Krohn Wetland Mitigation Bank
2014 Annual Monitoring Report

January 21, 2015

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Table of Contents

Krohn Wetland Mitigation Bank – 2014 Annual Monitoring Report (21 pp)

Report Prepared by Eric Mohring and Carol Strojny - January 21, 2015

Cover Photo: Deep marsh vegetation, eastern lobe of the Krohn Wetland Bank

BWSR Site ID 3798, Account # 1481

USACE #2008-01879-DAS

Project Site: Madelia Township, T 107 N R 30 W, Section 22

Project Overview

The goal of this project is to restore 37.9 acres of wetland on a 50-acre tract of land located just north of Madelia, MN in Watonwan County (Figure 1). Wetland Conservation Act (WCA) actions eligible for credit on this site include restoration of completely drained wetland areas, restoration of farmed wetlands, and establishment of an upland buffer. Plant communities to be restored include deep marsh, shallow marsh, fresh wet meadow, and wet-mesic prairie. The wet-mesic prairie area was planted in the transitional zone between the upland buffer and the fresh wet meadow.

The banking plan for this project was approved by the WCA Local Government Unit in 2008. The US Army Corps of Engineers (USACE) signed a Mitigation Banking Instrument for this project in November of 2014, which allows us to move forward with obtaining federally-approved credits.

Construction on the site was completed in March of 2010. Hydrology was restored by breaking and re-routing tiles and constructing an embankment with an inline water control structure as the outlet. Vegetative restoration was conducted by installing seed down to design pool elevation and by planting emergent vegetation. Supplemental seeding occurred in 2011, 2012, and 2013 to enhance native vegetative establishment (Appendix 1 –Management History). The first full growing season was in 2011, with annual monitoring reports submitted in 2011, 2012, and 2013.

While the site is establishing, annual monitoring reports are a requirement of both the State's WCA and the USACE'S compensatory mitigation rule. This report summarizes restoration success of this site through the fourth full growing season. All credits generated from this bank will be used towards the mitigation of wetland impacts resulting from local road improvements.

Monitoring Methods

Hydrology

Hydrology monitoring was conducted using a data logger installed in well A2d and a data logger installed in the upstream side of the stop-log box that serves as the outlet for the basin (Figure 2). The data logger in the outlet structure measured pool levels.

Soil boring and well construction information was included in the 2011 annual monitoring report. Daily precipitation, monthly precipitation, and monthly normals were obtained from the State Climatology Office.

Vegetation

Vegetation was assessed on July 16th and August 12th (2014). The earlier date focused on shallow and deep marsh communities. Species lists and percent areal cover were estimated by conducting step-point transects. While walking a transect (Figure 3), vegetation at every left footstep was noted. Each transect resulted in a list of species and a tally of 'hits' for each species. Percent cover was estimated by dividing the 'hits' for each species by the total number of points from the transect. Transects from last year were repeated. Additional species present were noted during meandered walks about the site. Estimates of cover from meandered walks were noted for the upland area in the southern half of the site where there were no transects (Appendix 2). Areas with sparse vegetation or weedy cover were mapped. Panoramic landscape photographs were repeated at three different locations (Figures 3 and 4).

Results

Hydrology

2014 Precipitation

Antecedent moisture conditions were assessed using the "Evaluating Antecedent Precipitation Conditions for Assessing Wetland Hydrology" technical guidance from January of 2011.[1] Conditions were normal to wetter-than normal through mid-July based on the 30-day rolling sum of precipitation (**Figure 5**). During mid-July through mid-August dryer conditions prevailed. The "NRCS method" (using three prior months) showed antecedent precipitation conditions within or just slightly above the 'normal' range for the 2014 growing season.

2014 Water Levels

Water levels were near the design pool elevation through June (**Figure 5**). As in previous years, the water table as measured in well A2d showed more fluctuation than the pool level as measured in the outlet control structure. Water levels declined from July through mid-August. During July through September, the pool elevation was mostly higher than the water table, indicating groundwater recharge into the basin.

2009-2014 Hydrology Summary

The 2009-2014 review of water levels show the initial "hydrologic lift" after completion of construction in 2009 (**Figure 6**). In subsequent years, the water levels were at or near the projected pool level when moisture conditions were in the 'normal' or 'above normal' ranges. We used these data to make elevation-based estimates for the wetland area meeting the following two hydrology criteria:

1. The hydrology technical criterion "water table within 12 inches of the surface for 14 consecutive days during the growing season in most years"; and
2. The performance criterion of "water table within 12 inches of the surface for 28 consecutive days or two periods of 14 consecutive days during the growing season in most years."

This probability-duration analysis involved: 1) Determining, for each year, the maximum water level attained for 14 consecutive days, as well as for two periods of 14 consecutive days during the growing season; 2) Determining the 50% probability value of these annual maxima; and 3) Adding one foot to this elevation. The resulting elevations were **1011.9** for one period of 14 consecutive days, and **1011.4** for two periods of 14 consecutive days. In other words, areas in the basin with elevation less than **1011.9** are estimated to meet the technical hydrology criterion; areas in the basin with elevation less than **1011.4** are estimated to meet the hydrology criterion of "water table within 12 inches of the surface for 28 consecutive days or two periods of 14 consecutive days during the growing season in most years" (**Figure 7**).

Vegetation

Upland vegetation is dominant to an elevation of 1012.5, where the vegetation becomes a mixture of big bluestem (*Andropogon gerardii*, facultative) and Virginia wild rye (*Elymus virginicus*, facultative wetland). Facultative wetland plants become dominant at an elevation around 1011.5, down to

[1] **Evaluating Antecedent Precipitation Conditions for Assessing Wetland Hydrology**
http://www.bwsr.state.mn.us/wetlands/wca/antecedent-precip.pdf

elevations of around 1010.5-1010.0, where the shallow marsh (wetland obligate) vegetation starts. We estimate the deep marsh elevations to be around the 1010 elevation line and below.

Sub-aquatic vegetation cover in the deep marsh (sago pondweed).

Two transects were completed in the marsh communities, with an average of percent cover for each species intercepted (Appendix 2a). The highest diversity was observed at the edge (Photo Figure 4), with greater coverage of cattails (*Typha* spp.) further in until the subaquatic vegetation became dominant. Deep marsh vegetation included emergent, sub-aquatic, and floating-leaved plants. Emergent plants were mainly cattails, with sago pondweed (*Stuckenia pectinata*) (25-35% cover) and water smartweed (*Persicaria amphibium*) as sub-aquatic plants, and duckweed (*Lemna minor*) scattered on the surface. Shallow marsh vegetation was dominated by cattails but also had arrowhead (*Sagittaria* sp.), river bulrush (*Schoenoplecuts fluviatilis*), softstem bulrush (*Schoenoplectus tabernaemontani*), spikerushes (*Eleocharis* spp.), water plantain (*Alisma plantago*), and other species interspersed.

