Appendix 3- USDA NRCS Soil map

Appendix 4- USDA NRCS Soil Series Description

LOCATION THATCHERFLATS ID
Established Series
Rev. MJC-FRK-RJS
01/2008

THATCHERFLATS SERIES

The Thatcherflats series consists of very deep, moderately well drained soils formed in silty alluvium on stream terraces. Slopes range from 0 to 2 percent. Permeability is slow. Average annual precipitation is about 15 inches and the average annual air temperature is about 43 degrees F.

TAXONOMIC CLASS: Fine-silty, mixed, superactive, frigid Typic Natrixeralfs

TYPICAL PEDON: Thatcherflats silt loam, nonirrigated pasture; on a 0.5 percent slope at 4,930 feet elevation. When described on August 11, 1988, the soil was moist below 56 inches. (Color is for air dry soil unless otherwise noted.)

A1--0 to 2 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 3/3) moist; strong very fine platy structure; soft, very friable, slightly sticky and slightly plastic; common very fine roots; common very fine and fine irregular pores; moderately alkaline (pH 8.0); abrupt smooth boundary. (2 to 3 inches thick)

A2--2 to 5 inches; light yellowish brown (10YR 6/4) silt loam, brown (10YR 4/3) moist; strong coarse platy structure parting to moderate medium platy; hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; slightly effervescent; strongly alkaline (pH 8.5); abrupt wavy boundary. (0 to 4 inches thick)

Btn--5 to 9 inches; brown (10YR 5/3) silty clay, dark grayish brown (10YR 4/2) moist; strong medium columnar structure parting to strong fine and medium angular blocky; hard, friable, moderately sticky and moderately plastic; common very fine roots; few very fine tubular pores; many distinct clay films on faces of peds and in pores; slightly effervescent; strongly alkaline (pH 8.6); abrupt smooth boundary. (3 to 14 inches thick)

Btkn1--9 to 11 inches; very pale brown (10YR 8/2) silt loam, yellowish brown (10YR 5/4) moist; moderate fine angular blocky structure; hard, firm, moderately sticky and moderately plastic; few very fine roots; common very fine and fine tubular pores; common distinct clay films on faces of peds and in pores; strongly effervescent; very strongly alkaline (pH 9.4); clear wavy boundary. (2 to 8 inches thick)

Btkn2--11 to 25 inches; very pale brown (10YR 7/3) silt loam, yellowish brown (10YR 5/4) moist; moderate fine and medium angular blocky structure; hard, friable, moderately sticky and moderately plastic; few very fine roots; common very fine tubular pores; many distinct clay films on faces of peds and in pores; few fine, strongly effervescent, irregularly shaped lime filaments; strongly effervescent; very strongly alkaline (pH 9.4); gradual smooth boundary. (0 to 14 inches thick)

Bkn1--25 to 45 inches; very pale brown (10YR 7/3) silt loam, light yellowish brown (10YR 6/4) moist; massive; hard, friable, moderately sticky and moderately plastic; few very fine roots; common very fine tubular pores; few fine, strongly effervescent, irregularly shaped lime filaments; strongly effervescent; strongly alkaline (pH 9.0); gradual smooth boundary. (8 to 22 inches thick)

Bkn2--45 to 56 inches; very pale brown (10YR 7/3) silt loam, light yellowish brown (10YR 6/4) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine tubular pores; strongly effervescent; strongly alkaline (pH 9.0); gradual smooth boundary. (11 to 17 inches thick)

Bkn3--56 to 60 inches; very pale brown (10YR 7/3) silt loam, light yellowish brown (10YR 6/4) moist; few fine distinct yellowish brown (10YR 5/6) moist redox concentrations; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine tubular pores; strongly effervescent; strongly alkaline (pH 8.9).

TYPE LOCATION: Caribou County, Idaho; about 1 mile north northwest of the Thatcher LDS church; about 280 feet east and 400 feet south of the northwest corner of sec. 15, T. 11 S., R. 40 E.

RANGE IN CHARACTERISTICS:
Depth to natric horizon - 2 to 7 inches
Thickness of natric horizon - 7 to 36 inches
Average annual soil temperature - 44 to 46 degrees F
Depth to redox features - 40 to 60 inches
Depth to high water table - 40 to 60 inches from March through July

Particle-size control section:
Clay content - averages 27 to 35 percent

A horizons
Value - 6 or 7 dry, 3 through 5 moist
Chroma - 3 or 4 dry or moist

Btn horizons
Value - 4 or 5 dry, 4 through 6 moist
Chroma - 2 through 4 dry or moist
Texture - SICL or SIC
Clay content - 28 to 43 percent

Btkn horizons
Hue - 10YR or 7.5YR
Value - 6 through 8 dry, 4 through 6 moist
Chroma -2 through 4 dry or moist
Texture - SIL or SICL

Bkn Horizons
Hue - 10YR or 7.5YR
Value - 6 or 7 dry, 4 through 6 moist
Chroma - 3 or 4 dry or moist

COMPETING SERIES: This is the Whitearth series. Whitearth soils are well drained.

GEOGRAPHIC SETTING: Thatcherflats soils are on slightly elevated stream terraces. Slopes range from 0 to 2 percent. Elevations range from 4,900 to 6,200 feet. The soil formed in reworked silty alluvium from loessal deposits. The average annual precipitation ranges from 13 to 16 inches, the average annual air temperature is 39 to 44 degrees F and the frost free season is 70 to 100 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Bear Lake, Chesbrook (T), Lago (T) and Wursten series. Bear Lake, Lago and Wursten soils have mollic epipedons. Chesbrook soils lack an argillic horizon. Wursten soils have a coarse-loamy particle-size control section. Bear Lake and Chesbrook soils are commonly found in poorly drained depressional to flat positions. Lago soils are on slightly convex to smooth areas and are in complex with Bear Lake soils. Wursten soils occur on low to high terraces on well drained positions.

