type of wetland.

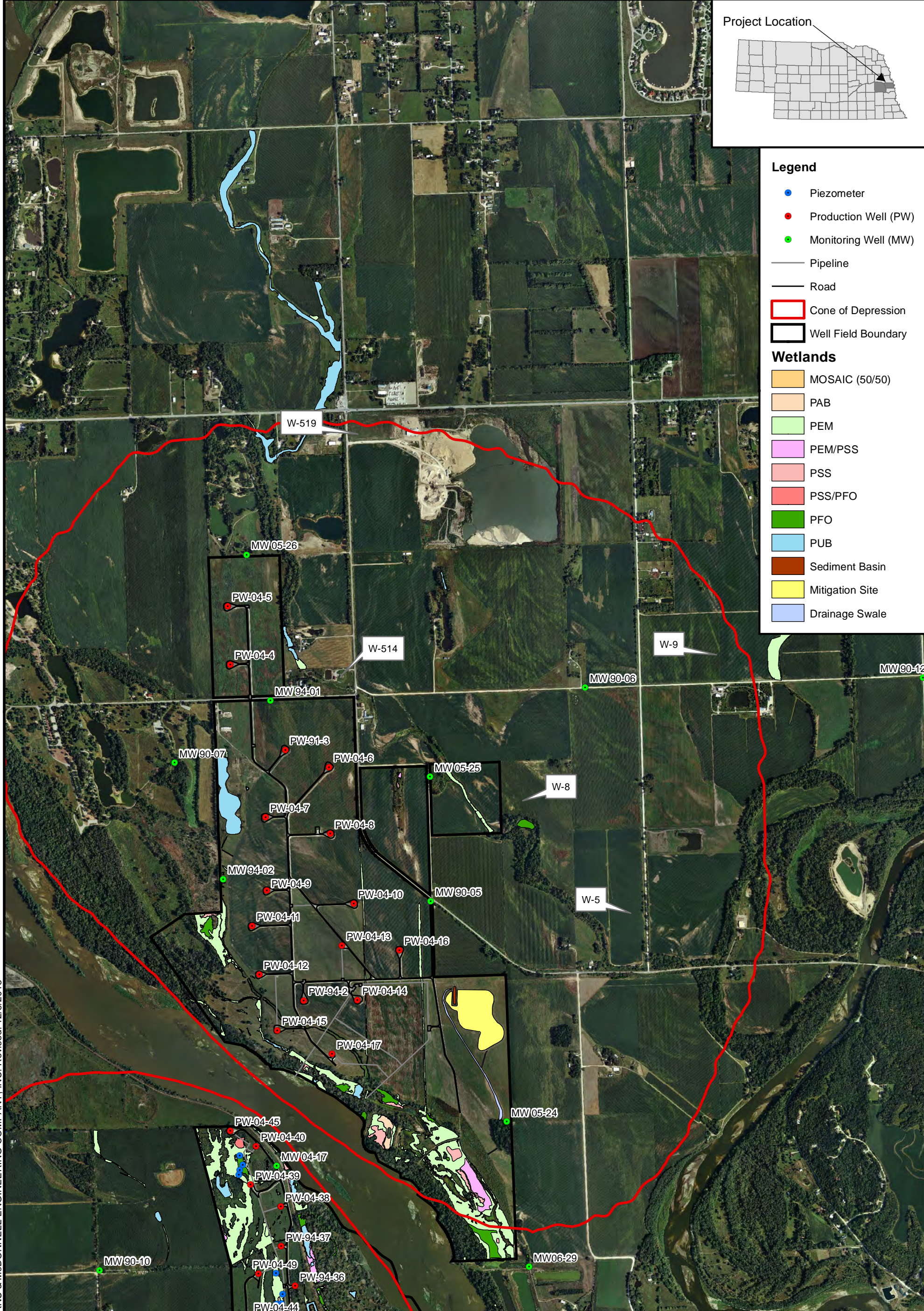


Legend

- Piezometer
- Production Well (PW)
- Monitoring Well (MW)
- Pipeline
- Road
- Cone of Depression
- Well Field Boundary

Wetlands

- MOSAIC (50/50)
- PAB
- PEM
- PEM/PSS
- PSS
- PSS/PFO
- PFO
- PUB
- Sediment Basin
- Mitigation Site
- Drainage Swale



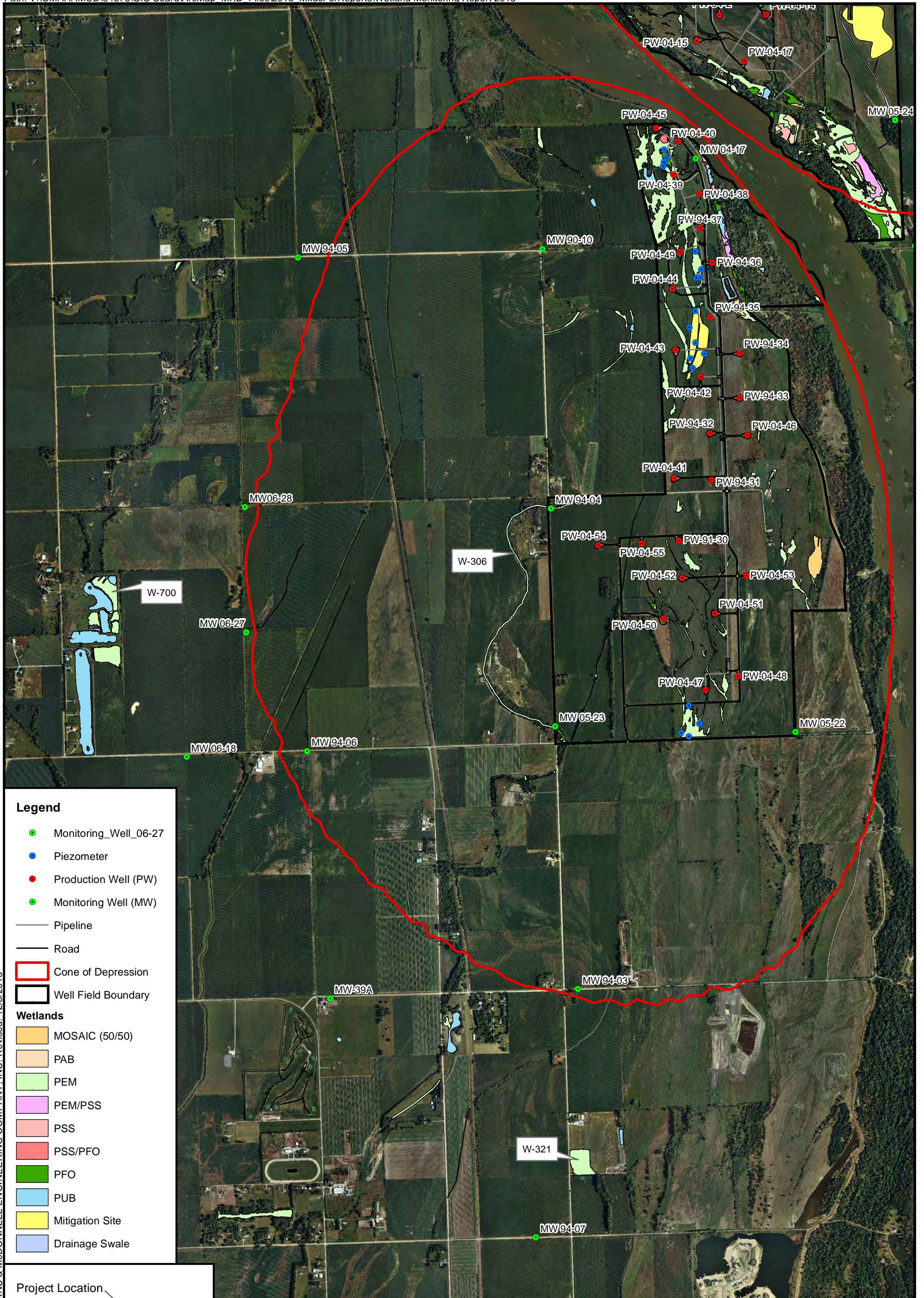
0 1,000 2,000 4,000 feet

W-55 Monitored Wetland



Figure 2-3
Monitoring Locations
Douglas County Cone
of Depression
Metropolitan Utilities District

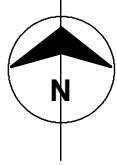
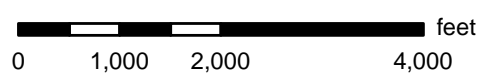
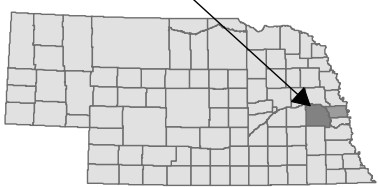
Source: Wilson & Company 2013 Aerial Photography



Legend

- Monitoring_Well_06-27
- Piezometer
- Production Well (PW)
- Monitoring Well (MW)
- Pipeline
- Road
- Cone of Depression
- Well Field Boundary
- Wetlands**
- MOSAIC (50/50)
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- PSS/PFO
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- PUB
- Mitigation Site
- Drainage Swale

Project Location



W-55 Monitored Wetland



Figure 2-4
Monitoring Locations
Saunders County Cone of Depression
Metropolitan Utilities District

2.3 HYDROLOGICAL MONITORING

Several different types of hydrological data are being collected and analyzed. This hydrological data is being used to document the effect the existing water table has on wetlands in the two well fields and the potential effect Project operation may have.

2.3.1 Groundwater Monitoring Wells

Permanent monitoring wells designed to measure local groundwater levels have been installed by the District at specific locations in and around the Douglas County and Saunders County well fields and cones of depression (Figures 2-1 through 2-4). The location of these groundwater monitoring wells was recorded using GPS. Data loggers have been installed at the monitoring wells so that groundwater levels can be measured and recorded on a daily basis. Groundwater data from the monitoring wells will be correlated with the other hydrological data that is being collected to evaluate if any Project-induced groundwater system changes are occurring.

2.3.2 Production Wells

The Project production wells that are pumped to provide raw water to the new water treatment facility during Project operation are located in the Douglas County and Saunders County well fields (Figures 2-1 and 2-2). These water production wells have also been fitted with data loggers that measure and record the depth to the water table at each well head whether or not the well is actively being pumped. In addition, the rate at which each well is being pumped is measured in millions of gallons per day (MGD). The locations of these water production wells were recorded using GPS. Data from the water production wells (production rate, drawdown, cone of depression, etc.) during Project operation will be correlated with the other hydrological data that is being collected to evaluate if Project-induced changes to wetlands are occurring.

2.3.3 Piezometers

A total of 18 piezometers were installed in five wetlands in the Saunders County well field (Figure 2-2). Twelve of these were installed in three existing wetlands (four piezometers per wetland) already being monitored as part of the Wetland Monitoring Plan (Burns & McDonnell 2005a). Four piezometers were installed in the Phase I Mitigation Site located adjacent to the Wet Meadow and described in the Phase I Wetland Mitigation Plan (Burns & McDonnell 2005d). The remaining two piezometers were installed in the Phase II Wet Meadow Mitigation Site (Burns & McDonnell 2007c). In July 2010, eight of the existing piezometers were replaced by installing a new piezometer adjacent to the old ones. The replacement of some piezometers was necessary as a result of the undermining of existing piezometers due to frost heave, erosion, or animal activity. A modified installation approach was implemented during

the replacement of the eight piezometers. Additional rebar was driven into the ground at divergent angles before the concrete base was poured. This additional rebar should help stabilize the piezometers against frost heave. The locations and elevations of the installed piezometers have been recorded using GPS.

In each of the five wetlands being monitored with piezometers, one of the piezometers was located near the center or low point. Since subsurface groundwater flow is generally from north to south, one piezometer was installed at the northern edge of each wetland; the remaining two piezometers were installed along the southern edge of each wetland.

The piezometers installed in two existing wetlands in the Wet Meadow (W-5 and W-25) and the created Phase I and Phase II Wet Meadow Mitigation Sites adjacent to the Wet Meadow are designed to monitor the shallow, perched water table between the soil surface and the clay layer before and after Project operation begins. Piezometers were also installed in a PEM wetland (W-100) in the southern portion of the Saunders County well field that is outside of the Wet Meadow boundary (and also outside of the perched water table located above the shallow clay layer) to monitor the shallow groundwater prior to and during Project operation. All piezometers are being monitored on an approximately monthly basis during the growing season to assess the seasonal and annual fluctuation in the shallow water table, and the variation between years. For additional information on the installation and monitoring of the piezometers, please refer to Burns & McDonnell's Wetland Monitoring Plan (2005a).

2.3.4 Bathymetric Monitoring of Ponds

Bathymetric monitoring of ponds located in the Douglas County and Saunders County well fields and associated cones of depression was initiated in 2004 (Burns & McDonnell 2005c). Using GPS and a boat-mounted sonar recorder, bathymetric maps were developed for each of the 45 ponds being monitored. These maps established baseline conditions by depicting each pond's water surface area and water depth contours. Prior to initiation of Project operations, water surface elevations at each pond were monitored four times (March, August, September, and October) each year. The pond surface water elevation data collected provides a basis for comparing the seasonal pre-Project changes with the changes that may occur with operation of the Project.

Permanent benchmarks and elevations were established near each pond above the high water mark during the early summer of 2005. The location and elevation of each permanent benchmark was established using a survey-grade GPS. Water surface elevations were measured from the established permanent benchmark using a surveyor's level. The 2005 bathymetric monitoring also included the contour mapping of one pond that was overlooked during the 2004 mapping effort (Burns & McDonnell 2006b).

During the 2006 bathymetric monitoring effort, an additional pond was surveyed at the request of the landowner (Burns & McDonnell 2007b). In 2008, two ponds were added and two ponds were removed. An additional pond, DG-11, was added by request of the landowner in 2009 and is being monitored by photographic documentation only at this time. In 2010, pond DG-02A was added to the monitored ponds at the request of the landowner. Currently, a total of 47 ponds are being monitored.

The seasonal variation in surface water elevation of the 47 ponds will be compared between baseline and operational conditions and evaluated in concert with the other hydrologic data that are being collected. The bathymetric data collected from the ponds will be used to indicate if Project operation is resulting in water level fluctuations for a specific pond or ponds and if these fluctuations are different than would normally occur under baseline conditions.

2.3.5 Other Hydrological Data

Additional hydrological data is also collected during the annual monitoring effort each year. This additional data includes monthly total precipitation, monthly average ambient air temperature, and stream gauge data for the Platte and Elkhorn Rivers.

* * * * *

3.0 DATA ANALYSIS

The following sections provide a brief discussion of the data analysis and the results of the 2013 annual wetland monitoring efforts in the well fields and cones of depression.

3.1 WETLAND MONITORING IN THE WELL FIELDS

The spring and fall 2013 monitoring efforts in the well fields consisted of the systematic sampling and analysis of wetland and nearby upland vegetation and the collection and comparison of various types of hydrological data.

3.1.1 Vegetation Data

Vegetation monitoring of the wetlands in the well fields was conducted in June and September 2013 to characterize major wetland and upland plant communities and the variation between them. This sampling effort represents the fifth full year of monitoring during operation of the water treatment plant.

Vegetation sampling took place in sample plots established along permanent transects and gradsects established in each wetland ecosystem as described previously. Data obtained during 2013 has been analyzed and compared to baseline data and the results are discussed below and included in Appendix I. Additionally, some comparisons of vegetation data collected during each sampling period during Project operation have also been included.

All of the wetland vegetation data obtained during monitoring was input into a Microsoft Access database that has been designed specifically to accommodate seasons and years of data. The database was also designed for the rapid comparative assessment of selected vegetative characteristics within and among wetlands and wetland types in general. In 2012, the Corps issued an update to the National Wetland Plant List (NWPL; Lichvar and Kartesz 2009) which resulted in changes to some of the wetland indicator statuses and nomenclature. However, for consistency with previous analyses, nomenclature and plant characteristics were again obtained from the USDA PLANTS Database (USDA NRCS 2013). A complete list of plant species that have been identified in each of the monitored wetlands has been compiled and is included in Appendix IV. The vegetative characteristics that were analyzed are described below.

In the initial data collection process in the field, the percent cover for each plant species observed in each sample plot was estimated. As explained in the following paragraphs, these collected vegetative data were used to calculate a weighted average for each sampling unit in addition to calculating the species richness; species diversity; percent native species; percent invasive species; the percentage of perennial,

biennial, and annual species; the mean coefficient of conservatism (c-value); and the Floristic Quality Index (FQI).

3.1.1.1 Change in Wetness

Species abundance and the wetland indicator status for each species can be used to calculate a measure of how wet an area is. This measure of wetness is referred to as the weighted average (Tiner 1999) or the Prevalence Index (Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region (Version 2.0, 2010)). For the current year's data, the average or mean weighted average (WA_M) was calculated for each wetland as a whole and for each gradsect located in the emergent wetlands. The WA_M is calculated using the following formula:

$$\text{Mean Weighted Average}(WA_M) = \frac{\sum IE}{\sum I}$$

where I = importance value for the species (e.g., percent cover)

E = ecological index for the species

The importance value used for this evaluation is the percent cover for the species in the sample plot. The ecological index is a value between 1 and 5 that corresponds to the wetland indicator status for the given species. An ecological index value of 1 corresponds to an obligate or wetland plant and a value of 5 corresponds to an upland plant. The calculated WA_M should be equal to or less than 3.0 in order for a specific site to be considered a wetland if hydric soils and sufficient hydrology are present. In transitional areas, a WA_M should approach 3.5, depending on landscape position, hydrology, and other related features.

3.1.1.2 Change in Species Composition

Change in species composition over time will be analyzed by comparing the various vegetative indices that are being calculated each year. These indices were calculated from the collected data to assist in interpreting any changes observed in the vegetation communities. These additional calculations are explained in the following paragraphs and include:

- Species richness
- Species diversity
- Percent of native vegetation
- Percent of invasive species
- Percent of perennial/annual/biennial vegetation

- Floristic Quality Index (FQI)
- Mean c-value

Species richness is the count of the number of different species identified in a plant community. This parameter is used to help characterize the plant community being examined, and is often used in concert with species diversity indices (Greig-Smith 1983). In most cases, a higher species richness value is obtained from a better quality or more diverse plant community.

Species diversity is an index that combines species richness and equitability (the evenness of the contribution of different species to the community) in order to investigate the heterogeneity of a plant community that is more a measure of the functional or apparent number of species rather than the absolute number of species as in species richness (Greig-Smith 1983). Species diversity in this study is the number of different species in an area weighted by some measure of abundance. Here, the measure of abundance used is the number of occurrences of each species in each wetland out of the total number of plots. The formula for species diversity follows Simpson (1949) and is included below:

$$\text{Species Diversity (D)} = \frac{N(N-1)}{\sum n(n-1)}$$

where N = total number of occurrences for all species in all plots

n = number of occurrences for each individual species

Simpson's Reciprocal Index (1/D) is calculated and included in the data analysis. In general, diversity increases with increasing heterogeneity; so, the higher the diversity value, the more diverse the plant community.

Assessing the abundance of native and invasive species provides an indication of the quality of the plant community and, when used long-term, provides an indication of whether there is a shift in quality over time. For this study, the percent of native vegetation is the percent of plant species out of the total species occurring in the wetland that are considered to be native to the United States. The percent of invasive vegetation is the percent of plant species out of the total species occurring in the wetland that are considered to be invasive in the United States or have the potential to dominate a community to the exclusion of more desirable species. Invasive species can be both native and non-native plants.

Additionally, the percentages of the total plant species that are annual, biennial, and perennial are indicated. This parameter shows the contribution of the different types of plants, and provides, in part, an indication of the diversity of the plant community in question.

A Floristic Quality Analysis (FQA) will also be conducted on the vegetation data. The FQA is typically conducted on vegetation data collected during a pedestrian survey of the whole site. However, because the sampling of these wetlands is so extensive, the FQA calculations will be based on data collected from the sample plots rather than a separate survey. The mean c-value and FQI are calculated using c-values that were assigned for the Nebraska region by Rolfsmeier and Steinauer (2003). The c-value is a number between 0 and 10 that is assigned to each plant species in a region. The c-value assigned is an indication of whether the plant is native to the area and how tolerant to disturbances the species is. For example, a native plant that is found only in intact natural communities would be assigned a value of 10, while an invasive or non-native species commonly found on roadsides, for example, would be assigned a value of 0. The mean c-value is the average of the c-values from the plant species identified in the site.

While the mean c-value provides a measure of the botanical quality of a site that can be compared from year to year, it does not take into account the size of the site or the quality of the surrounding area. Therefore, the FQI is calculated to combine the mean c-value with the total number of species identified in the site. The FQI is calculated using the following formula:

$$\text{Floristic Quality Index (FQI)} = \bar{c} \sqrt{n}$$

where \bar{c} = mean coefficient of conservatism

n = number of native species

With this calculation, higher FQI numbers correspond to more natural sites that have a higher diversity. Lower FQI values imply a more disturbed or lower quality site.

3.1.1.3 Statistical Analysis

Statistical Analysis of the vegetation data was first included in the 2010 Annual Wetland Monitoring Report, since a sufficient number of sampling efforts had taken place since the beginning of operation to allow for an evaluation of the vegetative characteristics. To determine whether any observed changes in the vegetative indices that are calculated each year are significant, a statistical analysis is conducted to compare the baseline data, which captured some of the natural variation in the wetlands, to the operational data to determine if Project operation is having any significant effect on the wetlands. Statistical Analysis is again included in the 2013 Annual Wetland Monitoring Report.

Through discussions between the District, Corps, and Burns & McDonnell, the Repeated Measures ANOVA was selected as the statistical test appropriate for this analysis. The statistical add-on package to Microsoft Excel that was utilized for this analysis is the EZAnalyze program (www.ezanalyze.com). The Repeated Measures ANOVA is able to compare multiple sampling seasons of data against the baseline average for a given vegetative index. A post-hoc analysis is also included when a significant difference is detected to determine which sampling efforts were significantly different. A Bonferroni correction is then applied to the p-values to decrease the error that may occur when comparing multiple data sets. The final p-Bonferroni values are reviewed to determine if any of the sampling efforts are significantly different from the baseline average value. This indication of significance is the analysis used when triggering thresholds for monitoring intensity or identifying possible impacts to the wetland due to Project operation.

The Repeated Measures ANOVA test is conducted on each of the vegetative indices that are calculated for each sampling effort: WA_M , FQI, c-Value, Species Richness, and Species Diversity.

3.1.2 False-color Infrared (CIR) Aerial Photography

In accordance with the reduced monitoring intensity level, as described in Section 4.0, Thresholds, CIR aerial photography was obtained in 2013 after not being flown in 2012. CIR and natural color aerial photography was flown by Wilson and Company on August 20, 2013, and are included in Appendix I, Section A.

3.2 WETLAND MONITORING IN THE CONES OF DEPRESSION

As stated above, CIR aerial photography was obtained in 2013. Wetland monitoring of the wetlands in the cones of depression based on CIR aerial photography is included in Appendix II. Future monitoring of these wetlands will continue according to the monitoring requirements as described in Section 4.0 Thresholds.

3.3 HYDROLOGICAL MONITORING

Several different types of hydrological data were collected during the 2012 monitoring efforts. The collected data, their sources, and any analyses performed are discussed below and included in Appendix III.

3.3.1 Groundwater Monitoring Wells

Permanent wells designed to measure groundwater levels before and during Project operation have been monitored by the District using the installed data loggers. A total of 22 monitoring wells were monitored during 2013. Monitoring well 39A in Saunders County was included in past years, but monitoring at this

Corps-owned well was abandoned in October 2012 and is, therefore, no longer included. Water level readings were measured and recorded on a regular basis using an electronic datalogger. The collected data in 2013 have been graphed over time and are presented for each monitoring well in Section A of Appendix III.

3.3.2 Production Wells

The Project production wells that are pumped to provide raw water to the new water treatment plant during Project operation were monitored in 2013 using installed data loggers. The total production well pumping rates by month, the total volume pumped per month, and the average monthly pumping rates for each production well have been included in Tables 1 and 2 in Section B, Appendix III. These data will be evaluated and analyzed to provide corroborating information should any changes be detected in the other monitoring data.

3.3.3 Piezometers

Sixteen piezometers were installed in four wetlands in the Saunders County well field in 2005. Twelve of the piezometers were installed in May and four piezometers (located in the Phase I Wet Meadow Mitigation Site, WM-1, adjacent to the Wet Meadow) were installed in late October. In May of 2009, two additional piezometers were installed in the Phase I Wet Meadow Expansion Mitigation Site, WM-2, for a total of 18 piezometers. As described in Section 2.3.3, eight of the piezometers were reinstalled adjacent to their original position in July of 2010. The collected data from the 2013 monitoring efforts have been graphed over time and are presented in Section C, Appendix III.

The piezometers installed in PEM W-25 (PZ-01 through PZ-04), PFO W-5 (PZ-05 through PZ-08), PEM WM-1 (PZ-13 through PZ-16), and PEM WM-2 (PZ-17 and PZ-18) are all located above the shallow clay layer associated with the Wet Meadow (Figures 1, 3, and 4; Section C, Appendix III). Piezometers installed in PEM W-100 (PZ-09 through PZ-12) are outside of both the Wet Meadow boundary and the perched water table located above the shallow clay layer (Figure 2, Section C, Appendix III). These readings are used to provide corroborating hydrological evidence should any changes be detected in the wetland vegetation data.

3.3.4 Bathymetric Monitoring of Ponds

The post-operation bathymetric monitoring of ponds located in the Douglas County and Saunders County well fields and associated cones of depression was completed during 2013 as planned. The data collected from these monitoring efforts is presented in a separate report entitled the *2013 Annual Bathymetric Monitoring Report for the Ponds within the Well Fields and Cones of Depression* (Burns & McDonnell

2014). Pond monitoring is conducted to document the variation in each monitored pond's seasonal water surface elevation. The data presented in the bathymetric monitoring report will provide corroborating hydrological evidence should any changes be detected in the wetland vegetation data.

3.3.5 Other Hydrological Data

Additional hydrological data collected during the 2013 monitoring efforts included monthly total precipitation, monthly average ambient air temperature, and stream gauge data. The monthly total precipitation and monthly average ambient air temperature were both obtained from the weather station at Fremont Municipal Airport in Fremont, Nebraska. The 2013 precipitation and temperature data and the historical average monthly precipitation and temperature have been graphed over time; the graphs are included in Figures 1 and 2 (Section D, Appendix III).

Stream gauge data was obtained from the USGS stream gauge stations on the Platte and Elkhorn Rivers. Platte River data was obtained from the stream gauge near Venice, Nebraska (USGS Stream Gauge No. 06796550). The installation of this stream gauge took place at the request of and through funding by the District. Data collected from this stream gauge is represented in Figure 3 (Section D, Appendix III). The Elkhorn River data was obtained from the stream gauge near Waterloo, Nebraska (USGS Stream Gauge No. 06800500). Data collected from this stream gauge is represented in Figure 4 (Section D, Appendix III).

* * * * *

4.0 THRESHOLDS

According to the Section 404 Permit conditions, the monitoring of wetlands in the well fields and cones of depression will take place during Project operation. To determine whether an impact is taking place at a given wetland, thresholds have been established in accordance with the baseline data that was collected. As monitoring data are evaluated after each sampling effort, thresholds are either met or not met, and the intensity of monitoring may be increased or decreased as a result. The wetland monitoring intensity levels and the process for determining whether a wetland has met the thresholds used to identify potential changes in the wetlands is described below.

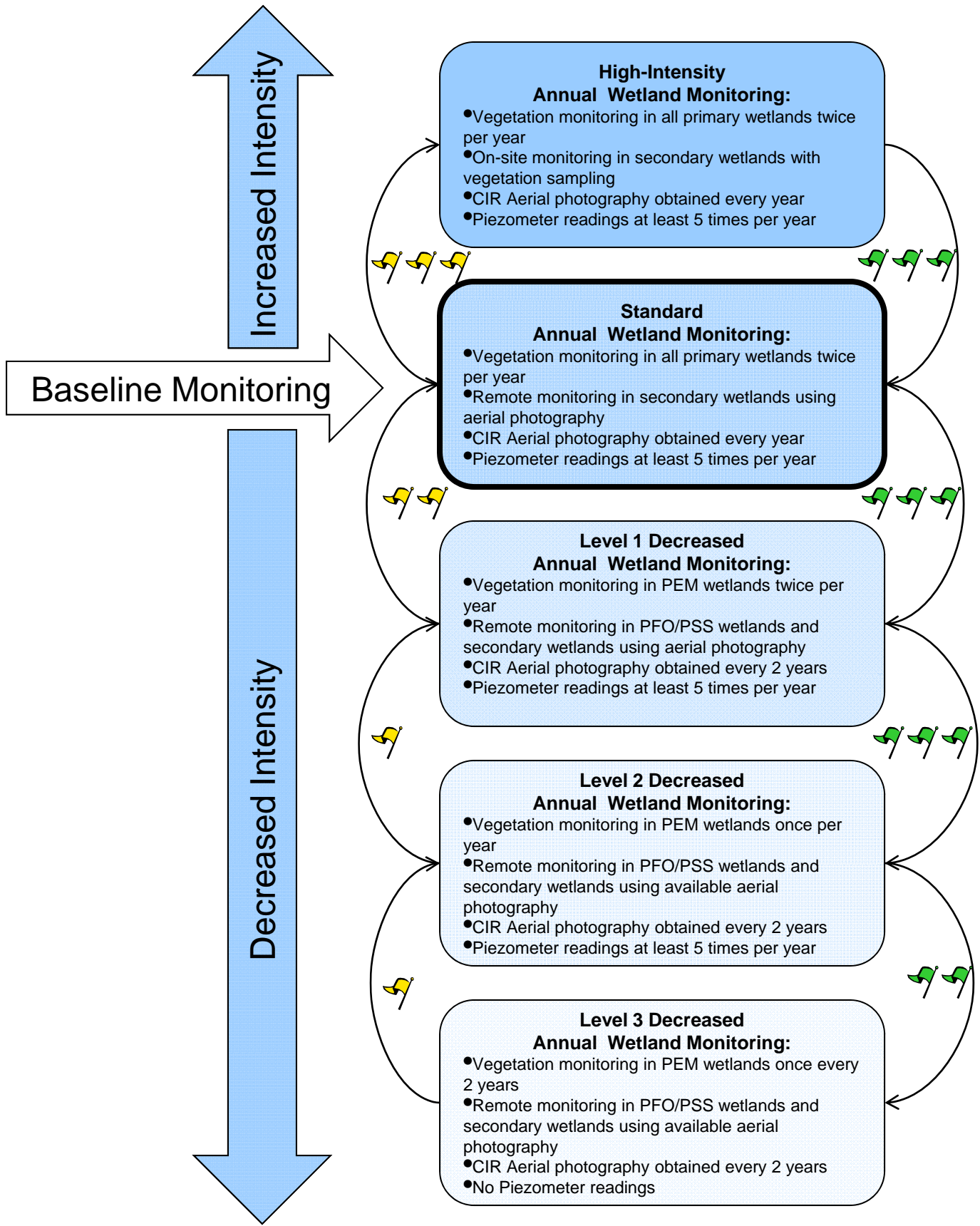
4.1 LEVELS OF WETLAND MONITORING INTENSITY

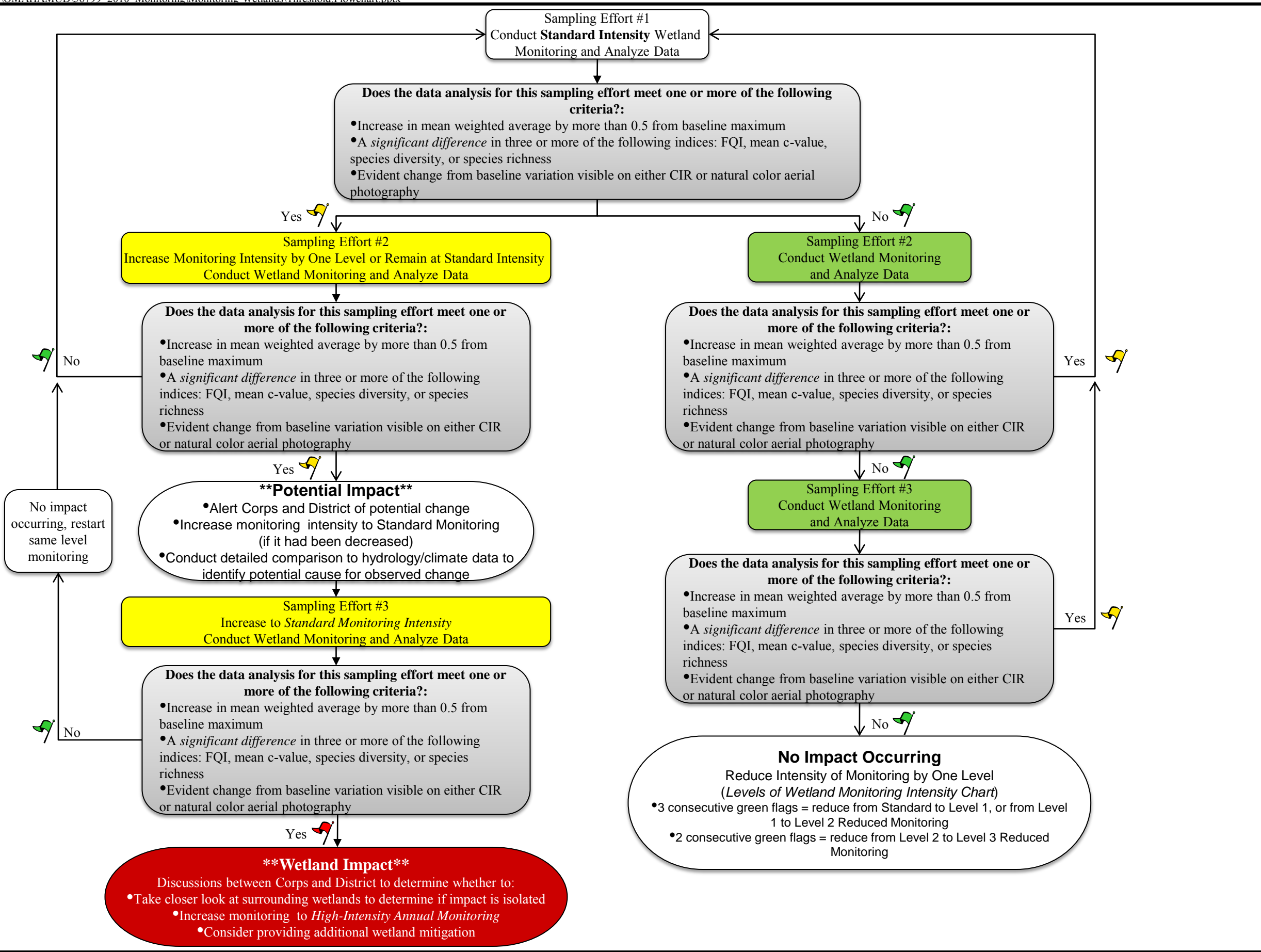
A Wetland Monitoring Plan was developed and implemented in 2005 (Burns & McDonnell 2005a). This Monitoring Plan describes in detail the standard annual monitoring approach. During the years of baseline monitoring and the first several seasons of operational monitoring, the standard approach was considered an appropriate protocol. However, as monitoring continued, it became apparent that it may be beneficial to adjust the amount of data being collected based on whether impacts were being observed or not. If impacts have been documented (“yellow flags”), the intensity of monitoring increases. If no impacts have been documented (“green flags”), then the intensity of monitoring decreases. The five levels of monitoring intensity are listed below and described in detail in Figure 4-1.

- High-Intensity Annual Wetland Monitoring
- Standard Annual Wetland Monitoring
- Level 1 Decreased Annual Wetland Monitoring
- Level 2 Decreased Annual Wetland Monitoring
- Level 3 Decreased Annual Wetland Monitoring

4.2 METHOD FOR DETERMINING WETLAND IMPACTS

A series of evaluations and comparisons to the baseline data is being conducted after each sampling effort during Project operation to determine whether wetland impacts are occurring. The process for these evaluations is outlined in a flowchart included in Figure 4-2. A “green flag” on the chart indicates that no thresholds have been triggered and no significant impacts to wetlands due to Project operation have been observed. A “yellow flag” on the chart indicates that a change or an anomaly has been detected in either a vegetative index, the aerial photography, or in the hydrological monitoring. This anomaly may be attributable to Project operation or it may be due to one of many naturally-occurring environmental or climatic factors. A “red flag” indicates that a threshold has been triggered and an impact to wetlands due to Project operation has likely occurred.





Legend

- = No impact occurring. Continue standard monitoring protocol.
- = Impacts possible at this wetland. Continue monitoring until three consecutive sampling efforts show change.
- = Impacts likely. District will initiate discussion with Corps.




Figure 4-2
Flowchart for
Determining Wetland
Impacts

5.0 RESULTS

The following sections provide the results of the data analysis for each of the wetlands monitored during the 2013 effort. The complete set of data (figures, summary tables, ground photographs, and raw data sheets) for each monitored wetland in the well fields is available in Appendix I. In addition, a comprehensive species list of vegetation observed at the monitored wetlands between 2005 and 2013 is included in Appendix II. Finally, Appendix III contains all hydrological data collected and analyzed in graphic form.

The various vegetative indices, aerial photography, and other supporting hydrological data that are collected annually have been analyzed to compare 2013 data to baseline averages. To determine whether any differences from baseline averages are significant, further analysis is required to identify if an observed change to a wetland has taken place and if it would be indicative of a Project-induced impact. A discussion of the threshold analysis that was conducted for each wetland is included below.

5.1 WETLAND MONITORING IN THE WELL FIELDS

Data collected during monitoring of the wetlands in the well fields included qualitative vegetation data. In addition, hydrological data was collected for the area. The results of the data collection are presented in the following sections.

5.1.1 Vegetation Sampling

Three PEM wetlands (W-68, W-25, and W-100) were initially sampled in June of 2013 as part of the Level 2 decreased monitoring effort. As was recommended in the 2012 Annual Wetland Monitoring Report, data analysis was conducted following the spring monitoring effort to determine a strategy for the fall 2013 effort. It was determined, and approved by the District and the Corps, that W-68 would remain on the Level 2 Decreased Monitoring schedule. However, an additional monitoring effort was warranted September 2013 at W-25 and W-100. A discussion of the data to support this strategy is included in the following paragraphs and in a separate letter report submitted to the Corps and included in Appendix IV. Table 5-1 shows the results of the various vegetative indices collected for each of the monitored wetlands in 2013. Detailed results for each wetland are included in the sections that follow.

Table 5-1: Summary of 2013 Wetland Vegetation Data Analysis										
Wetland ID	Mean Weighted Average (W _M)		Species Richness		Species Diversity		FQI		Mean C-value	
	Spring 2013	Fall 2013	Spring 2013	Fall 2013	Spring 2013	Fall 2013	Spring 2013	Fall 2013	Spring 2013	Fall 2013
W-68	2.42	NA	56	NA	22.30	NA	24.19	NA	3.39	NA
W-25	2.64	2.37	34	33	16.36	14.17	14.25	13.57	2.56	2.57
W-100	3.41	3.63	33	18	15.60	9.63	9.73	3.74	1.90	1.00

5.1.1.1 PEM Wetland 68 – Douglas County









Wetland 68 is a PEM wetland located in Douglas County, Nebraska (Figure 1, Section A-1, Appendix I). The vegetation in this wetland was sampled using 3 transects, 12 gradsects, and 60 sample plots. Dominant species observed in this wetland during the June 2013 monitoring effort included fox sedge (*Carex vulpinoidea*), Kentucky bluegrass (*Poa pratensis*), and sawtooth sunflower (*Helianthus grosseserratus*). Wetland 68 (excluding the upland gradsects) had a W_M of 2.42 in the spring of 2013 (Table 5-2), indicating that it continues to be dominated by wetland vegetation. The baseline maximum threshold W_M for W-68 is 2.78. The W_M for spring 2013 remained below the baseline threshold as illustrated in Figure 2 in Section A-1 in Appendix I. This wetland contained an average of 91 percent native species and 38 percent invasive species in 2013. The FQI for this wetland during the same time period was 24.19, a significant increase of the low 2012 value. Tables 1 and 2 in Section A-2 of Appendix I contain a summary of the monitoring data and the complete species list from the 2013 monitoring effort.

Table 5-2: Wetland 68 Comparison of 2013 Vegetation Data to Baseline Averages				
	Spring 2013	Baseline Mean	Baseline Low	Baseline High
W _M	2.42	2.55	2.33	2.78
Species Richness	56	56.14	46.00	70.00
Species Diversity	22.30	20.43	16.63	24.29
Mean C-value	3.39	3.58	3.22	3.83
FQI	22.30	24.62	22.50	28.89

The W_M for the 2013 spring sampling effort did not increase by 0.5 or more from the baseline maximum W_M of 2.78 as shown above in Table 5-2 and in Figure 2 in Appendix I, Section A-1. Additionally, calculated values for species richness, species diversity, and mean c-value all returned to a value near or above the baseline mean values (Table 5-2). Only the FQI calculated value remained below the baseline low value, but it did increase from 18.05 to 22.30 between 2012 and 2013. Using the repeated measures ANOVA, the analysis of the spring 2013 data indicated no statistically significant changes from baseline

averages in any of the vegetative indices. Analysis of the natural color and CIR aerial photography indicated no visible changes at W-68 in 2013 (Appendix I, Section A-1). The data gathered during the operational monitoring effort in 2013 resulted in a green flag as outlined in Figure 4-2 or illustrated in Table 5-3. Following the analysis of the Spring 2013 data, it was recommended and approved by the Corps that Level 2 Decreased Monitoring continue at W-68. Therefore, no additional monitoring was conducted in 2013. The next monitoring effort at W-68 is scheduled for fall 2014.

Table 5-3: Record of Thresholds Evaluation by Sampling Season for Wetland 68

Sampling Season	Increase in W _{AM} by more than 0.5?	A significant difference in three or more of the following indices?				Change visible on aerial photos?	Flag?	Monitoring Intensity Change?
		FQI	mean c-value	species diversity	species richness			
Sept. 2008	No	No	No	No	No	No		No
June 2009	No	No	No	Yes	Yes	No		No
Sept. 2009	No	No	No	No	No	No		Yes - Decrease to Level 1
June 2010	No*	No	No	Yes	Yes	No		No - Remain at Level 1
Sept. 2010	No	No	No	No	No	NA		No - Remain at Level 1
June 2011	No	No	No	No	No	No		Yes – Decrease to Level 2
Sept. 2012	No	Yes	Yes	No	Yes	NA		No – Remain at Level 2
June 2013	No	No	No	No	No	No		No – Remain at Level 2

* = A significant decrease in W_{AM} occurred, indicating that the wetland was wetter than baseline average.

5.1.1.2 PEM Wetland 25 – Saunders County

Wetland 25 is a PEM wetland located in Saunders County, Nebraska (Figure 1, Section B-1, Appendix I). The vegetation in this wetland was sampled using 3 transects, 15 gradsects, and 75 sample plots. Dominant species observed in this wetland during the 2013 monitoring efforts included sawtooth sunflower (*Helianthus grosseserratus*), reed canarygrass (*Phalaris arundinacea*), and fox sedge. Wetland 25 (excluding the upland gradsects) had a W_{AM} of 2.64 in the spring of 2013 and 2.37 in the fall (Table 5-4), indicating that it continues to be dominated by wetland vegetation. The baseline maximum threshold W_{AM} prior to Project operation for W-25 is 2.52. The W_{AM} for the spring 2013 monitoring effort exceeded the baseline maximum threshold as illustrated in Figure 2 in Section B-1 in Appendix I. Additionally, statistical analysis showed a statistically significant difference in species diversity, mean c-value, and FQI compared to the baseline mean. As a result, it was recommended and approved by the Corps and the District, that a fall 2013 monitoring visit would be conducted at W-25. The W_{AM} for the fall 2013 monitoring effort was 2.37 which is within the baseline range. For the two 2013 monitoring efforts, this wetland contained an average of 88 percent native species and 47.5 percent invasive species.

The average FQI for this wetland during the same time period was 13.91, still below the baseline low value of 14.42. The average species richness value in 2013 was 33.5 while the mean c-value averaged to 2.57. Tables 1 and 2 in Section B-2 of Appendix I contain a summary of the monitoring data and the complete species list from the 2013 monitoring effort.

	Spring 2013	Fall 2013	Baseline Mean	Baseline Low	Baseline High
W _A _M	2.64	2.37	2.28	1.93	2.52
Species Richness	34	33	48.71	28.00	66.00
Species Diversity	16.36	14.17	22.71	16.63	24.29
Mean C-value	2.56	2.57	3.18	2.77	3.69
FQI	14.25	13.57	20.96	14.42	25.85

The W_A_M for the 2013 spring sampling did not increase by 0.5 or more, but was just above the baseline maximum W_A_M of 2.52 as shown in Table 5-4 and in Figure 2 in Appendix I, Section B-1. The statistical analysis using the repeated measures ANOVA indicated statistically significant changes from baseline averages in two of the four indices being evaluated in 2013 (FQI and mean c-value; Table 5-5). Species diversity, mean c-value, and FQI remained below the baseline low value in 2013. The data gathered and analyzed following the June 2013 monitoring effort prompted a decision to temporarily increase the monitoring intensity to Level 1 Reduced Monitoring. Despite the fact that the thresholds were not technically met that would trigger an increase in monitoring intensity, the 2012 severe drought and vegetative index values outside of the baseline ranges, coupled with the spring 2013 W_A_M value greater than the baseline maximum led to the decision to add a second 2013 monitoring effort in September. The W_A_M for the 2013 fall monitoring effort was 2.37, within the observed baseline range. (Table 5-6; Figure 2, Appendix I, Section C-1). Additionally, only two of the four vegetation indices showed statistically significant differences when compared to the baseline mean values (FQI and mean c-value). Analysis of the natural color and CIR aerial photography indicated no visible changes at W-25 in 2013 (Appendix I, Section B-1). Following the 2013 monitoring efforts, it is recommended that W-25 return to Level 2 Decreased Monitoring in 2014 with the monitoring effort scheduled for September 2014.

Sampling Season	Increase in WA_M by more than 0.5?	A significant difference in three or more of the following indices?				Change visible on aerial photos?	Flag?	Monitoring Intensity Change?
		FQI	mean c-value	species diversity	species richness			
Sept. 2008	No	No	No	No	No	No	🚩	No
June 2009	No	No	No	No	No	No	🚩	No
Sept. 2009	No	No	Yes	No	No	No	🚩	Yes - Decrease to Level 1
June 2010	No	No	No	Yes	Yes	No	🚩	No - Remain at Level 1
Sept. 2010	No	Yes	Yes	No	No	NA	🚩	No - Remain at Level 1
June 2011	No	Yes	Yes	No	No	No	🚩	Yes – Decrease to Level 2
Sept. 2012	No	Yes	Yes	Yes	Yes	NA	🚩	No – Remain at Level 2
June 2013	*No	Yes	Yes	No	No	No	🚩	*Yes – Increase to Level 1
Sept 2013	No	Yes	Yes	No	No	No	🚩	No – Return to Level 2

*The June 2013 WA_M was above the baseline maximum following extreme drought in 2012. Due to the drought, a temporary increase in monitoring intensity was initiated in 2013.