The wet meadow transect was dominated by sedges (*Carex* spp.), rushes (*Juncus* spp.), bulrushes (*Scirpus* spp.) (48% cover), and marsh milkweed (*Asclepias incarnata)(*40%) (Photo Figure 4, Species list Appendix 2b). Native grasses were also present with 12% cover. All species from the transect were facultative wetland or obligate wetland plants. In addition to the seven species encountered on the transect, 11 other native species were observed. In the southeast corner there is a wet meadow/shallow marsh swale with spikerushes (20-30%), foxtail barley (*Hordeum jubatum*)(10-20%), curly dock (*Rumex crispus*) (5-10%), asters (*Symphiotrichum* spp.)(30%), sloughgrass (*Beckmannia syzigachne*)(2-5%), narrowleaf cattail (*Typha angustifolia*)(3%), and river bulrush (10%) common.

Swale area in southeast corner with a mixture of wet meadow and shallow marsh species.

South of the wet meadow transect is an area with a greater percentage of big bluestem (facultative wetland) and Virginia wild rye (facultative wetland) – together with 70% cover. Switchgrass (*Panicum virgatum*) (20%), native forbs (10%) and annual weeds (10%) such as common ragweed (*Ambrosia artemisiifolia*) and foxtails (*Setaria* spp.) were present. Depending on hydrology and soil indicators observed during a final delineation, this area may be mapped as an upland or wet-mesic prairie.

Big bluestem and Virginia wild rye uphill from transect area of wet meadow.

Areas to the east of the basin were planned as wet-mesic prairie but will likely be classified as upland prairie. Hydrology indicators based on well data are lacking for those areas (Figure 7). One transect has a dominance of Virginia wild rye

(21%) and big bluestem (31%) (Photo Figure 3, Appendix 2c). Ten other native species have 2-10% cover, with non native cover estimated at seven percent. Percent cover of facultative wetland plants was 36% and facultative plant cover was 48%. The remaining coverage (17%) was represented by facultative upland plants. The transect further east of this one was much weedier, with 95% weedy cover (Photo Figure 3, Appendix 2d). Common ragweed and foxtails were the common weedy species, together making up 82% cover. This poorly-vegetated area was mapped out to be 0.9 acres in size.

Two wet-mesic prairie transects from the northern part of the project area (Figure 3) are in areas that meet technical hydrologic criteria (Figure 7). Both transects have at least 50% native cover, with Virginia wildrye, foxtail barley, and fowl bluegrass (*Poa palustris*) averaging 16%, 14%, and 7%, respectively. Foxtails are the most common weed, followed by common ragweed. This area is diverse, with at least 14 native species of grasses, bulrushes, rushes, and forbs (Appendix 2e). Approximately two acres of weedy patches were mapped, where native cover was less than 50% cover (Figure 3).

Upland area in southern portion of the bank area, where Canada wildrye is dominant.

Observations for the upland were made in the northwestern corner and the southern portion of the easement. From the transect in the northwestern area, native cover was 72%, with Canada wildrye (*Elymus Canadensis*) dominant (20%) (Appendix 2f). Weedier species included common ragweed (24%) and Canada thistle (*Cirsium arvense*) (4%). The southern portion of the field was heavily dominant to Canada wild rye (70%), with only 10% weed cover that included Canada thistle, common ragweed, foxtails, and sweet clover (*Melilotus officinalis*). The weediest patches that had 50% native cover or less total 3.2 acres and have been mapped (Figure 3). These areas tend to be along the field edges. Including the native species listed above, a total of 23 native plants were observed in the upland areas.

Discussion

Hydrologic restoration of the site is progressing as planned and our vegetative management activities are yielding positive results. Areas in the basin below an elevation of 1011.9 are estimated to meet the technical hydrology criterion; areas in the basin with an elevation below 1011.4 are estimated to meet the hydrology criterion of "water table within 12 inches of the surface for 28 consecutive days or two periods of 14 consecutive days during the growing season in most years" (Figure 7). These data will be helpful in determining the final delineation line, especially in areas where seed was recently installed.

This year's observations of vegetation show significant improvements in the upland prairie and wet-mesic prairie communities. Approximately 30 acres were reseeded in 2013 with a wet–mesic mix consisting of switchgrass, big bluestem, Indian grass (*Sorghastrum nutans*), Canada wild rye, slender wheatgrass (*Elymus trachycaulis*), golden alexanders *(Zizia aurea),* New England Aster *(Symphyotrichum novae-anglia),* and wild bergamot *(Monarda fistulosa.* Weed-dominated areas have decreased from 30 acres to approximately six acres, which are dominated by common ragweed or foxtails. The upland prairie vegetation had the greatest transition, with a decrease in weedy species such as dandelion (38% to 0%) and foxtails (25% to 0%), and an increase in Canada wildrye (4% to 70%).

Foxtail cover also decreased in wet mesic prairie/upland transects and wet mesic prairie transects (**Appendix 2c,d,e**). Common ragweed cover remained about the same in most transects. In general, there was more Virginia wild rye and fowl bluegrass observed in the mesic prairie transects. The wet mesic prairie/upland areas still require vegetative management to achieve higher native cover. During a 'hands on training' session sponsored by BWSR for resource professionals in July, we speculated that some of the ragweed dominant areas were borrow areas for previous construction projects. Despite several seeding attempts, germination of native seeds has not been successful in certain areas.

The wet meadow, shallow marsh, and deep marsh communities have remained fairly consistent in diversity and native perennial plant cover. The main changes to note are that this year, the deep marsh was described under inundated conditions and we were able to estimate subaquatic vegetative cover. Cottonwood (*Populus deltoides*) stems are scattered along the wetland fringe and will be removed by cutting and stump treatment in 2015.

Cottonwood saplings becoming established along the wetland fringe.

Performance indicators were recently revised during the development of a mitigation bank instrument with the USACE (**Table below**). Based on these indicators of success, we are eligible to receive 50% of our projected credits. Additional management will be required to improve native vegetative cover. Depending on the availability of funding, additional seed may be installed in upland and wet-mesic areas lacking 50% native cover prior to the growing season in 2015. Wet meadow and marsh areas are in good condition. The small scattered patches of reed canarygrass will continue to be managed along with the scattered stems of cottonwood. The current marsh transects combine shallow and deep marsh areas. Separate transects or observation in the shallow marsh and deep marsh communities will have to be made to determine a more precise percent cover of native species for these communities.