5.1.1.3 PEM Wetland 100 – Saunders County

Wetland 100 is a PEM wetland located in Saunders County, Nebraska (Figure 1, Section C-1, Appendix I). The vegetation in this wetland was sampled using 3 transects, 11 gradsects, and 55 sample plots. W-100 still showed lingering effects of the 2012 drought, but did demonstrate an increase in vegetative cover. Dominant species observed during the 2013 monitoring efforts included annual marsh elder (*Iva annua*) and marijuana (*Cannabis sativa*). Wetland 100 (excluding the upland gradsects) had a WA_M of 3.41 in the spring and 3.63 in the fall of 2013 (Table 5-6), indicating that it continues to be dominated by upland vegetation. The baseline maximum threshold WA_M prior to Project operation for W-100 is 2.96. The WA_M for both the spring and fall of 2013 greatly exceeded the baseline threshold as illustrated in Figure 2 in Section C-1 in Appendix I. This wetland contained an average of 78.5 percent native species and 69.5 percent invasive species in 2013. The average FQI for this wetland during the same time period was 6.74, implying a moderately-low ecological value. Tables 1 and 2 in Section C-2 of Appendix I contain a summary of the monitoring data and the complete species list from both of the 2013 monitoring efforts.

The WA_M for the 2013 spring sampling was well above the baseline high value of 2.96, although it did not exceed the baseline value by more than 0.5 as shown in Table 5-6 and in Figure 2 in Appendix I, Section C-1. The statistical analysis, using the repeated measures ANOVA, indicated statistically significant changes in two of the four indices (FQI and mean c-value) in the spring compared to baseline averages in 2013 (Table 5-7).

	Spring 2013	Fall 2013	Baseline Mean	Baseline Low	Baseline High
W _A _M	3.41	3.63	2.40	1.71	2.96
Species Richness	33	18	28.71	23.00	33.00
Species Diversity	15.60	9.63	14.13	11.34	17.09
Mean C-value	1.91	1.00	3.41	3.00	3.72
FQI	9.73	3.74	16.42	14.70	18.33

The data gathered and analyzed following the June 2013 monitoring effort at W-100 prompted a decision to conduct an additional monitoring effort at W-100 in the fall. Despite the fact that the thresholds were not technically met that would trigger an increase in monitoring intensity, the severe drought and subsequent change in the vegetation community in 2012 coupled with the spring 2013 W_A_M value significantly greater than the baseline maximum led to the decision to add a second 2013 monitoring effort. The W_A_M for the 2013 fall monitoring effort was again well above the baseline maximum, this time showing an increase of more than 0.5 (Table 5-6; Figure 2, Appendix I, Section C-1). Additionally, all four vegetation indices showed statistically significant differences when compared to the baseline mean values. Analysis of the 2013 natural color and CIR aerial photography indicated a general lack of wetland signatures typically seen in previous years at W-100 (Appendix I, Section C-1). It is recommended that monitoring at W-100 be formally increased to Level 1 Decreased Monitoring for 2014 with monitoring efforts scheduled for June and September.

Sampling Season	Increase in W _A _M by more than 0.5?	A significant difference in three or more of the following indices?				Change visible on aerial photos?	Flag?	Monitoring Intensity Change?
		FQI	mean c-value	species diversity	species richness			
Sept. 2008	No*	No	No	No	No	No	🚩	No
June 2009	No*	No	No	No	No	No	🚩	No
Sept. 2009	No	No	No	No	No	No	🚩	Yes - Decrease to Level 1
June 2010	No	No	No	No	No	No	🚩	No - Remain at Level 1
Sept. 2010	No	Yes	Yes	No	No	NA	🚩	No - Remain at Level 1
June 2011	No	Yes	Yes	No	Yes	No	🚩	Yes - Decrease to Level 2
Sept. 2012	Yes	Yes	Yes	Yes	Yes	NA	🚩	No – Remain at Level 2
June 2013	No	Yes	Yes	No	No	No	🚩	Yes – Increase to Level 1
Sept. 2013	Yes	Yes	Yes	Yes	Yes	No	🚩	Yes – Remain at Level 1

* = A significant decrease in WAM occurred, indicating that the wetland was wetter than baseline average.

5.1.2 False-color Infrared (CIR) Aerial Photography

As described above, CIR aerial photography was scheduled and obtained in 2013. CIR and natural color aerial photography were flown by Wilson and Company on August 20, 2013, and are included for the wetlands in the well fields in Appendix I, Section A. Some deviations from past CIR aerial photography were noted in the 2013 review of the monitored wetlands, particularly W-100 as described above. As Project operation continues and potential impacts are noted, a more detailed analysis may be warranted.

5.2 WETLAND MONITORING IN THE CONES OF DEPRESSION

As stated above, natural color and CIR aerial photography were obtained in 2013 after not being obtained in 2012 per the Level 2 Decreased Monitoring protocol. Figures depicting the monitoring of the wetlands in the cones of depression based on natural color and CIR aerial photography are included in Appendix II. A detailed analysis of the secondary wetlands has not been conducted at this time; however some deviations from past aerial photography were noted in 2013, particularly with regard to land use at some of the wetlands. As Project operation continues and potential impacts are noted, a more detailed analysis of these wetlands may be warranted.

5.3 HYDROLOGICAL MONITORING

Several different types of hydrological data were collected during the 2013 monitoring efforts. These collected data have been analyzed and the results are discussed below and included in Appendix III.

5.3.1 Groundwater Monitoring Wells

The groundwater monitoring well data collected for 2013 have been graphed and are presented for each monitoring well in Figures 1 through 23 in Section A of Appendix III. Readings from these monitoring wells provide additional hydrological data for comparison should any changes be detected in the wetland vegetation data. In general water elevation readings at the groundwater monitoring wells recovered from historically low readings in 2012, particularly in the late summer. Year 2013 readings showed highest elevation readings in June and July for most wells.

5.3.2 Production Wells

The Project production wells are monitored using installed data loggers. The total production well pumping rates by month, the total volume pumped per month, and the average monthly pumping rates for each production well have been included in Tables 1 and 2 in Section B, Appendix III.

Platte West Well Field Production Wells operated throughout 2013, completing the fifth full year of operation. As in past years, pumping was well below regulated capacity. The rate of pumping during

March 2013 was considerably higher than previous years (80 percent higher) due to a planned plant outage at one of the District's other production facilities.

Due to concerns from the lingering drought of 2012, the District planned self-imposed pumping restrictions during the months of April, May, June, August, and September. No restrictions were planned for July. The planned restrictions were a 25 percent reduction from average monthly flows (2009 through 2012) for all months except May which was a planned 33 percent reduction. The District achieved the planned target flows for April, May, and June averaging approximately 24.2 MGD (million gallons per day) of pumpage for this three-month period as compared to a 2009-2012 average of 36.9 MGD. Due to nearly normal river flows in August the self-imposed restrictions were lifted for August and September. Annual production in 2013 (January through November) declined to 11,048 million gallons (MG) from the 2012 production of 11,891 MG. Both 2012 and 2013 included several months of self-imposed pumping restriction and were both significantly below the record high production year of 2011 (12,448 MG – January through November).

5.3.3 Piezometers

Eighteen piezometers have been installed and are being monitored in the Saunders County well field. The collected data from the 2013 monitoring efforts have been graphed over time and are presented in Section C, Appendix III. Many of the 2013 piezometer readings were again within inches of the bottom of the piezometers and held steady over multiple readings. The bottom elevation of each piezometer is included in the legend of each figure in Section C, Appendix III. Based on the consistent readings over months indicated by many of the piezometers, it is likely that the readings are the result of residual moisture and sediment retained in the tips of the piezometers rather than an accurate measurement of the local water table elevation. In these cases, the actual water table elevation is assumed to be lower than the reported level. In general, water level elevations taken from the piezometers were lower than those observed during baseline conditions for each of the wetlands monitored.

5.3.4 Bathymetric Monitoring of Ponds

The post-operation bathymetric monitoring of ponds located in the Douglas County and Saunders County well fields and associated cones of depression was completed during 2013 as planned. In 2013, most of the pond water levels were highest in March before gradually dropping in August and September, and rebounding in October. Of the 47 ponds monitored in 2013, 23 ponds showed a statistically significant difference in water level elevation when comparing the operational data to the baseline data. This was a notable increase from the seven ponds showing statistically significant differences in 2012. In general, the dry conditions experienced in the region in 2012 and 2013 coupled with the proximity of the ponds to the Douglas County well field, in particular, may be contributing to these changes. Detailed analysis of

these monitoring efforts is included in a separate report, *2013 Annual Bathymetric Monitoring Report for the Ponds within the Well Fields and Cones of Depression* (Burns & McDonnell 2014).

5.3.5 Other Hydrological Data

Additional hydrological data collected during the 2013 monitoring efforts included monthly total precipitation, monthly average ambient air temperature, and stream gauge data. The monthly precipitation from January 1 through December 2013 was very sporadic with wetter than normal months in April, May, August, and October, but very dry months in July and September (Appendix III, Section D). Precipitation was below 0.50 inch in July and September. Overall, the January through December 2012 recorded precipitation total was 24.77 inches, while the annual historical average during the same period was 28.4 inches, indicating a return to nearly average conditions after receiving only 16.12 inches in 2012 (The Weather Channel 2013). Historically, the amount of precipitation increases from January to a peak in June, declines to a plateau in late summer, and continues to decline through the end of the year.

Average ambient air temperature in 2013 fell within the expected monthly high and low temperature range based on historical averages (Figure 2, Section D, Appendix III). Average monthly temperatures ranged between 33 °F and 87 °F from January 1 through December 31, 2013.

According to the monthly historical Palmer Z Drought Indices for 2013, the Project area experienced mid-range drought conditions in June, July, August, and September after enduring extreme drought conditions in much of 2012. The Palmer Drought Indices integrate water supply (precipitation) with water demand (evapotranspiration as computed from temperature) in a soil moisture model (NOAA 2013).

Stream gauge data were obtained from the USGS stream gauge stations on the Platte and Elkhorn Rivers. Historically, stream elevations are highest in the spring and lowest in late summer and early fall (Figures 3 and 4, Section D, Appendix III). In 2013, the mean stream elevation of the Platte River was slightly below the historic monthly mean stream elevation during most months, except for a considerable peak in October likely attributable to heavy rainfall that month. The lowest recorded stream elevation in 2013 was recorded in July. The July level was approximately 0.5 foot below the historical value.

In 2012, mean stream elevations in the Elkhorn River were generally about a foot to foot and a half below historical averages with no single month above the historical average. The pattern paralleled the historic trend with the highest elevation recorded in June and the lowest in September.

* * * * *

6.0 DISCUSSION AND RECOMMENDATIONS

The goal of monitoring wetlands within the Douglas County and Saunders County well fields and associated cones of depression is to evaluate the impact that operation of the Project may have on the existing wetlands. To accomplish this goal, a monitoring approach consisting of a systematic, multi-tiered vegetation sampling procedure has been developed and implemented. Monitoring efforts conducted from the inception of the monitoring program in 2005 through this year's monitoring effort (in 2013) are discussed in the sections below. A review of the thresholds analysis and the current and proposed level of monitoring efforts proposed for next year are also included below.

6.1 DISCUSSION

The following sections discuss the 2013 wetland monitoring efforts for wetlands in the well fields and cones of depression.

6.1.1 Wetland Monitoring in the Well Fields

Data obtained during the 2013 sampling season have been analyzed and the results are included in Appendix I. In 2013, the Level 2 Decreased Annual Wetland Monitoring protocol was initiated with the understanding that data analysis would be completed following the spring monitoring effort at which point a determination would be made regarding the next step in monitoring. This analysis was completed and submitted to the District and the Corps prior to the fall monitoring effort. The analysis prompted the recommendation to perform an additional monitoring effort at two of the three PEM wetlands (W-25 and W-100) in September 2013. W-68 remained within normal ranges and it was decided that an additional monitoring effort in 2013 was unnecessary at that wetland.

Following the 2013 analysis of W-25 and W-100, which included two sampling seasons as described above, it appears that W-25 is returning to normal wetness and species composition based on both pre- and post-operational studies. However, W-100 is still showing vegetative indices outside of the baseline range including a WA_M over 0.5 greater than the baseline maximum (3.63 in the fall of 2013) indicating an area no longer dominated by hydrophytic vegetation. In addition, it was noted during the fall 2013 monitoring effort that W-100 appeared to have been treated with a broadleaf herbicide prior to the monitoring. Many broadleaf species were wilted and/or dried. Tire tracks were visible throughout the wetland including across the transects and gradsects. Numerous rebar demarcating sampling locations were bent or missing completely. Rebar were replaced during the monitoring effort, but the spraying had an impact on the vegetation data collected.

The WA_M calculated for each wetland and each sampling season since monitoring began have been graphed and are included as Figure 5 in Appendix I. This vegetative parameter has been accepted as the most likely indicator of change in the monitored wetlands and these graphs provide a useful visual reference of the WA_M over time. A trend line has also been calculated for each wetland. The trend line for W-68 in Douglas County has a negative slope following the latest monitoring effort, which indicates that the wetland is actually trending towards being wetter rather than drying out as might be anticipated given the operation of the Project. Prior to 2012, the trend lines of W-25 and W-100 in Saunders County also had negative or nearly level slopes. However, following the 2012 summer of extreme drought conditions and resulting higher WA_M values calculated for W-25 and W-100, both trend lines are currently positive, trending slightly toward drier conditions. The upward trend line pattern continued in 2013 at these wetlands, although the calculated WA_M values did decrease on average compared to 2012.

The statistical analysis of the other vegetative parameters at W-25 and W-100 indicated that these monitored wetlands were still experiencing differences in 2013, but recovering following the extreme drought in 2012. At W-68, nearly all values for these vegetative indices were near the baseline average, with the exception of FQI, which was still very near the baseline low value.

6.1.2 Wetland Monitoring in the Cones of Depression

Aerial photography was obtained in 2013 consistent with the protocol developed for Level 2 Decreased Monitoring. No discernible changes were noticed during review and comparison of the 2013 aerials to past photography. Project-specific aerial photography will not be obtained in 2014 per the guidelines of the Level 2 Decreased Annual Wetland Monitoring protocol. Natural color and CIR aerial photography will again be obtained in 2015 and compared to previously obtained images. Over time, these photographs will continue to provide documentation of the normal fluctuations in size, shape, or condition of the various wetlands and will be compared to the baseline conditions. No change in the monitoring protocol for the wetlands in the cones of depression is anticipated at this time.

6.1.3 Hydrological Monitoring

In addition to the wetland monitoring efforts, several different types of hydrological data have been gathered and analyzed as part of the ongoing monitoring efforts. These hydrological data include groundwater monitoring wells, piezometers, monthly average precipitation, monthly average ambient air temperature, and stream gauge data for the Platte and Elkhorn Rivers. Each of these pieces of data remains appropriate and relevant to the monitoring effort and no change to the collection or analysis of this data is recommended at this time.

6.2 RECOMMENDATIONS

This report summarizes the 2013 wetland monitoring efforts. As a result of the conditions observed in the wetlands discussed above, it is recommended that wetland monitoring efforts in 2014 continue without changes to the methodology at wetlands W-68 in Douglas County and W-25 in Saunders County. Level 2 decreased monitoring is conducted once annually at these wetlands and will continue to rotate between the June and September sampling seasons. Since 2013 vegetation monitoring was originally scheduled for June, wetland monitoring will be conducted in September 2014 at these wetlands. In accordance with the Levels of Wetland Monitoring Intensity (Figure 4-1), if W-68 and/or W-25 receive a “green flag” indicating none of the vegetative indices register a statistically significant difference following the 2014 monitoring, the monitoring intensity will potentially be decreased to Level 3 Decreased Monitoring.

Finally, it is recommended that the monitoring intensity at W-100 be increased to Level 1 Decreased Monitoring with monitoring efforts scheduled for both spring and fall in 2013. W-100 differs from the other monitored wetlands described in this report in that it is underlain by a sandy layer rather than a thick clay layer. Additionally, W-100 is located much farther from the Platte River and, therefore, is not as directly tied to the river water elevation compared to W-68 and, to a lesser extent, W-25. If the WA_M value and other vegetative indices at W-100 continue to show statistically significant changes, the level of monitoring intensity at W-100 may continue to be increased or an impact may be occurring which will be discussed with the District and the Corps.

Consistent with the protocol for both Level 1 and Level 2 Decreased Monitoring, aerial photography will not be flown in 2014. However, all hydrological data will again be collected and analyzed. Data collected in 2014 will continue to be compared to the baseline data in an attempt to determine the effects, if any, of Project operation.

* * * * *

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APPENDIX I

**WETLAND MONITORING DATA FOR THE DOUGLAS COUNTY AND
SAUNDERS COUNTY WELL FIELDS (FIGURES, TABLES,
PHOTOGRAPHS, DATA SHEETS)**

APPENDIX I - SECTION A

PEM WETLAND 68, DOUGLAS COUNTY WELL FIELD WETLAND MONITORING DATA

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- Figure 3 2013 CIR Aerial Photography of PEM Wetland 68
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- Figure 5 Mean Weighted Average of Wetland 68 Over Time

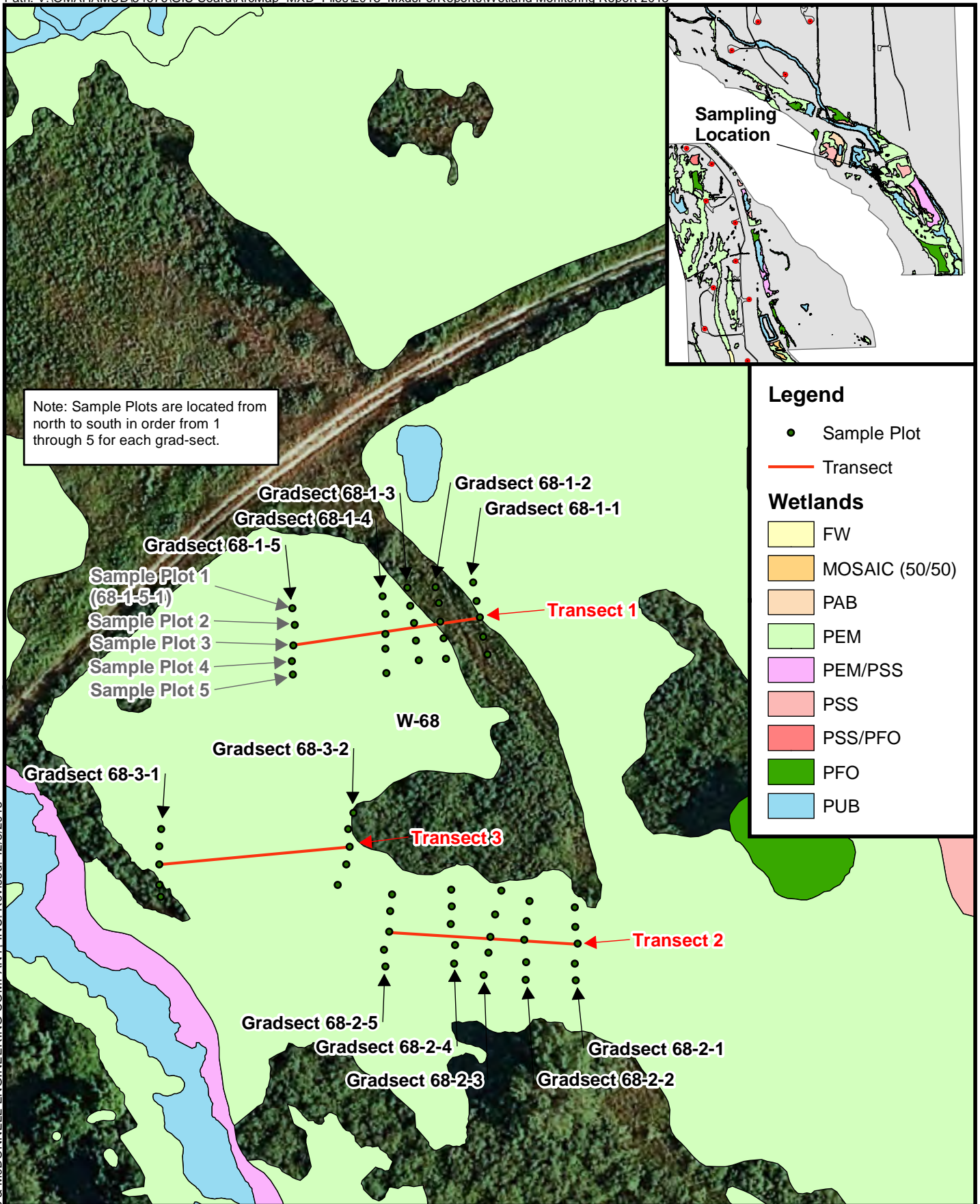
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SECTION A-1
FIGURES



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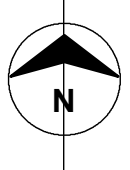
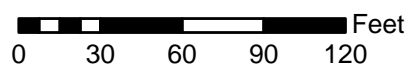


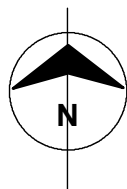
Figure 1
Location Map for
PEM Wetland 68
Douglas County Wellfield
Metropolitan Utilities District

Source: Wilson & Company 2013 Aerial Photography



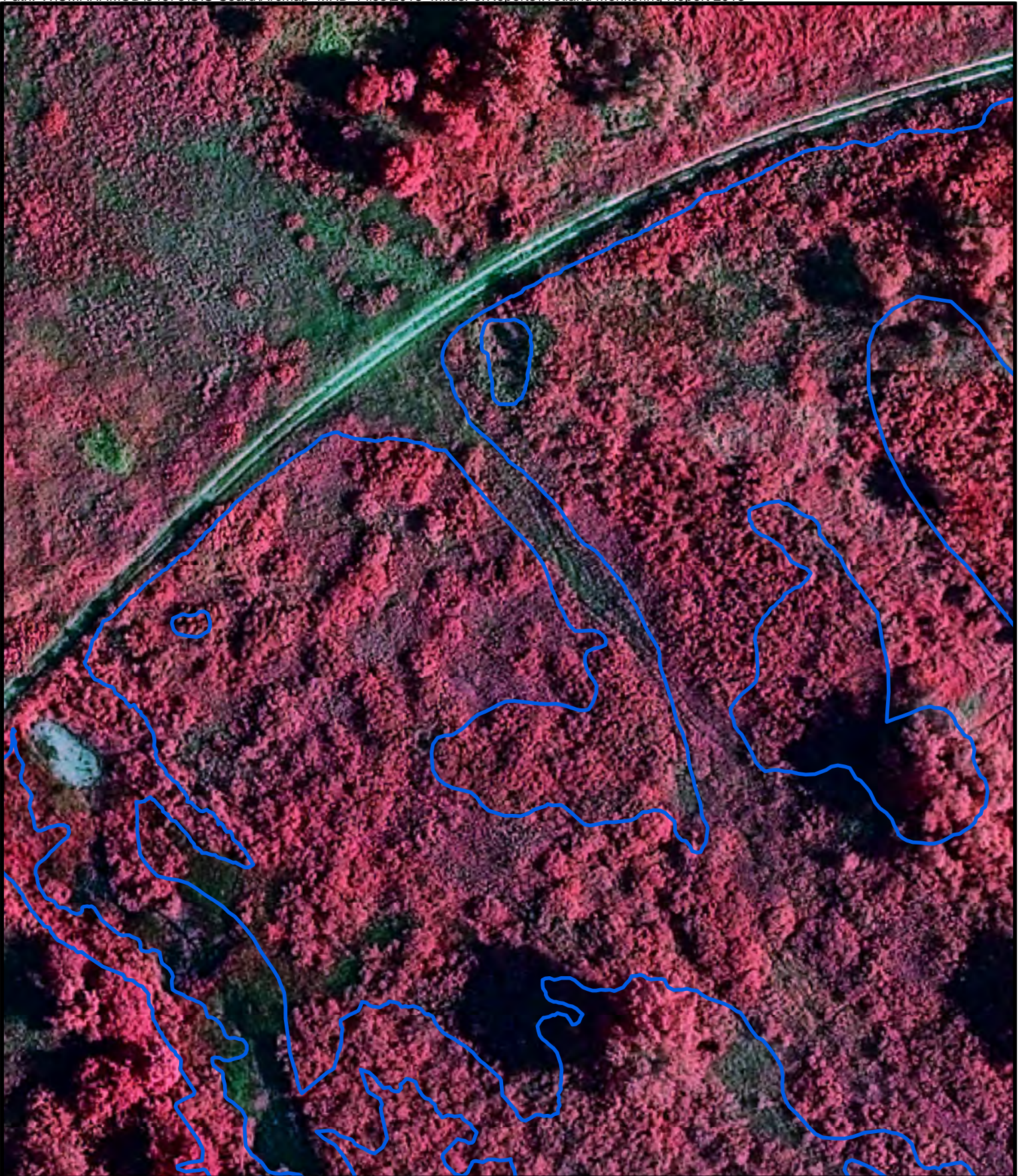
Source: Wilson & Company 2013 Aerial Photography

1:750 Approximate Scale
(1 inch = 62.5 feet)




 Approximate Wetland Boundary

Figure 2
2013 Natural Color Aerial Photograph
of PEM Wetland 68
Douglas County
Wellfield Wetland Monitoring
Metropolitan Utilities District



Source: Wilson & Company 2013
Color Infrared Aerial Photography

1:750 Approximate Scale
(1 inch = 62.5 feet)

 Approximate Wetland Boundary

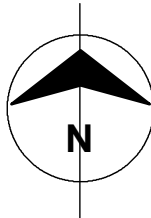


Figure H
2013 CIR Aerial Photography
of PEM Wetland 68
Douglas County
Wellfield Wetland Monitoring
Metropolitan Utilities District

Figure 4 Mean Weighted Average of Wetland Gradsects Compared to the Baseline Threshold in Wetland-68

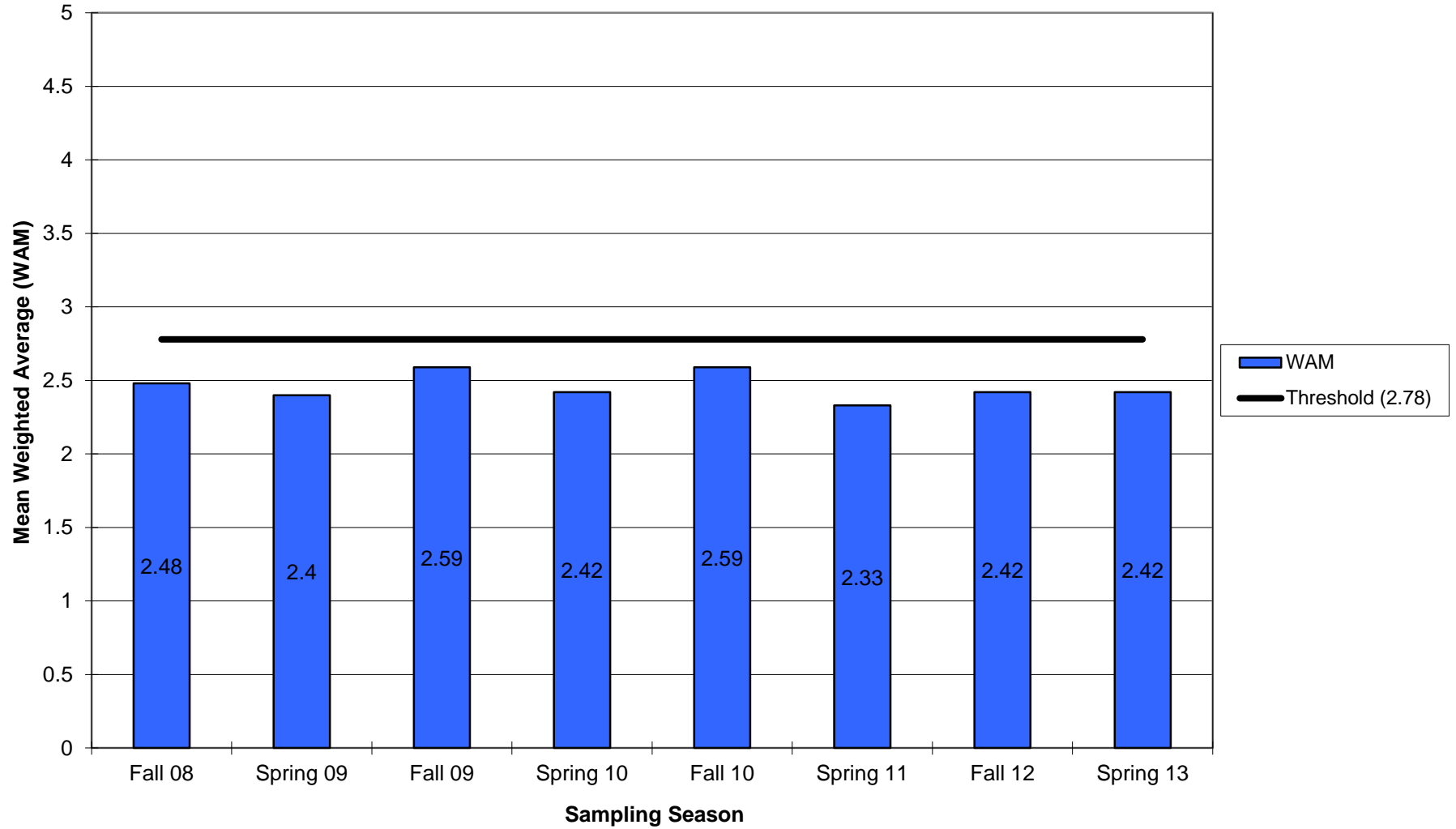
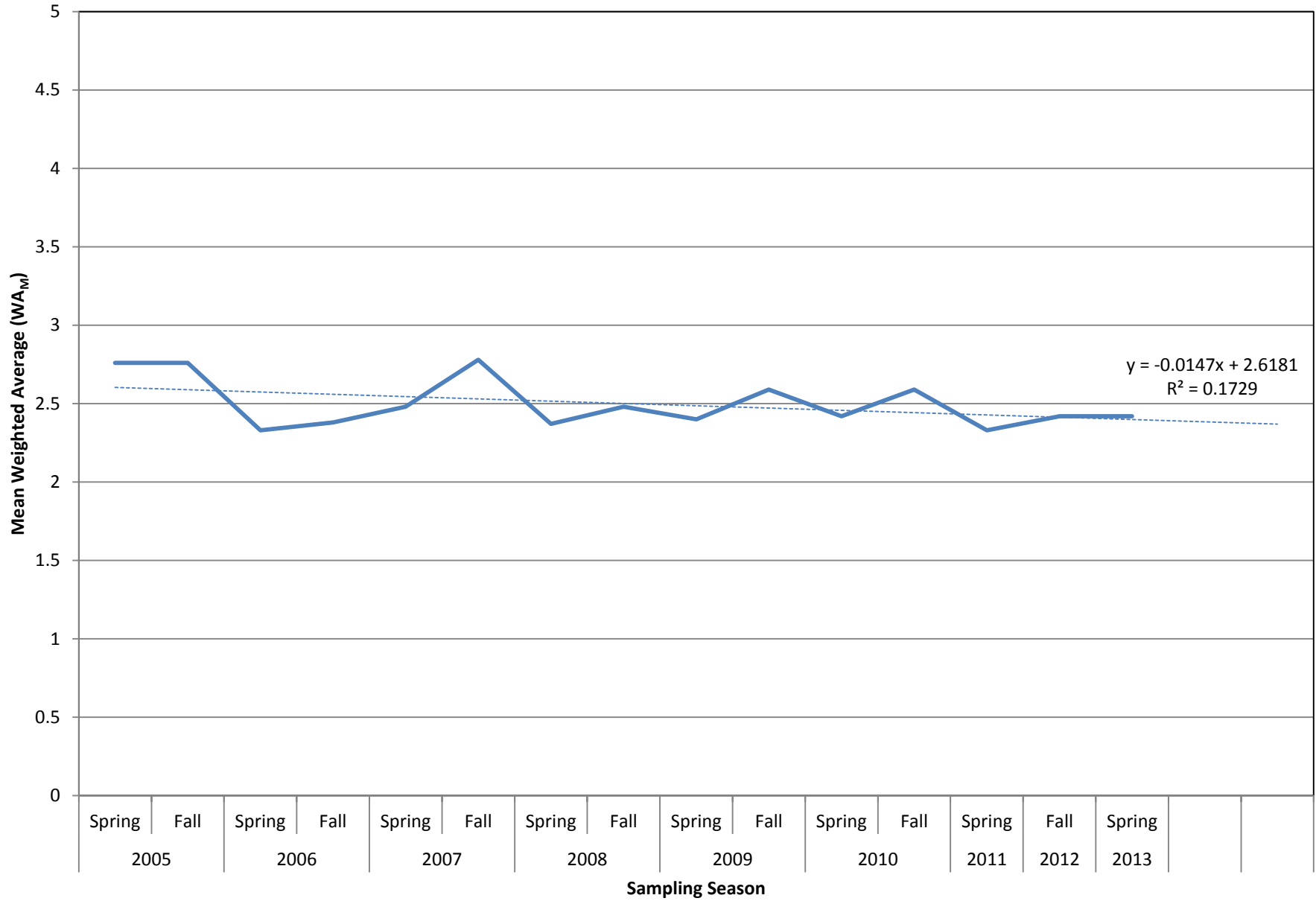


Figure 5 Mean Weighted Average of Wetland 68 Over Time



SECTION A-2
TABLES

Table 1 Summary of Wetland Monitoring Data for Wetland 68

Wetland Name: W-68	Number of Transects/Macroplots: 3
Wetland Type: PEM	Number of Gradsects: 12
County: Douglas	Number of Sample Plots: 60
	Number of Wetland Sample Plots: 50

Sampling Effort: **2013 Spring**

Weighted Average: 2.42	Percent Native Species: 91
Species Richness: 56	Percent Invasive Species: 38
Species Diversity: 22.30	Percent Perennial/Biennial/Annual Species: 86 / 4 / 14
FQI: 24.19	Mean C-Value: 3.39

Dominant Species:

Scientific Name	Common Name	Wetland Indicator Status	Percent Cover per Wetland
<i>Carex vulpinoidea</i>	Fox sedge	OBL	35.9
<i>Helianthus grosseserratus</i>	Sawtooth sunflower	FACW	19.3
<i>Phalaris arundinacea</i>	Reed canarygrass	FACW+	14.9
<i>Poa pratensis</i>	Kentucky bluegrass	FACU	40.8
<i>Solidago gigantea</i>	Giant goldenrod	FACW	14.25
<i>Spartina pectinata</i>	Prairie cordgrass	FACW	13.3

Table 2 Species List and Vegetative Characteristics for Wetland 68

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Thursday, January 02, 2014

Sampling Effort: **2013 Spring**

Scientific Name	Common Name	Wetland Indicator Status ¹	Ecological Index ²	C-Value	Native Status	Invasive?	Frequency ³	Average Percent Cover ⁴
<i>Ambrosia artemisiifolia</i>	Annual ragweed	FACU	4	0	Native	<input checked="" type="checkbox"/>	5	0.38
<i>Amorpha fruticosa</i>	Desert false indigo	OBL	1	5	Native	<input checked="" type="checkbox"/>	3	2.75
<i>Anemone canadensis</i>	Canadian anemone	FACW	2	4	Native	<input type="checkbox"/>	2	0.35
<i>Apios americana</i>	Groundnut	FACW	2	6	Native	<input type="checkbox"/>	3	0.40
<i>Apocynum cannabinum</i>	Indianhemp	FAC	3	2	Native	<input checked="" type="checkbox"/>	1	0.30
<i>Asclepias syriaca</i>	Common milkweed	NL	3	1	Native	<input checked="" type="checkbox"/>	1	0.30
<i>Boehmeria cylindrica</i>	Smallspike false nettle	OBL	1	6	Native	<input type="checkbox"/>	7	2.05
<i>Bromus inermis</i>	Smooth brome	NL	3		Native & Introduced	<input checked="" type="checkbox"/>	4	2.10
<i>Calystegia sepium</i>	Hedge false bindweed	FAC	3	1	Native & Introduced	<input checked="" type="checkbox"/>	4	1.20
<i>Carex bicknellii</i>	Bicknell's sedge	FACU	4	6	Native	<input type="checkbox"/>	1	1.25
<i>Carex blanda</i>	Eastern woodland sedge	FAC	3	2	Native	<input type="checkbox"/>	7	5.80
<i>Carex brevior</i>	Shortbeak sedge	FAC	3	4	Native	<input type="checkbox"/>	2	1.05
<i>Carex molesta</i>	Troublesome sedge	FAC	3	3	Native	<input type="checkbox"/>	1	0.30
<i>Carex vulpinoidea</i>	Fox sedge	OBL	1	4	Native	<input type="checkbox"/>	36	35.90
<i>Cirsium altissimum</i>	Tall thistle	NL	3	1	Native	<input checked="" type="checkbox"/>	1	0.30
<i>Commelina communis</i>	Asiatic dayflower	FAC	3		Introduced	<input type="checkbox"/>	1	0.75
<i>Cornus drummondii</i>	Roughleaf dogwood	FAC	3	3	Native	<input type="checkbox"/>	2	0.60
<i>Eleocharis erythropoda</i>	Bald spikerush	OBL	1	5	Native	<input type="checkbox"/>	15	11.40

1 = OBL - obligate; FACW - facultative wet; FAC - facultative; FACU - facultative upland; UPL - upland; NI - no indicator

2 = Ecological Index values correspond to the wetland indicator status for each species

3 = Frequency is the total number of plots in which the species was identified

4 = Average percent cover is calculated from the coverages estimated during this monitoring effort.

Table 2 Species List and Vegetative Characteristics for Wetland 68

Report generated:
Thursday, January 02, 2014

<i>Equisetum arvense</i>	Field horsetail	FAC	3	4	Native	<input checked="" type="checkbox"/>	8	1.65
<i>Galium aparine</i>	Stickywilly	FACU	4	0	Native	<input checked="" type="checkbox"/>	19	11.90
<i>Galium obtusum</i>	Bluntleaf bedstraw	FACW	2	6	Native	<input type="checkbox"/>	26	9.45
<i>Helianthus grosseserratus</i>	Sawtooth sunflower	FACW	2	4	Native	<input checked="" type="checkbox"/>	27	19.30
<i>Helianthus maximiliani</i>	Maxilian sunflower	UPL	5	4	Native	<input type="checkbox"/>	11	2.05
<i>Ipomoea purpurea</i>	Tall morning-glory	FACU	4		Introduced	<input checked="" type="checkbox"/>	3	0.61
<i>Juncus effusus</i>	Common rush	OBL	1	6	Native	<input type="checkbox"/>	2	1.55
<i>Juncus tenuis</i>	Poverty rush	FAC	3	3	Native	<input type="checkbox"/>	1	0.75
<i>Leersia oryzoides</i>	Rice cutgrass	OBL	1	4	Native	<input type="checkbox"/>	1	0.75
<i>Leersia virginica</i>	White grass	FACW	2	4	Native	<input type="checkbox"/>	1	0.75
<i>Lycopus americanus</i>	American water horehound	OBL	1	4	Native	<input checked="" type="checkbox"/>	1	0.05
<i>Lysimachia thyrsoiflora</i>	Tufted loosestrife	OBL	1	7	Native	<input type="checkbox"/>	11	6.75
<i>Medicago lupulina</i>	Black medick	FAC	3		Introduced	<input checked="" type="checkbox"/>	3	0.15
<i>Muhlenbergia schreberi</i>	Nimblewill	FACU	4	0	Native	<input checked="" type="checkbox"/>	1	0.75
<i>Oxalis stricta</i>	Common yellow oxalis	FACU	4	0	Native	<input checked="" type="checkbox"/>	1	0.05
<i>Phalaris arundinacea</i>	Reed canarygrass	FACW+	2	0	Native	<input checked="" type="checkbox"/>	21	14.90
<i>Phragmites australis</i>	Common reed	FACW	2		Native	<input checked="" type="checkbox"/>	1	0.75
<i>Physalis heterophylla</i>	Clammy groundcherry	NL	3	4	Native	<input checked="" type="checkbox"/>	2	0.35
<i>Physalis longifolia</i>	Longleaf groundcherry	NL	3	0	Native	<input type="checkbox"/>	2	0.35
<i>Poa pratensis</i>	Kentucky bluegrass	FACU	4		Native & Introduced	<input checked="" type="checkbox"/>	32	40.80
<i>Rudbeckia hirta</i>	Blackeyed susan	FACU	4	4	Native	<input type="checkbox"/>	3	0.40

1 = OBL - obligate; FACW - facultative wet; FAC - facultative; FACU - facultative upland; UPL - upland; NI - no indicator

2 = Ecological Index values correspond to the wetland indicator status for each species

3 = Frequency is the total number of plots in which the species was identified

4 = Average percent cover is calculated from the coverages estimated during this monitoring effort.

Table 2 Species List and Vegetative Characteristics for Wetland 68

Report generated:
Thursday, January 02, 2014

<i>Sagittaria latifolia</i>	Broadleaf arrowhead	OBL	1	5	Native	<input type="checkbox"/>	1	0.75
<i>Schoenoplectus pungens</i>	Common threesquare	OBL	1	4	Native	<input type="checkbox"/>	15	5.80
<i>Schoenoplectus tabernaemont</i>	Softstem bulrush	OBL	1	5	Native	<input type="checkbox"/>	1	1.25
<i>Sium suave</i>	Hemlock waterparsnip	OBL	1	7	Native	<input type="checkbox"/>	1	0.05
<i>Solidago canadensis</i>	Canada goldenrod	FACU	4	2	Native	<input type="checkbox"/>	21	11.55
<i>Solidago gigantea</i>	Giant goldenrod	FACW	2	3	Native	<input type="checkbox"/>	31	14.25
<i>Spartina pectinata</i>	Prairie cordgrass	FACW	2	5	Native	<input type="checkbox"/>	24	13.30
<i>Symphotrichum lanceolatum</i>	White panicle aster	NI	3	2	Native	<input type="checkbox"/>	4	1.65
<i>Symphotrichum lateriflorum</i>	Calico aster	FACW	2	5	Native	<input type="checkbox"/>	7	2.55
<i>Symphotrichum ontarionis</i>	Bottomland aster	FAC	3	5	Native	<input type="checkbox"/>	12	6.30
<i>Symphotrichum pilosum</i>	Hairy white oldfield aster	FACU	4	0	Native	<input type="checkbox"/>	1	0.30
<i>Symphotrichum praealtum</i>	Willowleaf aster	FACW	2	5	Native	<input type="checkbox"/>	1	0.30
<i>Teucrium canadense</i>	Canada germander	FACW	2	4	Native	<input checked="" type="checkbox"/>	7	2.55
<i>Thlaspi arvense</i>	Field Pennycress	FACU	4	0	Introduced	<input checked="" type="checkbox"/>	1	0.75
<i>Toxicodendron radicans</i>	Eastern poison ivy	FACU	4	2	Native	<input type="checkbox"/>	4	1.40
<i>Ulmus rubra</i>	Slippery elm	FAC	3	5	Native	<input type="checkbox"/>	1	0.30
<i>Unknown 1</i>	Unknown seedling	--	3		--	<input type="checkbox"/>	1	0.05

1 = OBL - obligate; FACW - facultative wet; FAC - facultative; FACU - facultative upland; UPL - upland; NI - no indicator

2 = Ecological Index values correspond to the wetland indicator status for each species

3 = Frequency is the total number of plots in which the species was identified

4 = Average percent cover is calculated from the coverages estimated during this monitoring effort.

SECTION A-3
WETLAND 68 GROUND PHOTOGRAPHS



Photo 1: View west of Transect 1 in W-68 (June 2013).



Photo 2: View north of Gradsect 1 on Transect 1 in W-68 (June 2013).



Photo 3: View north of Gradsect 2 on Transect 1 in W-68 (June 2013).



Photo 4: View north of Gradsect 3 on Transect 1 in W-68 (June 2013).



Photo 5: View north of Gradsect 4 on Transect 1 in W-68 (June 2013).



Photo 6: View north of Gradsect 5 on Transect 1 in W-68 (June 2013).



Photo 7: View west of Transect 2 in W-68 (June 2013).



Photo 8: View north of Gradsect 1 on Transect 2 in W-68 (June 2013).



Photo 9: View north of Gradsect 2 on Transect 2 in W-68 (June 2013).



Photo 10: View north of Gradsect 3 on Transect 2 in W-68 (June 2013).



Photo 11: View north of Gradsect 4 on Transect 2 in W-68 (June 2013).



Photo 12: View north of Gradsect 5 on Transect 2 in W-68 (June 2013).



Photo 13: View east of Transect 3 in W-68 (June 2013).



Photo 14: View north of Gradsect 1 on Transect 3 in W-68 (June 2013).



Photo 15: View north of Gradsect 2 on Transect 3 in W-68 (June 2013).

SECTION A-4

**RAW DATA SHEETS – WETLAND VEGETATION COVER AND WATER
DEPTH AT WETLAND 68**

Wetland Vegetation Cover and Water Depth at Wetland 68

Wetland Name: W-68

Wetland Transect/Gradsect #: 68-1-1

Sampling Date: 6/10/2013 **Last Rain Date:** **Last Rain Amount (in):** 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 6 6 6 6

Ambrosia artemisiifolia					3
Andropogon gerardii			2		
Asclepias syriaca			3		
Carex molesta				2	
Carex sp. 1				3	
Dichanthelium oligosanthes				3	
Equisetum arvense		1		2	3
Festuca arundinacea					2
Galium obtusum	3	3	2		
Geum canadense					2
Helianthus grosseserratus		3	4	3	
Helianthus hirsutus					3
Helianthus maximiliani					4
Medicago lupulina				2	3
Phalaris arundinacea	5	4	2		
Poa pratensis	4	5	6	6	5
Schoenoplectus pungens		2	2		
Solidago canadensis	3	2	3	4	
Solidago gigantea			2		
Spartina pectinata			3	4	4
Symphyotrichum pilosum		3			
Toxicodendron radicans	2	3			

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 68

Wetland Name: W-68

Wetland Transect/Gradsect #: 68-1-2

Sampling Date: 6/10/2013 Last Rain Date: Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 7 6 6 6

Ambrosia artemisiifolia	3		1		
Asclepias syriaca		3			
Bromus inermis	4	3	3		
Carex blanda					3
Carex molesta	3				
Carex vulpinoidea				4	
Equisetum arvense					2
Galium aparine				3	
Galium obtusum				3	
Helianthus grosseserratus			4	4	5
Helianthus maximiliani	3		2		
Medicago lupulina	2	2	2		
Poa pratensis	6	7	6	6	6
Rudbeckia hirta					2
Solidago canadensis	2	4	4	3	3
Solidago gigantea					5
Spartina pectinata	3	3			4
Symphotrichum lateriflorum					3
Symphotrichum ontarionis				3	

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 68

Wetland Name: W-68

Wetland Transect/Gradsect #: 68-1-3

Sampling Date: 6/10/2013 Last Rain Date: Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 6 6 7 6

Amorpha fruticosa					3
Carex vulpinoidea	3	4	5		4
Cornus drummondii		3			
Galium aparine				3	3
Helianthus grosseserratus			5	5	5
Helianthus maximiliani	2				
Oxalis stricta					2
Poa pratensis	7	5	5	4	5
Schoenoplectus pungens	3				
Solidago canadensis	4	3	4		4
Solidago gigantea	3	3	3	3	3
Spartina pectinata	3	4	3	2	
Symphotrichum lateriflorum				3	3
Symphotrichum praealtum					3
Toxicodendron radicans		2	3		

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 68

Wetland Name: W-68

Wetland Transect/Gradsect #: 68-1-4

Sampling Date: 6/10/2013 Last Rain Date: Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 6 6 6 6

Apocynum cannabinum					3
Boehmeria cylindrica				2	
Carex brevior				3	
Carex vulpinoidea	6	4	5	5	4
Commelina communis	4				
Cornus drummondii	3				
Equisetum arvense	2			3	
Galium aparine				5	4
Galium obtusum	3	2	2		
Helianthus grosseserratus	3			2	3
Helianthus maximiliani		3	3		
Phalaris arundinacea	3				
Poa pratensis	6	6	7	5	6
Solidago canadensis	3	3	3		4
Solidago gigantea	3	3	3	4	5
Spartina pectinata		4		3	6
Symphotrichum lateriflorum		2	2	5	
Toxicodendron radicans	4				
Unknown 1					2

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 68

Wetland Name: W-68

Wetland Transect/Gradsect #: 68-1-5

Sampling Date: 6/10/2013 Last Rain Date: Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 7 6 6 6

Boehmeria cylindrica			2		
Calystegia sepium			3		
Carex vulpinoidea	4	3	3	4	5
Equisetum arvense				3	3
Galium aparine		3	4		
Galium obtusum	3	3			2
Helianthus grosseserratus	3	4	3	3	4
Helianthus maximiliani	2	3	2	3	2
Poa pratensis	6	4	4	5	6
Rudbeckia hirta			2	3	
Schoenoplectus pungens					3
Solidago canadensis		4	4	3	3
Solidago gigantea	2	3	4	4	2
Spartina pectinata				4	4
Symphotrichum ontarionis	4	4	4	4	3

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 68

Wetland Name: W-68

Wetland Transect/Gradsect #: 68-2-1

Sampling Date: 6/10/2013 Last Rain Date: Last Rain Amount (in): 0

<i>Canopy Coverage Analysis</i>	<u>Plot 1</u>	<u>Plot 2</u>	<u>Plot 3</u>	<u>Plot 4</u>	<u>Plot 5</u>
Depth of Standing Water (in):				0.5	0
Open Water (in):				4	2
Bare Soil (in):	6	6	6	5	6
Ambrosia artemisiifolia			1	2	1
Boehmeria cylindrica				3	
Carex vulpinoidea	4	4	6	5	5
Eleocharis erythropoda	4			4	4
Equisetum arvense					3
Galium aparine			3		
Galium obtusum	3	4	3	3	4
Helianthus grosseserratus	4	5	2		
Ipomoea purpurea			3		
Leersia oryzoides				4	
Lycopus americanus					2
Lysimachia thyrsoiflora	4	3	3	3	3
Phalaris arundinacea		4	3		3
Physalis longifolia	3				
Poa pratensis	5	5	4	3	3
Schoenoplectus pungens	3	3	2	4	3
Solidago canadensis	5				
Solidago gigantea	3	3	4		
Spartina pectinata	4			4	4
Symphyotrichum lanceolatum				3	4
Symphyotrichum ontarionis	3	3	3		
Teucrium canadense	3		3		3

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 68

Wetland Name: W-68

Wetland Transect/Gradsect #: 68-2-2

Sampling Date: 6/10/2013 Last Rain Date: Last Rain Amount (in): 0

<i>Canopy Coverage Analysis</i>	<u>Plot 1</u>	<u>Plot 2</u>	<u>Plot 3</u>	<u>Plot 4</u>	<u>Plot 5</u>
Depth of Standing Water (in):	1		0.5	3	
Open Water (in):	6		6	7	
Bare Soil (in):	6	6	5	6	6
Boehmeria cylindrica		3			
Calystegia sepium					3
Carex blanda			4	4	3
Carex vulpinoidea	6	6	4	4	6
Eleocharis erythropoda	4	4	3	3	4
Galium obtusum	3		4	3	4
Juncus effusus				3	
Lysimachia thyrsoiflora	3	3	6	6	
Phalaris arundinacea	3	3	4	5	6
Schoenoplectus pungens	4		4		
Solidago gigantea		4			
Spartina pectinata	4	3	4	3	3
Symphyotrichum lanceolatum	3				

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

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Wetland Vegetation Cover and Water Depth at Wetland 68

Wetland Name: W-68

Wetland Transect/Gradsect #: 68-2-3

Sampling Date: 6/10/2013 Last Rain Date: Last Rain Amount (in): 0

<i>Canopy Coverage Analysis</i>	<u>Plot 1</u>	<u>Plot 2</u>	<u>Plot 3</u>	<u>Plot 4</u>	<u>Plot 5</u>
Depth of Standing Water (in):		1	0.5		
Open Water (in):		6	5		
Bare Soil (in):	6	6	6	6	7
<i>Apios americana</i>				2	3
<i>Boehmeria cylindrica</i>	3				3
<i>Carex blanda</i>	4	5	6		
<i>Eleocharis erythropoda</i>	4	5	5	4	4
<i>Galium aparine</i>				2	2
<i>Galium obtusum</i>	2	4		2	3
<i>Helianthus grosseserratus</i>					3
<i>Lysimachia thyrsoiflora</i>		2			
<i>Muhlenbergia schreberi</i>					4
<i>Phalaris arundinacea</i>	5	4	5	4	
<i>Poa pratensis</i>				5	3
<i>Schoenoplectus pungens</i>		3	3		
<i>Sium suave</i>		2			
<i>Solidago gigantea</i>				3	3
<i>Spartina pectinata</i>	3				3
<i>Symphotrichum lanceolatum</i>	3				
<i>Symphotrichum ontarionis</i>				4	3
<i>Toxicodendron radicans</i>					3

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 68

Wetland Name: W-68

Wetland Transect/Gradsect #: 68-2-4

Sampling Date: 6/10/2013 Last Rain Date: Last Rain Amount (in): 0

<i>Canopy Coverage Analysis</i>	<u>Plot 1</u>	<u>Plot 2</u>	<u>Plot 3</u>	<u>Plot 4</u>	<u>Plot 5</u>
Depth of Standing Water (in):	0				
Open Water (in):	3				
Bare Soil (in):	6	6	6	6	6
Amorpha fruticosa					6
Apios americana				2	
Boehmeria cylindrica		4			
Calystegia sepium		3			
Carex bicknellii	5				
Carex vulpinoidea	4	6	4		3
Eleocharis erythropoda	5	3			
Galium aparine		3		6	6
Galium obtusum		3	4		
Helianthus grosseserratus			4		
Ipomoea purpurea				1	
Phalaris arundinacea	5	4	5		
Phragmites australis				4	
Physalis heterophylla				2	
Schoenoplectus pungens	4	3			
Solidago gigantea		3	4	3	
Spartina pectinata				3	
Symphotrichum pilosum	3				
Teucrium canadense	4				
Thlaspi arvense					4
Ulmus rubra					3

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 68

Wetland Name: W-68

Wetland Transect/Gradsect #: 68-2-5

Sampling Date: 6/10/2013 Last Rain Date:

Last Rain Amount (in): 0

<i>Canopy Coverage Analysis</i>	<u>Plot 1</u>	<u>Plot 2</u>	<u>Plot 3</u>	<u>Plot 4</u>	<u>Plot 5</u>
Depth of Standing Water (in):					3.5
Open Water (in):					7
Bare Soil (in):	6	7	6	6	6
Anemone canadensis		2			
Bromus inermis			4		
Carex vulpinoidea	6	3		5	4
Cirsium altissimum		3			
Equisetum arvense	2				
Galium aparine	2			4	
Galium obtusum			3		
Helianthus grosseserratus	5	3	5	5	
Juncus effusus					5
Juncus tenuis			4		
Lysimachia thyrsoiflora					4
Phalaris arundinacea			3	3	4
Poa pratensis		5	5	5	
Sagittaria latifolia					4
Schoenoplectus pungens					3
Schoenoplectus tabernaemont					5
Solidago canadensis				3	
Solidago gigantea	4	2			
Spartina pectinata			4		

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 68

Wetland Name: W-68

Wetland Transect/Gradsect #: 68-3-1

Sampling Date: 6/10/2013 Last Rain Date: Last Rain Amount (in): 0

<i>Canopy Coverage Analysis</i>	<u>Plot 1</u>	<u>Plot 2</u>	<u>Plot 3</u>	<u>Plot 4</u>	<u>Plot 5</u>
Depth of Standing Water (in):					0
Open Water (in):					5
Bare Soil (in):	6	6	6	6	7
Amorpha fruticosa	1	1			
Bromus arvensis				3	
Carex vulpinoidea		3			
Cirsium arvense	3	2	3	3	
Conyza canadensis				3	2
Cornus drummondii	3				
Equisetum arvense	2				
Galium aparine	6	6	7	6	3
Galium obtusum	2				
Geum canadense		1			
Ipomoea purpurea	3		3	3	
Juncus effusus					4
Phalaris arundinacea	3	3			4
Phragmites australis			4		
Phyla lanceolata		1			
Physalis heterophylla			3		
Polygonum pensylvanicum			2	3	
Schoenoplectus pungens	2				
Schoenoplectus tabernaemont					4
Solidago canadensis				2	
Solidago gigantea		3	2		
Spartina pectinata	3				

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 68

Wetland Name: W-68

Wetland Transect/Gradsect #: 68-3-2

Sampling Date: 6/10/2013 Last Rain Date:

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 6 6 6 6

Amorpha fruticosa					4
Anemone canadensis				3	
Calystegia sepium	3				
Carex brevior			4		
Carex vulpinoidea		5	6	3	
Equisetum arvense			3		
Galium aparine	5	3		4	4
Galium obtusum		4	3	2	
Helianthus grosseserratus		3	4	5	3
Helianthus maximiliani			3		
Ipomoea purpurea					3
Leersia virginica					4
Phalaris arundinacea	2	3			
Physalis heterophylla					3
Physalis longifolia			2		
Poa pratensis		4		5	
Schoenoplectus pungens				2	
Solidago canadensis	5	3			
Solidago gigantea	4	4	3	2	
Symphyotrichum lateriflorum		3			
Symphyotrichum ontarionis	4				
Teucrium canadense	3	3	3		

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

APPENDIX I - SECTION B

PEM WETLAND 25, SAUNDERS COUNTY WELL FIELD WETLAND MONITORING DATA

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- Figure 3 2013 CIR Aerial Photography of PEM Wetland 25
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- Figure 5 Mean Weighted Average of Wetland 68 Over Time

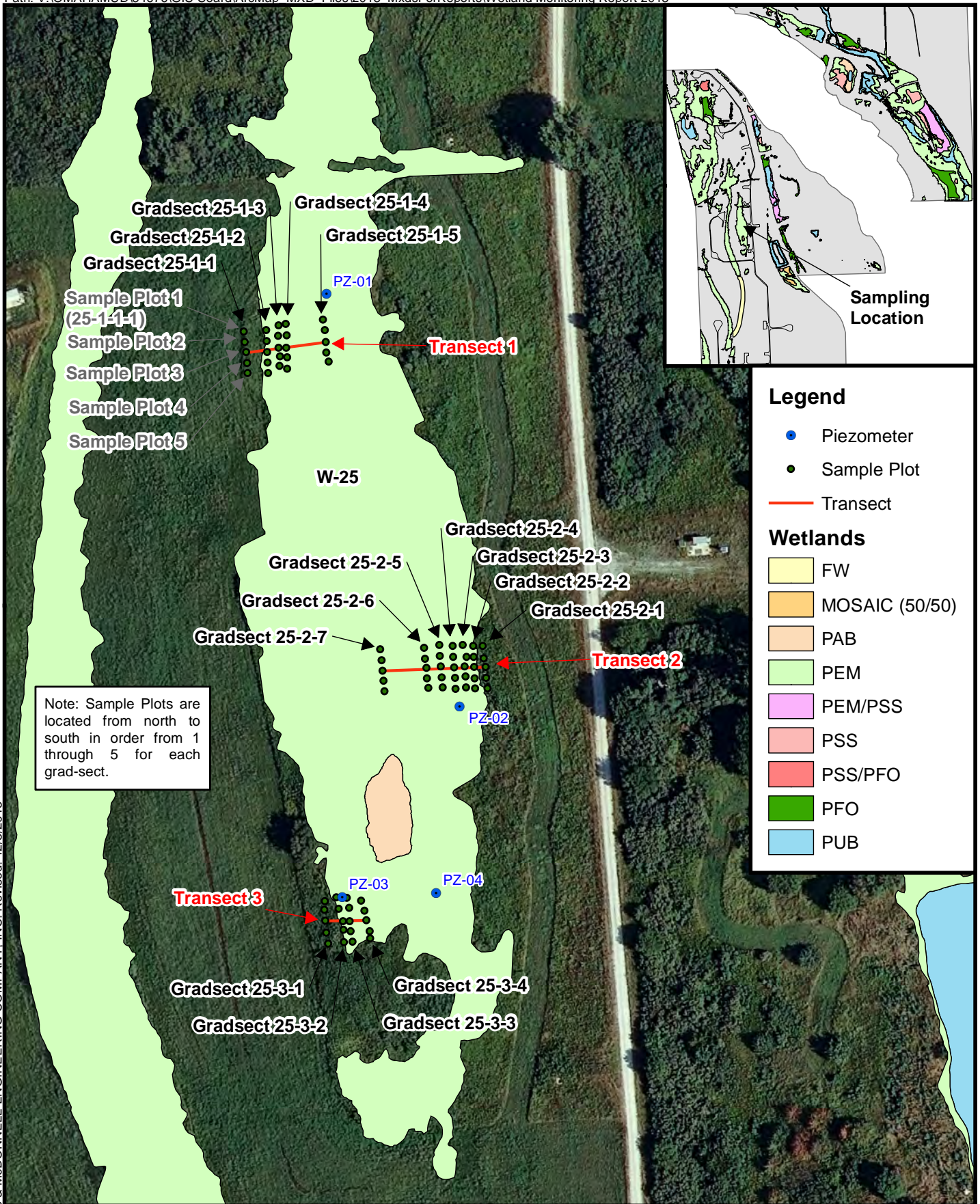
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- Table 1 Summary of Wetland Monitoring Data for Wetland 25
- Table 2 Species List and Vegetative Characteristics for Wetland 25

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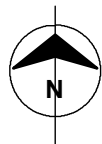
B-4 RAW DATA SHEETS – WETLAND VEGETATION COVER AND WATER DEPTH AT WETLAND 25

SECTION B-1
FIGURES



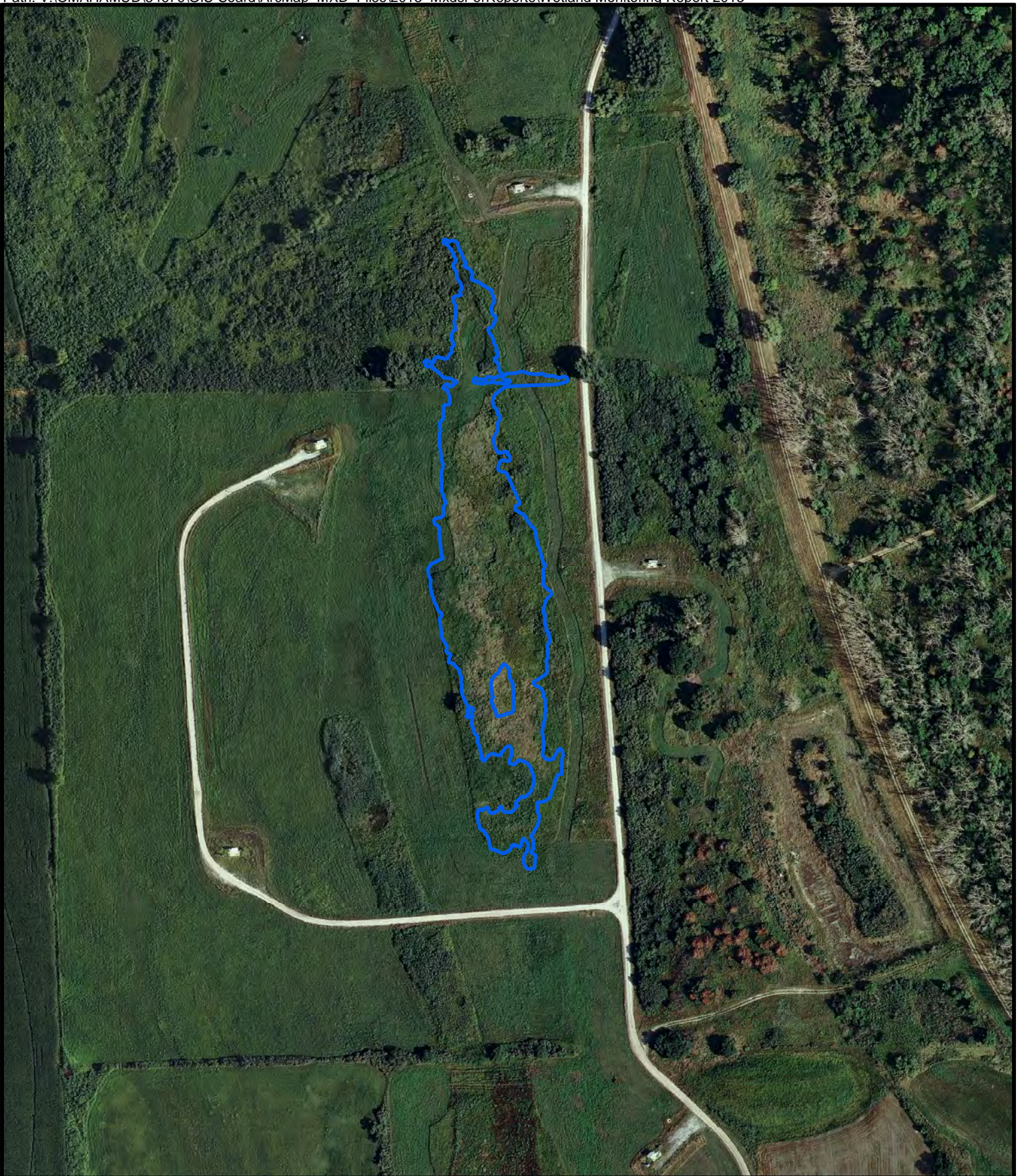
COPYRIGHT © 2013 BURNS & McDONNELL ENGINEERING COMPANY, INC. Revised: 12/8/2013

0 50 100 150 200 Feet



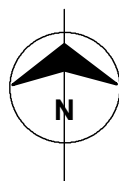
Source: Wilson & Company 2013 Aerial Photography

Figure 1
Location Map for
PEM Wetland 25
Saunders County Wellfield
Metropolitan Utilities District



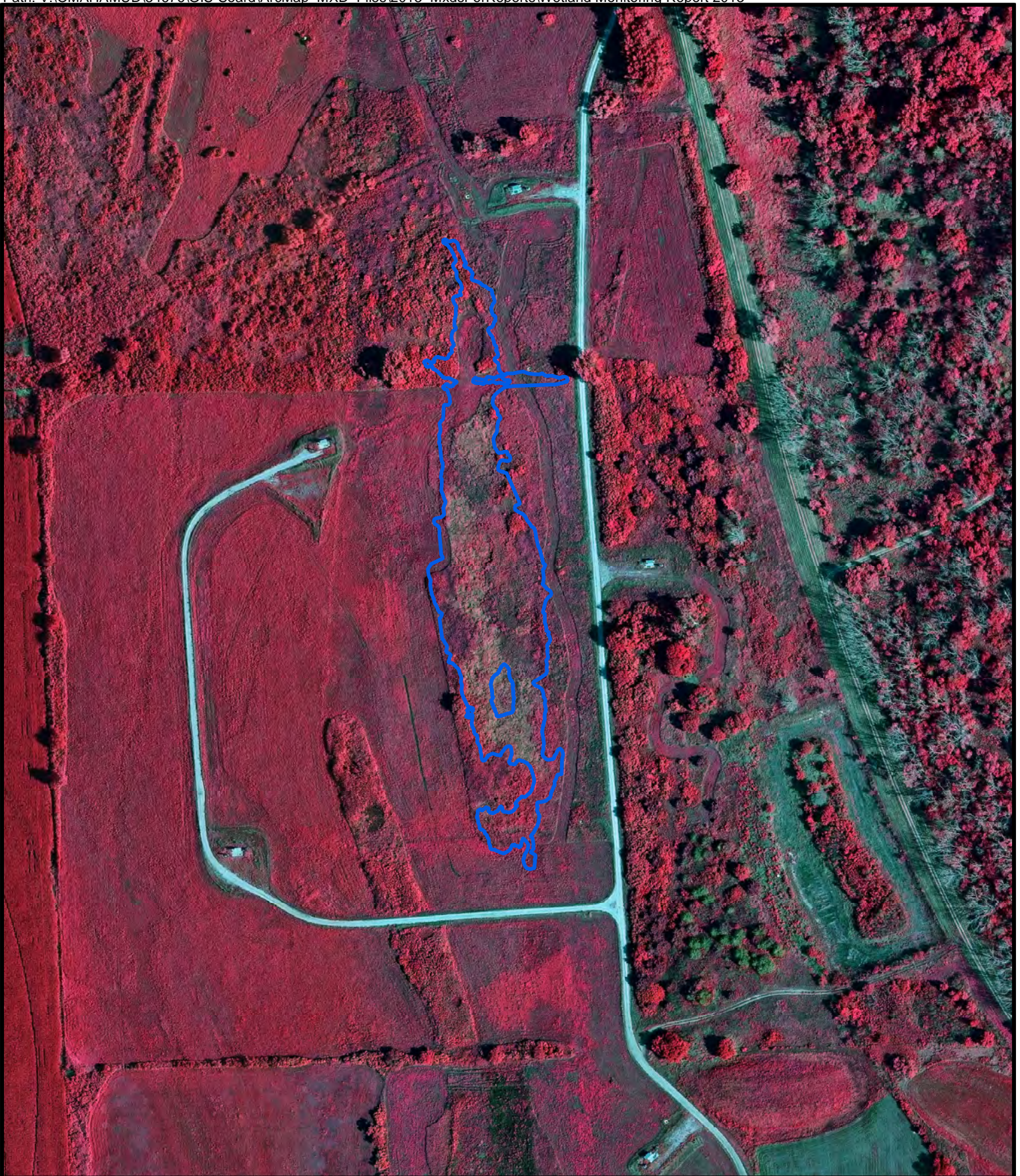
Source: Wilson & Company 2013 Aerial Photography

1:3000 Approximate Scale
(1 inch = 250 feet)



 Approximate Wetland Boundary


Figure 2
2013 Natural Color Aerial Photography
of PEM Wetland 25
Saunders County
Wellfield Wetland Monitoring
Metropolitan Utilities District



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Source: Wilson & Company 2013
Color Infrared Aerial Photography

1:3000 Approximate Scale
(1 inch = 250 feet)

 Approximate Wetland Boundary

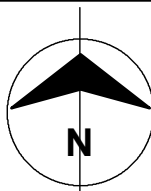


Figure H
2013 CIR Aerial Photography
of PEM Wetland 25
Saunders County
Wellfield Wetland Monitoring
Metropolitan Utilities District

Figure 4 Mean Weighted Average of Wetland Gradsects Compared to the Baseline Threshold in Wetland W-25

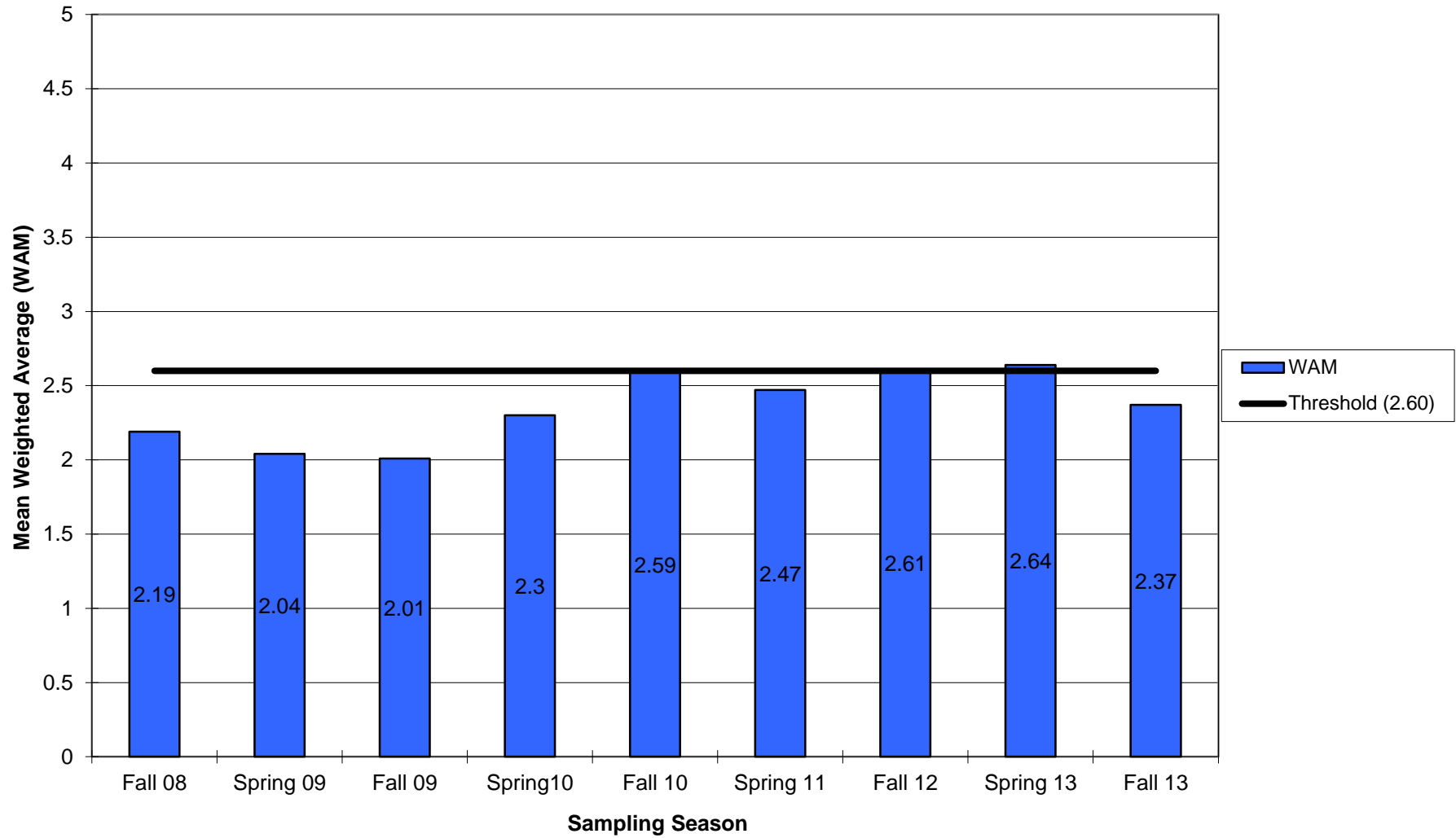
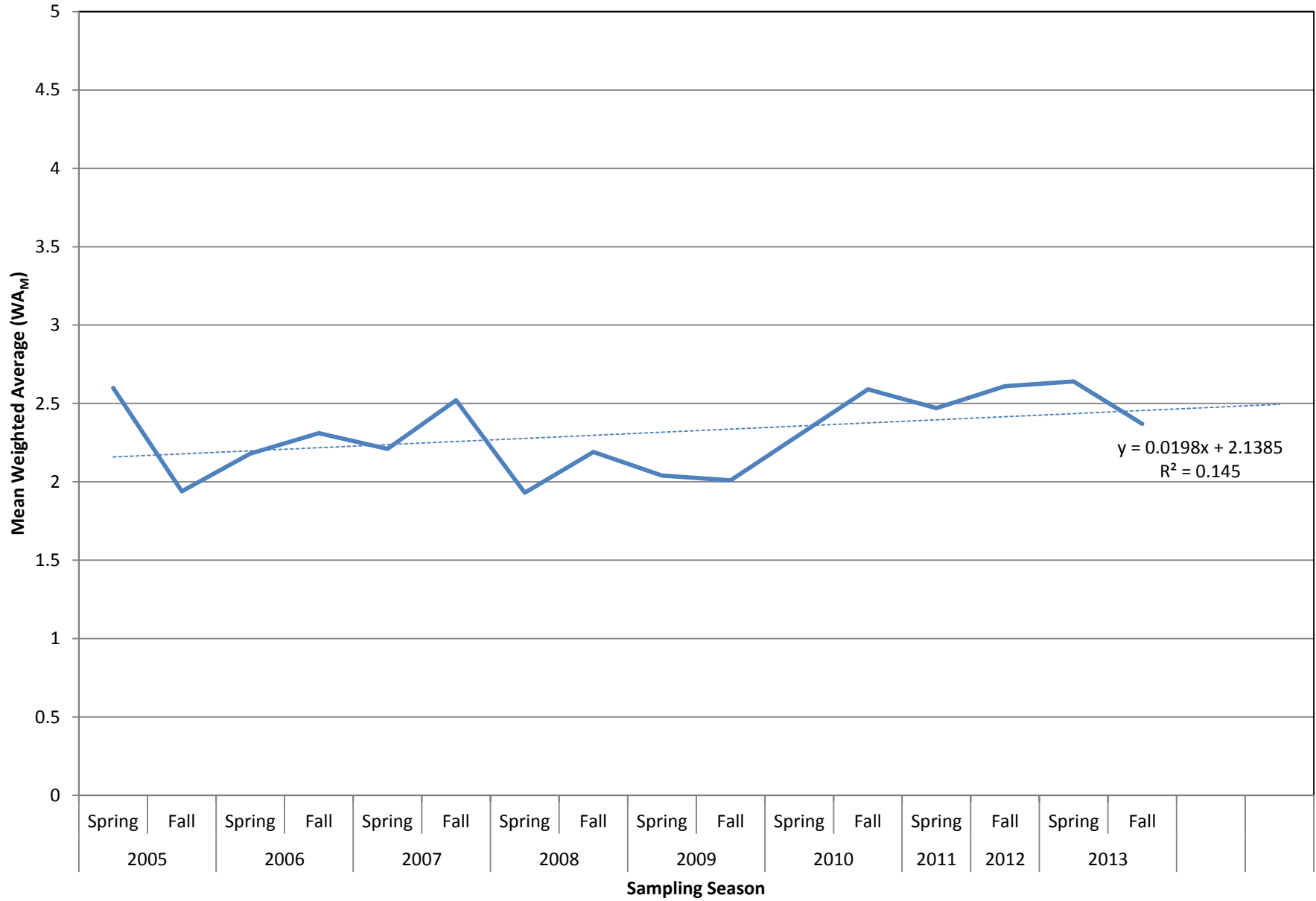


Figure 5 Mean Weighted Average of Wetland 25 Over Time



SECTION B-2
TABLES

Table 1 Summary of Wetland Monitoring Data for Wetland 25

Wetland Name: W-25	Number of Transects/Macroplots: 3
Wetland Type: PEM	Number of Gradsects: 16
County: Saunders	Number of Sample Plots: 80
	Number of Wetland Sample Plots: 65

Sampling Effort: **2013 Fall**

Weighted Average: 2.37	Percent Native Species: 85
Species Richness: 33	Percent Invasive Species: 48
Species Diversity: 14.17	Percent Perennial/Biennial/Annual Species: 70 / 6 / 30
FQI: 13.57	Mean C-Value: 2.57

Dominant Species:

Scientific Name	Common Name	Wetland Indicator Status	Percent Cover per Wetland
<i>Carex vulpinoidea</i>	Fox sedge	OBL	33.77
<i>Helianthus grosseserratus</i>	Sawtooth sunflower	FACW	35.15
<i>Phalaris arundinacea</i>	Reed canarygrass	FACW+	24.23
<i>Solidago canadensis</i>	Canada goldenrod	FACU	14

Sampling Effort: **2013 Spring**

Weighted Average: 2.64	Percent Native Species: 91
Species Richness: 34	Percent Invasive Species: 47
Species Diversity: 16.36	Percent Perennial/Biennial/Annual Species: 79 / 6 / 24
FQI: 14.25	Mean C-Value: 2.56

Dominant Species:

Scientific Name	Common Name	Wetland Indicator Status	Percent Cover per Wetland
<i>Carex vulpinoidea</i>	Fox sedge	OBL	19.73
<i>Helianthus grosseserratus</i>	Sawtooth sunflower	FACW	27.88
<i>Parietaria pennsylvanica</i>	Pennsylvania pellitory	FAC	33.38
<i>Phalaris arundinacea</i>	Reed canarygrass	FACW+	25.96

Table 2 Species List and Vegetative Characteristics for Wetland 25

Report generated:
Thursday, January 02, 2014

Sampling Effort: **2013 Fall**

Scientific Name	Common Name	Wetland Indicator Status ¹	Ecological Index ²	C-Value	Native Status	Invasive?	Frequency ³	Average Percent Cover ⁴
<i>Ambrosia artemisiifolia</i>	Annual ragweed	FACU	4	0	Native	<input checked="" type="checkbox"/>	12	5.04
<i>Apocynum cannabinum</i>	Indianhemp	FAC	3	2	Native	<input checked="" type="checkbox"/>	17	2.96
<i>Asclepias syriaca</i>	Common milkweed	NL	3	1	Native	<input checked="" type="checkbox"/>	7	2.46
<i>Boehmeria cylindrica</i>	Smallspike false nettle	OBL	1	6	Native	<input type="checkbox"/>	4	0.54
<i>Cannabis sativa</i>	Marijuana	FACU-	4		Introduced	<input checked="" type="checkbox"/>	28	9.19
<i>Carex vulpinoidea</i>	Fox sedge	OBL	1	4	Native	<input type="checkbox"/>	42	33.77
<i>Chenopodium album</i>	Lambsquarters	FAC	3		Native & Introduced	<input checked="" type="checkbox"/>	3	0.85
<i>Cirsium altissimum</i>	Tall thistle	NL	3	1	Native	<input checked="" type="checkbox"/>	3	0.50
<i>Cirsium arvense</i>	Canada thistle	FACU	4		Introduced	<input checked="" type="checkbox"/>	7	1.23
<i>Cornus drummondii</i>	Roughleaf dogwood	FAC	3	3	Native	<input type="checkbox"/>	7	3.00
<i>Desmanthus illinoensis</i>	Illinois bundleflower	FACU	4	5	Native	<input type="checkbox"/>	3	0.31
<i>Erechtites hieraciifolia</i>	American burnweed	FAC	3	1	Native	<input type="checkbox"/>	1	0.23
<i>Galium obtusum</i>	Bluntleaf bedstraw	FACW	2	6	Native	<input type="checkbox"/>	5	1.12
<i>Helianthus grosseserratus</i>	Sawtooth sunflower	FACW	2	4	Native	<input checked="" type="checkbox"/>	36	35.15
<i>Iva annua</i>	Annual marsh elder	FAC	3	1	Native	<input type="checkbox"/>	1	0.23
<i>Lactuca serriola</i>	Prickly lettuce	FAC	3		Introduced	<input checked="" type="checkbox"/>	1	0.23
<i>Lycopus americanus</i>	American water horehound	OBL	1	4	Native	<input checked="" type="checkbox"/>	1	0.04
<i>Parietaria pensylvanica</i>	Pennsylvania pellitory	FAC	3	0	Native	<input checked="" type="checkbox"/>	3	1.04

1 = OBL - obligate; FACW - facultative wet; FAC - facultative; FACU - facultative upland; UPL - upland; NI - no indicator

2 = Ecological Index values correspond to the wetland indicator status for each species

3 = Frequency is the total number of plots in which the species was identified

4 = Average percent cover is calculated from the coverages estimated during this monitoring effort.

Table 2 Species List and Vegetative Characteristics for Wetland 25

Report generated:
Thursday, January 02, 2014

<i>Phalaris arundinacea</i>	Reed canarygrass	FACW+	2	0	Native	<input checked="" type="checkbox"/>	23	24.23
<i>Physalis heterophylla</i>	Clammy groundcherry	NL	3	4	Native	<input checked="" type="checkbox"/>	2	0.46
<i>Physalis longifolia</i>	Longleaf groundcherry	NL	3	0	Native	<input type="checkbox"/>	2	0.46
<i>Poa pratensis</i>	Kentucky bluegrass	FACU	4		Native & Introduced	<input checked="" type="checkbox"/>	11	12.65
<i>Polygonum amphibium</i>	Water knotweed	OBL	1		Native	<input type="checkbox"/>	14	4.96
<i>Polygonum caespitosum</i>	Oriental lady's thumb	NI	3		Introduced	<input type="checkbox"/>	1	0.04
<i>Polygonum scandens</i>	Climbing false buckwheat	FACU	4		Native & Introduced	<input type="checkbox"/>	1	0.23
<i>Setaria pumila ssp. pumila</i>	Yellow foxtail	FAC	3		Introduced	<input checked="" type="checkbox"/>	3	1.77
<i>Solanum carolinense</i>	Carolina horsenettle	UPL	5	2	Native	<input checked="" type="checkbox"/>	3	1.04
<i>Solidago canadensis</i>	Canada goldenrod	FACU	4	2	Native	<input type="checkbox"/>	22	14.00
<i>Solidago gigantea</i>	Giant goldenrod	FACW	2	3	Native	<input type="checkbox"/>	15	10.96
<i>Spartina pectinata</i>	Prairie cordgrass	FACW	2	5	Native	<input type="checkbox"/>	5	3.27
<i>Toxicodendron radicans</i>	Eastern poison ivy	FACU	4	2	Native	<input type="checkbox"/>	2	0.46
<i>Viola sp.</i>	Violet	--	3		Native	<input type="checkbox"/>	2	0.08
<i>Vitis riparia</i>	Riverbank grape	FAC	3	3	Native	<input type="checkbox"/>	1	0.04

Sampling Effort: **2013 Spring**

Scientific Name	Common Name	Wetland Indicator Status ¹	Ecological Index ²	C-Value	Native Status	Invasive? ³	Frequency ³	Average Percent Cover ⁴
<i>Ambrosia artemisiifolia</i>	Annual ragweed	FACU	4	0	Native	<input checked="" type="checkbox"/>	16	1.74
<i>Andropogon gerardii</i>	Big bluestem	FAC-	3	5	Native	<input type="checkbox"/>	1	0.58

1 = OBL - obligate; FACW - facultative wet; FAC - facultative; FACU - facultative upland; UPL - upland; NI - no indicator

2 = Ecological Index values correspond to the wetland indicator status for each species

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4 = Average percent cover is calculated from the coverages estimated during this monitoring effort.

Table 2 Species List and Vegetative Characteristics for Wetland 25

Report generated:
Thursday, January 02, 2014

<i>Apocynum cannabinum</i>	Indianhemp	FAC	3	2	Native	<input checked="" type="checkbox"/>	11	1.52
<i>Asclepias syriaca</i>	Common milkweed	NL	3	1	Native	<input checked="" type="checkbox"/>	5	1.31
<i>Boehmeria cylindrica</i>	Smallspike false nettle	OBL	1	6	Native	<input type="checkbox"/>	4	0.92
<i>Cannabis sativa</i>	Marijuana	FACU-	4		Introduced	<input checked="" type="checkbox"/>	42	16.88
<i>Carex sp. 1</i>	Sedge	--	3		Native	<input type="checkbox"/>	16	11.92
<i>Carex vulpinoidea</i>	Fox sedge	OBL	1	4	Native	<input type="checkbox"/>	25	19.73
<i>Chenopodium album</i>	Lambsquarters	FAC	3		Native & Introduced	<input checked="" type="checkbox"/>	3	0.31
<i>Cirsium altissimum</i>	Tall thistle	NL	3	1	Native	<input checked="" type="checkbox"/>	5	1.31
<i>Cirsium arvense</i>	Canada thistle	FACU	4		Introduced	<input checked="" type="checkbox"/>	5	1.15
<i>Cornus drummondii</i>	Roughleaf dogwood	FAC	3	3	Native	<input type="checkbox"/>	5	1.31
<i>Desmanthus illinoensis</i>	Illinois bundleflower	FACU	4	5	Native	<input type="checkbox"/>	1	0.04
<i>Equisetum hyemale</i>	Scouringrush horsetail	FACW	2	4	Native	<input type="checkbox"/>	1	0.04
<i>Erigeron strigosus</i>	Prairie fleabane	FAC	3	2	Native	<input checked="" type="checkbox"/>	1	0.23
<i>Galium aparine</i>	Stickywilly	FACU	4	0	Native	<input checked="" type="checkbox"/>	10	2.27
<i>Galium obtusum</i>	Bluntleaf bedstraw	FACW	2	6	Native	<input type="checkbox"/>	11	2.85
<i>Helianthus grosseserratus</i>	Sawtooth sunflower	FACW	2	4	Native	<input checked="" type="checkbox"/>	28	27.88
<i>Helianthus maximiliani</i>	Maxilian sunflower	UPL	5	4	Native	<input type="checkbox"/>	1	0.04
<i>Ipomoea purpurea</i>	Tall morning-glory	FACU	4		Introduced	<input checked="" type="checkbox"/>	1	0.23
<i>Parietaria pensylvanica</i>	Pennsylvania pellitory	FAC	3	0	Native	<input checked="" type="checkbox"/>	41	33.38
<i>Phalaris arundinacea</i>	Reed canarygrass	FACW+	2	0	Native	<input checked="" type="checkbox"/>	22	25.96
<i>Poa pratensis</i>	Kentucky bluegrass	FACU	4		Native & Introduced	<input checked="" type="checkbox"/>	17	15.35

1 = OBL - obligate; FACW - facultative wet; FAC - facultative; FACU - facultative upland; UPL - upland; NI - no indicator

2 = Ecological Index values correspond to the wetland indicator status for each species

3 = Frequency is the total number of plots in which the species was identified

4 = Average percent cover is calculated from the coverages estimated during this monitoring effort.

Table 2 Species List and Vegetative Characteristics for Wetland 25

Report generated:
Thursday, January 02, 2014

<i>Polygonum amphibium</i>	Water knotweed	OBL	1		Native	<input type="checkbox"/>	14	3.92
<i>Schoenoplectus fluviatilis</i>	River bulrush	OBL	1		Native	<input type="checkbox"/>	1	0.23
<i>Solanum carolinense</i>	Carolina horsenettle	UPL	5	2	Native	<input checked="" type="checkbox"/>	3	0.31
<i>Solidago canadensis</i>	Canada goldenrod	FACU	4	2	Native	<input type="checkbox"/>	18	9.15
<i>Solidago gigantea</i>	Giant goldenrod	FACW	2	3	Native	<input type="checkbox"/>	15	11.35
<i>Spartina pectinata</i>	Prairie cordgrass	FACW	2	5	Native	<input type="checkbox"/>	3	1.73
<i>Symphotrichum lanceolatum</i>	White panicle aster	NI	3	2	Native	<input type="checkbox"/>	3	0.50
<i>Symphotrichum pilosum</i>	Hairy white oldfield aster	FACU	4	0	Native	<input type="checkbox"/>	1	0.23
<i>Toxicodendron radicans</i>	Eastern poison ivy	FACU	4	2	Native	<input type="checkbox"/>	2	0.27
<i>Typha latifolia</i>	Broadleaf cattail	OBL	1	1	Native	<input checked="" type="checkbox"/>	1	0.04
<i>Viola sp.</i>	Violet	--	3		Native	<input type="checkbox"/>	9	2.04

1 = OBL - obligate; FACW - facultative wet; FAC - facultative; FACU - facultative upland; UPL - upland; NI - no indicator

2 = Ecological Index values correspond to the wetland indicator status for each species

3 = Frequency is the total number of plots in which the species was identified

4 = Average percent cover is calculated from the coverages estimated during this monitoring effort.

SECTION B-3
WETLAND 25 GROUND PHOTOGRAPHS



Photo 1: View east of Transect 1 in W-25 (June 2013).



Photo 2: View north of Gradsect 1 on Transect 1 in W-25 (June 2013).



Photo 3: View north of Gradsect 2 on Transect 1 in W-25 (June 2013).



Photo 4: View north of Gradsect 3 on Transect 1 in W-25 (June 2013).



Photo 5: View north of Gradsect 4 on Transect 1 in W-25 (June 2013).



Photo 6: View north of Gradsect 5 on Transect 1 in W-25 (June 2013).



Photo 7: View west of Transect 2 in W-25 (June 2013).



Photo 8: View north of Gradsect 1 on Transect 2 in W-25 (June 2013).



Photo 9: View north of Gradsect 3 on Transect 2 in W-25 (June 2013).



Photo 10: View north of Gradsect 4 on Transect 2 in W-25 (June 2013).



Photo 11: View north of Gradsect 5 on Transect 2 in W-25 (June 2013).



Photo 12: View north of Gradsect 6 on Transect 2 in W-25 (June 2013).



Photo 13: View north of Gradsect 7 on Transect 2 in W-25 (June 2013)



Photo 14: View east of Transect 3 in W-25 (June 2013).



Photo 15: View north of Gradsect 1 on Transect 3 in W-25 (June 2013).



Photo 16: View north of Gradsect 2 on Transect 3 in W-25 (June 2013).



Photo 17: View north of Gradsect 3 on Transect 3 in W-25 (June 2013).



Photo 18: View north of Gradsect 4 on Transect 3 in W-25 (June 2013).



Photo 19: View east of Transect 1 in W-25 (September 2013).



Photo 20: View north of Gradsect 1 on Transect 1 in W-25 (September 2013).



Photo 21: View north of Gradsect 2 on Transect 1 in W-25 (September 2013).