Portion of Credits to be Released	Performance Indicators	
15%	☒	Certification of construction.
50%	Two growing seasons where:	
	☒	Hydrology criteria is met.
	☒	Deep marsh vegetation has ≥ 2 species of native pondweeds, smartweeds, grasses, sedges, and/or rushes with ≥ 15% areal coverage.
	☒	Shallow marsh vegetation has ≥ 4 species of native grasses, sedges, rushes, or forbs with ≥15% areal coverage, and perennial vegetative cover at least 40%.
	☒	Wet meadow or wet-mesic prairie areas have ≥ 4 native herbaceous species cumulatively comprising ≥15% total cover, with at least 75% total vegetative cover.
	☒	Uplands with ≥ 5 seeded species germinated, and one seeded species dominant. Perennial vegetative cover ≥ 40%.
75%	☒	Hydrology meets wetland hydrology criteria based on antecedent conditions: water levels should reach an elevation of 1010.25 (also pool level) for a minimum of 28 consecutive days, or two periods of 14 consecutive days, during the growing season in most years under normal to wetter than normal conditions. Greater elevations of inundation are acceptable provided that the duration does not exceed 28 days.
	☐	Deep marsh vegetation shall include ≥ 3 species of native pondweeds, smartweeds, grasses, sedges, and/or rushes and achieve ≥ 50% areal coverage.
	☐	Shallow marsh vegetation shall include ≥ 8 species of native grasses, sedges, rushes, or forbs and achieve ≥75% or greater areal coverage.
	☐	Wet meadow or wet-mesic prairie areas have ≥ 12 native herbaceous species cumulatively comprising at least 90% of total cover.
	☐	Upland community has ≥ 15 species of native grasses and forbs and achieves ≥ 80% canopy coverage.
100	☒	Hydrology meets wetland hydrology criteria based on antecedent conditions: water levels should reach an elevation of 1010.25 (also pool level) for a minimum of 28 consecutive days, or two periods of 14 consecutive days, during the growing season in most years under normal to wetter than normal conditions. Greater elevations of inundation are acceptable provided that the duration does not exceed 28 days.
	☐	Deep marsh vegetation shall include ≥ 3 species of native pondweeds, smartweeds, grasses, sedges, and/or rushes and achieve approximately 50% or greater areal coverage.
	☐	Shallow marsh vegetation shall include ≥ 8 species of native grasses, sedges, rushes, or forbs and achieve approximately 75% or greater areal coverage.
	☐	Wet meadow or wet-mesic prairie areas have ≥ 12 native herbaceous species cumulatively comprising at least 90% of total cover.
	☐	The upland community has ≥ 15 species of native grasses and forbs and achieves ≥ 90% canopy coverage.

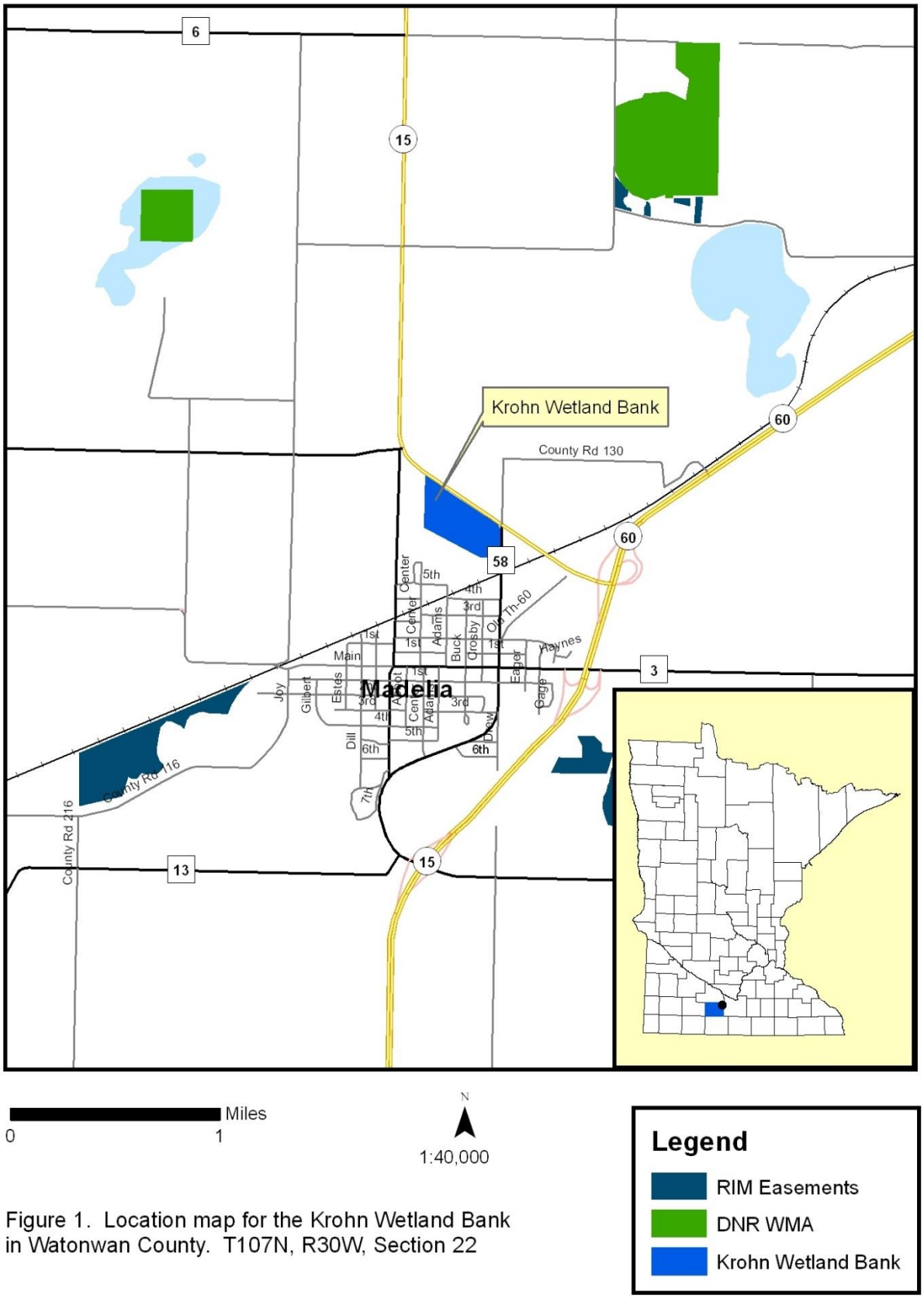

Figure 1. Location map for the Krohn Wetland Bank in Watonwan County. T107N, R30W, Section 22