Photo 22: View north of Gradsect 3 on Transect 1 in W-25 (September 2013).



Photo 23: View north of Gradsect 4 on Transect 1 in W-25 (September 2013).



Photo 24: View north of Gradsect 5 on Transect 1 in W-25 (September 2013).



Photo 25: View west of Transect 2 in W-25 (September 2013).



Photo 26: View north of Gradsect 1 on Transect 2 in W-25 (September 2013).



Photo 27: View north of Gradsect 3 on Transect 2 in W-25 (September 2013).



Photo 28: View north of Gradsect 4 on Transect 2 in W-25 (September 2013).



Photo 29: View north of Gradsect 5 on Transect 2 in W-25 (September 2013).



Photo 30: View north of Gradsect 6 on Transect 2 in W-25 (September 2013).



Photo 31: View north of Gradsect 7 on Transect 2 in W-25 (September 2013)



Photo 32: View east of Transect 3 in W-25 (September 2013).



Photo 33: View north of Gradsect 1 on Transect 3 in W-25 (September 2013).



Photo 34: View north of Gradsect 2 on Transect 3 in W-25 (September 2013).



Photo 35: View north of Gradsect 3 on Transect 3 in W-25 (September 2013).



Photo 36: View north of Gradsect 4 on Transect 3 in W-25 (September 2013).

SECTION B-4

**RAW DATA SHEETS – WETLAND VEGETATION COVER AND WATER
DEPTH AT WETLAND 25**

Wetland Vegetation Cover and Water Depth at Wetland 25

Wetland Name: W-25

Wetland Transect/Gradsect #: 25-1-1

Sampling Date: 6/11/2013 Last Rain Date:

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in):	6	6	6	6	6
Andropogon gerardii	5	6	6	6	6
Apocynum cannabinum				2	
Carex sp. 1			3	3	3
Desmanthus illinoensis	2	2	3	4	2
Eleocharis sp.	3	3	3	2	
Equisetum hyemale	2		2		
Juncus dudleyi	3				4
Parietaria pensylvanica				1	
Solidago canadensis	3	3	4	3	

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 25

Wetland Name: W-25

Wetland Transect/Gradsect #: 25-1-2

Sampling Date: 6/11/2013 **Last Rain Date:** **Last Rain Amount (in):** 0

Canopy Coverage Analysis **Plot 1** **Plot 2** **Plot 3** **Plot 4** **Plot 5**

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 6 6 6 6

Ambrosia artemisiifolia	3			2	
Cannabis sativa	2			2	2
Carex sp. 1	6	4	3	4	5
Equisetum hyemale	2				
Galium aparine				3	
Galium obtusum		2		3	3
Helianthus grosseserratus	3	7	7	6	6
Parietaria pensylvanica	4	5	5	6	3
Poa pratensis				4	
Solidago canadensis	3	3	3		
Solidago gigantea	4	3		2	
Symphotrichum lanceolatum				3	
Viola sp.		2	3	4	3

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 25

Wetland Name: W-25

Wetland Transect/Gradsect #: 25-1-3

Sampling Date: 6/11/2013 Last Rain Date:

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 6 6 6 6

Ambrosia artemisiifolia	2	3	3		
Apocynum cannabinum					3
Boehmeria cylindrica				3	3
Cannabis sativa					3
Carex sp. 1	6	5	4	3	5
Cirsium altissimum		3			
Cirsium arvense	3		3	3	
Erigeron strigosus					3
Galium obtusum	3			3	3
Helianthus grosseserratus	4	3	5	6	7
Parietaria pensylvanica	6	6	6	6	5
Solidago canadensis		3	4		
Solidago gigantea		3			
Viola sp.			2	3	3

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 25

Wetland Name: W-25

Wetland Transect/Gradsect #: 25-1-4

Sampling Date: 6/11/2013 **Last Rain Date:**

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in):

	5	6	6	5	6
Ambrosia artemisiifolia	3	2	3		
Apocynum cannabinum		2			
Asclepias syriaca			3		
Cannabis sativa	2	3		3	3
Carex sp. 1	6	5	4		4
Chenopodium album		3			
Cirsium altissimum	3	2			
Cirsium arvense	3	3			
Galium obtusum	2	4	3		
Helianthus grosseserratus		4	6	6	6
Parietaria pensylvanica	6	6	6	6	6
Phalaris arundinacea			4		3
Symphotrichum lanceolatum		2			
Symphotrichum pilosum			3		
Viola sp.				3	

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 25

Wetland Name: W-25

Wetland Transect/Gradsect #: 25-1-5

Sampling Date: 6/11/2013 Last Rain Date:

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 6 6 6 6

Andropogon gerardii

4

Apocynum cannabinum

3

Cannabis sativa

2

3

4

5

3

Carex vulpinoidea

3

5

6

4

3

Parietaria pensylvanica

3

4

6

5

3

Phalaris arundinacea

6

6

4

4

7

Typha latifolia

2

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 25

Wetland Name: W-25

Wetland Transect/Gradsect #: 25-2-1

Sampling Date: 6/11/2013 **Last Rain Date:** **Last Rain Amount (in):** 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 6 6 6 6

Ambrosia artemisiifolia	3	2	2		
Andropogon gerardii	4			5	4
Bromus inermis	3	4	3	3	4
Cannabis sativa				2	
Cornus drummondii					3
Desmanthus illinoensis	2			2	
Helianthus grosseserratus	3	4	5	4	4
Pascopyrum smithii	3				
Poa pratensis	5	6	6	5	5
Solidago canadensis	4	4	4	4	3
Solidago gigantea		3	3		
Verbascum thapsus	3				
Viola sp.	3				

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 25

Wetland Name: W-25

Wetland Transect/Gradsect #: 25-2-3

Sampling Date: 6/11/2013 Last Rain Date:

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 7 6 6 6

Ambrosia artemisiifolia	2	2	1		2
Apocynum cannabinum	2				
Cannabis sativa			3	3	2
Carex vulpinoidea	3				
Chenopodium album	2				
Galium aparine	2	5	2	3	
Helianthus grosseserratus	5	7	4	6	5
Parietaria pensylvanica			2		3
Poa pratensis			5	5	6
Solidago canadensis	5		5	4	5

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 25

Wetland Name: W-25

Wetland Transect/Gradsect #: 25-2-4

Sampling Date: 6/11/2013 Last Rain Date:

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 6 6 6 6

Ambrosia artemisiifolia		3		2	2
Apocynum cannabinum	1				
Cannabis sativa			2		3
Carex vulpinoidea	4	5	4	3	
Cornus drummondii		3	3	4	
Desmanthus illinoensis	2				
Galium aparine					3
Helianthus grosseserratus		3			6
Parietaria pensylvanica					4
Poa pratensis	6	6	6	6	6
Solidago canadensis	4	4	5	4	3
Solidago gigantea			3	5	4
Toxicodendron radicans			3		
Viola sp.					3

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 25

Wetland Name: W-25

Wetland Transect/Gradsect #: 25-2-5

Sampling Date: 6/11/2013 **Last Rain Date:** **Last Rain Amount (in):** 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 6 6 6 7

Ambrosia artemisiifolia				2	
Apocynum cannabinum	3				3
Cannabis sativa	2	5	4	4	3
Carex vulpinoidea	6	6	4	4	4
Cornus drummondii				3	2
Parietaria pensylvanica	3	4	3	5	3
Poa pratensis	4	4	4		
Solidago canadensis	4		3		
Solidago gigantea			6	6	7

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 25

Wetland Name: W-25

Wetland Transect/Gradsect #: 25-2-6

Sampling Date: 6/11/2013 Last Rain Date:

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 6 6 6 6

Apocynum cannabinum					3
Cannabis sativa	4	5	5	4	4
Carex vulpinoidea	5	5	6	3	4
Galium obtusum				3	
Parietaria pensylvanica	3	5	5	5	3
Poa pratensis	5	4	4	4	4
Solidago canadensis		3			
Solidago gigantea				6	5
Spartina pectinata					4
Symphotrichum lanceolatum				3	
Toxicodendron radicans	2				

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 25

Wetland Name: W-25

Wetland Transect/Gradsect #: 25-2-7

Sampling Date: 6/11/2013 **Last Rain Date:** **Last Rain Amount (in):** 0

Canopy Coverage Analysis **Plot 1** **Plot 2** **Plot 3** **Plot 4** **Plot 5**

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 6 6 6 6

Apocynum cannabinum			1	2	3
Boehmeria cylindrica					3
Cannabis sativa	7	6	3	3	4
Carex vulpinoidea	4	6	6	6	5
Chenopodium album	2				
Cirsium altissimum	4	3			
Galium aparine			3		
Galium obtusum		4			
Helianthus grosseserratus			7	5	
Helianthus maximiliani	2				
Parietaria pensylvanica	6	5	5	4	6
Solanum carolinense		3		2	
Spartina pectinata	4				4

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 25

Wetland Name: W-25

Wetland Transect/Gradsect #: 25-3-1

Sampling Date: 6/11/2013 Last Rain Date: Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 6 6 6 6

Asclepias syriaca				2	
Cannabis sativa	4	3	5	4	5
Elymus virginicus			3		
Equisetum hyemale				3	
Galium aparine	3				
Helianthus grosseserratus			5	5	5
Parietaria pensylvanica	4	3	5	4	4
Phalaris arundinacea	4	3			
Polygonum amphibium	4	4	4		
Solidago canadensis		3	4		
Solidago gigantea		3		3	3
Spartina pectinata	4	5			
Urtica dioica				5	

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 25

Wetland Name: W-25

Wetland Transect/Gradsect #: 25-3-2

Sampling Date: 6/11/2013 Last Rain Date:

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 6 6 6 6

Asclepias syriaca	2		3		
Cannabis sativa	4	3	4	4	3
Galium aparine			3		2
Helianthus grosseserratus		3	6	4	5
Ipomoea purpurea		3			
Parietaria pensylvanica		3	6	3	
Phalaris arundinacea	7	6	5	6	6
Polygonum amphibium	4	3	3		4
Solidago gigantea		3			4

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 25

Wetland Name: W-25

Wetland Transect/Gradsect #: 25-3-3

Sampling Date: 6/11/2013 Last Rain Date:

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 6 6 6 6

Cannabis sativa 3 3 3 3

Carex sp. 1 4

Galium aparine 2

Helianthus grosseserratus 4

Phalaris arundinacea 7 6 7 6 5

Polygonum amphibium 3 3 3 3 3

Solanum carolinense 2

Solidago canadensis 3

Solidago gigantea 6

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 25

Wetland Name: W-25

Wetland Transect/Gradsect #: 25-3-4

Sampling Date: 6/11/2013 **Last Rain Date:** **Last Rain Amount (in):** 0

Canopy Coverage Analysis **Plot 1** **Plot 2** **Plot 3** **Plot 4** **Plot 5**

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in):	6	6	6	6	6
<i>Asclepias syriaca</i>				3	4
<i>Boehmeria cylindrica</i>	3				
<i>Carex sp. 1</i>					3
<i>Phalaris arundinacea</i>	7	6	6	7	6
<i>Polygonum amphibium</i>	3	3	3	3	3
<i>Schoenoplectus fluviatilis</i>		3			

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Wetland Vegetation Cover and Water Depth at Wetland 25

Wetland Name: W-25

Wetland Transect/Gradsect #: 25-1-1

Sampling Date: 9/19/2013 Last Rain Date: Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 7 7 7 6 6

Andropogon gerardii 3 3 4 6 6

Desmanthus illinoensis 2 2 4 4

Panicum virgatum 4 5

Solidago canadensis 2 2 3

Spartina pectinata 3 4

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 25

Wetland Name: W-25

Wetland Transect/Gradsect #: 25-1-2

Sampling Date: 9/19/2013 **Last Rain Date:** **Last Rain Amount (in):** 0

Canopy Coverage Analysis **Plot 1** **Plot 2** **Plot 3** **Plot 4** **Plot 5**

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 7 7 7 7 6

Ambrosia artemisiifolia	4	2		4	
Apocynum cannabinum			3		
Cannabis sativa	2				
Carex vulpinoidea	5	4	3	4	5
Cirsium arvense					3
Desmanthus illinoensis				2	3
Galium obtusum			2		
Helianthus grosseserratus	4	6	5	5	6
Solidago canadensis	4	4	4	4	4
Solidago gigantea	4				
Viola sp.	2		2		

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 25

Wetland Name: W-25

Wetland Transect/Gradsect #: 25-1-3

Sampling Date: 9/19/2013 Last Rain Date:

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 7 7 7 7

Ambrosia artemisiifolia	4	4	3		
Apocynum cannabinum					2
Asclepias syriaca	4				
Boehmeria cylindrica			3		2
Cannabis sativa	3		3	3	3
Carex vulpinoidea	6	5	4	3	6
Cirsium arvense	3			2	
Galium obtusum	3				
Helianthus grosseserratus	4	5	6	7	6
Solidago canadensis		5	5		
Solidago gigantea		4			
Spartina pectinata		4			
Vitis riparia					2

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 25

Wetland Name: W-25

Wetland Transect/Gradsect #: 25-1-4

Sampling Date: 9/19/2013 **Last Rain Date:** **Last Rain Amount (in):** 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 7 7 7 7 7

Ambrosia artemisiifolia	5	5	3		
Apocynum cannabinum	3			3	
Asclepias syriaca	2		4		
Cannabis sativa	3	3			2
Carex vulpinoidea	6	5	4		4
Chenopodium album		4	2	3	
Cirsium altissimum		3			
Cirsium arvense	3				
Erechtites hieraciifolia	3				
Galium obtusum		3		2	
Helianthus grosseserratus	3	5	5	6	7
Lycopus americanus			2		
Phalaris arundinacea			4		4
Solidago canadensis			2		
Solidago gigantea			3		

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 25

Wetland Name: W-25

Wetland Transect/Gradsect #: 25-2-1

Sampling Date: 9/19/2013 **Last Rain Date:** **Last Rain Amount (in):** 0

Canopy Coverage Analysis **Plot 1** **Plot 2** **Plot 3** **Plot 4** **Plot 5**

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in):	6	6	6	6	5
Ambrosia artemisiifolia	3		2		
Andropogon gerardii				6	
Bromus inermis	4	6	3		6
Cannabis sativa				3	
Carex vulpinoidea	6	3		3	3
Cornus drummondii			3		4
Desmanthus illinoensis	3		3	3	3
Festuca arundinacea			3		
Helianthus grosseserratus	5	5	4	5	4
Panicum virgatum				3	
Poa pratensis	5	6	7	5	5
Pseudognaphalium obtusifoli	3				
Schizachyrium scoparium	3				
Solidago canadensis	5	6	6	4	
Solidago gigantea		4	3		
Spartina pectinata	5	3			
Symphotrichum pilosum		3	3		
Viola sp.	2				

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 25

Wetland Name: W-25

Wetland Transect/Gradsect #: 25-2-3

Sampling Date: 9/19/2013 Last Rain Date:

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 7 7 6 7 7

Ambrosia artemisiifolia	2				
Apocynum cannabinum	2				
Cannabis sativa		3	3		
Carex vulpinoidea	3	3	3	3	
Cirsium arvense	2				
Cornus drummondii			4		
Helianthus grosseserratus	6	6	4	6	5
Poa pratensis			6	5	6
Solidago canadensis	6	3	5	5	4

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 25

Wetland Name: W-25

Wetland Transect/Gradsect #: 25-2-4

Sampling Date: 9/19/2013 Last Rain Date:

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 5 5 5 6 6

Ambrosia artemisiifolia		3			
Apocynum cannabinum	2	3			3
Carex vulpinoidea	5	5		4	3
Cornus drummondii		4		4	3
Desmanthus illinoensis	2				
Helianthus grosseserratus		5	3	3	6
Poa pratensis	7	7	7	7	5
Solidago canadensis	6	3	5	4	4
Solidago gigantea			4	4	3
Toxicodendron radicans		3			

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 25

Wetland Name: W-25

Wetland Transect/Gradsect #: 25-2-5

Sampling Date: 9/19/2013 Last Rain Date:

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 6 7 7 7

Apocynum cannabinum	3		3		3
Cannabis sativa		4	3		
Carex vulpinoidea	6	6	4	4	4
Cirsium altissimum		2		3	
Cornus drummondii			4	3	3
Parietaria pensylvanica	4				
Physalis heterophylla			3		3
Poa pratensis	5				
Solidago canadensis	5				
Solidago gigantea			6	6	6
Spartina pectinata					4

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 25

Wetland Name: W-25

Wetland Transect/Gradsect #: 25-2-6

Sampling Date: 9/19/2013 Last Rain Date:

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 6 6 7 7

Apocynum cannabinum	2				3
Boehmeria cylindrica					2
Cannabis sativa	4	4	5	3	
Carex vulpinoidea	5	6	6	3	5
Lactuca serriola				3	
Parietaria pensylvanica	3	3			
Poa pratensis	4	4			
Solidago canadensis		2			
Solidago gigantea				6	5
Spartina pectinata					5
Toxicodendron radicans	3				

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 25

Wetland Name: W-25

Wetland Transect/Gradsect #: 25-2-7

Sampling Date: 9/19/2013 **Last Rain Date:** **Last Rain Amount (in):** 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 7 7 6 6 6

Apocynum cannabinum	2		3	3	3
Cannabis sativa	4	4	2	3	4
Carex vulpinoidea	3	7	6	6	7
Cirsium arvense	3		3		
Galium obtusum		4			
Helianthus grosseserratus	4	4	6	5	
Iva annua			3		
Phalaris arundinacea				4	
Setaria pumila ssp. pumila		3			
Solanum carolinense		3	3	4	
Solidago canadensis		3			
Spartina pectinata	4				

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 25

Wetland Name: W-25

Wetland Transect/Gradsect #: 25-3-1

Sampling Date: 9/19/2013 Last Rain Date: Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 7 7 7 7 7

Asclepias syriaca				3	2
Boehmeria cylindrica				4	2
Cannabis sativa	3			4	3
Elymus virginicus			4		
Helianthus grosseserratus		4	5	5	6
Phalaris arundinacea	3	3			
Polygonum amphibium	4	4	4		3
Polygonum scandens		3			
Solidago canadensis	3	4	4		
Spartina pectinata	5	5			
Zizia aurea	3				

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 25

Wetland Name: W-25

Wetland Transect/Gradsect #: 25-3-2

Sampling Date: 9/19/2013 Last Rain Date: Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in):	6	7	7	7	7
Asclepias syriaca			3		
Cannabis sativa	3			3	
Helianthus grosseserratus		5	7	6	6
Phalaris arundinacea	5	5	4	5	5
Polygonum amphibium	3	3	3	4	3
Solidago gigantea		3	4		3

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Wetland Vegetation Cover and Water Depth at Wetland 25

Wetland Name: W-25

Wetland Transect/Gradsect #: 25-3-3

Sampling Date: 9/19/2013 Last Rain Date:

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 6 7 7 6

Asclepias syriaca

3

Cannabis sativa

3

Helianthus grosseserratus

5

6

3

Phalaris arundinacea

5

5

7

6

5

Physalis longifolia

3

Polygonum amphibium

3

3

3

4

3

Polygonum scandens

3

Solidago canadensis

3

Solidago gigantea

5

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 25

Wetland Name: W-25

Wetland Transect/Gradsect #: 25-3-4

Sampling Date: 9/19/2013 Last Rain Date:

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 7 6 6 7 7

Asclepias syriaca

3 4

Boehmeria cylindrica

3

Helianthus grosseserratus

3

Phalaris arundinacea

6 7 6 6 6

Physalis longifolia

3

Polygonum amphibium

3 4 4 4

Spartina pectinata

4

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

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APPENDIX I - SECTION C

PEM WETLAND 100, SAUNDERS COUNTY WELL FIELD WETLAND MONITORING DATA

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- Figure 3 2013 CIR Aerial Photography of PEM Wetland 100
- Figure 4 Mean Weighted Average of Wetland Grad-sects Compared to the Baseline Threshold in Wetland 100
- Figure 5 Mean Weighted Average of Wetland 68 Over Time

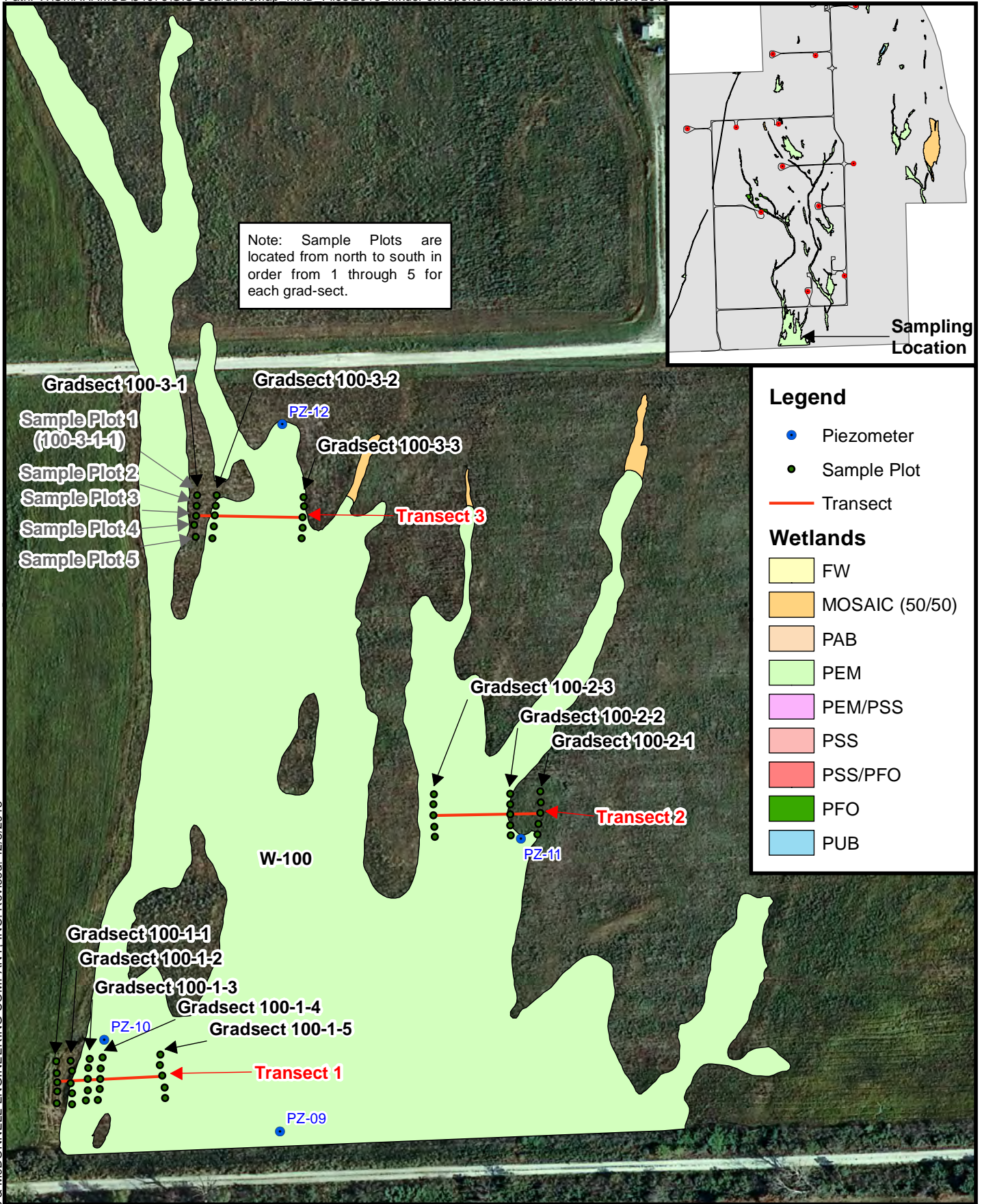
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- Table 1 Summary of Wetland Monitoring Data for Wetland 100
- Table 2 Species List and Vegetative Characteristics for Wetland 100

C-3 WETLAND 100 GROUND PHOTOGRAPHS

C-4 RAW DATA SHEETS – WETLAND VEGETATION COVER AND WATER DEPTH AT WETLAND 100

SECTION C-1
FIGURES



Note: Sample Plots are located from north to south in order from 1 through 5 for each grad-sect.

Legend

- Piezometer
- Sample Plot
- Transect

Wetlands

- FW
- MOSAIC (50/50)
- PAB
- PEM
- PEM/PSS
- PSS
- PSS/PFO
- PFO
- PUB

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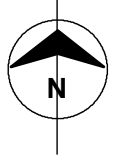
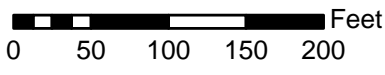


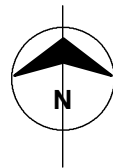
Figure 1
Location Map for
PEM Wetland 100
Saunders County Wellfield
Metropolitan Utilities District



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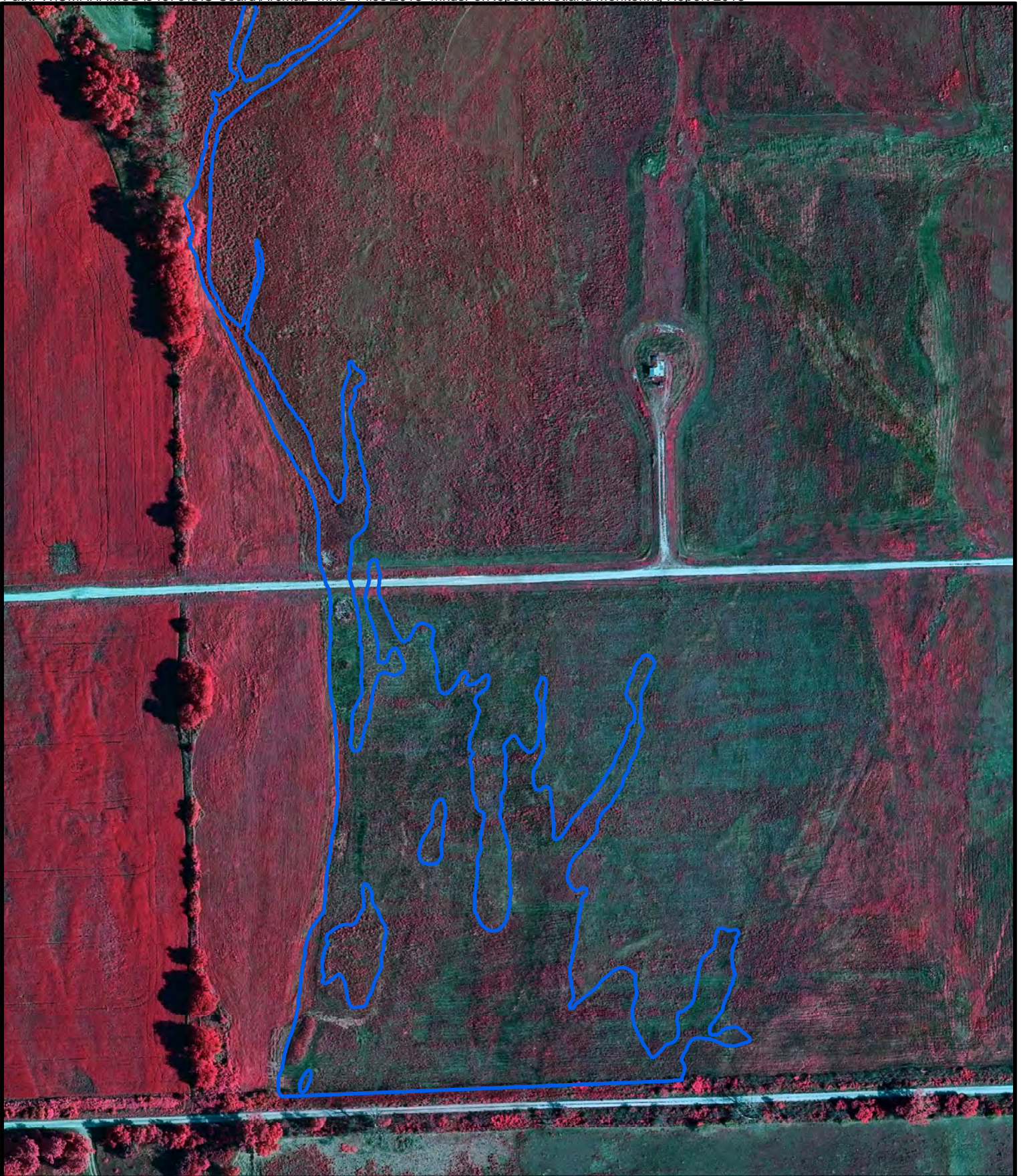
Source: Wilson & Company 2013 Aerial Photography

1:2250 Approximate Scale
(1 inch = 187.5 feet)



 Approximate Wetland Boundary

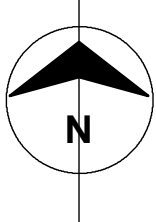
Figure 2
2013 Natural Color Aerial Photography
of PEM Wetland 100
Saunders County
Wellfield Wetland Monitoring
Metropolitan Utilities District



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Source: Wilson & Company 2013
Color Infrared Aerial Photography

1:2250 Approximate Scale
(1 inch = 187.5 feet)



 Approximate Wetland Boundary

Figure 3
2013 CIR Aerial Photography
of PEM Wetland 100
Saunders County
Wellfield Wetland Monitoring
Metropolitan Utilities District

Figure 4 Mean Weighted Average of Wetland Gradsects Compared to the Baseline Threshold in Wetland-100

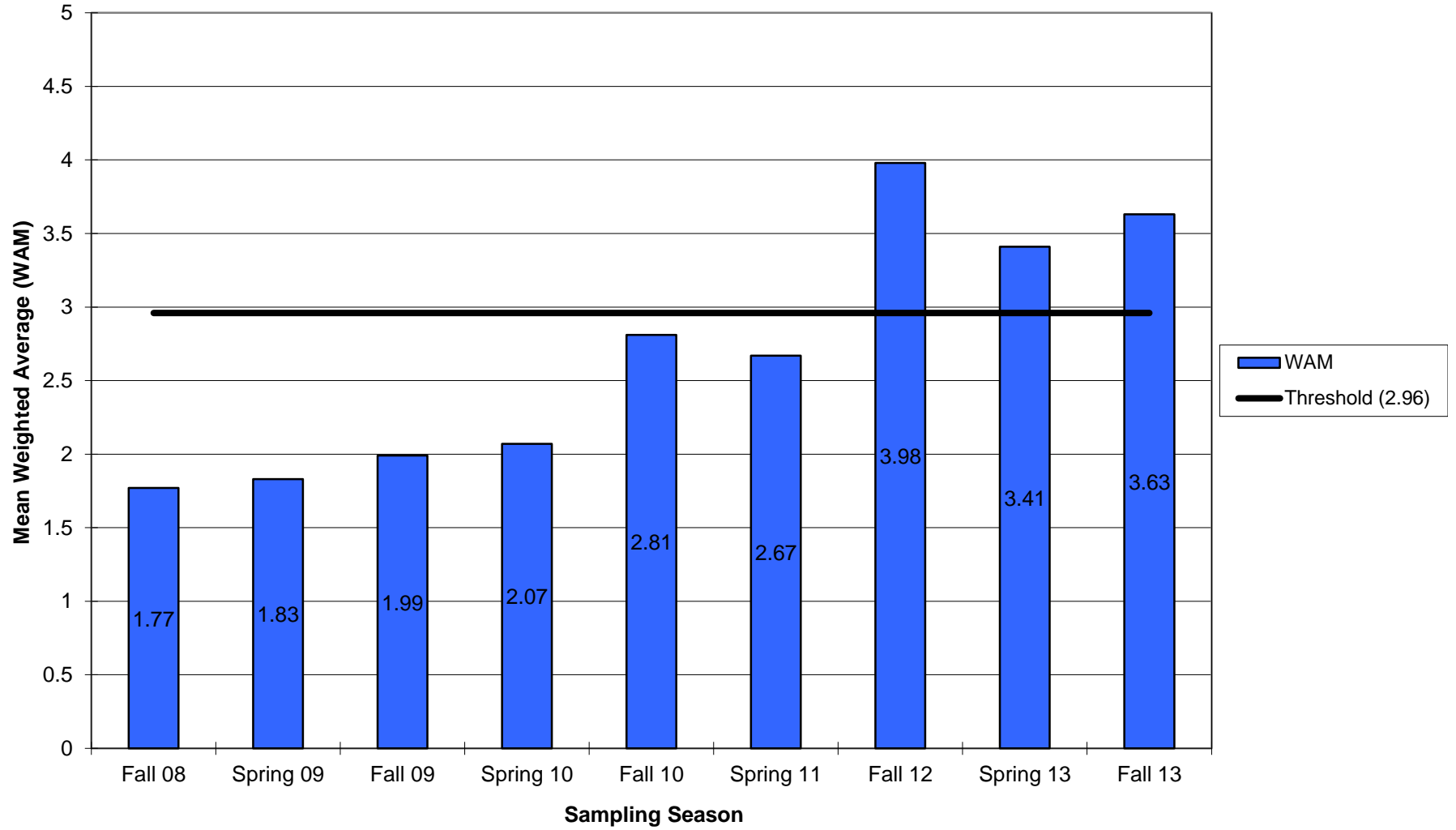
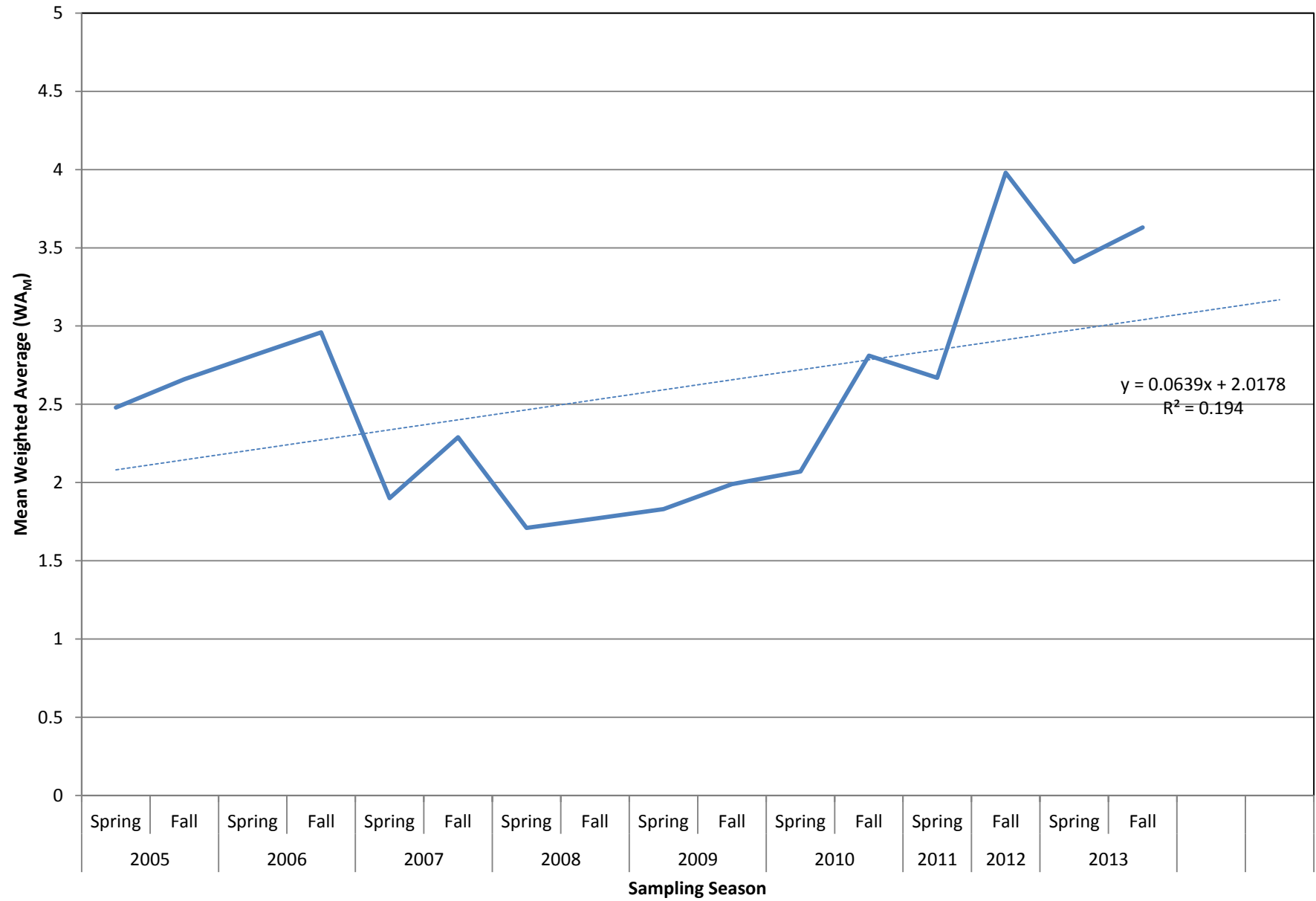


Figure 5 Mean Weighted Average of Wetland 100 Over Time



SECTION C-2
TABLES

Table 1 Summary of Wetland Monitoring Data for Wetland 100

Wetland Name: W-100	Number of Transects/Macroplots: 3
Wetland Type: PEM	Number of Gradsects: 11
County: Saunders	Number of Sample Plots: 55
	Number of Wetland Sample Plots: 40

Sampling Effort: **2013 Fall**

Weighted Average: 3.63	Percent Native Species: 78
Species Richness: 18	Percent Invasive Species: 78
Species Diversity: 9.63	Percent Perennial/Biennial/Annual Species: 50 / 17 / 50
FQI: 3.74	Mean C-Value: 1.00

Dominant Species:

Scientific Name	Common Name	Wetland Indicator Status	Percent Cover per Wetland
<i>Ambrosia artemisiifolia</i>	Annual ragweed	FACU	12.75
<i>Ambrosia trifida</i>	Great ragweed	FACW	4.31
<i>Cannabis sativa</i>	Marijuana	FACU-	5.19
<i>Iva annua</i>	Annual marsh elder	FAC	3.08
<i>Poa pratensis</i>	Kentucky bluegrass	FACU	11.75

Sampling Effort: **2013 Spring**

Weighted Average: 3.41	Percent Native Species: 79
Species Richness: 33	Percent Invasive Species: 61
Species Diversity: 15.60	Percent Perennial/Biennial/Annual Species: 61 / 12 / 42
FQI: 9.73	Mean C-Value: 1.91

Dominant Species:

Scientific Name	Common Name	Wetland Indicator Status	Percent Cover per Wetland
<i>Cannabis sativa</i>	Marijuana	FACU-	29.88
<i>Galium aparine</i>	Stickywilly	FACU	44.62
<i>Iva annua</i>	Annual marsh elder	FAC	28.19

Table 2 Species List and Vegetative Characteristics for Wetland 100

Report generated:
Thursday, January 02, 2014

Sampling Effort: **2013 Fall**

Scientific Name	Common Name	Wetland Indicator Status ¹	Ecological Index ²	C-Value	Native Status	Invasive?	Frequency ³	Average Percent Cover ⁴
<i>Ambrosia artemisiifolia</i>	Annual ragweed	FACU	4	0	Native	<input checked="" type="checkbox"/>	17	12.75
<i>Ambrosia trifida</i>	Great ragweed	FACW	2	0	Native	<input checked="" type="checkbox"/>	11	4.31
<i>Cannabis sativa</i>	Marijuana	FACU-	4		Introduced	<input checked="" type="checkbox"/>	14	5.19
<i>Chenopodium album</i>	Lambsquarters	FAC	3		Native & Introduced	<input checked="" type="checkbox"/>	1	0.06
<i>Cirsium altissimum</i>	Tall thistle	NL	3	1	Native	<input checked="" type="checkbox"/>	1	0.06
<i>Conyza canadensis</i>	Canadian horseweed	FACU-	4	0	Native	<input checked="" type="checkbox"/>	7	1.06
<i>Cyperus esculentus</i>	Yellow nutsedge	FACW	2	0	Native & Introduced	<input checked="" type="checkbox"/>	3	0.50
<i>Elymus virginicus</i>	Virginia wildrye	FAC	3	4	Native	<input type="checkbox"/>	1	0.38
<i>Festuca arundinacea</i>	Tall fescue	FACU	4		Introduced	<input checked="" type="checkbox"/>	3	2.31
<i>Helianthus annuus</i>	Common sunflower	FACU	4	0	Native	<input checked="" type="checkbox"/>	1	0.38
<i>Iva annua</i>	Annual marsh elder	FAC	3	1	Native	<input type="checkbox"/>	15	3.08
<i>Melilotus officinalis</i>	Yellow sweetclover	FACU	4		Introduced	<input checked="" type="checkbox"/>	1	0.38
<i>Oxalis stricta</i>	Common yellow oxalis	FACU	4	0	Native	<input checked="" type="checkbox"/>	4	0.88
<i>Phalaris arundinacea</i>	Reed canarygrass	FACW+	2	0	Native	<input checked="" type="checkbox"/>	1	0.38
<i>Poa pratensis</i>	Kentucky bluegrass	FACU	4		Native & Introduced	<input checked="" type="checkbox"/>	13	11.75
<i>Polygonum scandens</i>	Climbing false buckwheat	FACU	4		Native & Introduced	<input type="checkbox"/>	1	0.38
<i>Setaria faberi</i>	Japanese bristlegrass	UPL	5		Introduced	<input checked="" type="checkbox"/>	1	0.38
<i>Spartina pectinata</i>	Prairie cordgrass	FACW	2	5	Native	<input type="checkbox"/>	4	1.75

1 = OBL - obligate; FACW - facultative wet; FAC - facultative; FACU - facultative upland; UPL - upland; NI - no indicator

2 = Ecological Index values correspond to the wetland indicator status for each species

3 = Frequency is the total number of plots in which the species was identified

4 = Average percent cover is calculated from the coverages estimated during this monitoring effort.

Table 2 Species List and Vegetative Characteristics for Wetland 100

Report generated:
Thursday, January 02, 2014

Sampling Effort: **2013 Spring**

Scientific Name	Common Name	Wetland Indicator Status ¹	Ecological Index ²	C-Value	Native Status	Invasive?	Frequency ³	Average Percent Cover ⁴
<i>Ambrosia artemisiifolia</i>	Annual ragweed	FACU	4	0	Native	<input checked="" type="checkbox"/>	16	11.50
<i>Ambrosia trifida</i>	Great ragweed	FACW	2	0	Native	<input checked="" type="checkbox"/>	18	10.69
<i>Asclepias syriaca</i>	Common milkweed	NL	3	1	Native	<input checked="" type="checkbox"/>	1	0.06
<i>Bromus arvensis</i>	Field brome	NL	3		Introduced	<input type="checkbox"/>	3	3.12
<i>Bromus inermis</i>	Smooth brome	NL	3		Native & Introduced	<input checked="" type="checkbox"/>	1	0.94
<i>Cannabis sativa</i>	Marijuana	FACU-	4		Introduced	<input checked="" type="checkbox"/>	22	29.88
<i>Carex sp. 1</i>	Sedge	--	3		Native	<input type="checkbox"/>	3	2.25
<i>Chenopodium album</i>	Lambsquarters	FAC	3		Native & Introduced	<input checked="" type="checkbox"/>	18	5.12
<i>Cirsium altissimum</i>	Tall thistle	NL	3	1	Native	<input checked="" type="checkbox"/>	18	11.00
<i>Conyza canadensis</i>	Canadian horseweed	FACU-	4	0	Native	<input checked="" type="checkbox"/>	6	1.31
<i>Cyperus esculentus</i>	Yellow nutsedge	FACW	2	0	Native & Introduced	<input checked="" type="checkbox"/>	5	1.81
<i>Descurainia sophia</i>	Herb Sophia	NI	3	0	Introduced	<input checked="" type="checkbox"/>	7	7.88
<i>Desmanthus illinoensis</i>	Illinois bundleflower	FACU	4	5	Native	<input type="checkbox"/>	1	0.01
<i>Eleocharis erythropoda</i>	Bald spikerush	OBL	1	5	Native	<input type="checkbox"/>	2	1.31
<i>Festuca arundinacea</i>	Tall fescue	FACU	4		Introduced	<input checked="" type="checkbox"/>	2	2.50
<i>Galium aparine</i>	Stickywilly	FACU	4	0	Native	<input checked="" type="checkbox"/>	32	44.62
<i>Galium obtusum</i>	Bluntleaf bedstraw	FACW	2	6	Native	<input type="checkbox"/>	9	3.31
<i>Hordeum jubatum</i>	Foxtail barley	FACW	2	1	Native	<input checked="" type="checkbox"/>	3	1.69

1 = OBL - obligate; FACW - facultative wet; FAC - facultative; FACU - facultative upland; UPL - upland; NI - no indicator

2 = Ecological Index values correspond to the wetland indicator status for each species

3 = Frequency is the total number of plots in which the species was identified

4 = Average percent cover is calculated from the coverages estimated during this monitoring effort.

Table 2 Species List and Vegetative Characteristics for Wetland 100

Report generated:
Thursday, January 02, 2014

<i>Ipomoea purpurea</i>	Tall morning-glory	FACU	4		Introduced	<input checked="" type="checkbox"/>	10	1.88
<i>Iva annua</i>	Annual marsh elder	FAC	3	1	Native	<input type="checkbox"/>	35	28.19
<i>Oxalis stricta</i>	Common yellow oxalis	FACU	4	0	Native	<input checked="" type="checkbox"/>	4	1.19
<i>Parietaria pennsylvanica</i>	Pennsylvania pellitory	FAC	3	0	Native	<input checked="" type="checkbox"/>	9	6.50
<i>Phyla lanceolata</i>	Lanceleaf fogfruit	OBL	1	3	Native	<input type="checkbox"/>	2	0.12
<i>Poa pratensis</i>	Kentucky bluegrass	FACU	4		Native & Introduced	<input checked="" type="checkbox"/>	16	11.50
<i>Polygonum hydropiperoides</i>	Swamp smartweed	OBL	1		Native	<input type="checkbox"/>	5	2.12
<i>Rudbeckia hirta</i>	Blackeyed susan	FACU	4	4	Native	<input type="checkbox"/>	8	1.75
<i>Rumex crispus</i>	Curly dock	FACW	2		Introduced	<input checked="" type="checkbox"/>	1	0.06
<i>Spartina pectinata</i>	Prairie cordgrass	FACW	2	5	Native	<input type="checkbox"/>	1	0.94
<i>Thlaspi arvense</i>	Field Pennycress	FACU	4	0	Introduced	<input checked="" type="checkbox"/>	1	0.06
<i>Ulmus americana</i>	American elm	FAC	3	3	Native	<input type="checkbox"/>	1	0.06
<i>Vernonia baldwinii</i>	Baldwin's ironweed	FACW-	2	3	Native	<input checked="" type="checkbox"/>	1	0.01
<i>Vernonia fasciculata</i>	Prairie ironweed	FAC	3	4	Native	<input type="checkbox"/>	2	0.12
<i>Viola sp.</i>	Violet	--	3		Native	<input type="checkbox"/>	2	0.75

1 = OBL - obligate; FACW - facultative wet; FAC - facultative; FACU - facultative upland; UPL - upland; NI - no indicator

2 = Ecological Index values correspond to the wetland indicator status for each species

3 = Frequency is the total number of plots in which the species was identified

4 = Average percent cover is calculated from the coverages estimated during this monitoring effort.

SECTION C-3
WETLAND 100 GROUND PHOTOGRAPHS



Photo 1: View east of Transect 1 in W-100 (June 2013).



Photo 2: View north of Gradsect 1 on Transect 1 in W-100 (June 2013).



Photo 3: View north of Gradsect 2 on Transect 1 in W-100 (June 2013).



Photo 4: View north of Gradsect 3 on Transect 1 in W-100 (June 2013).



Photo 5: View north of Gradsect 4 on Transect 1 in W-100 (June 2013).



Photo 6: View north of Gradsect 5 on Transect 1 in W-100 (June 2013).



Photo 7: View west of Transect 2 in W-100 (June 2013).



Photo 8: View north of Gradsect 1 on Transect 2 in W-100 (June 2013).



Photo 9: View north of Gradsect 2 on Transect 2 in W-100 (June 2013).



Photo 10: View north of Gradsect 3 on Transect 2 in W-100 (June 2013).



Photo 11: View east of Transect 3 in W-100 (June 2013).



Photo 12: View north of Gradsect 1 on Transect 3 in W-100 (June 2013).



Photo 13: View north of Gradsect 2 on Transect 3 in W-100 (June 2013).



Photo 14: View north of Gradsect 3 on Transect 3 in W-100 (June 2013).



Photo 15: View east of Transect 1 in W-100 (September 2013).



Photo 16: View north of Gradsect 1 on Transect 1 in W-100 (September 2013).



Photo 17: View north of Gradsect 2 on Transect 1 in W-100 (September 2013).



Photo 18: View north of Gradsect 3 on Transect 1 in W-100 (September 2013).



Photo 19: View north of Gradsect 4 on Transect 1 in W-100 (September 2013).



Photo 20: View north of Gradsect 5 on Transect 1 in W-100 (September 2013).



Photo 21: View west of Transect 2 in W-100 (September 2013).



Photo 22: View north of Gradsect 1 on Transect 2 in W-100 (September 2013).



Photo 23: View north of Gradsect 2 on Transect 2 in W-100 (September 2013).



Photo 24: View north of Gradsect 3 on Transect 2 in W-100 (September 2013).



Photo 25: View east of Transect 3 in W-100 (September 2013).



Photo 26: View north of Gradsect 1 on Transect 3 in W-100 (September 2013).



Photo 27: View north of Gradsect 2 on Transect 3 in W-100 (September 2013).



Photo 28: View north of Gradsect 3 on Transect 3 in W-100 (September 2013).

SECTION C-4

**RAW DATA SHEETS – WETLAND VEGETATION COVER AND WATER
DEPTH AT WETLAND 100**

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: W-100

Wetland Transect/Gradsect #: 100-1-1

Sampling Date: 6/11/2013 Last Rain Date:

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 5 5 6 6

Ambrosia trifida					3
Asclepias syriaca		3		3	
Cannabis sativa				3	2
Cirsium altissimum				2	
Festuca arundinacea	6	6	6	6	6
Galium aparine		2	3	3	
Galium obtusum	2				
Ipomoea purpurea	2			2	
Poa pratensis			5	3	4
Solidago canadensis	3		3		

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: W-100

Wetland Transect/Gradsect #: 100-1-2

Sampling Date: 6/11/2013 Last Rain Date:

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 6 6 6 7

Ambrosia artemisiifolia			2		
Ambrosia trifida		3	3	6	4
Cannabis sativa	4	6	7	6	3
Cirsium altissimum	2				
Cyperus esculentus		2			
Descurainia sophia		5			5
Festuca arundinacea	6	3			
Galium aparine	3	5	3	5	4
Ipomoea purpurea	2			3	3
Iva annua			3	6	3
Parietaria pensylvanica				6	3
Poa pratensis	4				3
Rudbeckia hirta			2		
Spartina pectinata					4

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: W-100

Wetland Transect/Gradsect #: 100-1-3

Sampling Date: 6/11/2013 **Last Rain Date:** **Last Rain Amount (in):** 0

Canopy Coverage Analysis **Plot 1** **Plot 2** **Plot 3** **Plot 4** **Plot 5**

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 6 6 6 6

Ambrosia artemisiifolia	3				
Ambrosia trifida		3	3	3	4
Cannabis sativa	5	6	6	5	6
Chenopodium album	4	3		3	
Cirsium altissimum		3	3		3
Descurainia sophia			2		
Eleocharis erythropoda		3			4
Galium aparine	4	5	3	5	4
Ipomoea purpurea				3	2
Iva annua	5	5	6	4	4
Parietaria pensylvanica		3	4	4	
Polygonum hydropiperoides	5	3			

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: W-100

Wetland Transect/Gradsect #: 100-1-4

Sampling Date: 6/11/2013 Last Rain Date:

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 6 6 6 6

Ambrosia trifida					3
Cannabis sativa	6	7	5	5	3
Carex sp. 1		4	3		
Chenopodium album				3	3
Cirsium altissimum	4		3	3	3
Cyperus esculentus			2		4
Galium aparine	5	4	4	5	6
Ipomoea purpurea			2		
Iva annua	4	4	3	3	4
Poa pratensis				3	
Rudbeckia hirta		3	2		

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: W-100

Wetland Transect/Gradsect #: 100-1-5

Sampling Date: 6/11/2013 Last Rain Date:

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 6 6 6 6

Ambrosia trifida

4

4

3

2

Cannabis sativa

2

Carex sp. 1

4

Chenopodium album

2

3

Cirsium altissimum

4

Cyperus esculentus

3

Galium aparine

6

6

6

6

6

Ipomoea purpurea

2

2

3

2

Iva annua

3

3

3

3

3

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: W-100

Wetland Transect/Gradsect #: 100-2-1

Sampling Date: 6/11/2013 Last Rain Date:

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 6 6 6 6

Ambrosia artemisiifolia 4 3 5 4

Cannabis sativa 2 3 2

Chenopodium album 3

Cirsium altissimum 2 3 3 3 2

Descurainia sophia 3

Galium aparine 4 4 3 5 6

Galium obtusum 2 2 3

Iva annua 4 2 3 4 4

Mentha arvensis 1

Poa pratensis 3

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: W-100

Wetland Transect/Gradsect #: 100-2-2

Sampling Date: 6/11/2013 Last Rain Date:

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 6 6 6 6

Ambrosia artemisiifolia	2	3		4	
Cannabis sativa		3	5	3	4
Chenopodium album	3	2		3	2
Conyza canadensis			2		
Galium aparine	6	6	4	5	4
Galium obtusum	2				
Iva annua	5	4	3	3	3
Parietaria pensylvanica		2	3	4	3
Poa pratensis				2	
Rudbeckia hirta			2		

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: W-100

Wetland Transect/Gradsect #: 100-2-3

Sampling Date: 6/11/2013 Last Rain Date:

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 6 6 6 6

Ambrosia artemisiifolia		5		5	
Bromus arvensis			2	6	4
Chenopodium album		3			
Cirsium altissimum	4	4	4	3	5
Conyza canadensis	2	3	3	2	
Cyperus esculentus			3		
Descurainia sophia		2	4	6	5
Galium aparine	6	6	6		6
Hordeum jubatum	3		4		3
Iva annua	5	5	4	5	4
Poa pratensis	4	3	3	5	
Polygonum hydropiperoides		2			

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: W-100

Wetland Transect/Gradsect #: 100-3-1

Sampling Date: 6/11/2013 **Last Rain Date:**

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 6 6 7 7

Ambrosia artemisiifolia		1	4	2	2
Cannabis sativa	3	3		2	
Chenopodium album	3	3	3	2	2
Cirsium altissimum	3			2	
Conyza canadensis			2		
Desmanthus illinoensis					1
Festuca arundinacea	4	4	3	3	3
Galium obtusum	3	1			
Ipomoea purpurea	3				
Iva annua					2
Melilotus officinalis	4	5	5		
Parietaria pensylvanica				2	
Vernonia baldwinii			2	2	
Viola sp.	3	2			

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: W-100

Wetland Transect/Gradsect #: 100-3-2

Sampling Date: 6/11/2013 Last Rain Date:

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 7 7 7 7

Ambrosia artemisiifolia	5	2	2	4	2
Asclepias syriaca					2
Bromus inermis					4
Cannabis sativa				2	4
Chenopodium album	2	2	3		2
Cirsium altissimum					3
Galium aparine	2				3
Galium obtusum		2	2	3	
Iva annua	4	2	3	2	
Poa pratensis	5	4	5	4	3
Polygonum hydropiperoides		2	2		
Ulmus americana					2
Vernonia baldwinii				1	
Viola sp.				3	3

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: W-100

Wetland Transect/Gradsect #: 100-3-3

Sampling Date: 6/11/2013 Last Rain Date:

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 6 6 6 6

Ambrosia artemisiifolia	3		3	5	5
Ambrosia trifida	3	4	2	3	3
Chenopodium album			2	3	
Cirsium altissimum			3	4	3
Conyza canadensis				3	
Desmanthus illinoensis				1	
Galium aparine			2		
Galium obtusum	5	3	3	2	3
Iva annua	3	3	3		
Oxalis stricta	3	3	2		3
Phyla lanceolata			2	2	
Poa pratensis	3	3	3		
Rudbeckia hirta	3		2	3	3
Rumex crispus		2			
Thlaspi arvense		2			
Vernonia fasciculata				2	2

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: W-100

Wetland Transect/Gradsect #: 100-1-1

Sampling Date: 9/17/2013 Last Rain Date: Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 5 5 5 5 5

Festuca arundinacea 7 7 5 6 6

Poa pratensis 6 5

Solidago canadensis 3

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: W-100

Wetland Transect/Gradsect #: 100-1-2

Sampling Date: 9/17/2013 **Last Rain Date:** **Last Rain Amount (in):** 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 7 7 7 7

Ambrosia artemisiifolia 2

Ambrosia trifida 2 3 4

Cannabis sativa 2 3 3

Cyperus esculentus 3

Festuca arundinacea 5 3

Iva annua 2 2

Phalaris arundinacea 3

Poa pratensis 6

Spartina pectinata 4

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: W-100

Wetland Transect/Gradsect #: 100-1-3

Sampling Date: 9/17/2013 **Last Rain Date:**

Last Rain Amount (in): 0

Canopy Coverage Analysis **Plot 1** **Plot 2** **Plot 3** **Plot 4** **Plot 5**

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 7 7 7 7 7

Amaranthus albus

3

3

Ambrosia artemisiifolia

3

Ambrosia trifida

2

5

3

Cannabis sativa

3

4

2

3

Polygonum scandens

3

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: W-100

Wetland Transect/Gradsect #: 100-1-4

Sampling Date: 9/17/2013 Last Rain Date: Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 7 7 7 7 7

Amaranthus albus				2	
Cannabis sativa	3	3	3	3	
Cirsium altissimum				2	
Cyperus esculentus					2
Iva annua		2	3		
Spartina pectinata		2			

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: W-100

Wetland Transect/Gradsect #: 100-1-5

Sampling Date: 9/17/2013 Last Rain Date: Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 7 7 7 6 7

Amaranthus albus 3 3

Ambrosia trifida 2 3 2

Iva annua 2 3 3

Spartina pectinata 3 3

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: W-100

Wetland Transect/Gradsect #: 100-2-1

Sampling Date: 9/17/2013 Last Rain Date: Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 7 7 7 7 7

Amaranthus albus 3

Ambrosia artemisiifolia 5 4 4 5 2

Cannabis sativa 3

Iva annua 2

Poa pratensis 2

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: W-100

Wetland Transect/Gradsect #: 100-2-2

Sampling Date: 9/17/2013 Last Rain Date: Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 7 7 7 7 7

Amaranthus albus			2	2	3
------------------	--	--	---	---	---

Ambrosia artemisiifolia	3	5		5	3
-------------------------	---	---	--	---	---

Cannabis sativa			3		3
-----------------	--	--	---	--	---

Conyza canadensis	2				3
-------------------	---	--	--	--	---

Iva annua		1	2		2
-----------	--	---	---	--	---

Poa pratensis			3	3	
---------------	--	--	---	---	--

Setaria faberi	3				
----------------	---	--	--	--	--

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: W-100

Wetland Transect/Gradsect #: 100-2-3

Sampling Date: 9/17/2013 Last Rain Date:

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 7 7 7 7 7

Ambrosia artemisiifolia 2 5 4 4 2

Conyza canadensis 2 2 3 2

Poa pratensis 4 4 5

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: W-100

Wetland Transect/Gradsect #: 100-3-1

Sampling Date: 9/17/2013 Last Rain Date:

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 6 7 7 7 6

Amaranthus albus					3
Ambrosia artemisiifolia					4
Desmanthus illinoensis					2
Festuca arundinacea	4	2	2	4	4
Melilotus officinalis	3	3	3	2	
Panicum virgatum			2		
Setaria faberi					3

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: W-100

Wetland Transect/Gradsect #: 100-3-2

Sampling Date: 9/17/2013 **Last Rain Date:**

Last Rain Amount (in): 0

Canopy Coverage Analysis **Plot 1** **Plot 2** **Plot 3** **Plot 4** **Plot 5**

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in): 7 7 7 7 7

Ambrosia artemisiifolia 3 5

Cannabis sativa 3

Chenopodium album 2

Elymus virginicus 3

Helianthus annuus 3

Iva annua 2 3

Poa pratensis 4 4 5 4 4

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

Wetland Vegetation Cover and Water Depth at Wetland 100

Wetland Name: W-100

Wetland Transect/Gradsect #: 100-3-3

Sampling Date: 9/17/2013 Last Rain Date:

Last Rain Amount (in): 0

Canopy Coverage Analysis Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Depth of Standing Water (in):

Open Water (in):

Bare Soil (in):

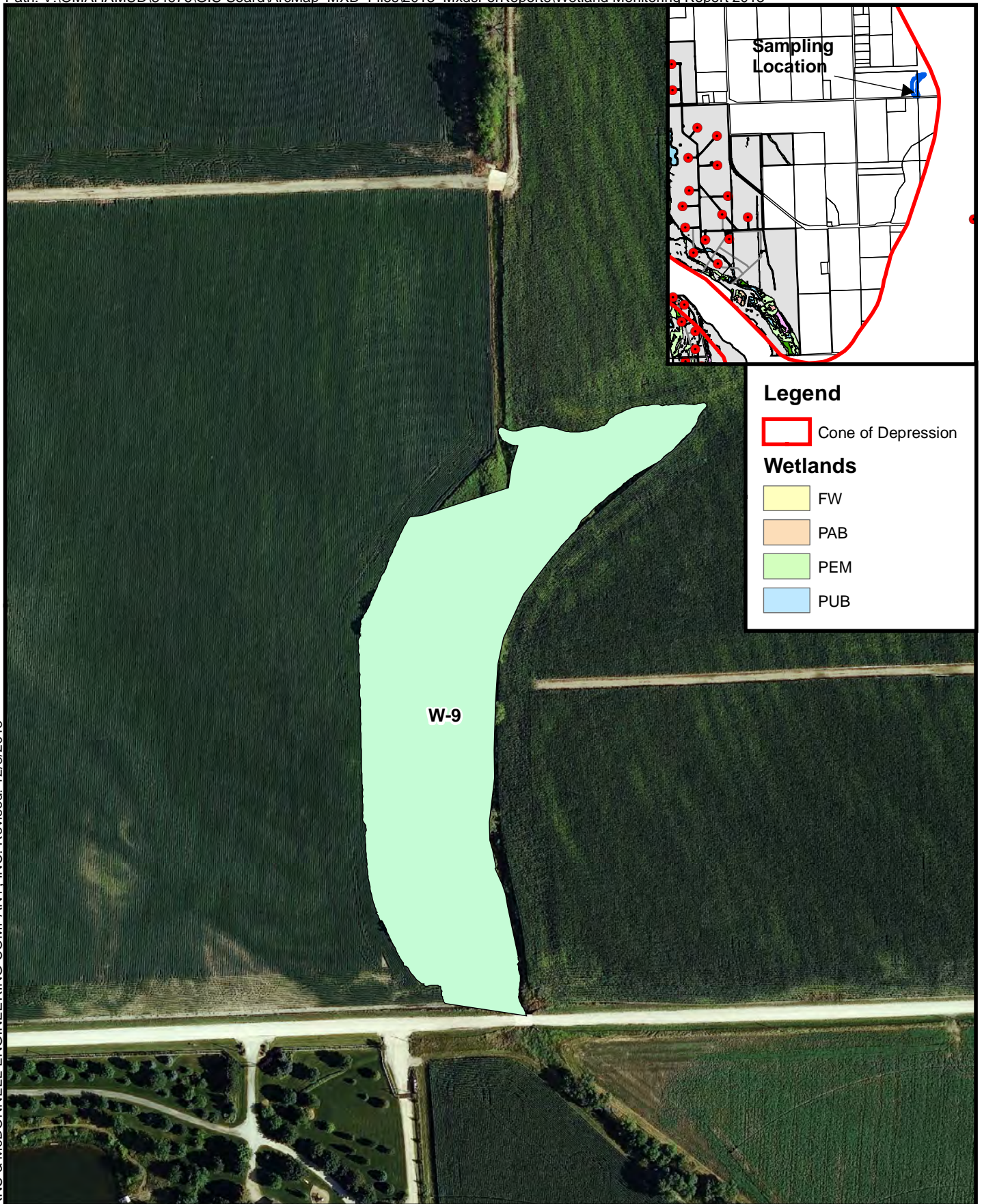
	7	7	7	7	7
Ambrosia artemisiifolia	3		3	2	6
Ambrosia trifida	2	3			
Conyza canadensis				2	
Cyperus esculentus			2		
Festuca arundinacea			3		
Iva annua	3	3	3		
Melilotus officinalis					3
Oxalis stricta	3	3	2		2
Poa pratensis	2	2			

Class 1: 0-1%; Class 2: 1-5%; Class 3: 5-25%; Class 4: 25-50%; Class 5: 50-75%; Class 6: 75-95%; Class 7: 95-100%

Thursday, January 02, 2014

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- Figure 3 2013 CIR Aerial Photography of PEM Wetland 9



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0 75 150 225 300 Feet

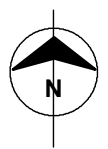


Figure 1
Location of PEM Wetland 9
Douglas County Wellfield
Wetland Monitoring
Metropolitan Utilities District

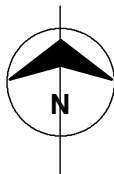
Source: Wilson & Company 2013 Aerial Photography



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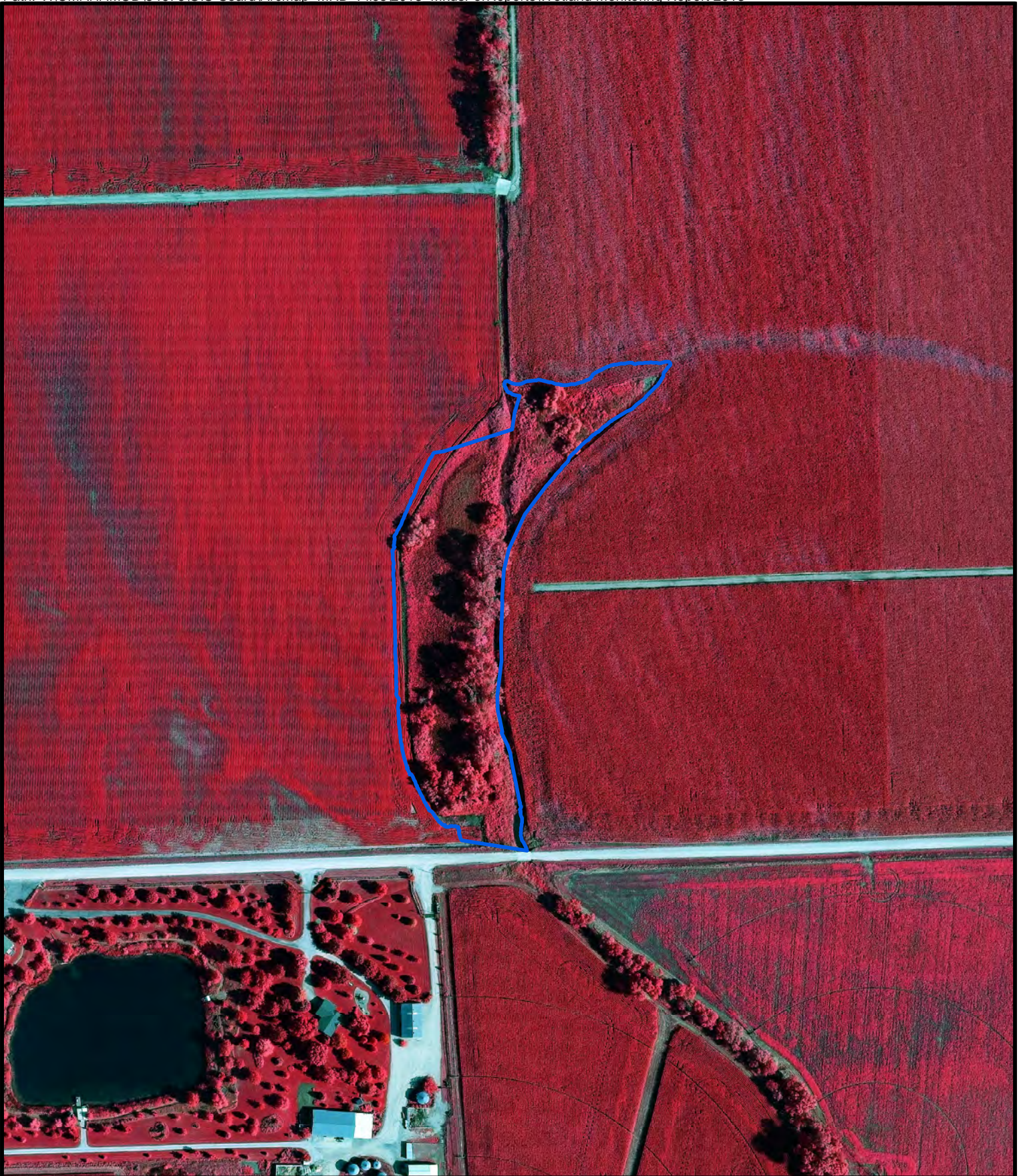
Source: Wilson & Company 2013 Aerial Photography

1:3000 Approximate Scale
(1 inch = 250 feet)



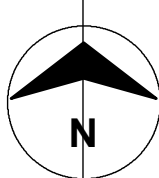
 Approximate Wetland Boundary

Figure 2
2013 Natural Color Aerial Photography
of PEM Wetland 9
Douglas County Cone of Depression
Wetland Monitoring
Metropolitan Utilities District



Source: Wilson & Company 2013
Color Infrared Aerial Photography

1:3000 Approximate Scale
(1 inch = 250 feet)

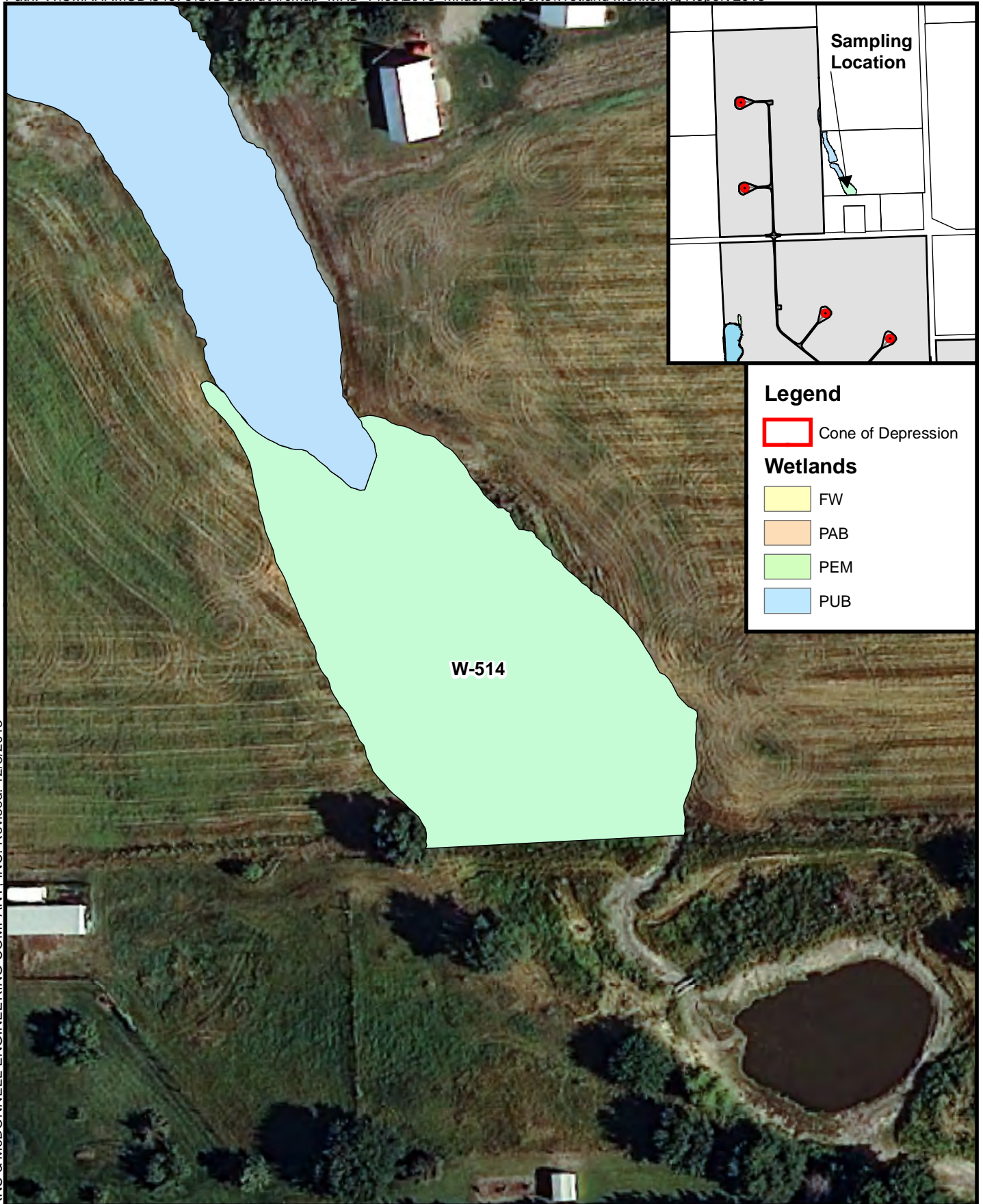


 Approximate Wetland Boundary

Figure H
2013 CIR Aerial Photography
of PEM Wetland 9
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0 25 50 75 100 Feet

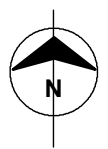
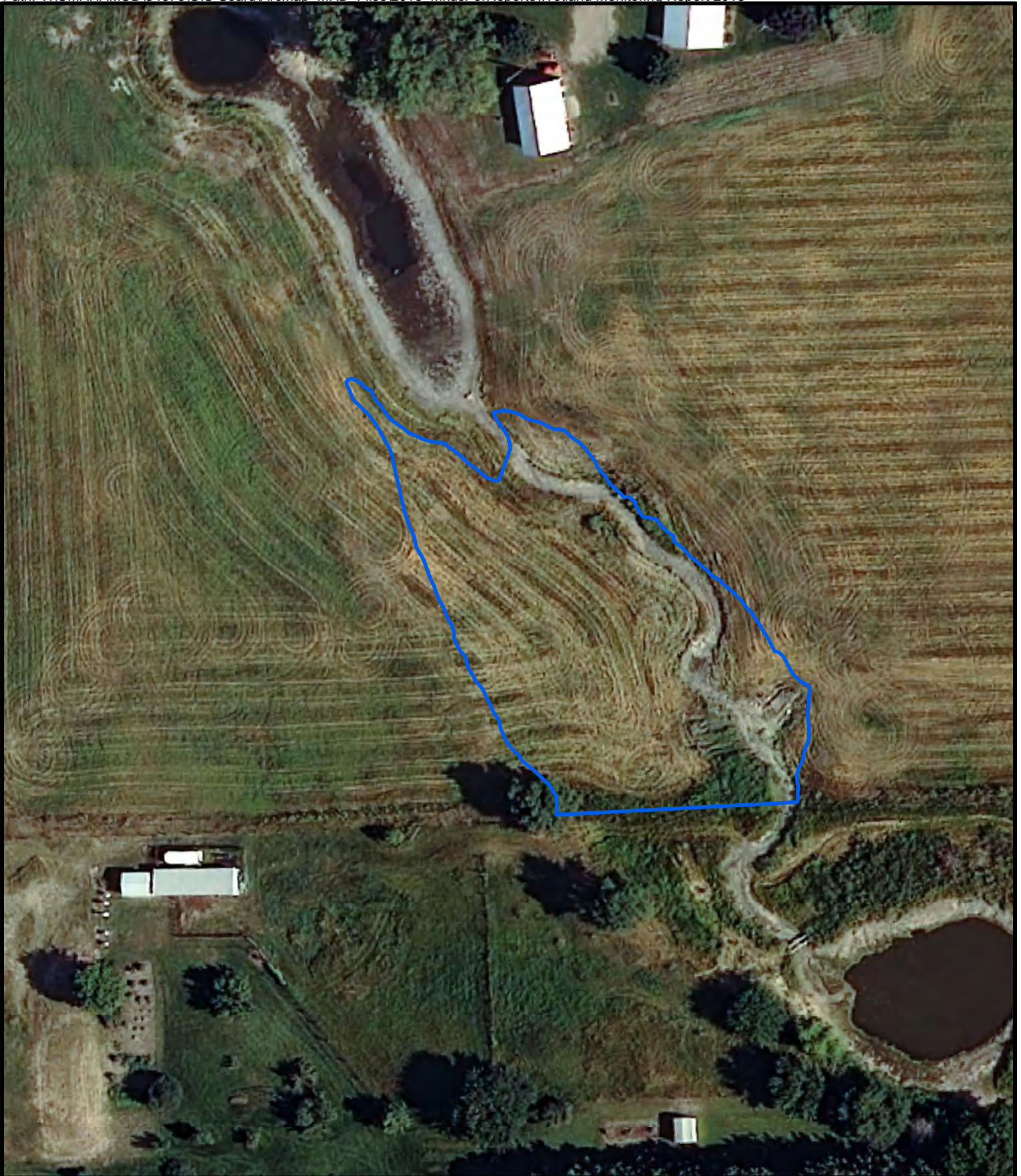
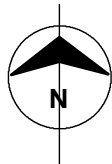


Figure 1
Location of PFO Wetland 514
Douglas County Wellfield
Wetland Monitoring
Metropolitan Utilities District



Source: Wilson & Company 2013 Aerial Photography

1:750 Approximate Scale
(1 inch = 62.5 feet)



 Approximate Wetland Boundary


Figure 2
2013 Natural Color Aerial Photography
of PEM Wetland 514
Douglas County Cone of Depression
Wetland Monitoring
Metropolitan Utilities District



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Source: Wilson & Company 2013
Color Infrared Aerial Photography

1:750 Approximate Scale
(1 inch = 62.5 feet)

 Approximate Wetland Boundary

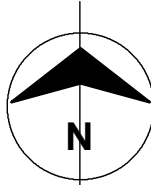
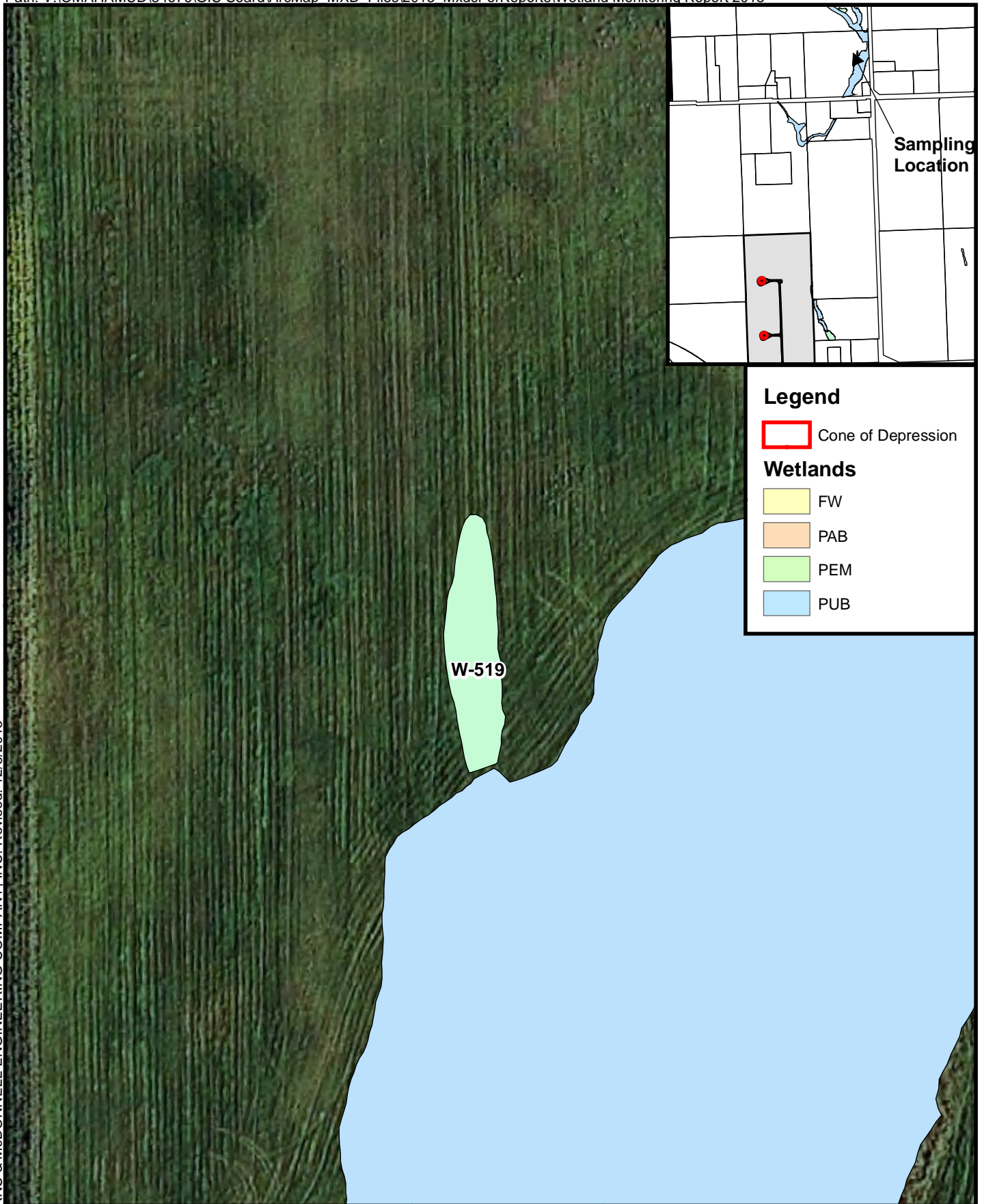


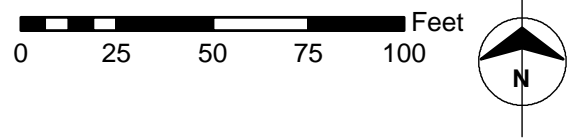
Figure H
2013 CIR Aerial Photography
of PEM Wetland 514
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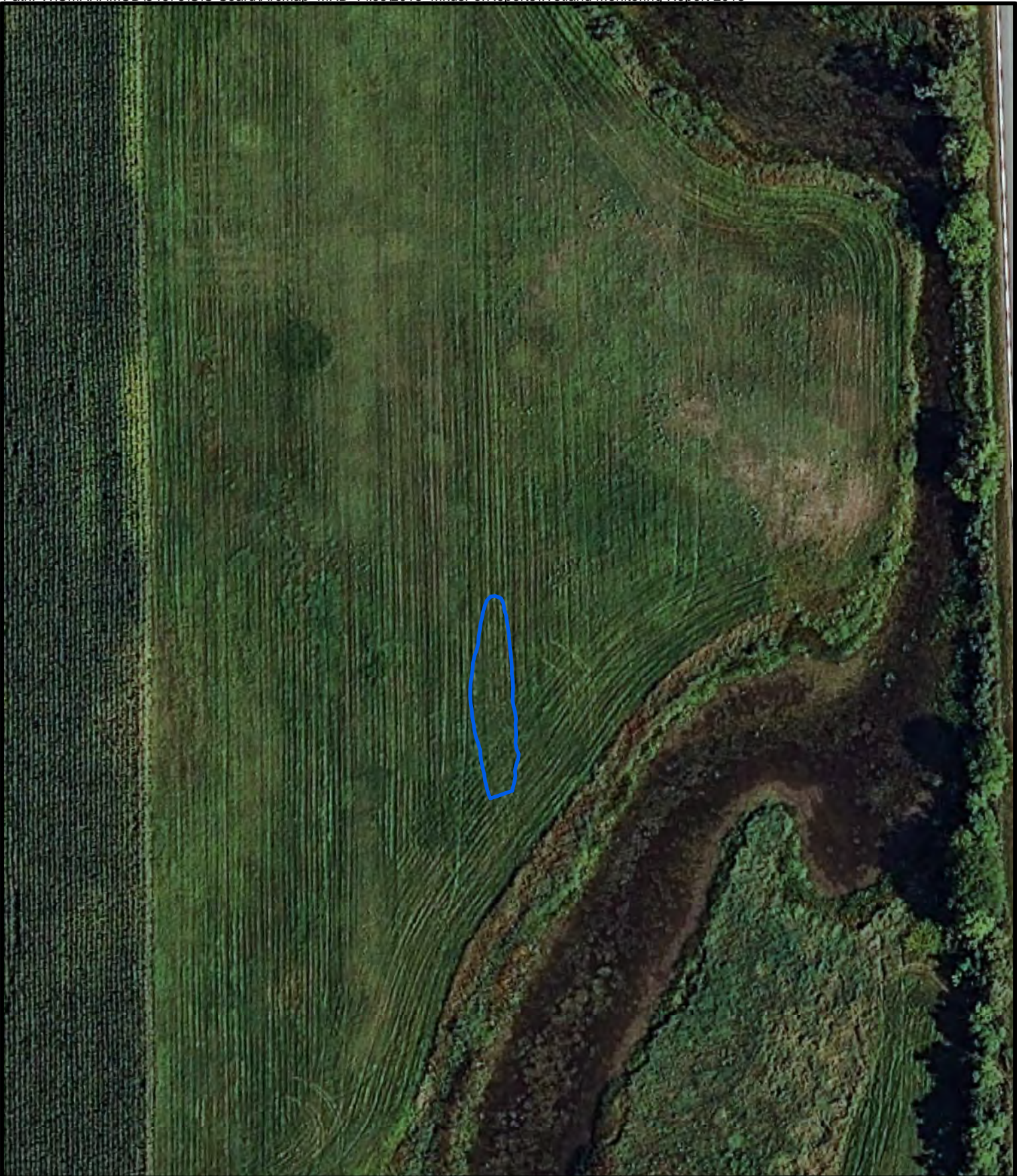
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Source: Wilson & Company 2013 Aerial Photography

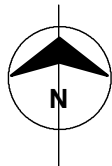


Figure 1
 Location of PEM Wetland 519
 Douglas County Wellfield
 Wetland Monitoring
 Metropolitan Utilities District



Source: Wilson & Company 2013 Aerial Photography

1:750 Approximate Scale
(1 inch = 62.5 feet)



 Approximate Wetland Boundary


Figure 2
2013 Natural Color Aerial Photography
of PEM Wetland 519
Douglas County Cone of Depression
Wetland Monitoring
Metropolitan Utilities District



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Source: Wilson & Company 2013
Color Infrared Aerial Photography

1:750 Approximate Scale
(1 inch = 62.5 feet)

 Approximate Wetland Boundary

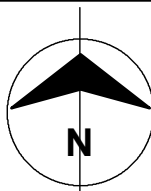
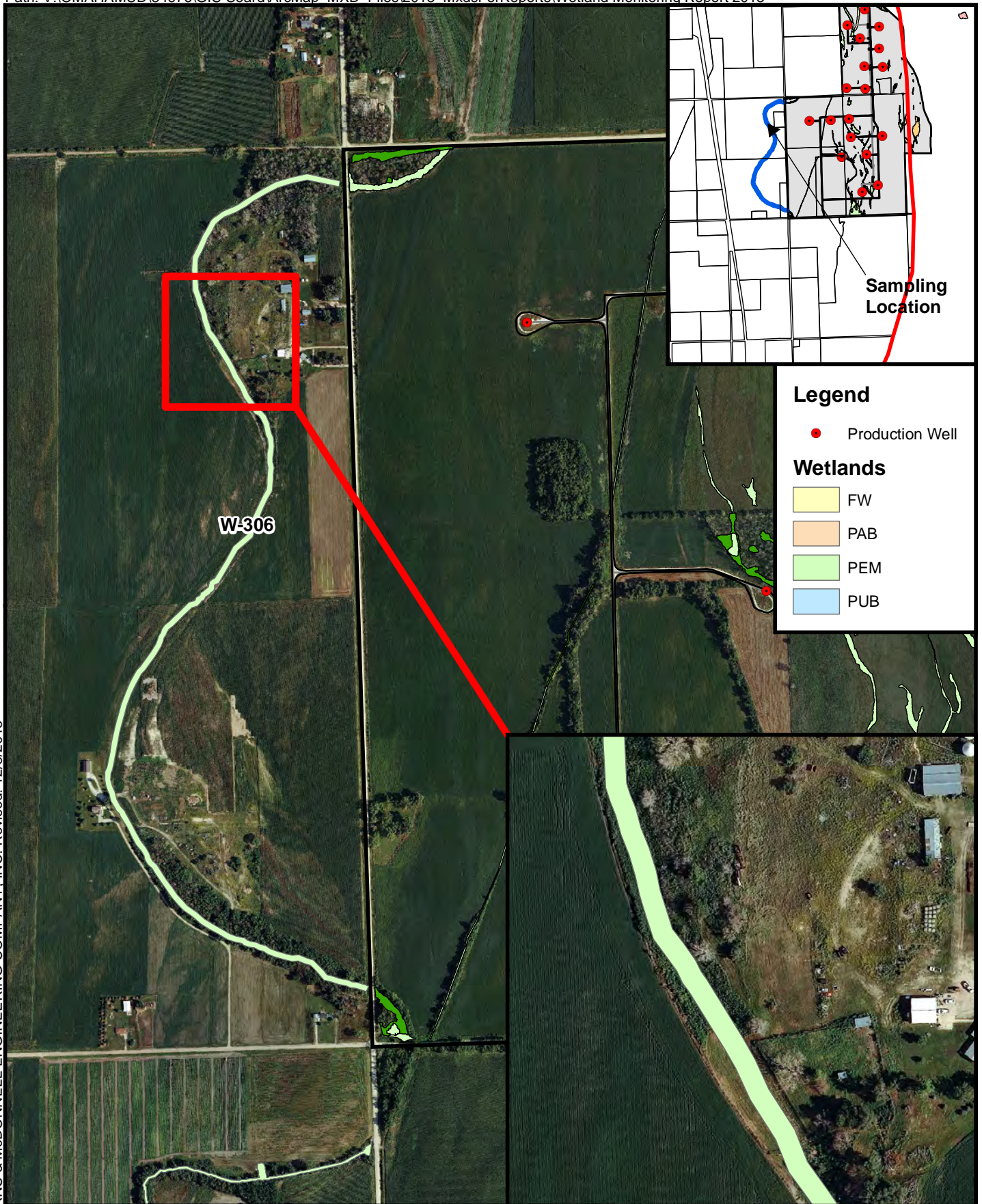


Figure H
2013 CIR Aerial Photography
of PEM Wetland 519
Douglas County Cone of Depression
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0 300 600 900 1,200 Feet

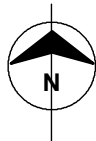
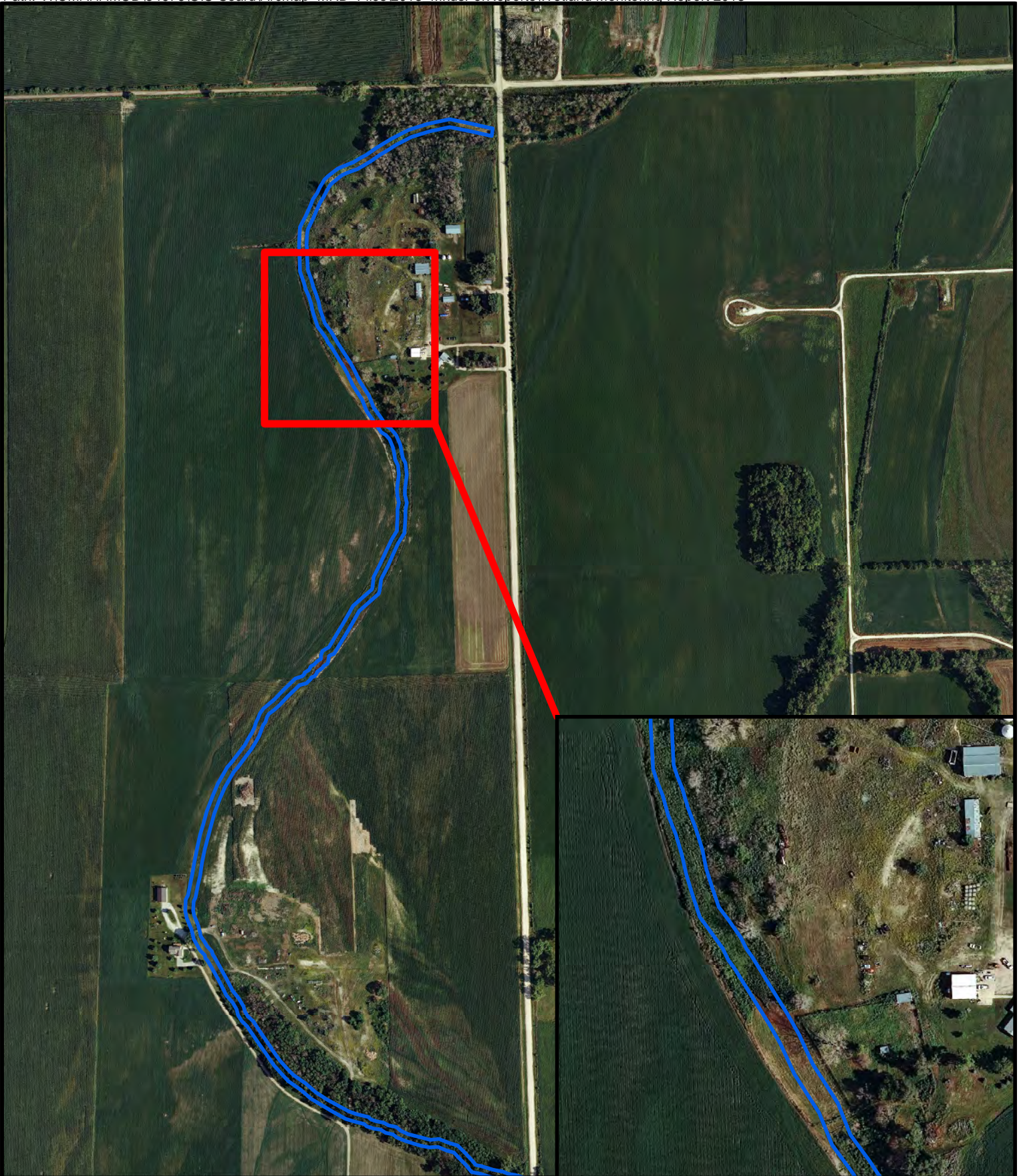