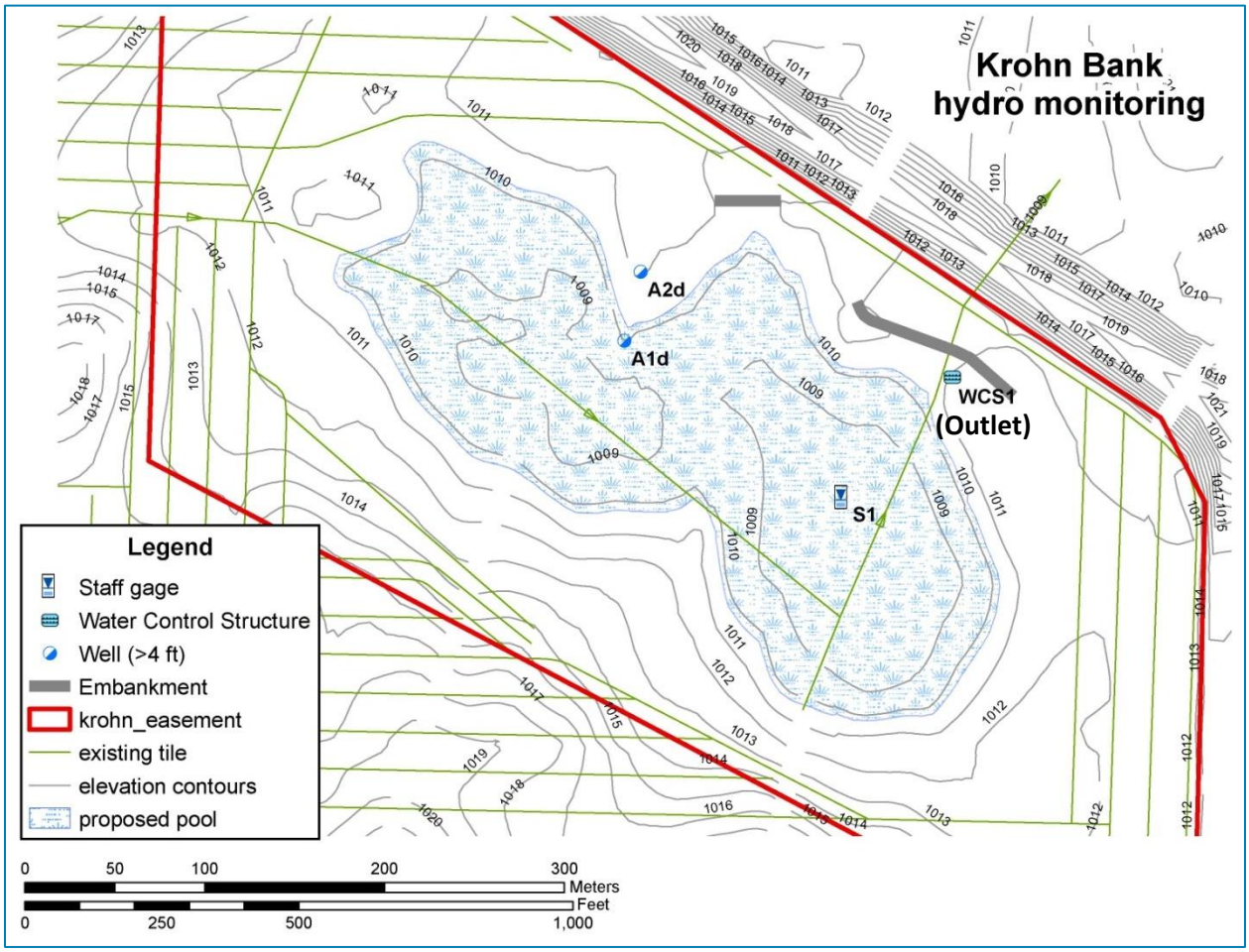

Figure 2: Krohn Wetland Bank hydrologic monitoring Locations. Well A1d and the staff gauge (S1) were not used in 2014.

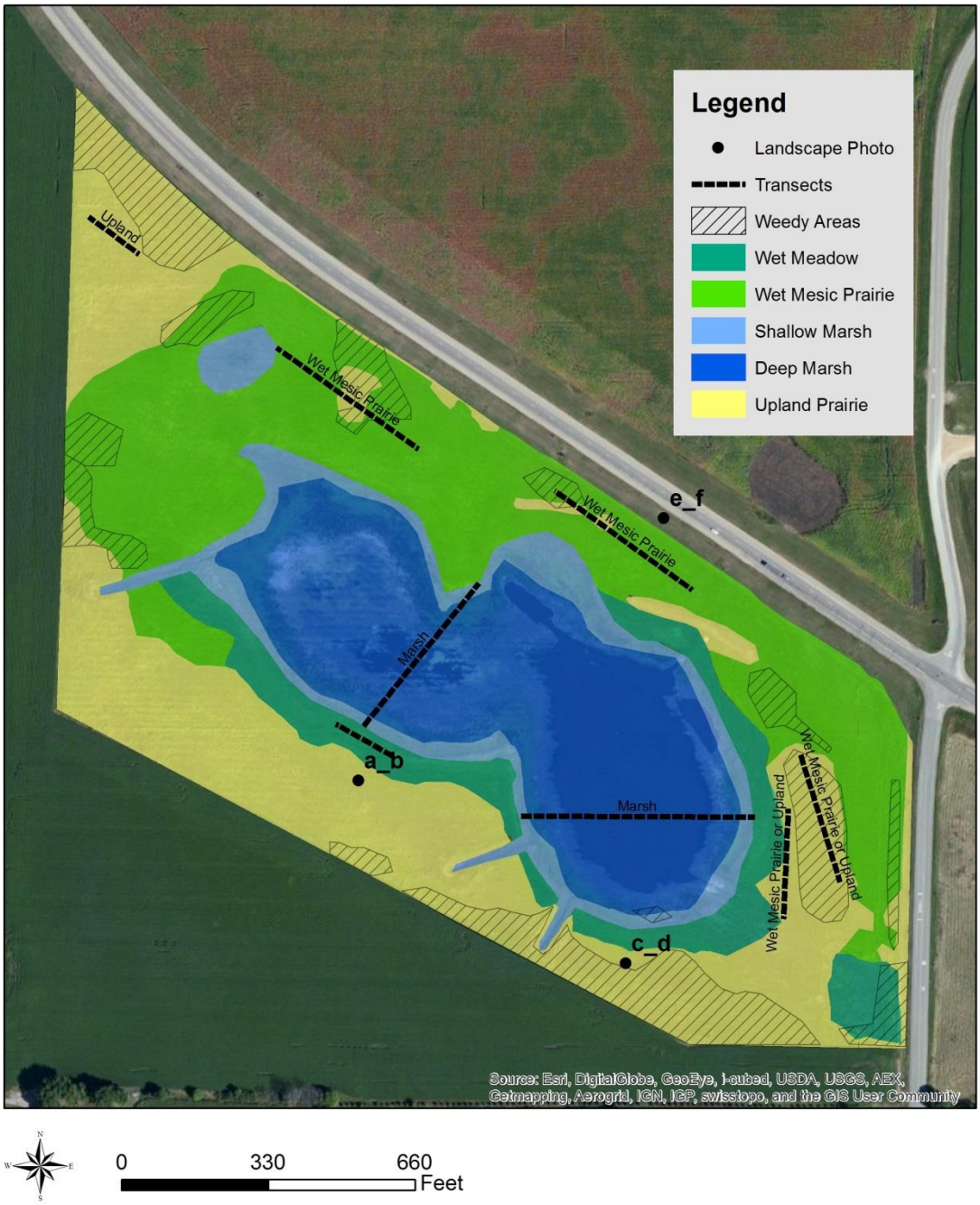

Figure 3. Reference map of photo points, transects, and communities for the Krohn Wetland Bank, Watonwan County, 2014.