Figure 1
Location of PEM Wetland 306
Douglas County Wellfield
Wetland Monitoring
Metropolitan Utilities District

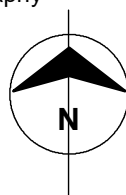
Source: Wilson & Company 2013 Aerial Photography



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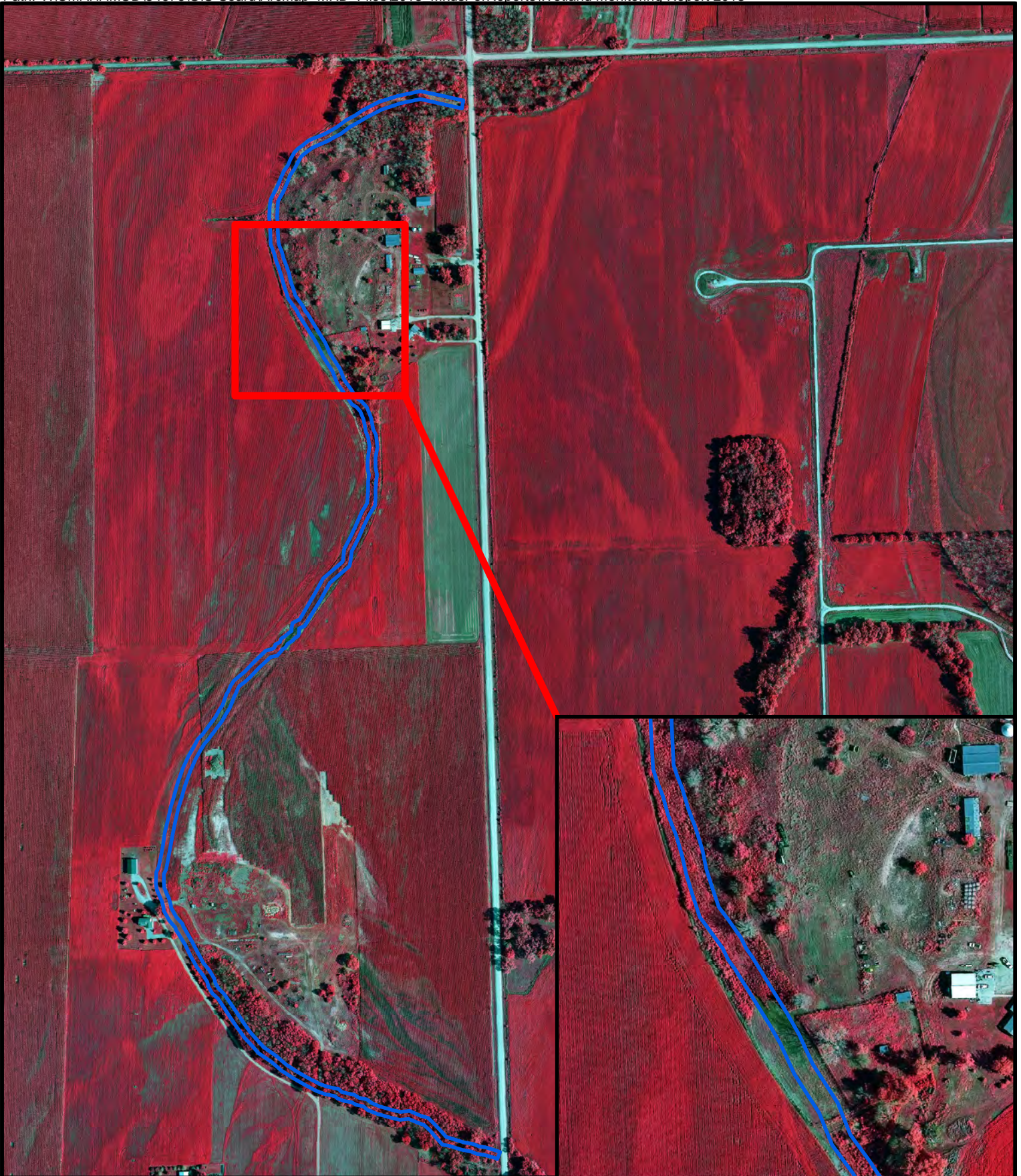
Source: Wilson & Company 2013 Aerial Photography

1:9000 Approximate Scale
(1 inch = 750 feet)



 Approximate Wetland Boundary


Figure 2
 2013 Natural Color Aerial Photography
 of PEM Wetland 306
 Saunders County Cone of Depression
 Wetland Monitoring
 Metropolitan Utilities District



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Source: Wilson & Company 2013
Color Infrared Aerial Photography

1:9000 Approximate Scale
(1 inch = 750 feet)

 Approximate Wetland Boundary

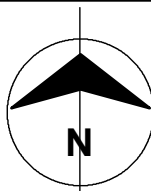
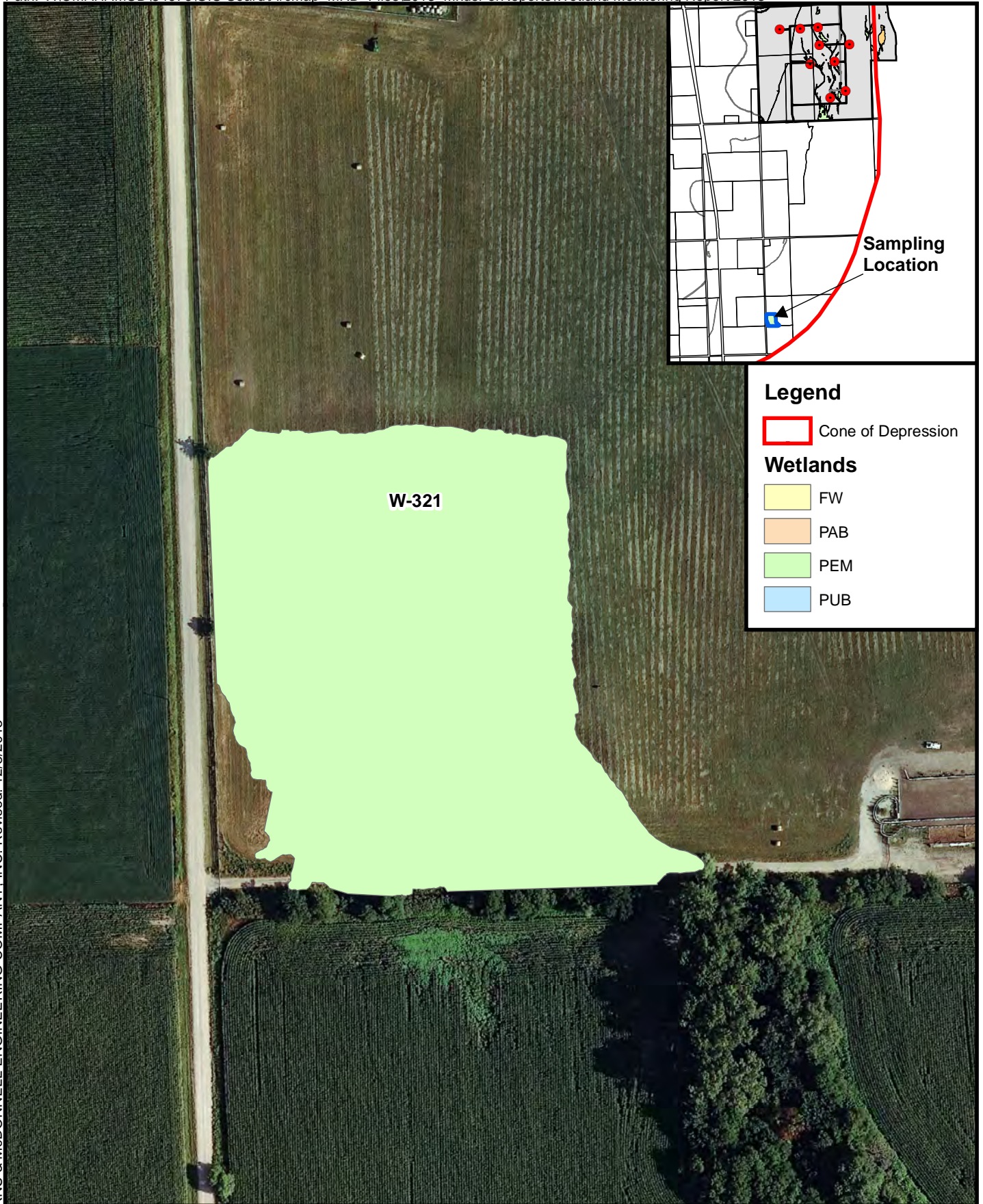


Figure 3
 2013 CIR Aerial Photography
 of PEM Wetland 306
 Saunders County Cone of Depression
 Wetland Monitoring
 Metropolitan Utilities District

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0 50 100 150 200 Feet

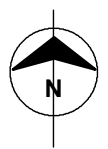


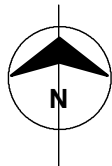
Figure 1
Location of PEM Wetland 321
Douglas County Wellfield
Wetland Monitoring
Metropolitan Utilities District

Source: Wilson & Company 2013 Aerial Photography



Source: Wilson & Company 2013 Aerial Photography

1:1500 Approximate Scale
(1 inch = 125 feet)




 Approximate Wetland Boundary


Figure 2
2013 Natural Color Aerial Photography
of PEM Wetland 321
Douglas County Cone of Depression
Wetland Monitoring
Metropolitan Utilities District



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Source: Wilson & Company 2013
Color Infrared Aerial Photography

1:1500 Approximate Scale
(1 inch = 125 feet)

 Approximate Wetland Boundary

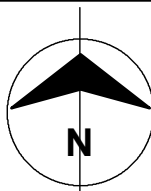
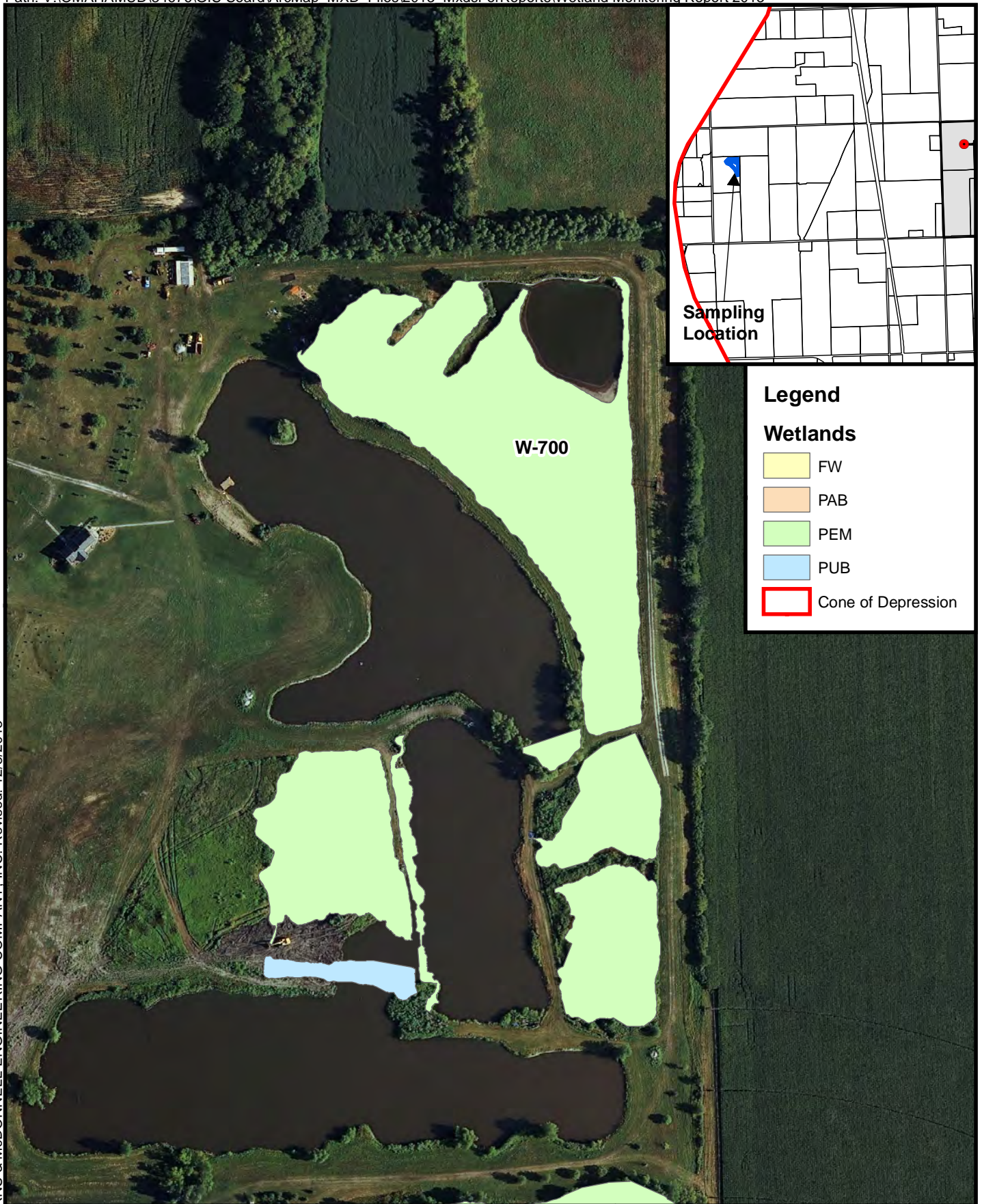


Figure 4
2013 CIR Aerial Photography
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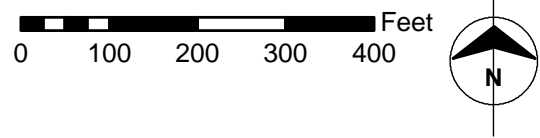


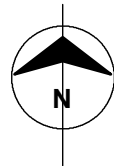
Figure 1
Location of PEM Wetland 700
Douglas County Wellfield
Wetland Monitoring
Metropolitan Utilities District

Source: Wilson & Company 2013 Aerial Photography



Source: Wilson & Company 2013 Aerial Photography

1:750 Approximate Scale
(1 inch = 62.5 feet)



 Approximate Wetland Boundary


Figure 2
2013 Natural Color Aerial Photography
of PEM Wetland 700
Saunders County Cone of Depression
Wetland Monitoring
Metropolitan Utilities District



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Source: Wilson & Company 2013
Color Infrared Aerial Photography

1:750 Approximate Scale
(1 inch = 62.5 feet)

 Approximate Wetland Boundary

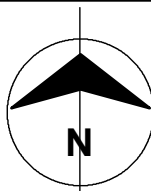
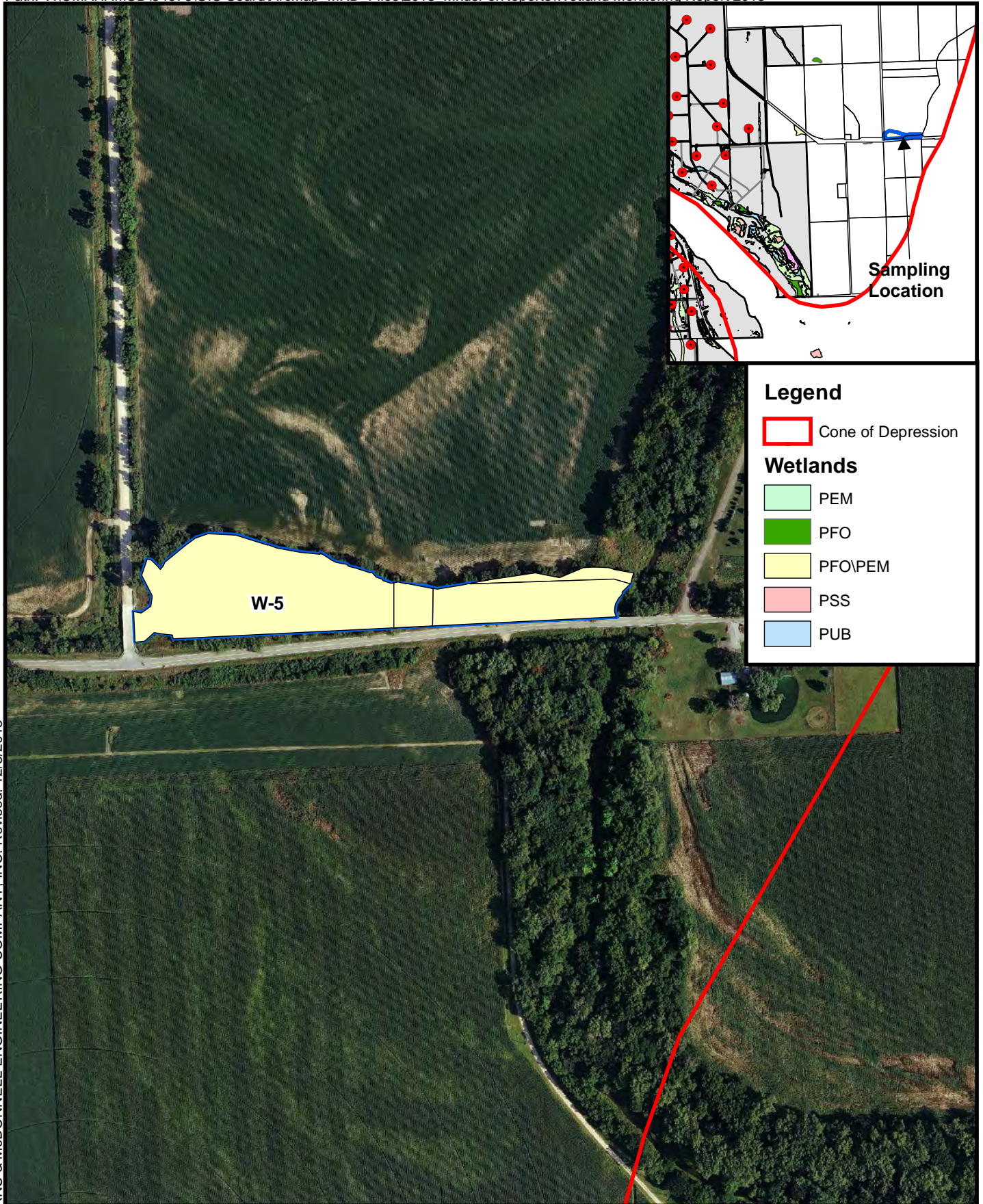


Figure H
2013 CIR Aerial Photography
of PEM Wetland 700
Saunders County Cone of Depression
Wetland Monitoring
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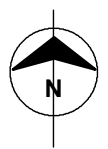
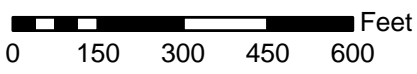


Figure 1
 Location of PFO/PEM Wetland 5
 Douglas County Wellfield
 Wetland Monitoring
 Metropolitan Utilities District

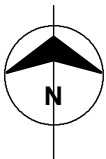
Source: Wilson & Company 2013 Aerial Photography



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Source: Wilson & Company 2013 Aerial Photography

1:3000 Approximate Scale
(1 inch = 250 feet)



 Approximate Wetland Boundary

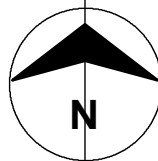
Figure 2
2013 Natural Color Aerial Photography
of PFO\PEM Wetland 5
Douglas County Cone of Depression
Wetland Monitoring
Metropolitan Utilities District



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Source: Wilson & Company 2013
Color Infrared Aerial Photography

1:3000 Approximate Scale
(1 inch = 250 feet)

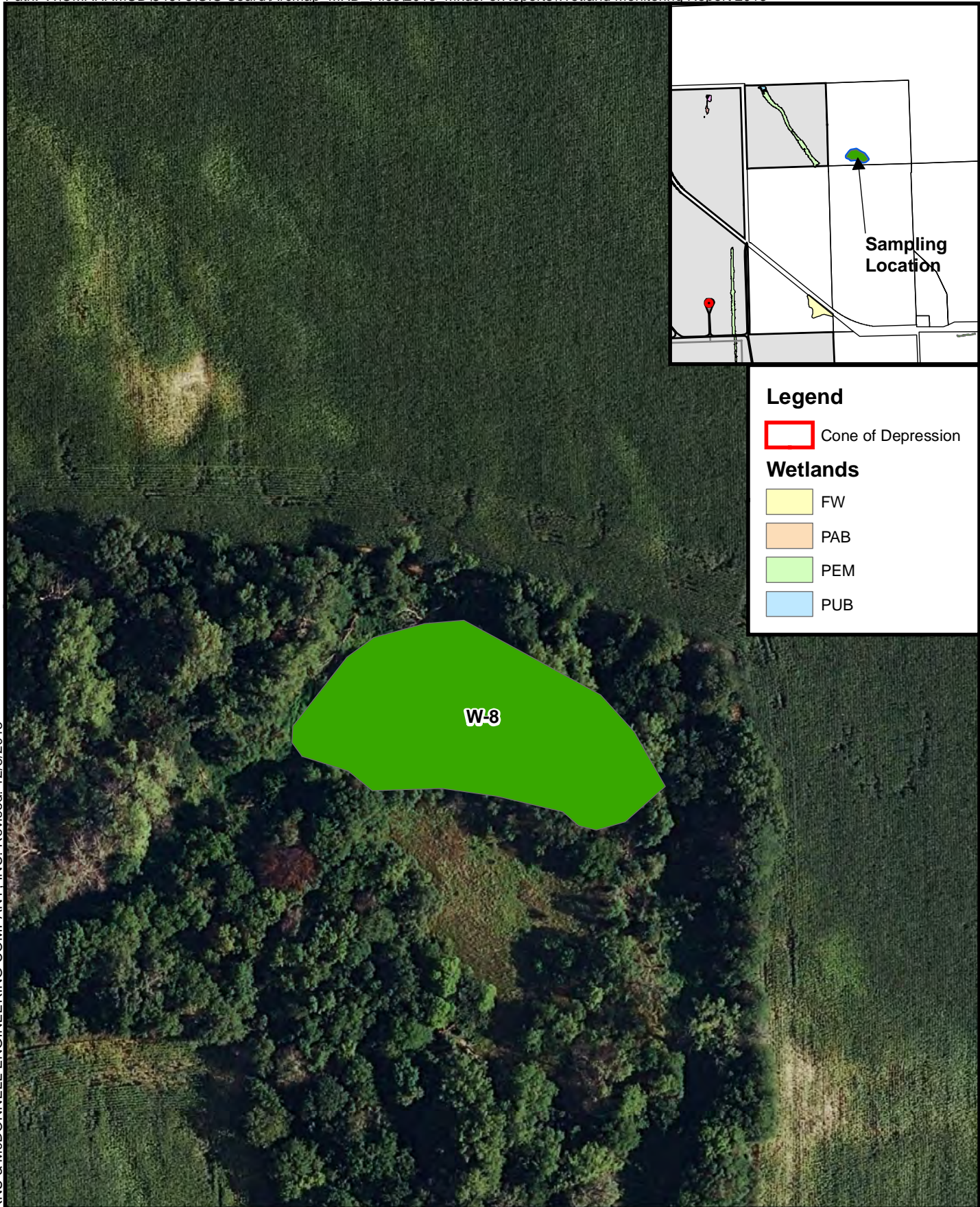


 Approximate Wetland Boundary

Figure H
2013 CIR Aerial Photography
of PFO/PEM Wetland 5
Douglas County Cone of Depression
Wetland Monitoring
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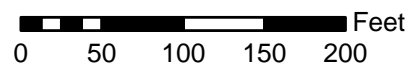


Figure 1
Location of PFO Wetland 8
Douglas County Wellfield
Wetland Monitoring
Metropolitan Utilities District

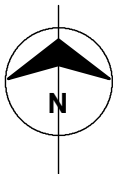
Source: Wilson & Company 2013 Aerial Photography



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Source: Wilson & Company 2013 Aerial Photography

1:1500 Scale
(1 inch = 125 feet)



 Approximate Wetland Boundary

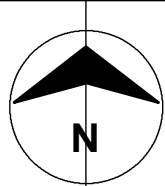
Figure 2
2013 Natural Color Aerial Photography
of PFO Wetland 8
Douglas County Cone of Depression
Wetland Monitoring
Metropolitan Utilities District



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Source: Wilson & Company 2013
Color Infrared Aerial Photography

1:1500 Scale
(1 inch = 125 feet)



 Approximate Wetland Boundary

Figure 3
2013 CIR Aerial Photography
of PFO Wetland 8
Douglas County Cone of Depression
Wetland Monitoring
Metropolitan Utilities District

APPENDIX II
COMPREHENSIVE VEGETATION SPECIES LIST
BY WETLAND, 2005-2013

Appendix II - Comprehensive Vegetation Species List by Wetland, 2005-2013

Scientific Name	Common Name	Native Status	Wetland Indicator Status	C Value	PEM			PFO		PSS	
					W-68	W-100	W-25	W-5	W-51	W-54	W-55
<i>Acalypha rhomboidea</i>	Common threeseed mercury	Native	FACU-	0		X			X	X	X
<i>Acer negundo</i>	Boxelder	Native	FAC	1	X						
<i>Acer rubrum</i>	Red maple	Native	--		X						
<i>Acer saccharinum</i>	Silver maple	Native	FACW	4						X	
<i>Achillea millefolium</i>	Common yarrow	Native & Introduced	FACU	2		X					
<i>Ageratina altissima</i>	White snakeroot	Native	NI	4					X		
<i>Agrimonia gryposepala</i>	Tall hairy agrimony	Native	FAC	5					X		
<i>Agrostis gigantea</i>	Redtop	Introduced	NI	0	X	X	X	X	X		
<i>Agrostis sp.</i>	Bentgrass	--	--					X			
<i>Agrostis stolonifera</i>	Creeping bentgrass	Introduced	FAC+		X		X	X	X		
<i>Amaranthus retroflexus</i>	Redroot amaranth	Native	FACU			X	X				
<i>Amaranthus tuberculatus</i>	Roughfruit amaranth	Native	OBL	0		X					
<i>Ambrosia artemisiifolia</i>	Annual ragweed	Native	FACU	0	X	X	X	X	X		X
<i>Ambrosia psilostachya</i>	Cuman ragweed	Native	FAC	1		X					
<i>Ambrosia trifida</i>	Great ragweed	Native	FACW	0		X			X		
<i>Amorpha fruticosa</i>	Desert false indigo	Native	OBL	5	X				X		
<i>Amphicarpaea bracteata</i>	American hogpeanut	Native	FACW	4					X		
<i>Andropogon gerardii</i>	Big bluestem	Native	FAC-	5	X	X	X				
<i>Anemone canadensis</i>	Canadian anemone	Native	FACW	4	X				X		
<i>Anemone caroliniana</i>	Carolina anemone	Native	NL	7	X						
<i>Anemone virginiana</i>	tall thimbleweed	Native	NI	4			X				
<i>Apios americana</i>	Groundnut	Native	FACW	6	X				X		X
<i>Apocynum cannabinum</i>	Indianhemp	Native	FAC	2	X		X				
<i>Arnoglossum plantagineum</i>	Groovestem Indian plantain	Native	FACW	7			X				
<i>Asarum canadense</i>	Canadian wildginger	Native	NL	0				X			
<i>Asclepias incarnata</i>	Swamp milkweed	Native	OBL	4	X	X	X				
<i>Asclepias sp.</i>	Milkweed	Native	--		X		X				
<i>Asclepias syriaca</i>	Common milkweed	Native	NL	1	X		X				
<i>Astragalus lotiflorus</i>	Lotus milkvetch	Native	NL	4	X						
<i>Avena sativa</i>	Common oat	Introduced	NL		X		X				
<i>Bidens cernua</i>	Nodding beggartick	Native	OBL	3			X				
<i>Bidens sp.</i>	Beggartick	Native	FACW				X				
<i>Boehmeria cylindrica</i>	Smallspike false nettle	Native	OBL	6	X	X	X		X	X	X

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<i>Brassica</i> sp.	Mustard	--	--		X						
<i>Bromus arvensis</i>	Field brome	Introduced	NL		X						
<i>Bromus inermis</i>	Smooth brome	Native & Introduced	NL		X	X	X				
<i>Calamagrostis canadensis</i>	Bluejoint	Native	OBL	6	X	X	X		X		
<i>Calamagrostis stricta</i>	Slimstem reedgrass	Native	NL	6	X		X	X	X		
<i>Calystegia sepium</i>	Hedge false bindweed	Native & Introduced	FAC	1	X	X					
<i>Camassia scilloides</i>	Atlantic camas	Native	FAC				X				
<i>Cannabis sativa</i>	Marijuana	Introduced	FACU-			X	X				
<i>Capsella bursa-pastoris</i>	Shepherd's purse	Introduced	FACU			X					
<i>Carduus nutans</i>	Nodding plumless thistle	Introduced	NL		X						
<i>Carex aquatilis</i>	Water sedge	Native	OBL	9		X					
<i>Carex bicknellii</i>	Bicknell's sedge	Native	FACU	6	X						X
<i>Carex blanda</i>	Eastern woodland sedge	Native	FAC	2					X		
<i>Carex brevior</i>	Shortbeak sedge	Native	FAC	4	X	X		X	X	X	X
<i>Carex cristatella</i>	Crested sedge	Native	FACW	5	X						
<i>Carex emoryi</i>	Emory's sedge	Native	OBL	5		X					
<i>Carex grayi</i>	Gray's sedge	Native	FACW	0			X				
<i>Carex molesta</i>	Troublesome sedge	Native	FAC	3	X	X					
<i>Carex pellita</i>	Woolly sedge	Native	OBL	4	X	X	X	X			
<i>Carex praegracilis</i>	Clustered field sedge	Native	FACW	4	X	X	X	X			
<i>Carex sartwellii</i>	Sartwell's sedge	Native	OBL	6				X			
<i>Carex</i> sp. 1	Sedge	Native	--		X	X	X	X	X	X	X
<i>Carex</i> sp. 2	Sedge	Native	--		X	X	X	X	X		
<i>Carex</i> sp. 3	Sedge	Native	--				X				
<i>Carex stricta</i>	Upright sedge	Native	OBL				X				
<i>Carex vulpinoidea</i>	Fox sedge	Native	OBL	4		X	X	X	X	X	X
<i>Celtis occidentalis</i>	Common hackberry	Native	FACU	4					X	X	X
<i>Chamaecrista fasciculata</i>	Partridge pea	Native	NL	1	X						
<i>Chenopodium album</i>	Lambsquarters	Native & Introduced	FAC			X	X				
<i>Cicuta maculata</i>	Spotted waterhemlock	Native	OBL	5	X						
<i>Cinna arundinacea</i>	Sweet woodreed	Native	FACW	5					X		
<i>Cirsium altissimum</i>	Tall thistle	Native	NL	1	X	X	X	X	X		
<i>Cirsium arvense</i>	Canada thistle	Introduced	FACU				X				
<i>Cirsium canescens</i>	Prairie thistle	Native	NL	4			X				

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Cirsium sp.	Thistle	--	--			X					
Commelina communis	Asiatic dayflower	Introduced	FAC		X						
Commelina erecta	Whitemouth dayflower	Native	NL	5					X		
Convolvulus arvensis	Field bindweed	Introduced	NL		X	X			X		
Conyza canadensis	Canadian horseweed	Native	FACU-	0	X	X	X				
Cornus drummondii	Roughleaf dogwood	Native	FAC	3	X		X	X	X	X	X
Cryptotaenia canadensis	Canada honewort	Native	FACU	4				X	X		
Cynodon dactylon	Bermudagrass	Introduced	FACU		X		X				
Cyperus acuminatus	Tapertip flatsedge	Native	OBL	3	X						
Cyperus esculentus	Yellow nutsedge	Native & Introduced	FACW	0	X	X	X				
Cyperus strigosus	Strawcolored flatsedge	Native	FACW	4	X		X				
Descurainia sophia	herb sophia	Introduced	NI	0		X					
Desmanthus illinoensis	Illinois bundleflower	Native	FACU	5	X		X	X			
Dichanthelium acuminatum	Tapered rosette grass	Native	FAC	6	X		X				
Dichanthelium oligosanthes	Heller's rosette grass	Native	FACU	4	X		X				
Digitaria ischaemum	Smooth crabgrass	Introduced	UPL		X						
Distichlis spicata	Saltgrass	Native	FACW	3	X				X		
Doellingeria umbellata	parasol whitetop	Native	FACW	2		X					
Echinochloa crus-galli	Barnyardgrass	Introduced	FACW			X	X				
Echinochloa sp.	Barnyardgrass	--	--				X				
Eleocharis compressa	Flatstem spikerush	Native	FACW	6			X				
Eleocharis erythropoda	Bald spikerush	Native	OBL	5	X	X	X	X			
Eleocharis lanceolata	Daggerleaf spikerush	Native	FACW+		X		X				
Eleocharis obtusa	Blunt spikerush	Native	OBL	3	X						
Eleocharis palustris	Common spikerush	Native	OBL	4		X					
Eleocharis sp.	Spikerush	--	--		X	X	X	X			
Elymus canadensis	Canada wildrye	Native	FACU	5	X	X	X				
Elymus hystrix	Eastern bottlebrush grass	Native	NL	6	X	X		X			
Elymus submuticus	Virginia wildrye	Native	NL		X				X		X
Elymus virginicus	Virginia wildrye	Native	FAC	4	X		X		X	X	X
Equisetum arvense	Field horsetail	Native	FAC	4	X		X	X	X		X
Equisetum hyemale	Scouringrush horsetail	Native	FACW	4			X				
Erechtites hieraciifolia	American burnweed	Native	FAC	1	X		X		X	X	
Erigeron annuus	Eastern daisy fleabane	Native	FACU	1		X					

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<i>Erigeron strigosus</i>	Prairie fleabane	Native	FAC	2	X		X				
<i>Eupatoriadelphus maculatus</i>	Spotted trumpetweed	Native	OBL			X					
<i>Eupatorium perfoliatum</i>	Common boneset	Native	OBL	5	X				X		
<i>Eupatorium purpureum</i>	Sweet scented joe pye weed	Native	NL				X		X		
<i>Eupatorium serotinum</i>	Lateflowering thoroughwort	Native	FAC	3				X			
<i>Eupatorium sp.</i>	Thoroughwort	Native	--		X						
<i>Euthamia gymnospermoides</i>	Texas goldentop	Native	FACW	4	X						
<i>Fragaria virginiana</i>	Virginia strawberry	Native	FACU	5					X		
<i>Fraxinus pennsylvanica</i>	Green ash	Native	FACW	2				X	X	X	X
<i>Galium aparine</i>	Stickywilly	Native	FACU	0	X	X	X	X	X	X	X
<i>Galium obtusum</i>	Bluntleaf bedstraw	Native	FACW	6	X	X	X	X	X		X
<i>Galium pilosum</i>	Hairy bedstraw	Native	NL						X		
<i>Galium trifidum</i>	Threepetal bedstraw	Native	OBL	8					X		
<i>Galium triflorum</i>	Fragrant bedstraw	Native	FACU	4	X				X		
<i>Gaura longiflora</i>	Longflower beeblossom	Native	NL	3			X				
<i>Geum canadense</i>	White avens	Native	FACU	3	X		X	X	X	X	X
<i>Gleditsia triacanthos</i>	Honeylocust	Native	FAC	1	X				X		
<i>Helenium autumnale</i>	Common sneezeweed	Native	FACW	6	X		X				
<i>Helianthus annuus</i>	Common sunflower	Native	FACU	0	X		X				
<i>Helianthus grosseserratus</i>	Sawtooth sunflower	Native	FACW	4	X	X	X	X	X		
<i>Helianthus hirsutus</i>	Hairy sunflower	Native	NL	6	X						
<i>Helianthus maximiliani</i>	Maxilian sunflower	Native	UPL	4	X		X		X		
<i>Helianthus pauciflorus</i>	Stiff sunflower	Native	NL	5	X			X	X		
<i>Helianthus sp.</i>	Sunflower	Native	--		X		X		X		
<i>Hieracium longipilum</i>	Hairy hawkweed	Native	NL	6			X				
<i>Hordeum jubatum</i>	Foxtail barley	Native	FACW	1	X	X	X	X			
<i>Hypericum sp.</i>	St. Johnswort	--	--		X						
<i>Impatiens capensis</i>	Jewelweed	Native	FACW	4	X						
<i>Impatiens sp.</i>	Touch-me-not	--	--		X						
<i>Ipomoea hederacea</i>	Ivyleaf morning-glory	Introduced	FACU		X						
<i>Ipomoea purpurea</i>	Tall morning-glory	Introduced	FACU		X	X	X				
<i>Iris virginica</i>	Virginia iris	Native	OBL	8							X
<i>Iva annua</i>	Annual marsh elder	Native	FAC	1		X	X	X			
<i>Juglans nigra</i>	Black walnut	Native	FACU	5					X		

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<i>Juncus arcticus</i> ssp. <i>Littoralis</i>	Mountain rush	Native	OBL	6			X				
<i>Juncus dudleyi</i>	Dudley's rush	Native	NL	5	X		X				
<i>Juncus effusus</i>	Common rush	Native	OBL	6	X		X				
<i>Juncus interior</i>	Inland rush	Native	FAC	4	X						
<i>Juncus</i> sp.	Rush	Native	--		X	X					
<i>Juncus tenuis</i>	Poverty rush	Native	FAC	3	X		X	X	X		
<i>Juncus torreyi</i>	Torrey's rush	Native	FACW	4	X		X				
<i>Lactuca ludoviciana</i>	Biannual lettuce	Native	FAC	3			X				
<i>Lactuca serriola</i>	Prickly lettuce	Introduced	FAC		X	X	X				
<i>Lactuca</i> sp.	Lettuce	--	--			X		X			
<i>Laportea canadensis</i>	Canadian woodnettle	Native	FACW	4	X				X		X
<i>Leersia oryzoides</i>	Rice cutgrass	Native	OBL	4	X	X	X		X		X
<i>Leersia virginica</i>	White grass	Native	FACW	4	X	X		X	X		
<i>Lepidium virginicum</i>	Virginia pepperweed	Native	FACU	0		X					
<i>Leptochloa fusca</i>	Bearded sprangletop	Native	OBL	1		X					
<i>Liatris punctata</i>	Dotted blazing star	Native	NL	5			X				
<i>Lonicera japonica</i>	Japanese honeysuckle	Introduced	FACU						X		
<i>Lycopus americanus</i>	American water horehound	Native	OBL	4	X	X	X	X			
<i>Lycopus asper</i>	Rough bugleweed	Native	OBL	5	X		X				
<i>Lycopus uniflorus</i>	Northern bugleweed	Native	OBL	6		X	X		X		X
<i>Lycopus virginicus</i>	Virginia water horehound	Native	OBL	5	X	X	X			X	X
<i>Lysimachia nummularia</i>	Creeping jenny	Introduced	OBL								X
<i>Lysimachia thyrsoiflora</i>	Tufted loosestrife	Native	OBL	7	X				X		
<i>Lythrum alatum</i>	Winged lythrum	Native	OBL	6		X					
<i>Medicago lupulina</i>	Black medick	Introduced	FAC		X		X				
<i>Medicago</i> sp.	Medick	Introduced	--				X				
<i>Melilotus officinalis</i>	Yellow sweetclover	Introduced	FACU		X						
<i>Melilotus</i> sp.	Clover	--	--		X						
<i>Mentha arvensis</i>	Wild mint	Native	FACW	4	X	X	X	X	X		
<i>Morus alba</i>	White mulberry	Introduced	FAC							X	
<i>Morus</i> sp.	Mulberry	--	--					X		X	
<i>Muhlenbergia asperifolia</i>	Scratchgrass	Native	FACW	5	X	X		X	X		
<i>Muhlenbergia cuspidata</i>	Plains muhly	Native	NL	5	X						
<i>Muhlenbergia mexicana</i>	Mexican muhly	Native	FACW	4	X						

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Muhlenbergia racemosa	Marsh muhly	Native	FACW	4	X				X		
Muhlenbergia schreberi	Nimblewill	Native	FACU	0	X				X		
Muhlenbergia sp.	Muhly	Native	--		X				X		
Oxalis stricta	Common yellow oxalis	Native	FACU	0	X						
Panicum capillare	Witchgrass	Native	FAC	0			X				
Panicum virgatum	Switchgrass	Native	FAC	4	X		X				
Parietaria pensylvanica	Pennsylvania pellitory	Native	FAC	0		X	X	X			
Parthenocissus quinquefolia	Virginia creeper	Native	FAC	5					X	X	X
Pascopyrum smithii	Western wheatgrass	Native	NL		X		X				X
Paspalum dilatatum	Dallisgrass	Introduced	NI						X		
Phalaris arundinacea	Reed canarygrass	Native	FACW+	0	X	X	X	X	X	X	X
Phragmites australis	Common reed	Native	FACW		X						
Phyla lanceolata	Lanceleaf fogfruit	Native	OBL	3	X	X	X	X		X	X
Physalis heterophylla	Clammy groundcherry	Native	NL	4		X	X				
Physalis longifolia	Longleaf groundcherry	Native	NL	0	X	X	X				
Physalis virginiana	Virginia groundcherry	Native	NL	6				X			
Physostegia virginiana	Obedient plant	Native	OBL	7		X		X			
Pilea pumila	Canadian clearweed	Native	FAC	4			X				
Plantago patagonica	Woolly plantain	Native	UPL	1	X						
Poa pratensis	Kentucky bluegrass	Native & Introduced	FACU		X	X	X	X	X		
Podophyllum peltatum	Mayapple	Native	FACU-	7	X				X		
Polygonatum biflorum	Smooth Solomon's seal	Native	UPL	4			X		X		
Polygonum amphibium	Water knotweed	Native	OBL				X				X
Polygonum aviculare	Prostrate knotweed	Introduced	FACW		X						
Polygonum caespitosum	Oriental lady's thumb	Introduced	NI			X	X		X		
Polygonum hydropiper	Marshpepper knotweed	Introduced	OBL				X				
Polygonum hydropiperoides	Swamp smartweed	Native	OBL		X	X	X		X		X
Polygonum pensylvanicum	Pennsylvania smartweed	Native	FACW+		X	X	X				X
Polygonum punctatum	Dotted smartweed	Native	OBL		X	X	X				
Polygonum scandens	Climbing false buckwheat	Native & Introduced	FACU		X	X	X				
Polygonum sp.	Polygonum	--	--		X	X	X	X	X	X	
Populus deltoides	Eastern cottonwood	Native	FAC	3					X	X	
Potamogeton amplifolius	Largeleaf pondweed	Native	OBL	10	X		X				
Pseudognaphalium obtusifolium	rabbit-tobacco	Native	NI	3			X				

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Potentilla arguta	Tall cinquefoil	Native	FACU						X		
Prunella vulgaris	Common selfheal	Native	FAC	4					X		
Prunus sp.	Plum	Native	--					X			
Pycnanthemum tenuifolium	Narrowleaf mountainmint	Native	FACW	7			X				
Pycnanthemum virginianum	Virginia mountainmint	Native	FAC	6			X	X			
Ranunculus sceleratus	Cursed buttercup	Native	OBL		X						
Rudbeckia hirta	Blackeyed susan	Native	FACU	4	X		X				
Rudbeckia laciniata	Cutleaf coneflower	Native	FAC	4					X		
Rumex crispus	Curly dock	Introduced	FACW			X	X				X
Rumex orbiculatus	Greater water dock	Native	OBL		X						
Rumex sp.	Dock	--	--		X	X					
Sagittaria latifolia	Broadleaf arrowhead	Native	OBL	5		X					
Salix amygdaloides	Peachleaf willow	Native	FACW	4	X				X	X	
Salix exigua	Narrowleaf willow	Native	OBL	3	X						X
Salix interior	Sandbar willow	Native	NL	3	X						X
Salix lutea	Yellow willow	Native	OBL	6	X						
Salix nigra	Black willow	Native	OBL	3					X	X	X
Sambucus canadensis	Common elderberry	Native	FAC	2						X	
Sanicula canadensis	Canadian blacksnakeroot	Native	NI	3					X	X	
Sanicula odorata	Clustered blacksnakeroot	Native	FAC	4				X	X	X	X
Saxifraga sp.	Saxifrage	Native	--					X			
Schedonorus phoenix	Tall fescue	Introduced	FACU		X	X	X	X	X		
Schizachyrium scoparium	Little bluestem	Native	FACU	4			X				
Schoenoplectus acutus var. acutus	Hardstem bulrush	Native	OBL	5		X	X				
Schoenoplectus fluviatilis	River bulrush	Native	OBL		X		X	X			X
Schoenoplectus pungens	Common threesquare	Native	OBL	4	X	X	X	X			X
Schoenoplectus tabernaemontani	Softstem bulrush	Native	OBL	5			X				
Scirpus sp.	Bulrush	Native	OBL		X						X
Setaria faberi	Japanese bristlegrass	Introduced	UPL				X				
Setaria pumila ssp. pumila	Yellow foxtail	Introduced	FAC			X	X				
Setaria verticillata	Hooked bristlegrass	Introduced	FAC				X				
Setaria viridis	Green bristlegrass	Introduced	NL				X				
Sium suave	Hemlock waterparsnip	Native	OBL	7	X						
Smilax bona-nox	Saw greenbrier	Native	FAC		X						

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Smilax sp.	Greenbrier	Native	--						X		
Smilax tamnoides	Bristly greenbrier	Native	FAC								X
Solanum carolinense	Carolina horsenettle	Native	UPL	2	X	X	X		X		
Solanum rostratum	Buffalobur nightshade	Native	NL	0			X				
Solidago canadensis	Canada goldenrod	Native	FACU	2	X	X	X	X			
Solidago gigantea	Giant goldenrod	Native	FACW	3	X	X	X	X	X	X	X
Solidago sp.	Goldenrod	--	--		X						
Sonchus oleraceus	Common sowthistle	Introduced	FACU	0			X				
Spartina pectinata	Prairie cordgrass	Native	FACW	5	X	X	X	X	X		X
Sphenopholus obtusata	Prairie wedgescale	Native	FACW	5		X	X	X			X
Sporobolus compositus	Composite dropseed	Native	FACU	3			X				
Stachys palustris	Marsh hedgenettle	Native	OBL	5							X
Symphoricarpos orbiculatus	Coralberry	Native	FACU-	2			X		X		
Symphotrichum ericoides	White heath aster	Native	FACU	3			X				
Symphotrichum lanceolatum	White panicle aster	Native	NI	2	X	X	X	X			
Symphotrichum lateriflorum	Calico aster	Native	FACW	5	X			X	X		
Symphotrichum novae-angliae	New England aster	Native	FACW	4	X						
Symphotrichum ontarionis	Bottomland aster	Native	FAC	5	X			X	X		X
Symphotrichum pilosum	Hairy white oldfield aster	Native	FACU	0	X		X	X	X		
Symphotrichum praealtum	Willowleaf aster	Native	FACW	5	X	X	X	X	X		
Symphotrichum puniceum	Purplestem aster	Native	OBL				X	X			
Symphotrichum sp.	Aster	Native	--			X	X	X	X		
Taraxacum officinale	Common dandelion	Native & Introduced	FACU			X	X		X		
Teucrium canadense	Canada germander	Native	FACW	4	X	X			X		
Thlaspi arvense	Field pennycress	Introduced	FACU	0		X					
Toxicodendron radicans	Eastern poison ivy	Native	FACU	2	X		X	X	X	X	X
Trifolium repens	White clover	Introduced	FACU		X	X					
Typha angustifolia	Narrowleaf cattail	Introduced	OBL				X				
Typha latifolia	Broadleaf cattail	Native	OBL	1	X		X				X
Ulmus americana	American elm	Native	FAC	3		X			X		
Ulmus pumila	Siberian elm	Introduced	NL						X		
Ulmus rubra	Slippery elm	Native	FAC	5	X						X
Ulmus sp.	Elm	--	--						X	X	
Unknown 1	Unknown seedling	--	--		X	X	X	X	X	X	X

Appendix II - Comprehensive Vegetation Species List by Wetland, 2005-2013

Scientific Name	Common Name	Native Status	Status	C Value	W-68	W-100	W-25	W-5	W-51	W-54	W-55
Unknown 2	Unknown seedling	--	--		X		X		X		
Unknown Poaceae 1	Unknown grass	--	--		X	X	X		X		
Unknown Poaceae 2	Unknown grass	--	--				X				
Urtica dioica	Stinging nettle	Native & Introduced	FACW	1					X		X
Verbena hastata	Swamp verbena	Native	FACW	4	X	X	X				
Verbena simplex	Narrowleaf vervain	Native	NL	4		X					
Verbena stricta	Hoary verbena	Native	NL	2		X					
Verbesina alternifolia	Wingstem	Native	FAC	4	X						
Vernonia baldwinii	Baldwin's ironweed	Native	FACW-	3			X				
Vernonia fasciculata	Prairie ironweed	Native	FAC	4	X	X	X				
Veronicastrum virginicum	Culver's root	Native	FAC	9			X				
Viola nephrophylla	Northern bog violet	Native	FACW	8			X				
Viola sp.	Violet	Native	--		X	X	X	X	X		X
Vitis riparia	Riverbank grape	Native	FAC	3	X	X	X		X	X	X
Vitis sp.	Grape	Native	--					X			
Zizia aurea	Golden zizia	Native	FAC	6			X				

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Figure 16 Monitoring Well Readings for MW 05-23 in Saunders County

Figure 17 Monitoring Well Readings for MW 05-24 in Douglas County

Figure 18 Monitoring Well Readings for MW 05-25 in Douglas County

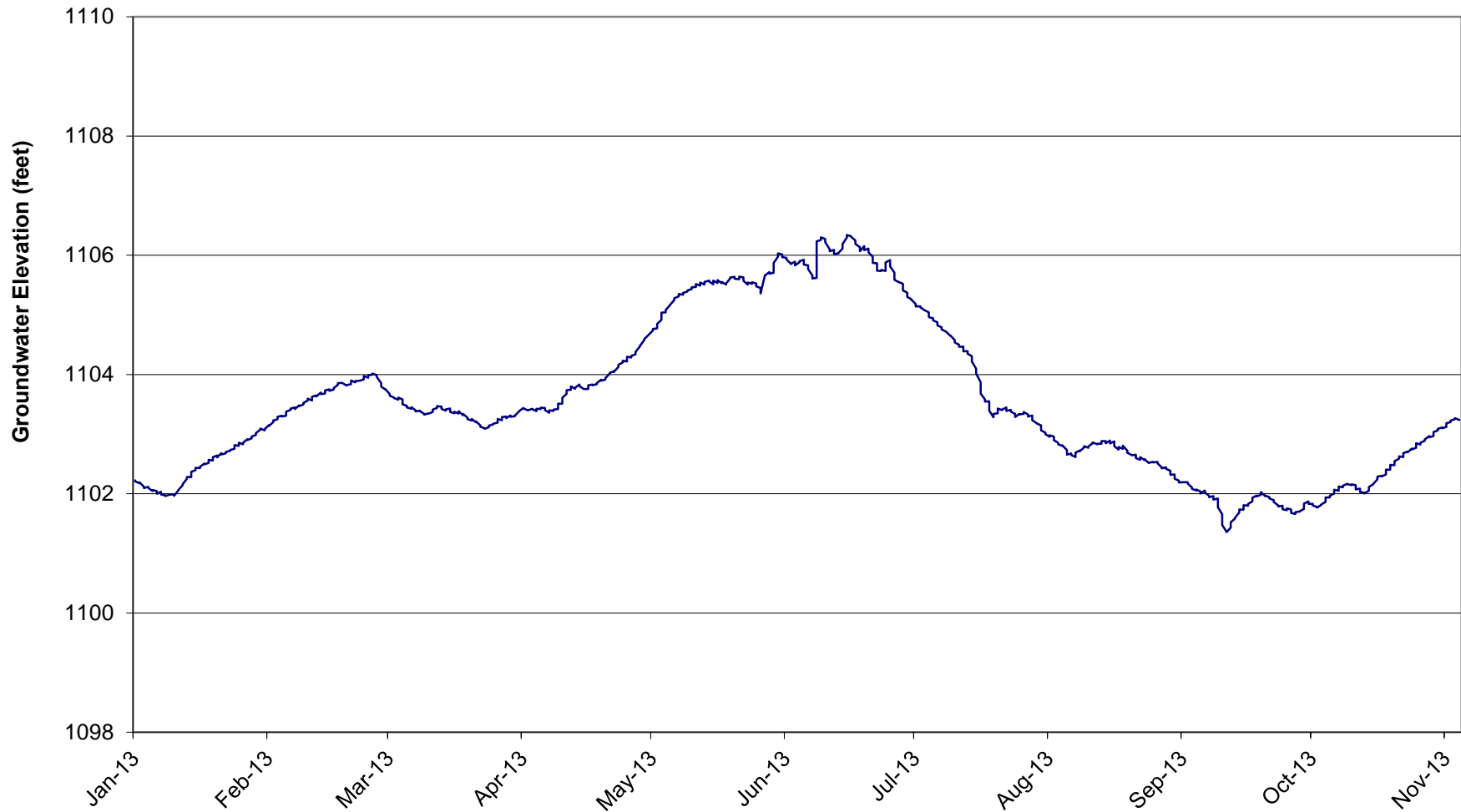
Figure 19 Monitoring Well Readings for MW 05-26 in Douglas County

Figure 20 Monitoring Well Readings for MW 06-27 in Saunders County

Figure 21 Monitoring Well Readings for MW 06-28 in Douglas County

Figure 22 Monitoring Well Readings for MW 06-29 in Douglas County

Figure 7 Monitoring Well Readings for MW 94-01 in Douglas County
(January 1, 2013 thru November 4, 2013)



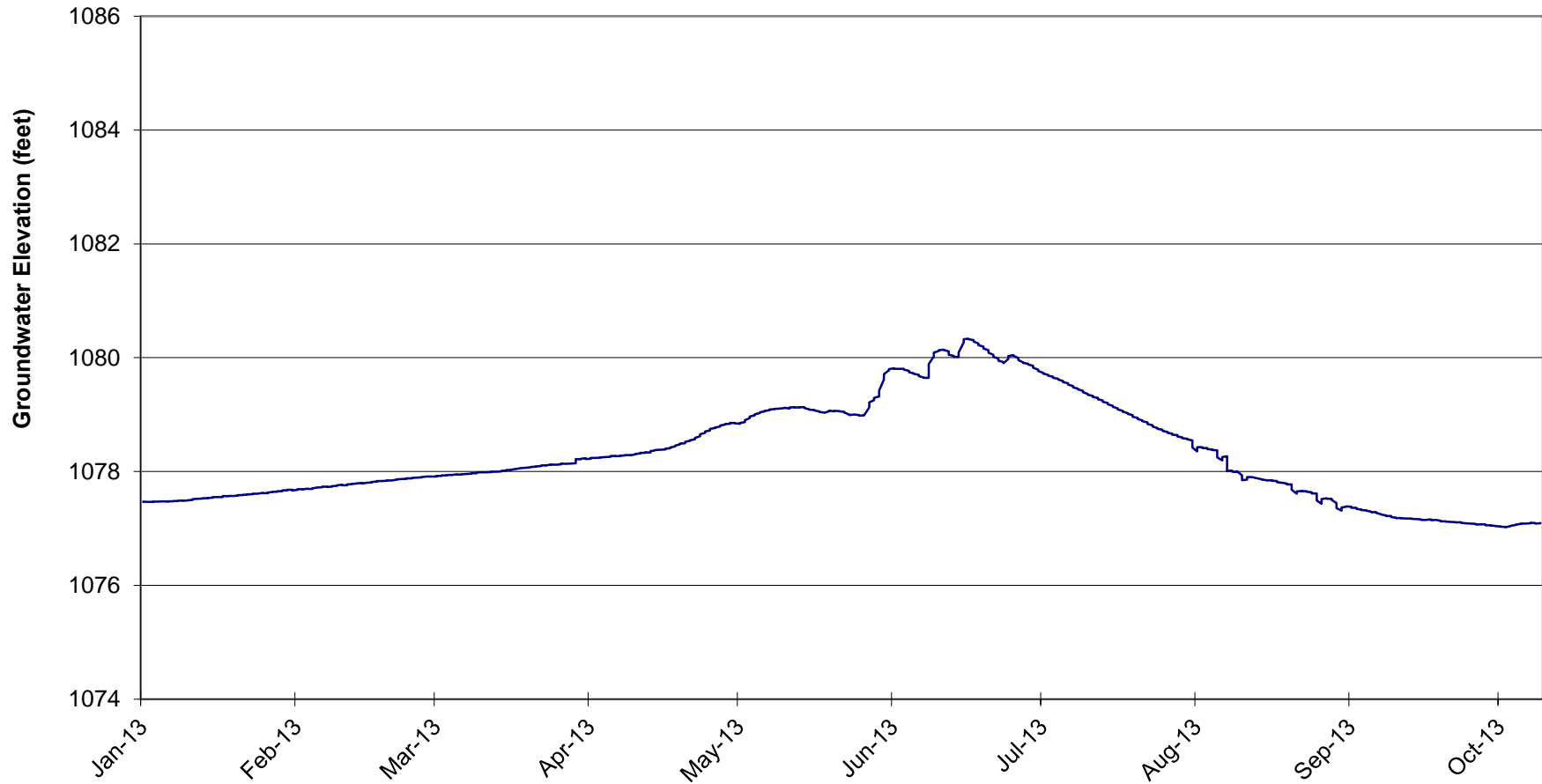
Note: Data obtained from Metropolitan Utilities District, Omaha, Nebraska

Figure 8 Monitoring Well Readings for MW 94-02 in Douglas County
(May 31, 2013 thru October 24, 2013)



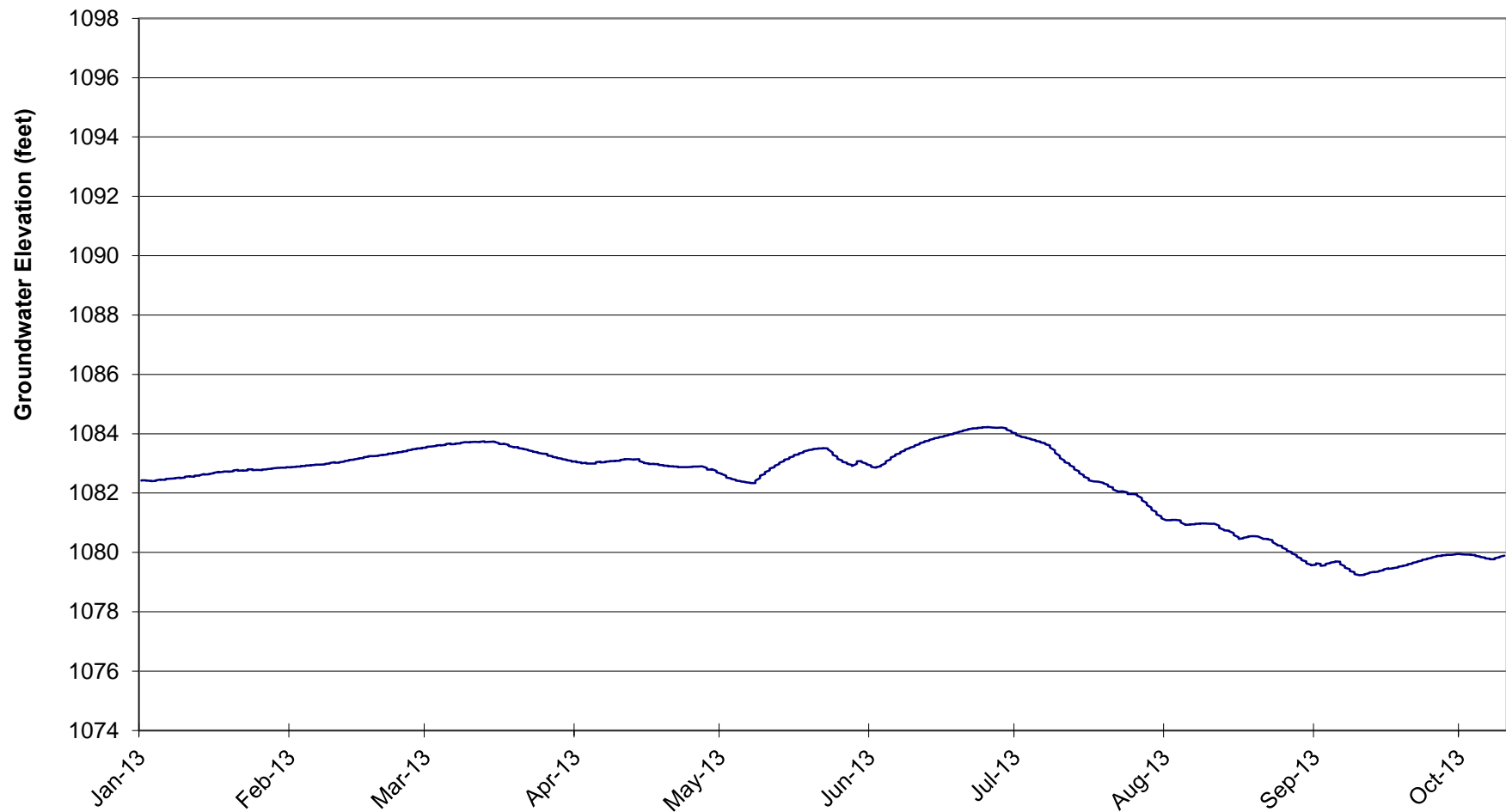
Note: Data obtained from Metropolitan Utilities District, Omaha, Nebraska

Figure 9 Monitoring Well Readings for MW 94-03 in Saunders County
(January 1, 2013 thru October 9, 2013)



Note: Data obtained from Metropolitan Utilities District, Omaha, Nebraska

Figure 10 Monitoring Well Readings for MW 94-04 in Saunders County
(January 1, 2013 thru October 10, 2013)



Note: Data obtained from Metropolitan Utilities District, Omaha, Nebraska

Figure 11 Monitoring Well Readings for MW 94-05 in Saunders County
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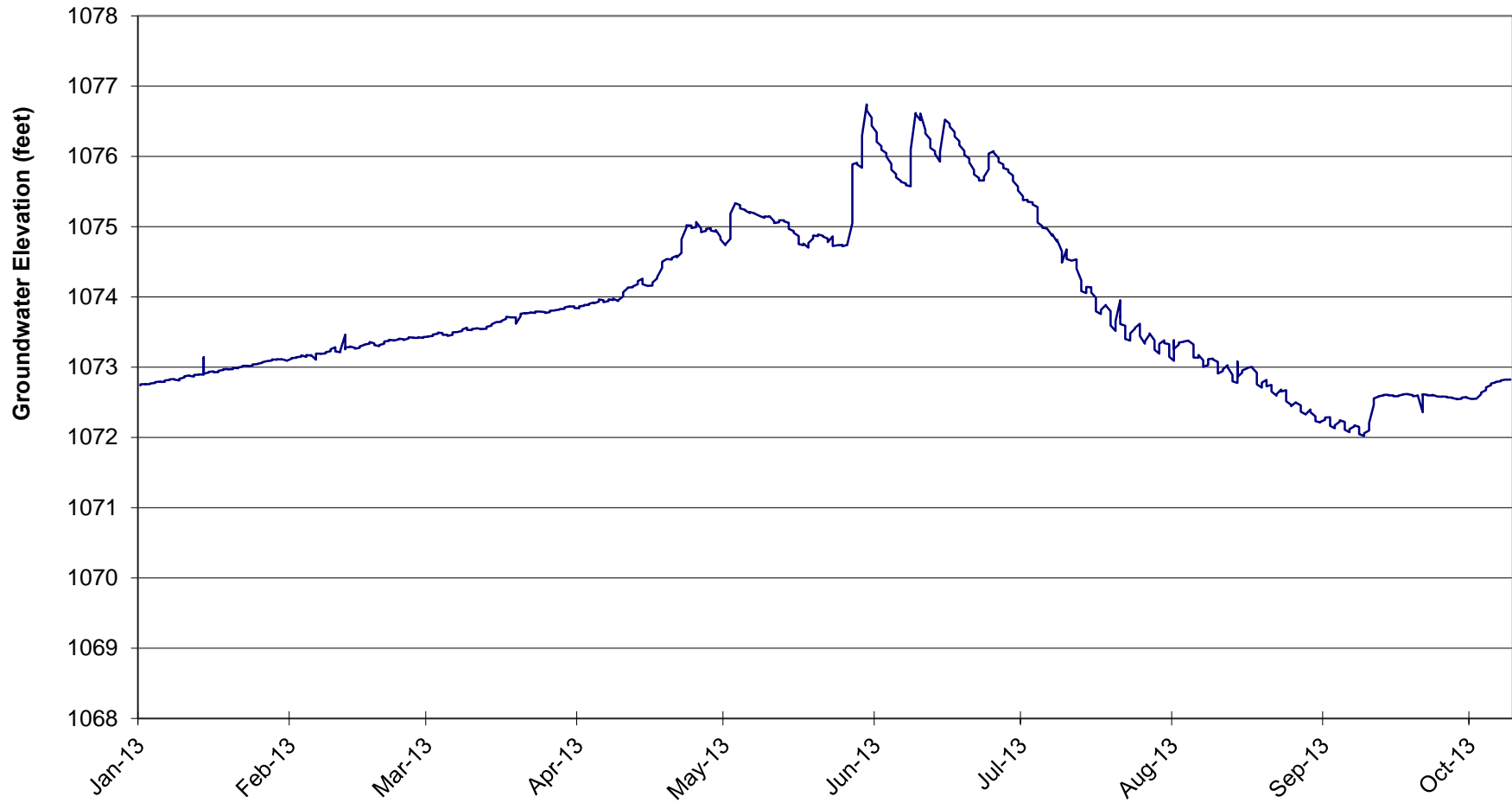
Note: Data obtained from Metropolitan utilities District, Omaha, Nebraska

Figure 12 Monitoring Well Readings from MW 94-06 in Saunders County
(January 1, 2013 thru October 17, 2013)



Note: Data obtained from Metropolitan Utilities District, Omaha, Nebraska

Figure 13 Monitoring Well Readings for MW 94-07 in Saunders County
(January 1, 2013 thru October 9, 2013)



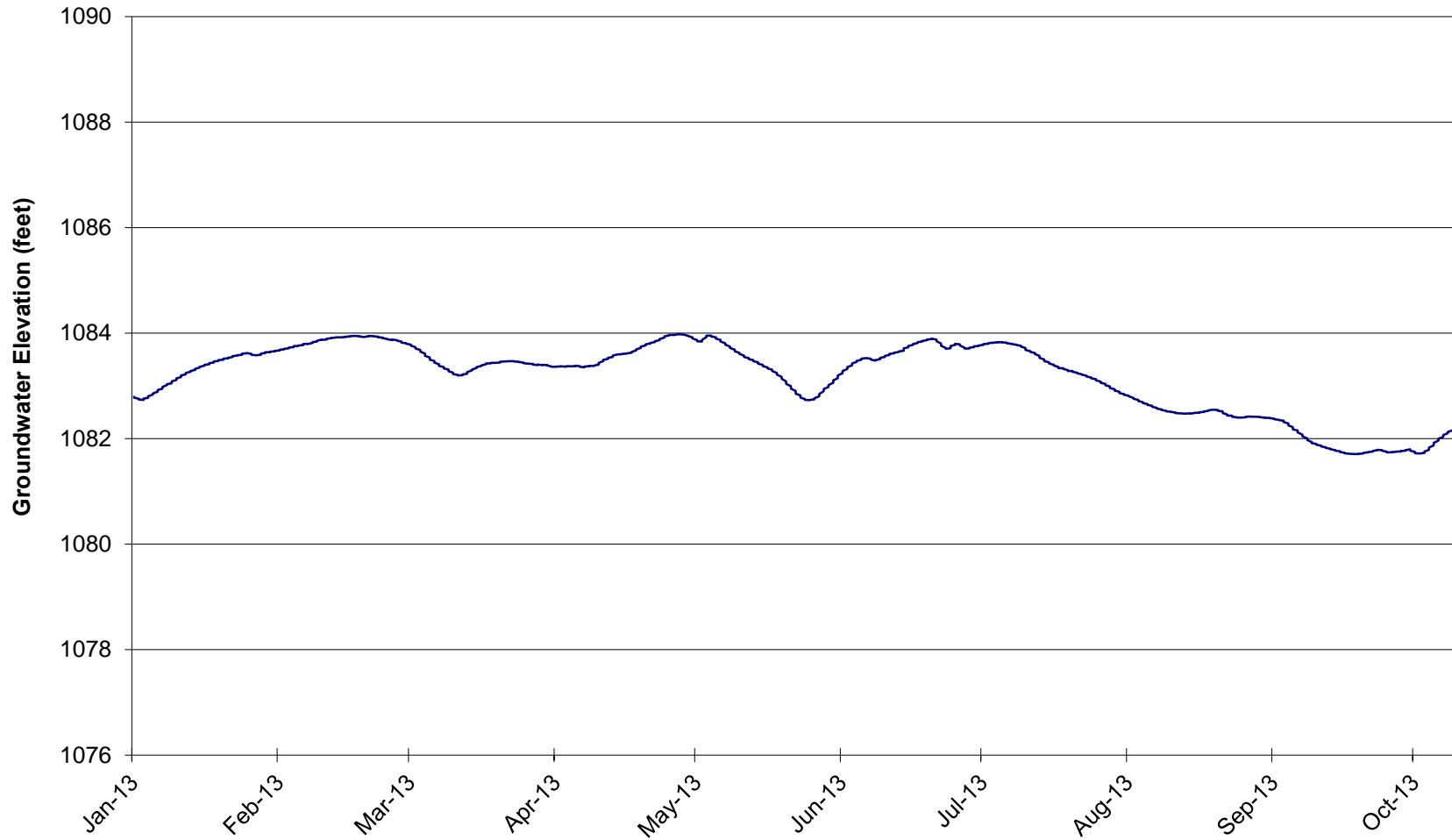
Note: Data obtained from Metropolitan Utilities District, Omaha, Nebraska

Figure 14 Monitoring Well Readings for MW 04-17 in Saunders County
(January 1, 2013 thru October 10, 2013)



Note: Data obtained from Metropolitan Utilities District, Omaha, Nebraska

Figure 15 Monitoring Well Readings for MW 05-22 in Saunders County
(January 1, 2013 thru October 10, 2013)



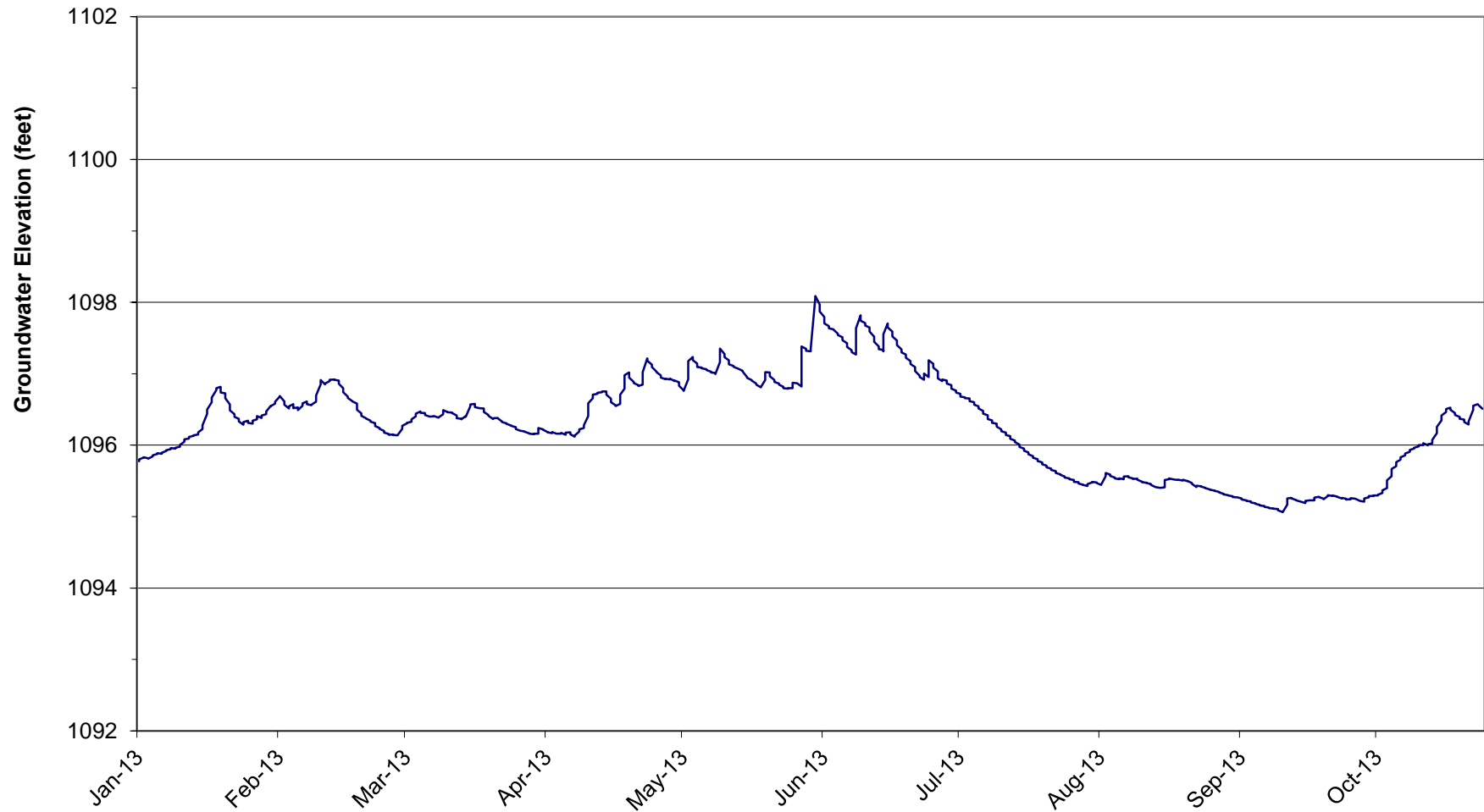
Note: Data obtained from Metropolitan Utilities District, Omaha, Nebraska

Figure 16 Monitoring Well Readings for MW 05-23 in Saunders County
(January 1, 2013 thru October 10, 2013)



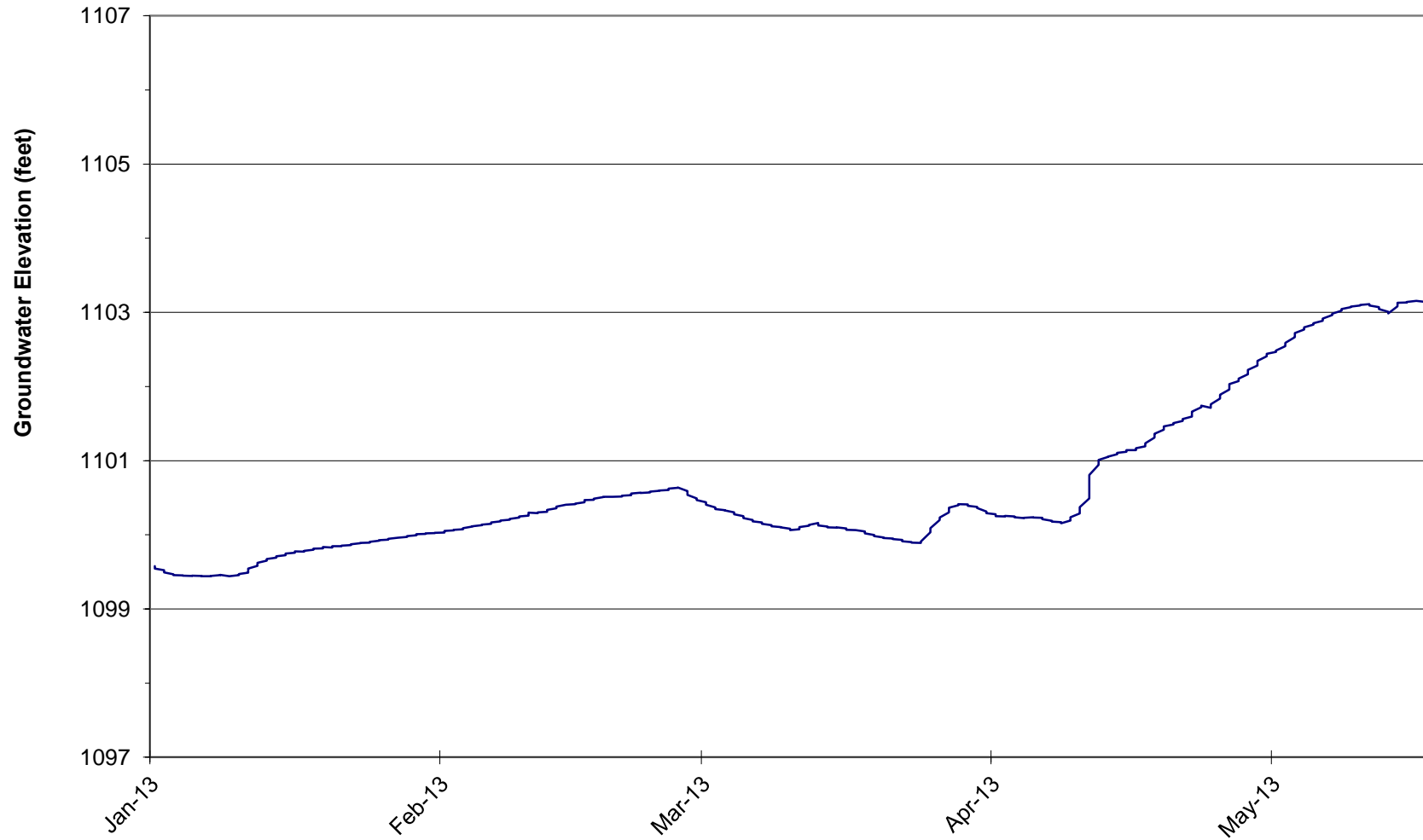
Note: Data obtained from Metropolitan Utilities District, Omaha, Nebraska

Figure 17 Monitoring Well Readings from MW 05-24 in Douglas County
(January 1, 2013 thru October 24, 2013)



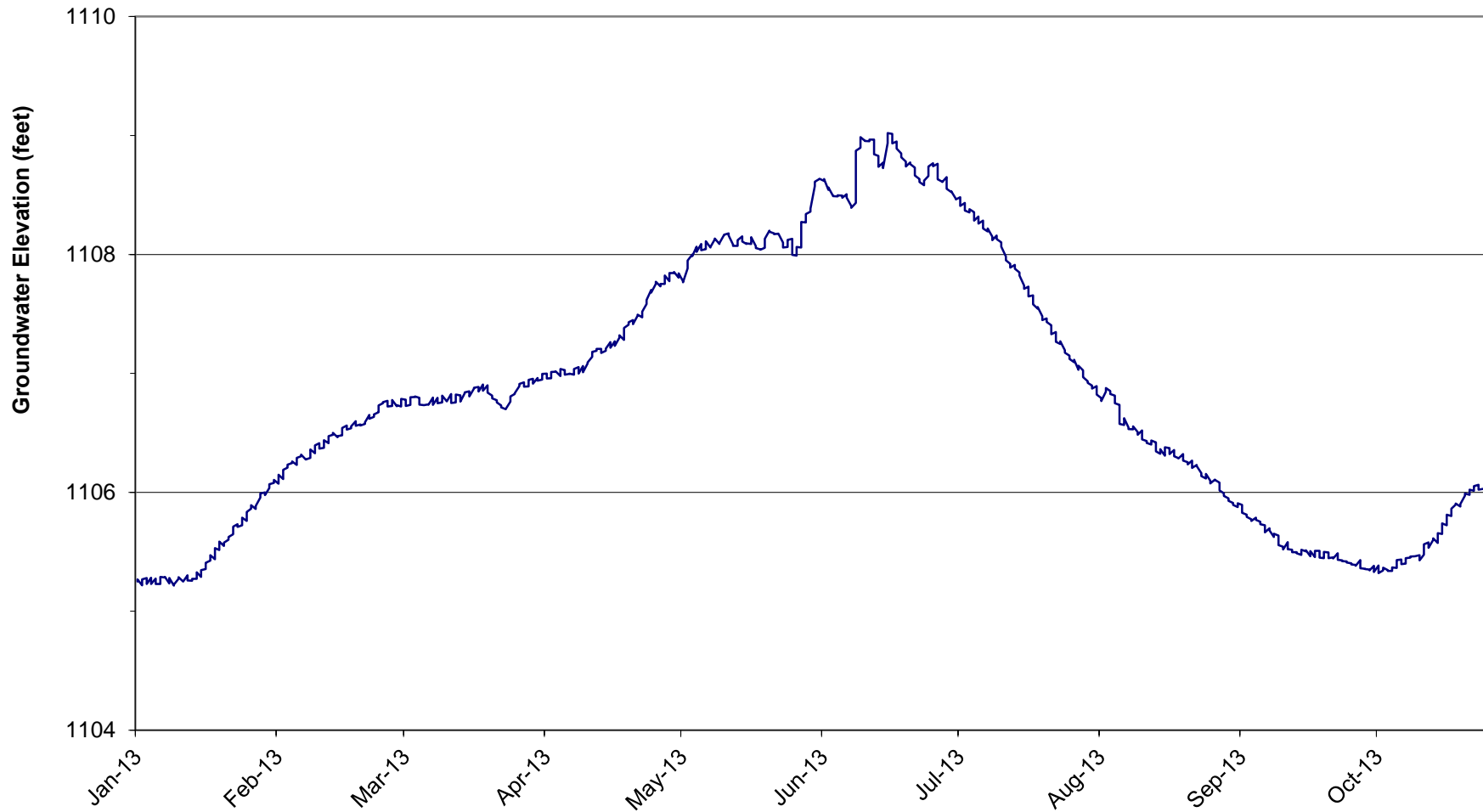
Note: Data obtained from Metropolitan Utilities District, Omaha, Nebraska

Figure 18 Monitoring Well Readings for MW 05-25 in Douglas County
(January 1, 2013 thru May 17, 2013)



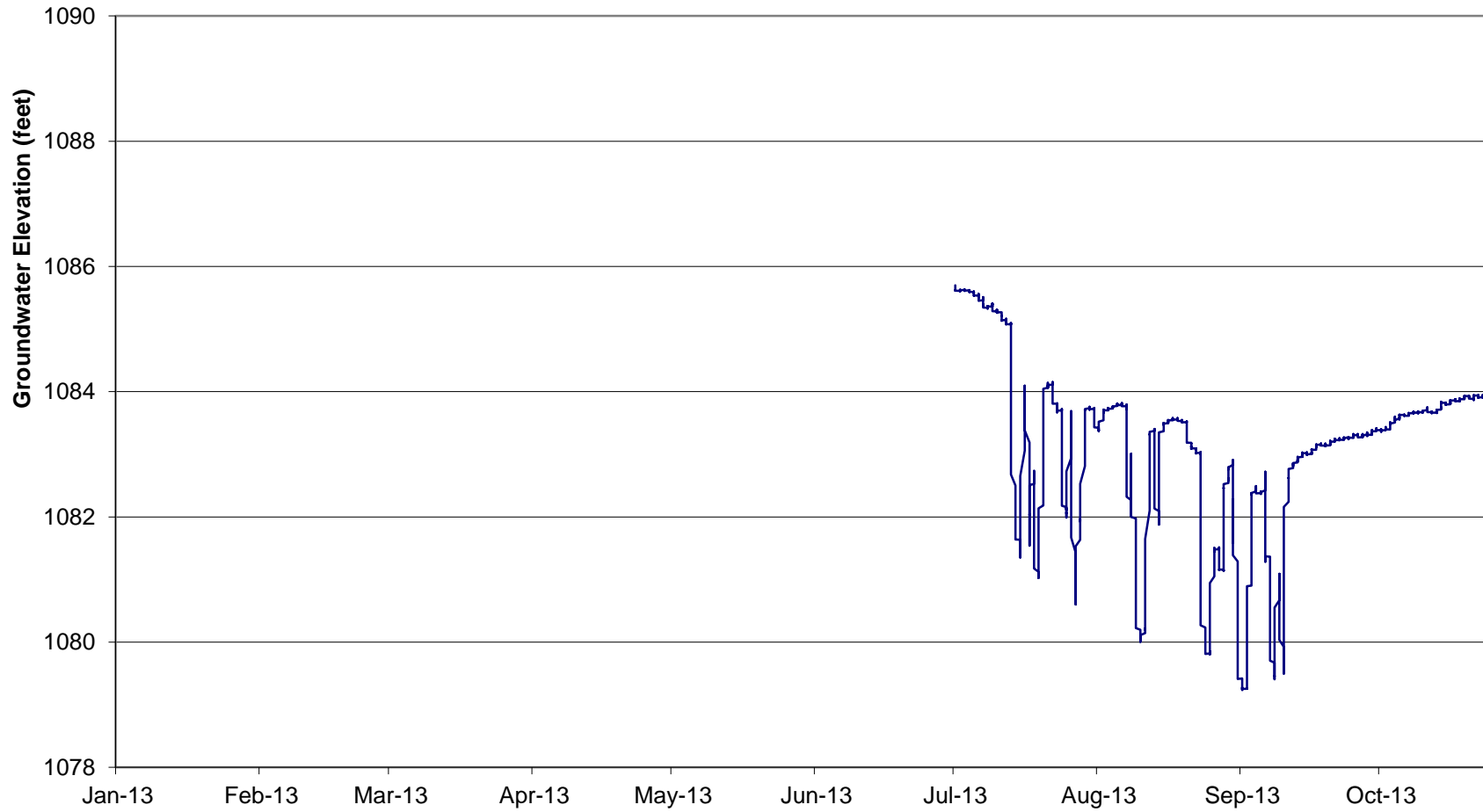
Note: Data obtained from Metropolitan Utilities District, Omaha, Nebraska

Figure 19 Monitoring Well Readings for MW 05-26 in Douglas County
(January 1, 2013 thru October 24, 2012)



Note: Data obtained from Metropolitan Utilities District, Omaha, Nebraska

Figure 20 Monitoring Well Readings for MW 06-18 in Saunders County
(July 1, 2013 thru October 24, 2013)



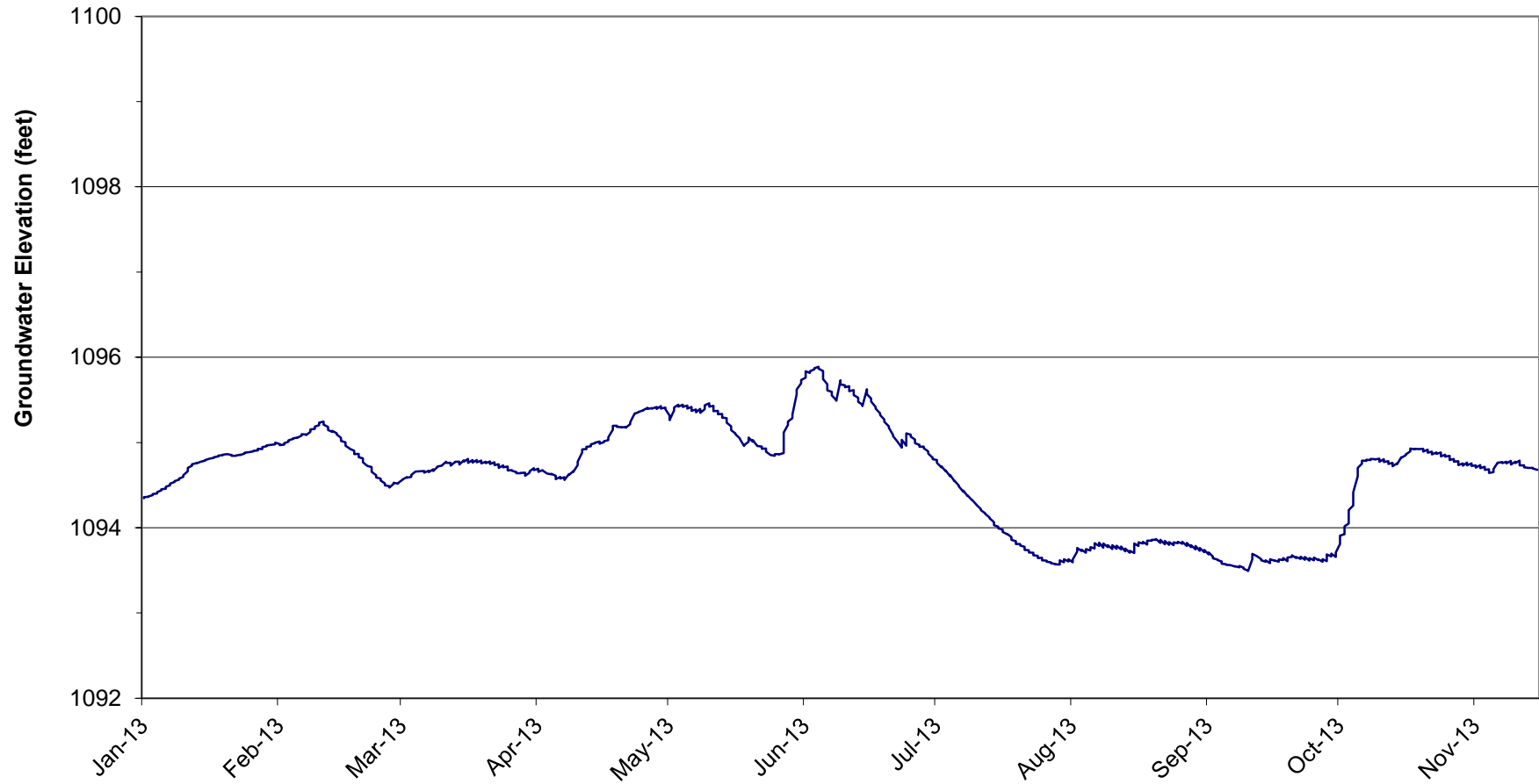
Note: Data obtained from Metropolitan Utilities District, Omaha, Nebraska

Figure 21 Monitoring Well Readings for MW 06-28 in Douglas County
(January 1, 2013 thru October 10, 2013)



Note: Data obtained from Metropolitan Utilities District, Omaha, Nebraska

Figure 22 Monitoring Well Readings for MW 06-29 in Douglas County
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Note: Data obtained from Metropolitan Utilities District, Omaha, Nebraska

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Table 2	2013 Production Well Pumping Rates, Total Million Gallons Per Day (MGD) – Saunders County Wellfield

Table 1 2013 Production Well Pumping Rates, Total Million Gallons Per Day (MGD) - Douglas County Wellfield

WELL # (PW)	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	YEARLY WELL DATA
94-2	108.37	97.72	105.73	45.77	0.00	90.93	99.90	101.23	85.86	65.78	19.96	821.25
91-3	0.00	0.00	0.00	0.00	0.00	0.00	15.43	1.89	9.58	0.00	0.00	26.90
04-4	0.00	0.00	0.00	0.00	1.53	0.00	0.00	0.00	0.17	0.00	0.00	1.70
04-5	0.00	0.00	0.00	0.00	1.28	0.00	0.00	0.00	0.13	0.00	0.00	1.41
04-6	32.27	8.65	88.32	74.89	0.00	39.49	83.45	49.80	52.72	22.87	71.58	524.04
04-7	0.00	0.00	0.00	0.00	0.00	6.44	0.00	0.00	0.11	0.00	0.00	6.55
04-8	0.00	0.00	0.00	0.00	25.09	27.17	47.24	32.37	5.36	0.00	0.00	137.23
04-9	0.00	0.00	0.00	0.00	0.00	0.00	11.86	3.02	10.42	1.22	0.00	26.52
04-10	68.63	89.92	98.07	24.85	48.92	53.05	69.66	42.33	20.65	0.00	0.00	516.08
04-11	0.00	0.00	53.86	11.12	25.70	32.63	93.11	95.69	95.55	97.23	25.08	529.97
04-12	0.00	0.00	0.00	0.00	0.00	0.00	56.28	92.99	78.69	98.04	22.87	348.87
04-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.05
04-14	0.00	0.00	16.45	0.00	0.00	28.05	12.26	20.26	10.01	0.00	0.00	87.03
04-15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.07	8.07
04-16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04-17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Monthly Totals, MG	209.27	196.29	362.43	156.63	102.52	277.76	489.19	439.58	369.30	285.14	147.56	
Daily Averages, MGD	6.75	6.77	11.69	5.22	3.31	9.26	15.78	14.18	12.31	9.20	4.92	