Landscape Project View a – from south side

Landscape Project View b – from south side

Landscape Project View c – from southeast side

Figure 4. Photographs for the fourth full growing season of the Krohn Wetland Bank (July 16th, 2014).

Landscape Project View d – from southeast side

Landscape Project View e – from north side

Landscape Project View f – from north side

Upland Transect area

Wet-mesic or Upland Vegetation Transect- just east of basin

Wet-mesic or Upland Vegetation Transect (weedy)

Wet meadow Transect – south of western lobe

Wet meadow – SW of eastern lobe

Shallow marsh fringe with sedges and bulrushes and cattails

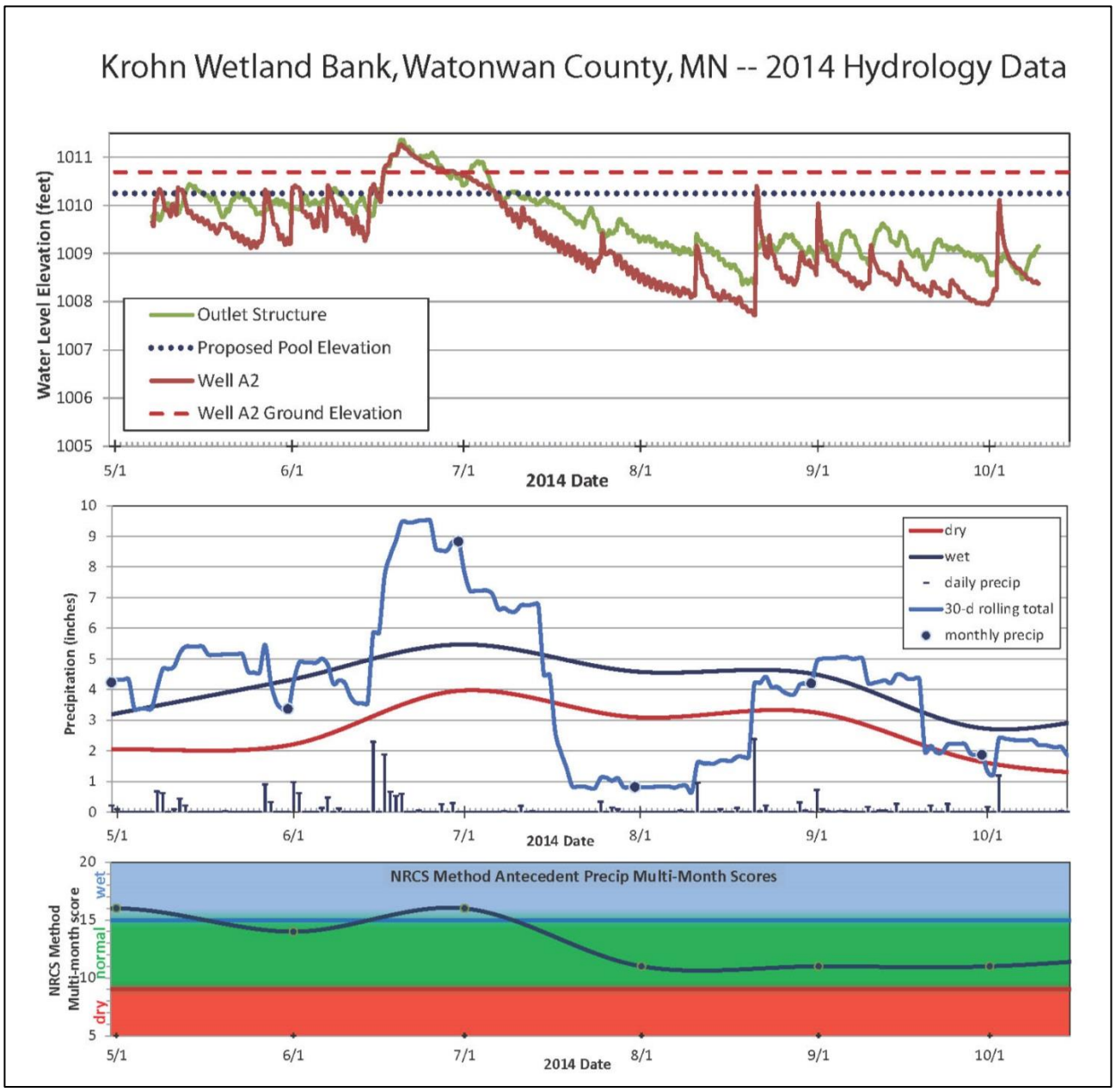

Figure 5: Water level data, 2014. **Bottom**: NRCS method antecedent precipitation multi month scores; **Middle**: precipitation analysis - daily and monthly precipitation, 30-day rolling average, normal range; **Top**: water level elevations in well and outlet structure.