Table 2 2013 Production Well Pumping Rates, Total Million Gallons Per Day (MGD) - Saunders County Wellfield

WELL # (PW)	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	YEARLY WELL DATA
91-30	5.31	0.00	0.00	9.32	30.77	60.60	33.19	40.81	39.50	4.52	3.17	227.19
94-31	0.00	23.77	55.55	8.14	53.03	10.70	48.76	36.92	34.12	6.59	16.80	294.38
94-32	97.85	0.00	41.97	54.77	0.00	0.00	29.03	15.56	7.91	2.23	0.00	249.32
94-33	101.25	91.56	60.01	25.02	0.00	45.18	38.99	33.14	53.12	44.69	73.80	566.76
94-34	98.82	88.22	2.79	0.00	0.00	2.72	57.39	76.25	70.49	22.07	0.00	418.75
94-35	0.00	0.00	65.92	0.00	40.09	35.53	88.80	28.02	13.09	71.26	24.66	367.37
94-36	122.39	70.04	78.88	0.00	45.20	24.44	75.82	51.30	39.03	52.02	5.90	565.02
94-37	24.76	65.76	79.26	15.62	0.00	39.62	68.25	52.97	55.85	24.46	28.64	455.19
04-38	0.00	7.18	103.19	1.14	4.79	87.00	96.09	37.18	29.75	76.55	2.13	445.00
04-39	92.66	33.67	0.00	6.65	27.70	37.08	27.71	48.20	49.73	67.56	45.87	436.83
04-40	0.00	29.79	56.20	31.91	9.50	2.15	33.62	80.46	54.19	0.00	16.43	314.25
04-41	0.00	0.00	0.00	0.00	0.00	0.00	13.00	10.45	2.62	0.00	60.34	86.41
04-42	0.00	0.00	10.84	0.00	0.00	0.00	66.15	31.35	80.95	73.02	15.86	278.17
04-43	0.03	0.00	0.00	27.75	46.92	64.74	62.15	78.01	7.33	4.61	0.00	291.54
04-44	31.06	70.23	44.82	9.64	3.76	28.22	18.73	21.84	26.63	27.03	66.89	348.85
04-45	3.75	0.00	14.03	30.35	19.51	39.85	81.55	70.79	54.86	5.94	2.16	322.79
04-46	0.00	0.57	28.93	0.00	32.96	83.54	60.21	56.88	66.27	15.72	18.32	363.40
04-47	0.00	8.09	1.71	0.00	57.49	1.01	28.15	27.57	31.44	10.91	24.88	191.25
04-48	9.18	0.00	31.64	0.62	29.33	22.84	6.49	4.41	15.14	23.17	2.04	144.86
04-49	0.00	0.00	84.20	99.34	24.80	16.98	51.70	70.28	27.87	43.61	6.89	425.67
04-50	0.00	0.00	53.02	0.00	13.17	5.15	11.09	16.62	8.51	13.75	36.39	157.70
04-51	0.00	0.00	0.00	32.34	18.49	0.58	37.33	30.47	37.03	60.62	26.71	243.57
04-52	46.75	35.00	1.63	12.38	25.27	25.61	63.34	63.21	43.58	16.73	1.79	335.29
04-53	0.00	0.00	87.42	47.65	23.03	0.00	0.00	0.00	0.00	0.00	0.00	158.10
04-54	0.00	0.00	0.00	7.59	43.07	6.55	47.19	35.62	13.18	0.00	26.65	179.85
04-55	0.00	0.00	0.00	45.85	0.00	8.11	34.14	13.29	6.86	14.99	21.70	144.94
Monthly Totals, MG	633.81	523.88	902.01	466.08	548.88	648.20	1178.87	1031.60	869.05	682.05	528.02	
Daily Averages, MGD	20.45	18.06	29.10	15.54	17.71	21.61	38.03	33.28	28.97	22.00	17.60	

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PIEZOMETERS

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Figure 1 2013 Piezometer Readings for PEM Wetland 25

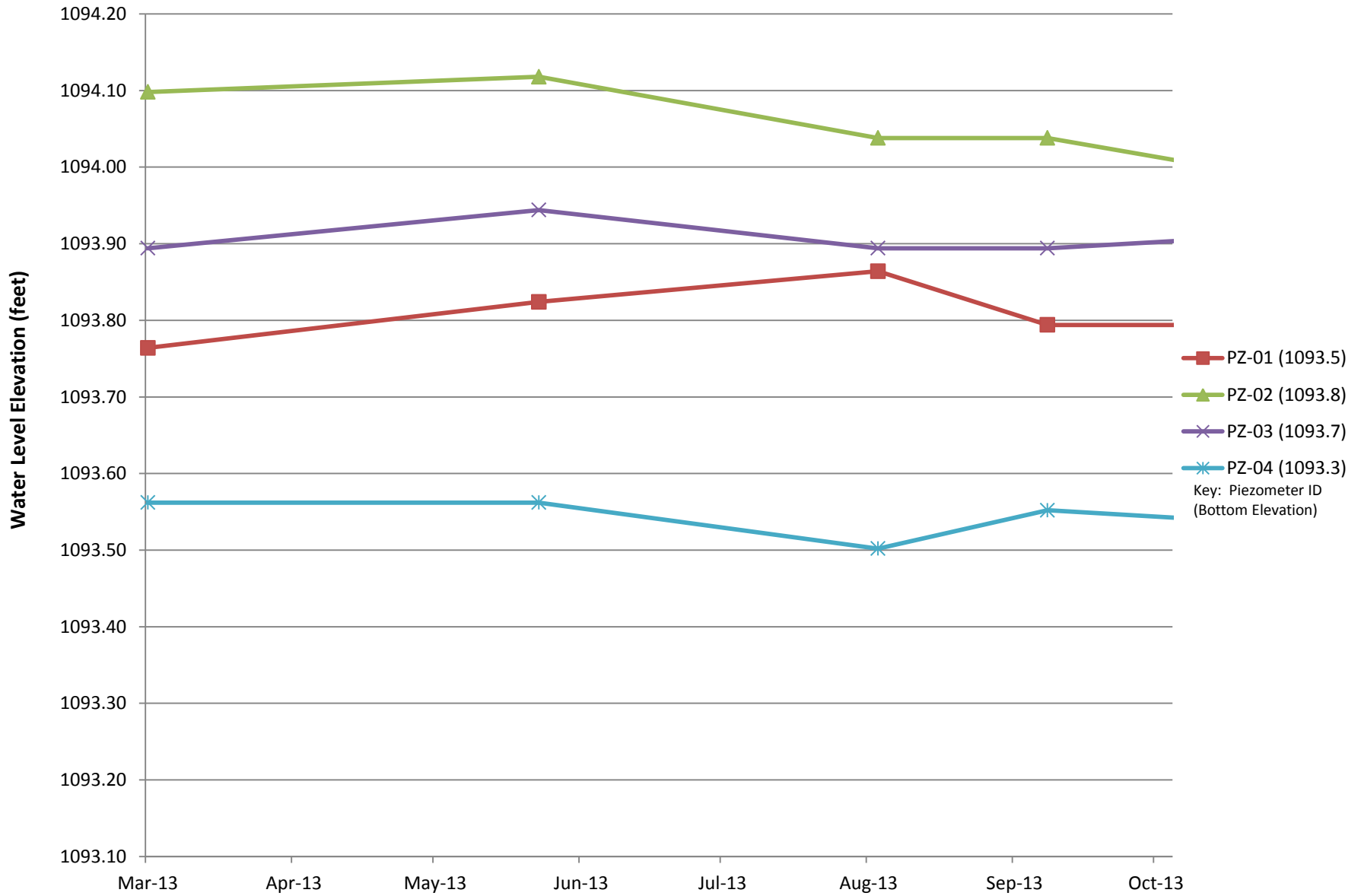


Figure 2013 Piezometer Readings for PEM Wetland 100

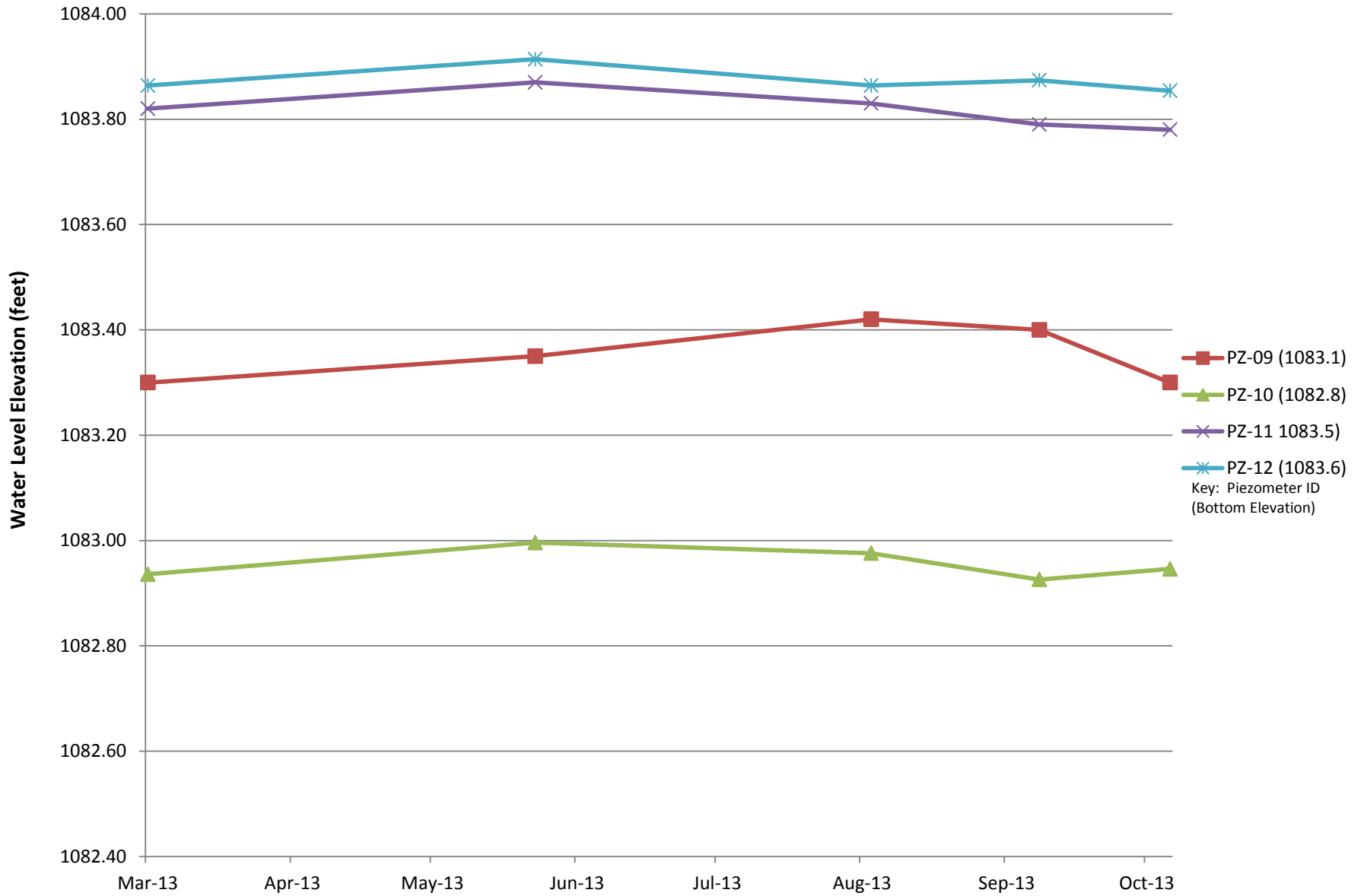


Figure 2013 Piezometer Readings for PFO Wetland 5

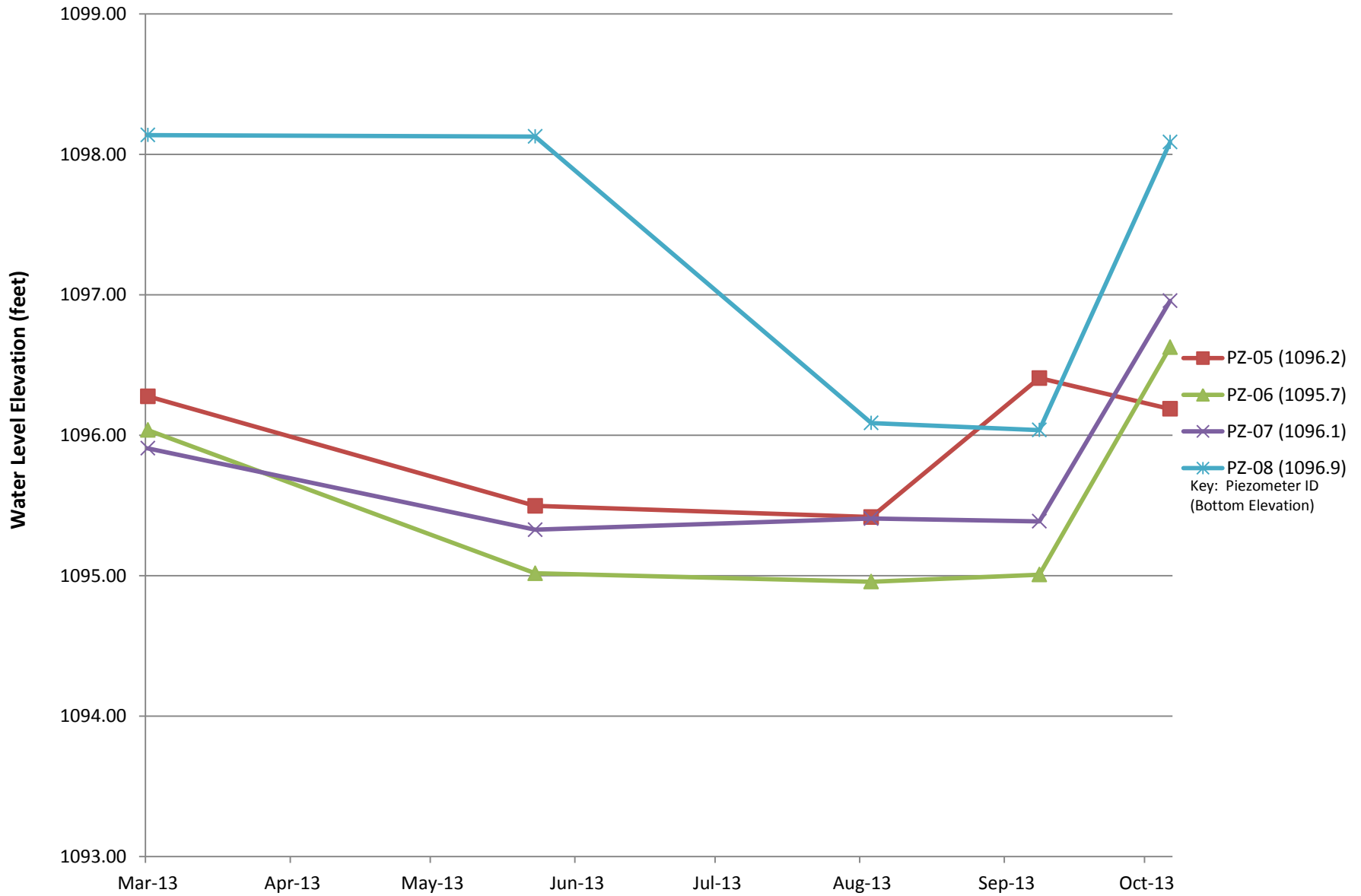
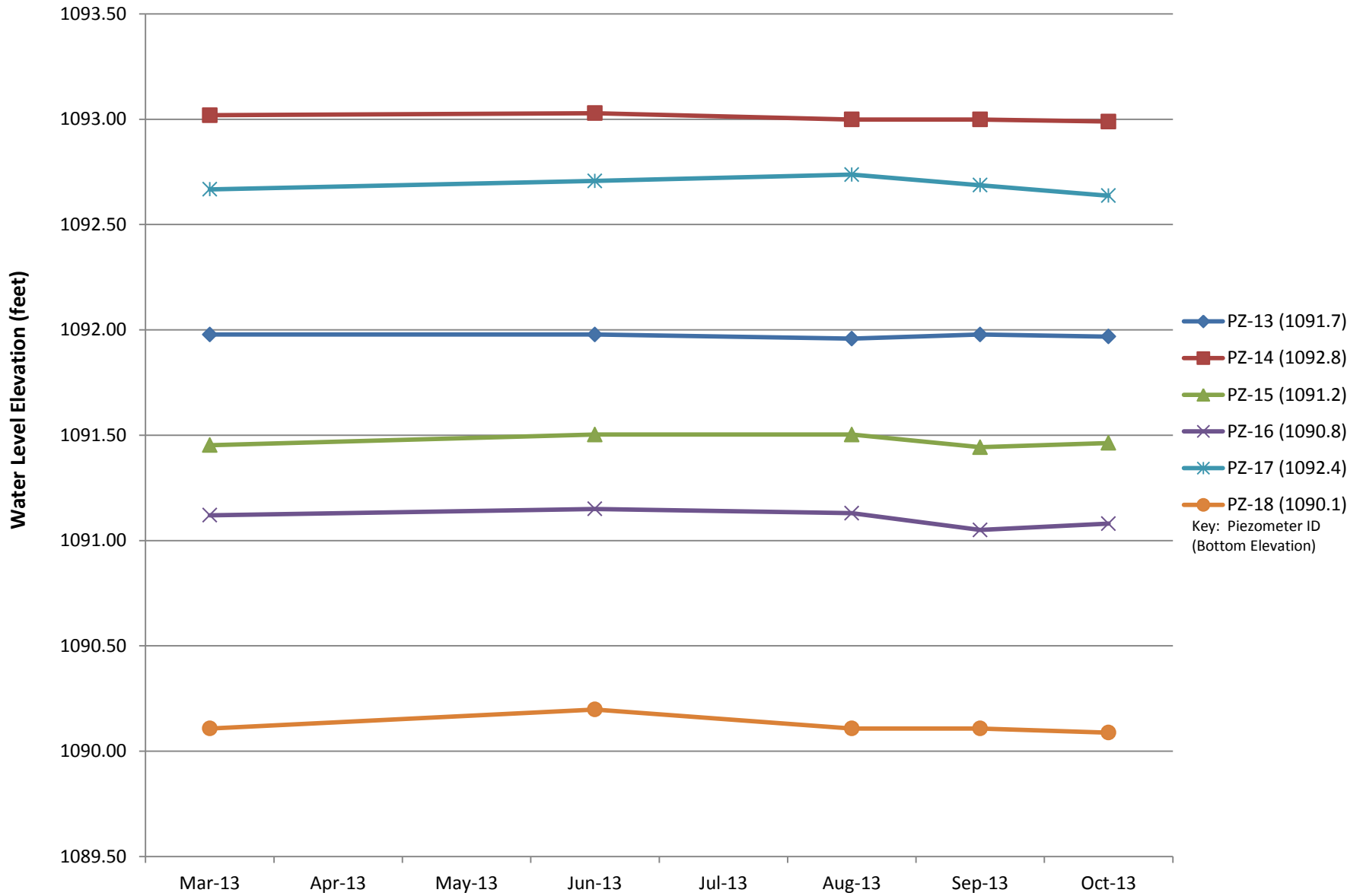


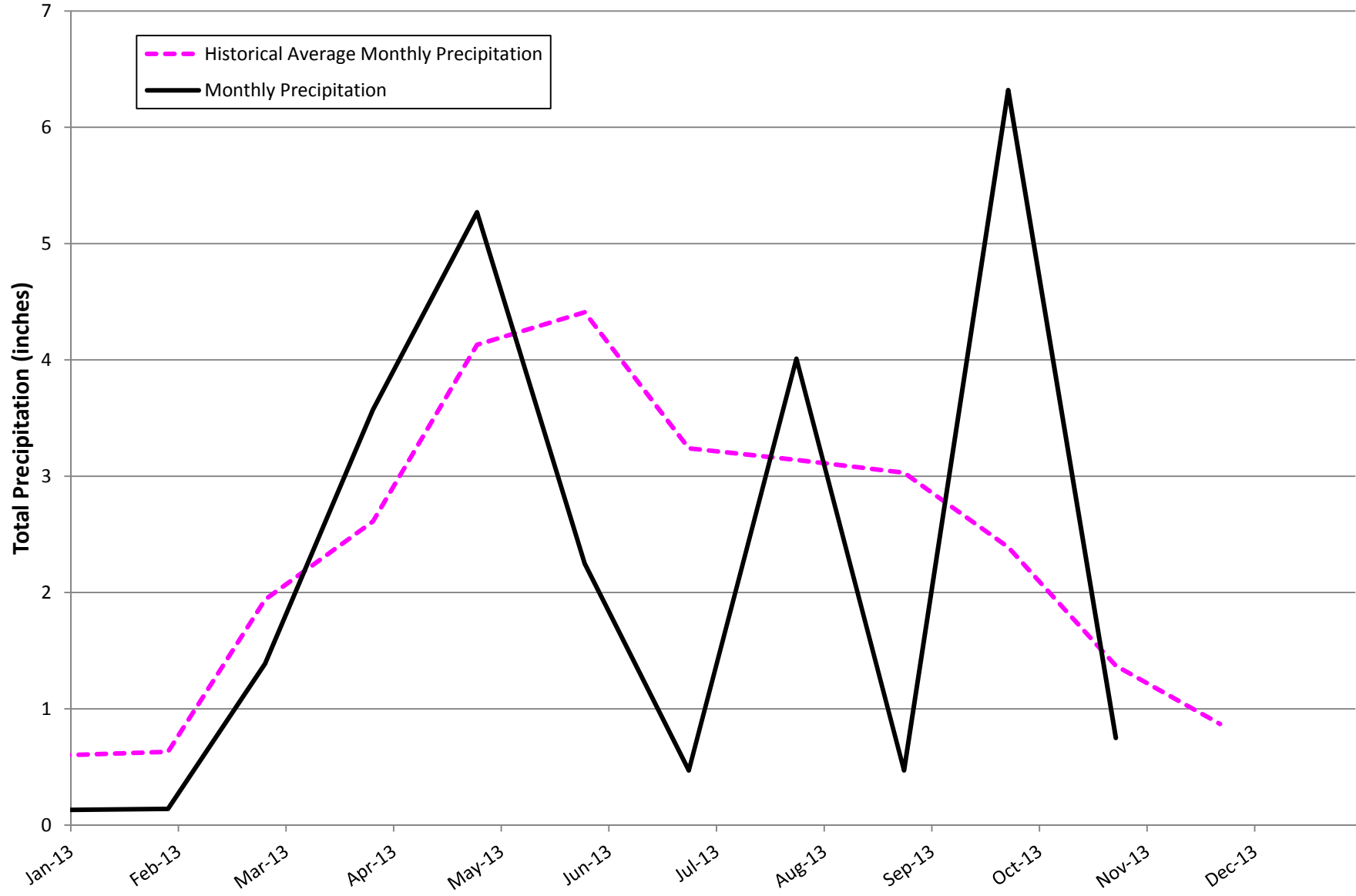
Figure 4 2013 Piezometer Readings at the Phase I and Phase II Wet Meadow Mitigation Sites (WM-1 and WM-2)



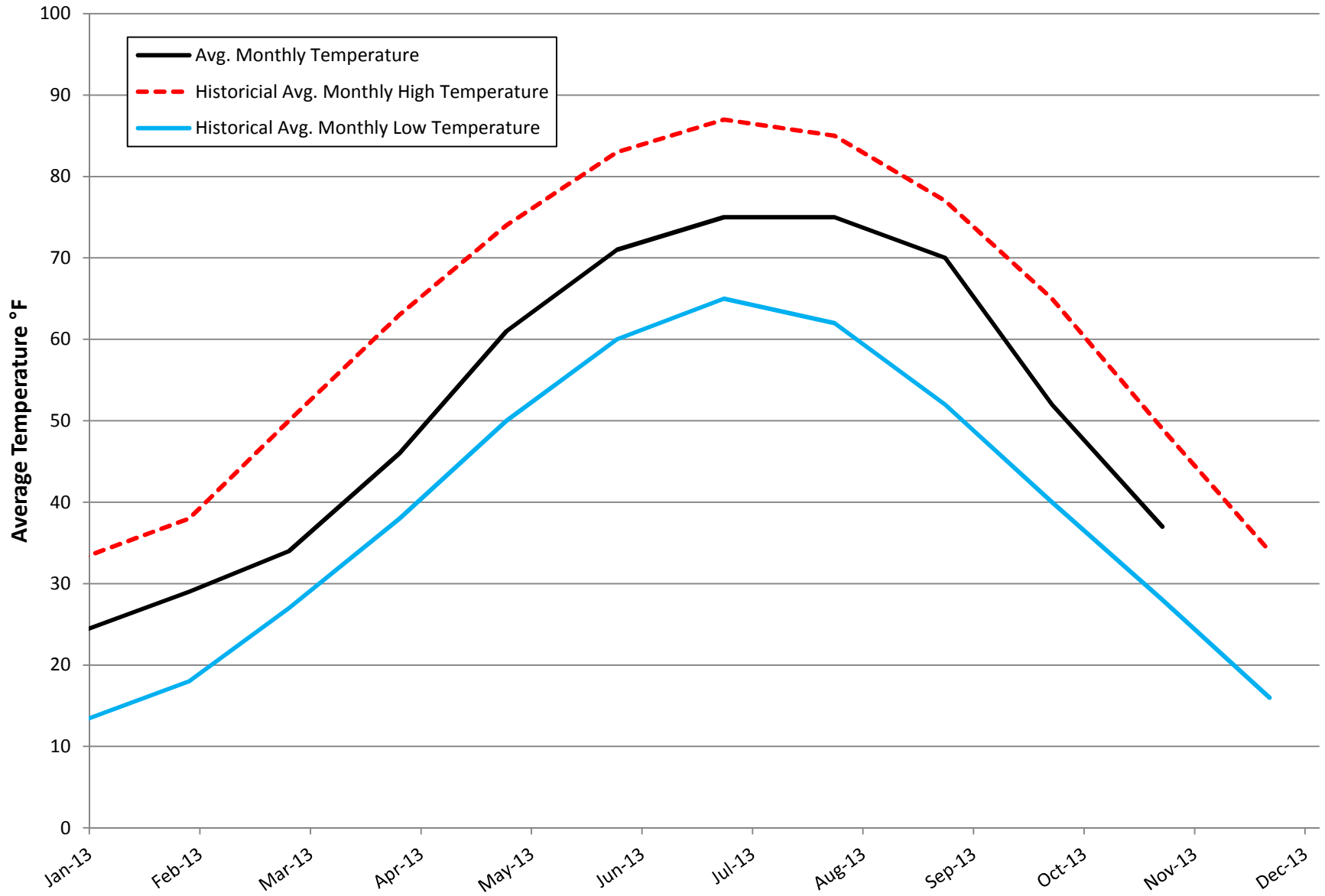
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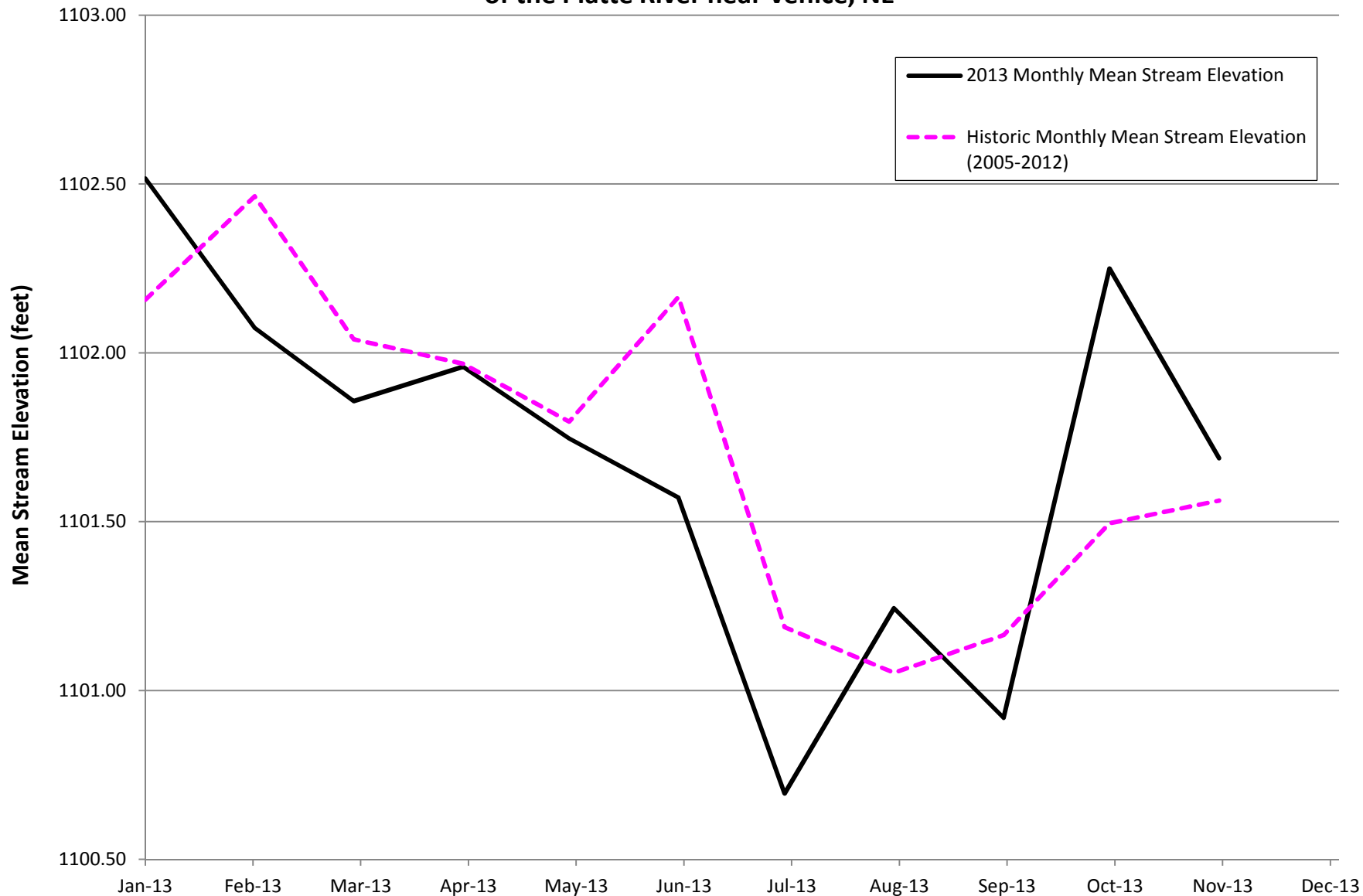
**Figure 1 2013 Total Monthly Precipitation
Fremont, NE**



**Figure 2 2013 Monthly Average Ambient Air Temperature
Fremont, NE**

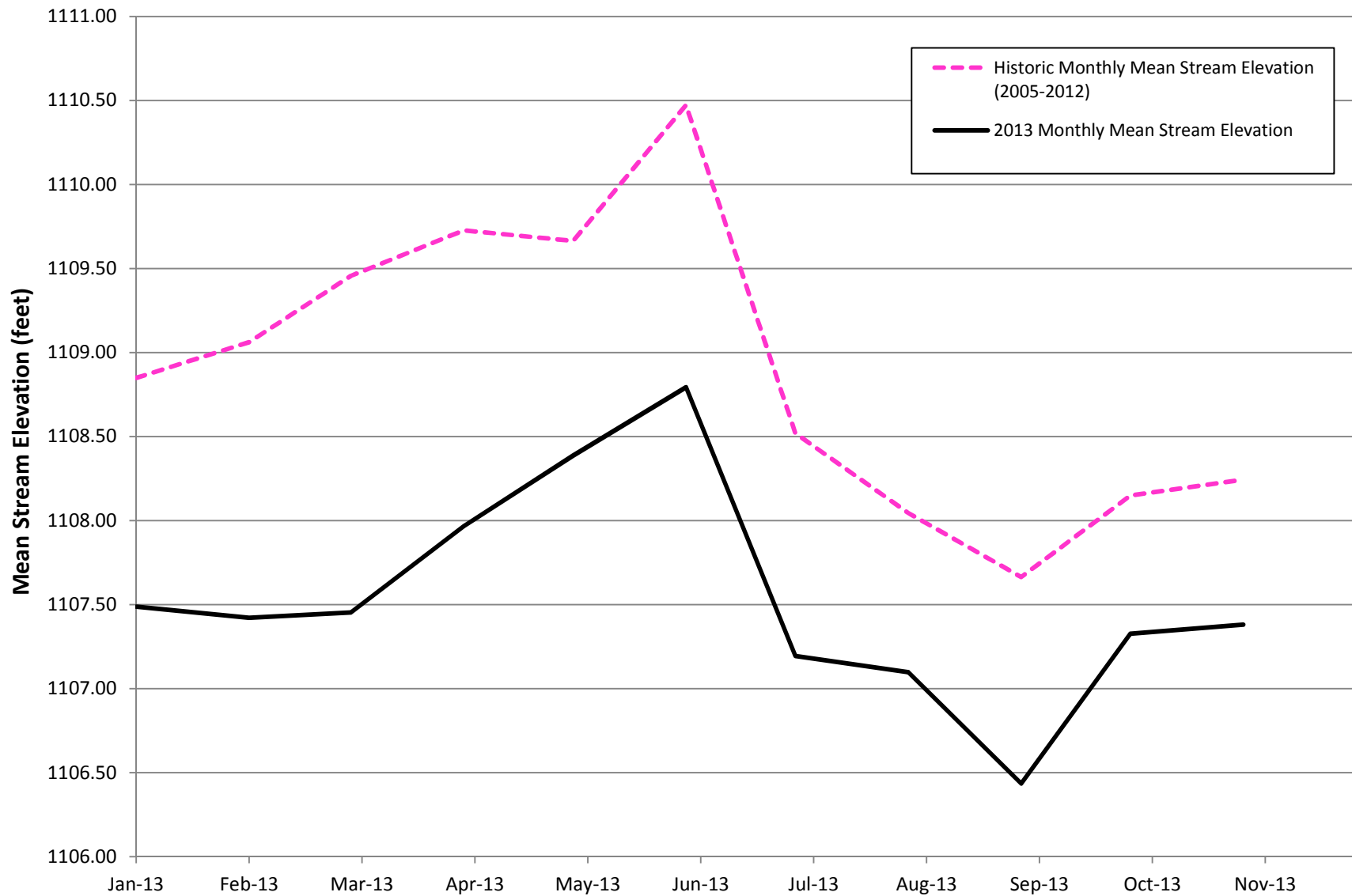


**Figure 3 2013 Monthly Mean Stream Elevation
of the Platte River near Venice, NE**



Source: USGS. 2013b. National Water Information System: Platte River near Venice, Nebraska 06796550.

**Figure 4 2013 Monthly Mean Stream Elevation
of the Elkhorn River at Waterloo, NE**



Source: USGS. 2013a. National Water Information System: Elkhorn River at Waterloo, Nebraska 06800500.

APPENDIX IV - 2013 SPRING MONITORING ANALYSIS LETTER



August 2, 2013

Mr. John P. Snowdon
U.S. Army Corps of Engineers
Wehrspann Field Office
8901 South 154th Street, Suite 1
Omaha, NE 68138-3621

Spring 2013 Wetland Monitoring Analysis Letter
Platte West Water Production Facilities Project
Metropolitan Utilities District
Burns & McDonnell Project No. 60787

Dear Mr. Snowdon:

INTRODUCTION

As discussed during our annual meeting in February, Burns & McDonnell has conducted an analysis of the spring wetland monitoring data for the three emergent wetlands within the Douglas and Saunders County well fields. This analysis was conducted to assess the progress at these wetlands following extreme drought conditions in the region in 2012. Wetlands 100 and 25, in particular, were significantly drier than normal based on analysis of the fall 2012 data. Rather than immediately alter the monitoring regime, it was decided that the regularly scheduled spring (June) 2013 monitoring efforts would be conducted. Analysis of the data would follow prior to the typical timing of fall 2013 monitoring (September) in case an increase in the level of monitoring was warranted. This brief letter report summarizes the analysis and makes recommendations for monitoring at these wetlands for the rest of 2013.









RESULTS

Wetland 68, a PEM wetland located in the Douglas County well field, was dominated by Kentucky bluegrass (*Poa pratensis*), fox sedge (*Carex vulpinoidea*), sawtooth sunflower (*Helianthus gorsseserratus*), reed canarygrass (*Phalaris arundinacea*), giant goldenrod (*Solidago gigantea*), and prairie cordgrass (*Spartina pectinata*) at the time of the 2013 spring monitoring visit. Wetland 68 (excluding the upland gradsects) had a WA_M of 2.42 in the spring of 2013 (Table 1), indicating that it continues to be dominated by wetland vegetation. The baseline maximum threshold WA_M for W-68 is 2.78. The FQI for this wetland during the same time period was 24.19.

As shown in Table 1, although the WA_M at W-68 remained slightly below the baseline mean even during the extreme drought conditions in 2012, the secondary indicators rebounded from below baseline low values to baseline mean levels in 2013. Running the repeated measures ANOVA statistical analysis typically performed during the annual report for the wetlands shows no significant differences between spring 2013 values and the baseline mean values (Table 2).

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Table 1. Wetland 68 Comparison of 2012 and 2013 Vegetation Data to Baseline Averages					
	Fall 2012	Spring 2013	Baseline Mean	Baseline Low	Baseline High
W _A _M	2.42	2.42	2.55	2.33	2.78
Species Richness	32	56	56.14	46.00	70.00
Species Diversity	16.03	22.30	20.43	16.63	24.29
Mean C Value	3.30	3.39	3.58	3.22	3.83
FQI	18.05	24.19	24.62	22.50	28.89

Table 2 Record of Thresholds Evaluation by Sampling Season for Wetland 68								
Sampling Season	Increase in W _A _M by more than 0.5?	A significant difference in three or more of the following indices?				Change visible on aerial photos?	Flag?	Monitoring Intensity Change?
		FQI	mean c-value	species diversity	species richness			
Sept. 2008	No	No	No	No	No	No		No
June 2009	No	No	No	Yes	Yes	No		No
Sept. 2009	No	No	No	No	No	No		Yes - Decrease to Level 1
June 2010	No*	No	No	Yes	Yes	No		No - Remain at Level 1
Sept. 2010	No	No	No	No	No	NA		No - Remain at Level 1
June 2011	No	No	No	No	No	No		Yes – Decrease to Level 2
Sept. 2012	No	Yes	Yes	No	Yes	NA		No – Remain at Level 2
June 2013	No	No	No	No	No	NA		No – Remain at Level 2

* = A significant decrease in W_A_M occurred, indicating that the wetland was wetter than baseline average.









Wetland 25, located in the Saunders County well field, was dominated by Pennsylvania pellitory (*Parietaria pennsylvanica*), sawtooth sunflower, reed canarygrass, and fox sedge at the time of the 2013 spring monitoring visit. Wetland 25 (excluding the upland gradsects) had a W_A_M of 2.64 in the spring of 2013 (Table 3), indicating that it continues to be dominated by wetland vegetation. The baseline maximum threshold W_A_M prior to Project operation for W-25 is 2.52. The W_A_M for 2013 exceeded the

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baseline threshold for the second consecutive sampling effort. The FQI for this wetland during the same time period was 14.25.

Table 3. Wetland 25 Comparison of 2012 and 2013 Vegetation Data to Baseline Averages					
	Fall 2012	Spring 2013	Baseline Mean	Baseline Low	Baseline High
WA _M	2.61	2.64	2.28	1.93	2.52
Species Richness	26	34	48.71	28.00	66.00
Species Diversity	14.97	16.36	22.71	16.63	24.29
Mean C Value	2.24	2.56	3.18	2.77	3.69
FQI	10.95	14.25	20.96	14.42	25.85

As shown in Table 3 above, the WA_M at W-25 remained below the 3.0 level indicating an area supporting predominantly wetland vegetation. In addition, the WA_M did not increase by more than 0.5 from the baseline maximum value of 2.52; a primary indicator of change in wetness. However, the value was slightly higher than that calculated following the fall 2012 monitoring effort. Running the repeated measures ANOVA statistical analysis typically performed during the annual report for the wetlands shows a significant difference between spring 2013 values and the baseline mean values for three of the four secondary indicators (Table 4).

Table 4. Record of Thresholds Evaluation by Sampling Season for Wetland 25								
Sampling Season	Increase in WA _M by more than 0.5?	A significant difference in three or more of the following indices?				Change visible on aerial photos?	Flag?	Monitoring Intensity Change?
		FQI	mean c-value	species diversity	species richness			
Sept. 2008	No	No	No	No	No	No		No
June 2009	No	No	No	No	No	No		No
Sept. 2009	No	No	Yes	No	No	No		Yes - Decrease to Level 1
June 2010	No	No	No	Yes	Yes	No		No - Remain at Level 1
Sept. 2010	No	Yes	Yes	No	No	NA		No - Remain at Level 1
June 2011	No	Yes	Yes	No	No	No		Yes - Decrease to Level 2
Sept. 2012	No	Yes	Yes	Yes	Yes	NA		No - Remain at Level 2
June 2013	No	Yes	Yes	No	Yes	NA		Yes - Increase to Level 1









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Wetland 100, located in the Saunders County well field, was dominated by stickywilly (*Galium aparine*), marijuana (*Cannabis sativa*), and annual marsh elder (*Iva annua*) at the time of the 2013 spring monitoring visit. Wetland 100 (excluding the upland gradsects) had a WA_M of 3.41 in the spring of 2013 (Table 5), indicating that it was dominated by upland vegetation. The baseline maximum threshold WA_M prior to Project operation for W-100 is 2.96. The WA_M for spring of 2013 exceeded the baseline threshold, but did not increase by more than 0.5 from the baseline maximum value of 2.96; a primary indicator of change in wetness. The FQI for this wetland during the same time period was 9.73, implying a relatively low ecological value.

Table 5. Wetland 100 Comparison of 2012 and 2013 Vegetation Data to Baseline Averages					
	Fall 2012	Spring 2013	Baseline Mean	Baseline Low	Baseline High
WA_M	3.98	3.41	2.40	1.71	2.96
Species Richness	5	33	28.71	23.00	33.00
Species Diversity	2.36	15.60	14.13	11.34	17.09
Mean C Value	1.00	1.91	3.41	3.00	3.72
FQI	2.00	9.73	16.42	14.70	18.33

As shown in Table 5 above, the WA_M at W-100 was again well above the 3.0 level indicating an area supporting facultative to upland vegetation. However, the value did rebound compared to the very high value calculated following the fall 2012 monitoring effort. In addition, a significant improvement in all of the secondary indicators was observed during the June 2013 monitoring effort. In fact, the repeated measures ANOVA for W-100 shows no significant difference between spring 2013 values and the baseline mean values for two of the four secondary indicators (Table 6).

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Table 6. Record of Thresholds Evaluation by Sampling Season for Wetland 100								
Sampling Season	Increase in WA_M by more than 0.5?	A significant difference in three or more of the following indices?				Change visible on aerial photos?	Flag?	Monitoring Intensity Change?
		FQI	mean c-value	species diversity	species richness			
Sept. 2008	No*	No	No	No	No	No		No
June 2009	No*	No	No	No	No	No		No
Sept. 2009	No	No	No	No	No	No		Yes - Decrease to Level 1
June 2010	No	No	No	No	No	No		No - Remain at Level 1
Sept. 2010	No	Yes	Yes	No	No	NA		No - Remain at Level 1
June 2011	No	Yes	Yes	No	Yes	No		Yes - Decrease to Level 2
Sept. 2012	Yes	Yes	Yes	Yes	Yes	NA		No - Remain at Level 2
June 2013	No	Yes	Yes	No	No	NA		Yes - Increase to Level 1

* = A significant decrease in WAM occurred, indicating that the wetland was wetter than baseline average.

CONCLUSION

Looking first at mean weighted average (WA_M), it is quickly evident that W-68 located in the Douglas County well field and closely tied to the water level of the nearby Platte River, has remained consistent over the years both prior to and since operation and in line with the baseline average, in fact trending slightly wetter (Figure 1, Appendix I). As a result, Wetland 68 will remain at Level 2 Decreased Monitoring and will not be monitored during the fall 2013 monitoring effort. The next monitoring effort at WM-68 will take place in the fall of 2014 in accordance with the alternating spring and fall schedule for Level 2 Decreased Monitoring.

Wetland 25 in the Saunders County well field has trended slightly drier since 2010 and was above the baseline maximum WA_M value in 2012 and 2013 (Figure 2, Appendix I). While the WA_M remains above the baseline maximum at this wetland, secondary indicators such as species richness, species diversity, mean c-value, and FQI were all improved from 2012 to 2013. This may indicate an initial recovery from the extreme drought conditions experienced in 2012. Since three of the four secondary indicators displayed a significant difference following the statistical analysis, the monitoring effort at W-25 will be increased to Level 1 Decreased Monitoring and will be analyzed during the fall 2013 visit. Level 1 Decreased Monitoring will included twice annual (spring and fall) monitoring at W-25 until the indicators suggest a change in wetness is no longer occurring, until another increase in the level of monitoring effort is warranted, or until another resolution is mutually decided upon by the District and the USACE.

Similar to W-25, W-100 in the southern portion of the Saunders County well field, has trended dried over recent years (Figure 3, Appendix I). During the fall 2012 monitoring effort, nearly all vegetation had

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died, presumably as a result of the extreme drought conditions. As observed in W-25, the WA_M at W-100 remains above the baseline maximum at this wetland, though lower (wetter) than in fall 2012. The secondary indicators were all improved from 2012 to 2013 and, in fact, showed significant differences in only two of four instances. However, since this wetland displayed such severe change in wetness and species composition during 2012, and the WA_M remains well above 3.0, it is recommended that the monitoring intensity be elevated to Level 1 Decreased Monitoring at W-100. As a result, W-100 will be monitored during the fall 2013 effort and remain on Level 1 Decreased Monitoring as discussed for W-25 above.

Currently, the fall 2013 monitoring effort is planned to take place the week of September 16. Data will be collected at W-25 and W-11 and analyzed again in the 2013 annual report at which time additional recommendations will be made. If you have any questions, need any additional information, or would like to schedule a site visit, please contact me by telephone at (816) 822-4330 or by email at ssoard@burnsmcd.com.

Sincerely,



Sarah J. Soard, PWS
Wetland Scientist

Enclosures

cc: Kevin Tobin, Metropolitan Utilities District
files



Burns & McDonnell World Headquarters
9400 Ward Parkway
Kansas City, MO 64114
Phone: 816-333-9400
Fax: 816-333-3690
www.burnsmcd.com

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