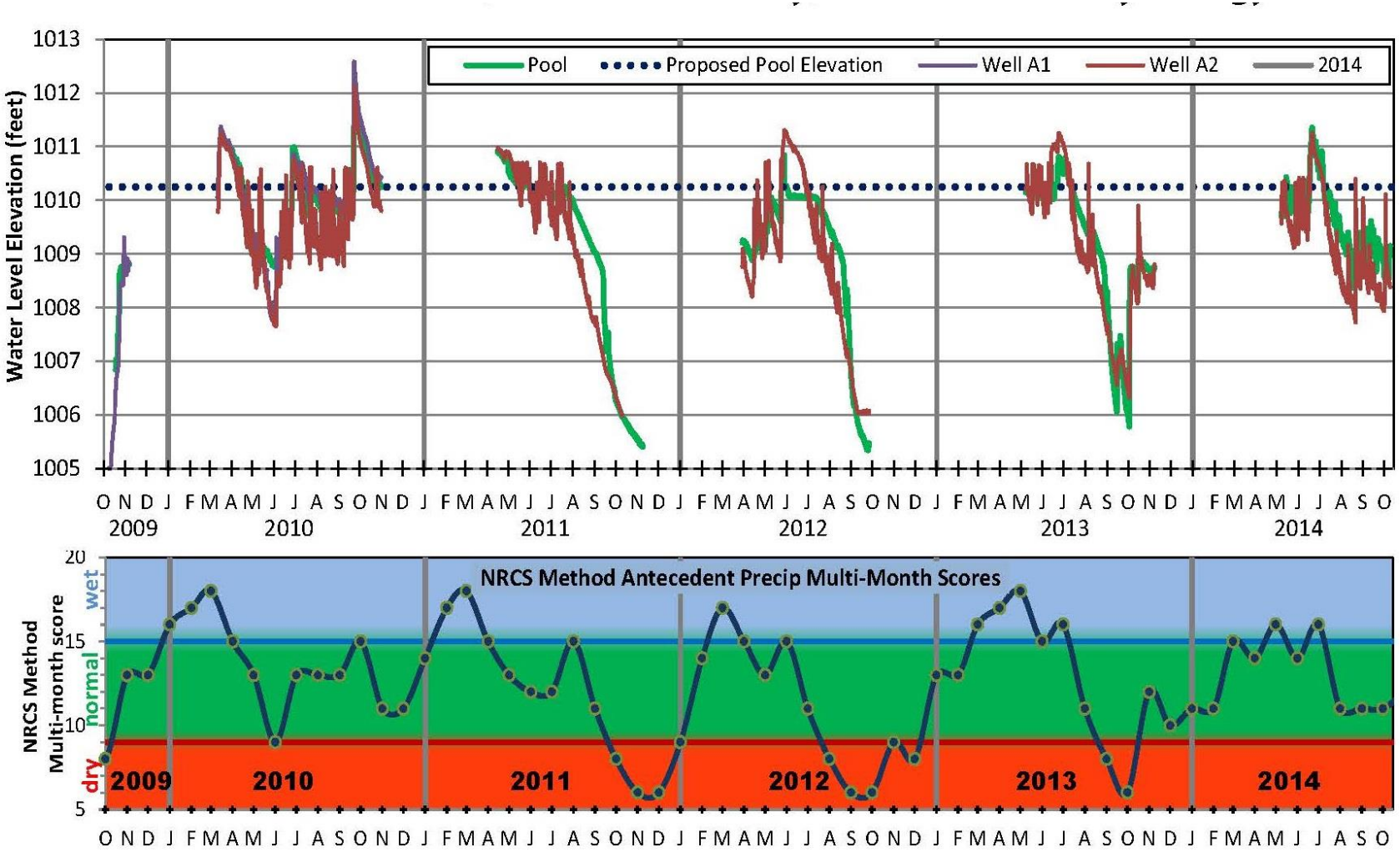

Figure 6

Plot of water level monitoring data along with plot of antecedent moisture conditions, for 2009-2014. **Bottom:** points plotted for each month are 3-month antecedent precipitation scores from the NRCS methodology using the three prior months of precipitation. **Above:** water level elevations measured in monitoring wells (A1,A2) and pool (via staff gauge and outlet structure).

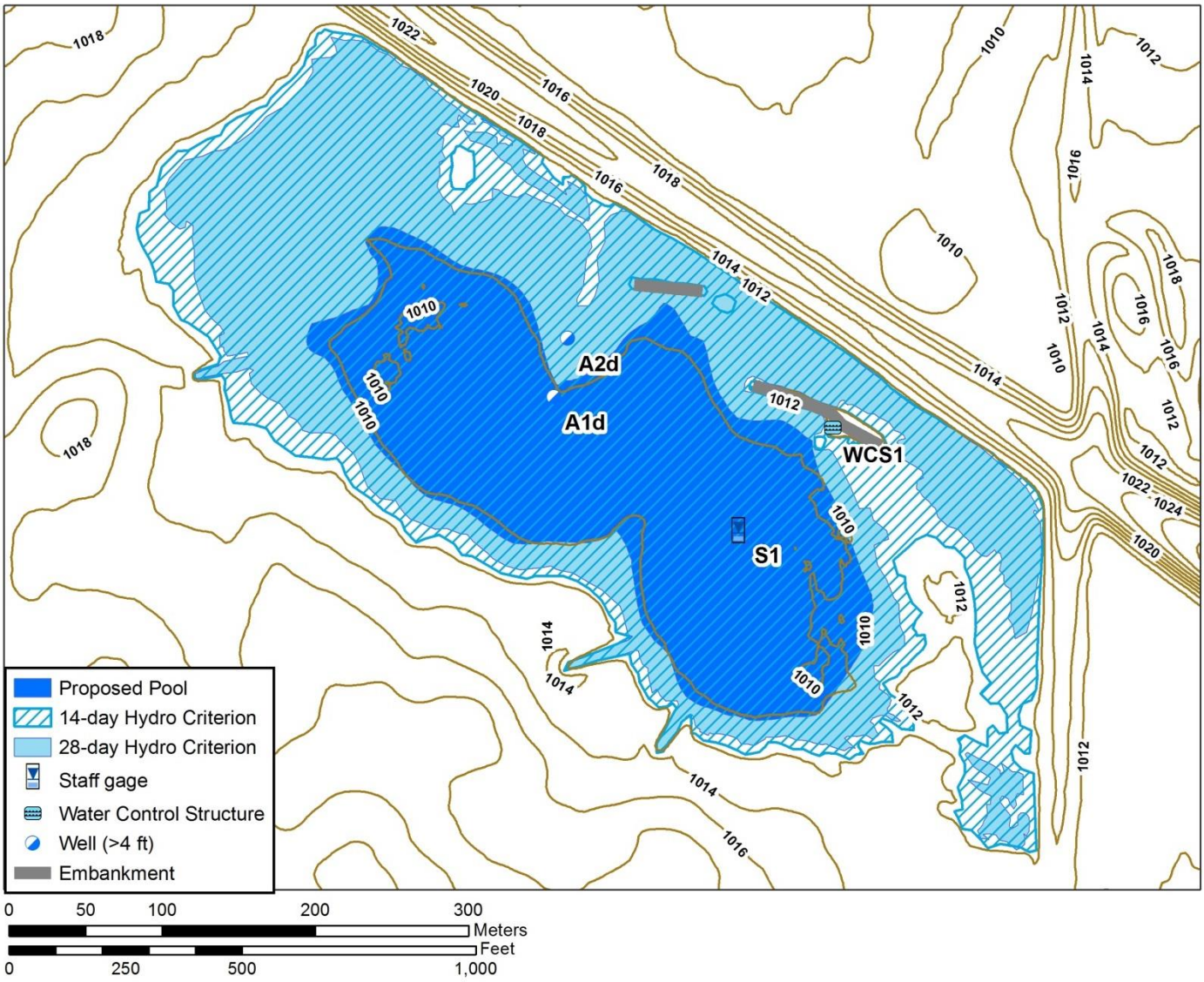

Figure 7: Estimates of areas meeting hydrology criteria based on probability duration analysis. Areas in the basin below elevation **1011.9** are estimated to meet the technical hydrology criterion, and areas in the basin with elevation below **1011.4** are estimated to meet the hydrology criterion of "water table within 12 inches of the surface for 28 consecutive days or two periods of 14 consecutive days during the growing season in most years."

Appendix 1. Management History for the Krohn Wetland Bank

Date	Activity
2009	Oat cover crop
Fall 2009	Construction began
March 2010	Construction completed
Spring 2010	Stop log manipulation (lower pool to enhance conditions for seeding)
May 20th 2010	Rodeo® application (37 ac) to kill oat cover crop and agricultural weeds
June 8th 2010	Shallow marsh fringe and wet meadow (10 ac) seed mixes hand broadcast seeded by BWSR staff with Truax Slinger and buckets; wetland temporary mix (one acre) planted
June 9th 2010	Wet mesic prairie and upland prairie seed mixes broadcast seeded using a four-wheel-mounted Vicon unit (too wet for drill seeder)
June 16th 2010	MN Native Landscapes installed 450 two-inch plugs along proposed pool edge (lake sedge, slough sedge, river bulrush, sweet flag, burr-reed, soft stem bulrush)
July 8th 2010	BWSR and DNR staff installed 80 plants of river bulrush, 15 water smartweed plants, ½ gallon coontail, ½ gallon native milfoil, four gallons Sago pondweed, and three gallons chara harvest from Burgdahl WMA and transplanted into inundated areas of basin
August 2010	Clipped 51 acres
Spring 2011	Supplemental seeding of wet meadow area south of basin (1 ac)
August 2011	Canada thistle sprayed (12 ac) by Coop.
November 2011	Interseeded 12 acres with Vicon broadcast unit (by Martin Co.)
Fall 2011	Boundaries posted
May 2012	Broadcast 1 ac emergent seed mix in southeast and northeast corners; broadcast 1 ac upland seed into south-central portion of site that had sparse vegetation
June 2012	Hand chopped thistle and removed reed canarygrass seed heads
June 25, 2012	Mowed upland and wet mesic prairie zones to control thistle
October 31 2012	Herbicide (glyphosate) control for thistles (approximately five acres)
June 3, 2013	Sprayed herbicide (Rodeo®) to prepare for supplemental seeding (25 ac)
July 17-18, 2013	Wet-mesic prairie mix inter-seeded by drill (30 ac)
July 23, 2013	Mowed interseeded areas (30 ac)
September 11, 2013	Mowed interseeded areas (25 ac)
September 12, 2013	Spot control of thistle (transline) and reed canary grass (Rodeo) throughout site
July 9th, 2014	Spot sprayed Transline® on thistle, birdsfoot trefoil, crown vetch, clover, and spot sprayed Garlon® 3A on stinging nettle (6 ac).
November 4, 2014	Spot sprayed rodeo on reed canarygrass and scattered thistles (<2 ac).

Appendix 2. Plant Species Observed at the Krohn Wetland Bank, 2014.

a) Marsh (shallow and deep): 2 transects (530 ft and 415 ft) through each lobe

					% Cover		
Group	Common name (Scientific name)	Indicator	Native	Invasive	Transect E	Transect W	Ave.
Algae	-				6%	14%	9.9%
Emergent	Arrowhead (*Sagittaria sp.*)	OBL	Yes	No	3%	2%	2.3%
Floating	Duckweed (*Lemna minor*)	OBL	Yes	No	1%	2%	1.3%
Emergent	Narrowleaf cattail (*Typha angustifolia*) and Hybrid cattails (*T. x glauca*)	OBL	No	-	30%	58%	43.7%
Emergent	River bulrush (*Schoenoplectus fluviatilis*)	OBL	Yes	No	1%	3%	2.0%
Sub-aquatic	Sago pondweed (*Stuckenia pectinata*)	OBL	Yes	No	55%	9%	31.9%
Emergent	Softstem bulrush (*Schoenoplectus tabernaemontani*)	OBL	Yes	No	2%	2%	1.8%
Emergent	Spikerush sp. (*Eleocharis sp.*)	FACW	Yes	No	2%	9%	5.6%
Emergent	Water plantain (*Alisma plantago*)	OBL	Yes	No	0%	3%	1.5%

Other species observed: Other species observed: Bottlebrush sedge (*Carex* comosa), Burreed (*Sparganium sp),* Chara, Porcupine Sedge (*Carex hystericina*), Rice cutgrass (*Leersia oryzoides*), Water smartweed (*Persicaria amphibia*), Woolgrass (*Scirpus cyperinus*).

b) Wet meadow: 1 transect (150 ft)

Common name (Scientific name)	Indicator	Native	Invasive	Strata	% areal cover
Broom Sedge (*Carex scoparia*)	-	Yes	No	H	12%
Fowl bluegrass (*Poa palustris*)	FACW	Yes	No	H	4%
Fox sedge (*Carex vulpinoidea*)	FACW	Yes	No	H	4%
Green Bulrush (*Scirpus atrovirens*)	OBL	Yes	No	H	28%
Marsh Milkweed (*Asclepias incarnata*)	OBL	Yes	No	H	40%
Torrys Rush (*Juncus torreyi*)	FACW	Yes	No	H	4%
Virginia Wild Rye (*Elymus virginicus*)	FACW	Yes	No	H	8%
Strata: V (woody vine), H (herb layer), S (saplings and shrubs), T (tree)					

Other species observed: Other species observed: Aster (*Symphyotrichum* sp.), Blue Vervain (*Verbena hastata*), Boneset (*Eupatorium perfoliatum*), Curly dock (*Rumex crispus),* Ironweed (*Vernonia fasciculata*), Mint (*Mentha arvensis*), Monkeyflower (*Mimulus ringens),* New England Aster (*Symphiotrichum novae-angliae*), Porcupine Sedge (*Carex hystericina*), Rice cutgrass (*Leersia oryzoides*), Sloughgrass (*Beckmannia syzigachne),* Sneezeweed (*Helenium autumnale*), Woolgrass (*Scirpus cyperinus*). Also scattered Canada thistle (*Cirsium arvense*) and foxtails (*Setaria* spp.).

c) Wet-mesic to upland prairie – just east of basin: 1 transect (250 ft)

Common name (Scientific name)	Indicator	Native	Invasive	Strata	% areal cover
Big bluestem (*Andropogon gerardii*)	FAC	Yes	No	H	31%
Blue Vervain (*Verbena hastata*)	FACW	Yes	No	H	2%
Canada thistle (*Cirsium arvense*)	FACU	No	Yes	H	5%
Common ragweed *(Ambrosia artemisiifoila)*	FACU	Yes	Yes	H	2%
Fowl bluegrass (*Poa palustris*)	FACW	Yes	No	H	7%
Foxtails (*Setaria spp.)*	FAC	No	No	H	2%
Giant goldenrod (*Solidago gigantea*)	FACW	Yes	No	H	2%
Golden Alexander (*Zizia aurea*)	FAC	Yes	No	H	7%
Indian grass (*Sorghastrum nutans*)	FACU	Yes	No	H	5%
Little bluestem (*Schizachyrium scoparium)*	FACU	Yes	No	H	2%
Sawtooth sunflower (*Helianthus grosseserratus*)	FACW	Yes	No	H	2%
Showy tick trefoil (*Desmodium canadense)*	FACU	Yes	No	H	2%
Switchgrass (*Panicum virgatum*)	FAC	Yes	No	H	7%
Virginia Wild Rye (*Elymus virginicus*)	FACW	Yes	No	H	21%
Strata: V (woody vine), H (herb layer), S (saplings and shrubs), T (tree)					

Other species observed: Blue lobelia (*Lobelia siphilitica*), Common milkweed (*Asclepias syriaca),* New England Aster (*Symphiotrichum novae-angliae*), Sneezeweed (*Helenium autumnale*), Purple prairie clover (*Dalea purpurea*).

d) Wet-mesic to upland prairie – further east of basin: 1 transect (290 ft)

Common name (Scientific name)	Indicator	Native	Invasive	Strata	% areal cover
Avens (*Geum aleppicum)*	FACW	Yes	No	H	2%
Big bluestem (*Andropogon gerardii*)	FAC	Yes	No	H	2%
Canada thistle (*Cirsium arvense*)	FACU	No	Yes	H	2%
Common ragweed (*Ambrosia artemisiifolia*)	FACU	Yes	Yes	H	55%
Dandelion (*Taraxacum officinale*)	FACU	No	No	H	9%
Foxtail (*Setaria spp.*)	FAC	No	No	H	27%
Yellow nutsedge (*Cyperus esculentus*)	FACW	No	No	H	2%
Strata: V (woody vine), H (herb layer), S (saplings and shrubs), T (tree)					

e) Wet-mesic prairie – northern area: 2 transects (380ft, and 375 ft)

Common name (Scientific name)	Indicator	Native	Invasive	Strata	% areal cover		Average
					NE	NW	
Avens (*Geum aleppicum)*	FACW	Yes	No	H	2%	%	1%
Canada thistle (*Cirsium arvense*)	FACU	No	Yes	H		2%	1%
Common ragweed (*Ambrosia artemisiifolia*)	FACU	Yes	Yes	H	9%	6%	8%
Dandelion (*Taraxacum officinale*)	FACU	No	No	H	4%	8%	6%
Fowl bluegrass (*Poa palustris*)	FACW	Yes	No	H	4%	9%	7%
Foxtail (*Setaria spp.*)	FAC	No	No	H	29%	25%	27%
Foxtail barley (*Hordeum jubatum*)	FAC	Yes	No	H	25%	2%	14%
Giant goldenrod (*Solidago gigantea*)	FACW	Yes	No	H	2%		1%
Green bulrush (*Scirpus atrovirens*)	OBL	Yes	No	H		6%	3%
Indianhemp (*Apocynum cannabinum)*	FAC	Yes	No	H		5%	2%
Kentucky bluegrass (*Poa pratensis)*	FAC	No	No	H	2%		1%
Marsh Milkweed (*Asclepias incarnata*)	OBL	Yes	No	H	4%	6%	5%
Reed canarygrass (*Phalaris arundinacea*)	FACW	No	Yes	H	4%		2%
Slenderwheat (*Elymus trachycaulus)*	FACU	Yes	No	H	2%		1%
Sow thistle (*Sonchus arvensis*)	FACU	No	Yes	H		6%	3%
Spikerush (*Eleocharis sp.*)	FACW-OBL	Yes	No	H		3%	2%
Torrys Rush (*Juncus torreyi*)	FACW	Yes	No	H		2%	1%
Virginia Wildrye (*Elymus virginicus*)	FACW	Yes	No	H	15%	17%	16%
Yellow nutsedge (*Cyperus esculentus*)	FACW	No	No	H		3%	2%
Strata: V (woody vine), H (herb layer), S (saplings and shrubs), T (tree)							

Other species observed: Asters (*Symphiotrichum spp*), Slender rush (*Juncus tenuis);* some quackgrass (*Elymus repens)* and Siberian elm (*Ulmus pumila)*.

f) Upland: 1 transect (140 ft) and general observations (listed below table)

Common name (Scientific name)	Indicator	Native	Invasive	Strata	% areal cover transect	% cover from meander (south)
Bergamot (*Monarda fistulosa*)	UPL	Yes	No	H	4%	
Big bluestem (*Andropogon gerardii*)	FAC	Yes	No	H	12%	5%
Black eyed susan (*Rudbeckia hirta*)	FACU	Yes	No	H	8%	
Canada thistle (*Cirsium arvense*)	FACU	No	Yes	H	4%	3%
Canada Wild Rye (*Elymus canadensis*)	FACU	Yes	No	H	20%	70%
Common ragweed *(Ambrosia artemisiifoila)*	FACU	Yes	Yes	H	24%	3%
Foxtail barley (*Hordeum jubatum*)	FAC	Yes	No	H	4%	2%
Horseweed (*Conyza canadensis*)	FACU	Yes	No	H	8%	
Indian grass (*Sorghastrum nutans*)	FACU	Yes	No	H	8%	2%
Western wheat (*Pascopyrum smithii)*	FACU	Yes	No	H	8%	
Foxtail (*Setaria spp.*)	FAC	No	No	H		3%
Slenderwheat (*Elymus trachycaulus)*	FACU	Yes	No	H		2%
Sideoats grama (*Bouteloua curtipendula*)						1%
Sweet clover (*Melilotus officinalis*)	FACU	No	Yes	H		2%
Other native forbs*						5-10%
Strata: V (woody vine), H (herb layer), S (saplings and shrubs), T (tree)						

***Other native forbs observed:** Blazing star (*Liatris* sp.), Canada goldenrod (*Solidago canadensis*), Common milkweed (*Ascelpias syriaca*), Coneflowers (*Ratibida sp.*), Early sunflower (*Heliopsis helianthoides*), Golden alexander (*Zizia aurea*), Hoary vervain (*Verbena stricta*), Little bluestem (*Schizachyrium scoparium*), Purple prairie clover (*Dalea purpurea*), Showy ticktrefoil (*Desmodium canadense*), Stiff goldenrod (*Oligoneuron rigidum*), White prairie clover (*Dalea candida*).