DRAINAGE AND PERMEABILITY: Moderately well drained; slow runoff; slow permeability; rare flooding for brief periods March through July.

USE AND VEGETATION: Thatcherflats soils are used for nonirrigated and irrigated pasture. The potential natural vegetation is greasewood and other vegetation adapted to saline soils.

DISTRIBUTION AND EXTENT: Southeastern Idaho. The soils of this series are not extensive. MLRA 13.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Bozeman, Montana

SERIES ESTABLISHED: Franklin County, Idaho, 1997.

REMARKS: Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - the zone from the surface to 5 inches (A1 and A2 horizons)

Natric horizon - the zone from 5 to 25 inches (Btn, Btkn1 and Btkn2 horizons)

Particle-size control section - the zone from 5 to 25 inches (Btn, Btkn1 and Btkn2 horizons)

NSSL # S89ID029012 (partial characterization)

National Cooperative Soil Survey
U.S.A.

Appendix 5- USDA NRCS Soils Map Unit Description

Map Unit Description (ID)

Caribou County Area, Idaho

DRAFT - SUBJECT TO CHANGE

835A - Thatcherflats silt loam, 0 to 2 percent slopes

Mean annual 12 to 16 inches *Frost-free period*: 80 to 110 days
Mean annual 40 to 45 degrees F *Farmland class*:

Thatcherflats and similar soils

Extent: about 75 percent of the unit
Landform(s): fan terraces *Wind erodibility group (WEG)*: 4L
flood plains
Slope gradient: 0 to 2 percent
Parent material: loess *Land capability subclass, irrigated*: 4s
Restrictive feature(s): none *Drainage class*: moderately well drained
Seasonal high water table: approximately 33 inches
Flooding frequency: rare
Ponding frequency: none

Soil loss tolerance (T factor): 3
Wind erodibility index (WEI): 86
Land capability subclass, non-irrigated: 4s
Land capability subclass, irrigated: 4s
Drainage class: moderately well drained
Hydric soil class: no
Hydrologic group: D

Soil loss tolerance (T factor): 3
Wind erodibility group (WEG): 4L
Wind erodibility index (WEI): 86
Land capability subclass, non-irrigated: 4s
Land capability subclass, irrigated: 4s
Drainage class: moderately well drained
Hydric soil class: no
Hydrologic group: D

Representative soil profile					*Texture*	*Permeability*	*Available Water Capacity*	*pH*	*Kw*	*Kf*
A1	–	0	to	2 in	silt loam	moderate	0.4 to 0.4 in	7.9 to 8.5	.55	.55
A2	–	2	to	5 in	silt loam	moderate	0.6 to 0.7 in	7.9 to 8.6	.55	.55
Btn	–	5	to	9 in	silty clay	very slow	0.6 to 0.7 in	8.5 to 9.0	.49	.49
Bkn1	–	9	to	11 in	silt loam	slow	0.3 to 0.4 in	8.5 to 9.6	.49	.49
Bkn2	–	11	to	25 in	silt loam	slow	2.3 to 2.6 in	8.5 to 9.6	.49	.49
Bkn1	–	25	to	45 in	silt loam	moderate	3.3 to 3.7 in	8.5 to 9.4	.55	.55
Bkn2	–	45	to	56 in	silt loam	moderate	1.9 to 2.1 in	8.5 to 9.4	.55	.55
Bkn3	–	56	to	60 in	silt loam	moderate	0.7 to 0.7 in	8.5 to 9.4	.55	.55

Ecological Site / Plant Association:

Survey Area Version: 0
Survey Area Version Date: 07/08/2011

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Appendix 6- USGS Streamstats Ungaged Site Report

Streamstats Ungaged Site Report

Date: Wed May 22 2013 18:24:34 Mountain Daylight Time
Site Location: Idaho
NAD27 Latitude: 42.4725 (42 28 21)
NAD27 Longitude: -111.7791 (-111 46 45)
NAD83 Latitude: 42.4724 (42 28 21)
NAD83 Longitude: -111.7799 (-111 46 47)
Drainage Area: 22.16 mi2
Percent Urban: 4.29 %
Percent Impervious: 0.23 %

Peak-Flow Basin Characteristics

100% Peak Flow Region 8 (22.2 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	22.2	2.5	874.8
Mean Basin Slope from 30m DEM (percent)	14.5	5.1	53.6
Slopes gt 30pct from 30m DEM (percent)	19.5	1.2	88.7

Low-Flow Basin Characteristics

100% Low Flow Region 8 (22.2 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	22.2	6.6	874.8
Percent Forest (percent)	13	2.3	93.9
Mean Annual Precipitation (inches)	15.2	14.2	56
Mean Basin Elevation (feet)	5840	5691.9	8951
Mean Basin Slope from 30m DEM (percent)	14.5	6.15	53.2
Slopes gt 30pct from 30m DEM (percent)	19.5	1.2	86.6

Monthly and Annual Basin Characteristics

100% Low Flow Region 8 (22.2 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	22.2	6.6	874.8
Percent Forest (percent)	13	2.3	93.9
Mean Annual Precipitation (inches)	15.2	14.2	56
Mean Basin Elevation (feet)	5840	5691.9	8951
Mean Basin Slope from 30m DEM (percent)	14.5	6.15	53.2
Slopes gt 30pct from 30m DEM (percent)	19.5	1.2	86.6

Appendix 7- USDA-NRCS. WETS Table Documentation. Excerpt for Grace, ID.

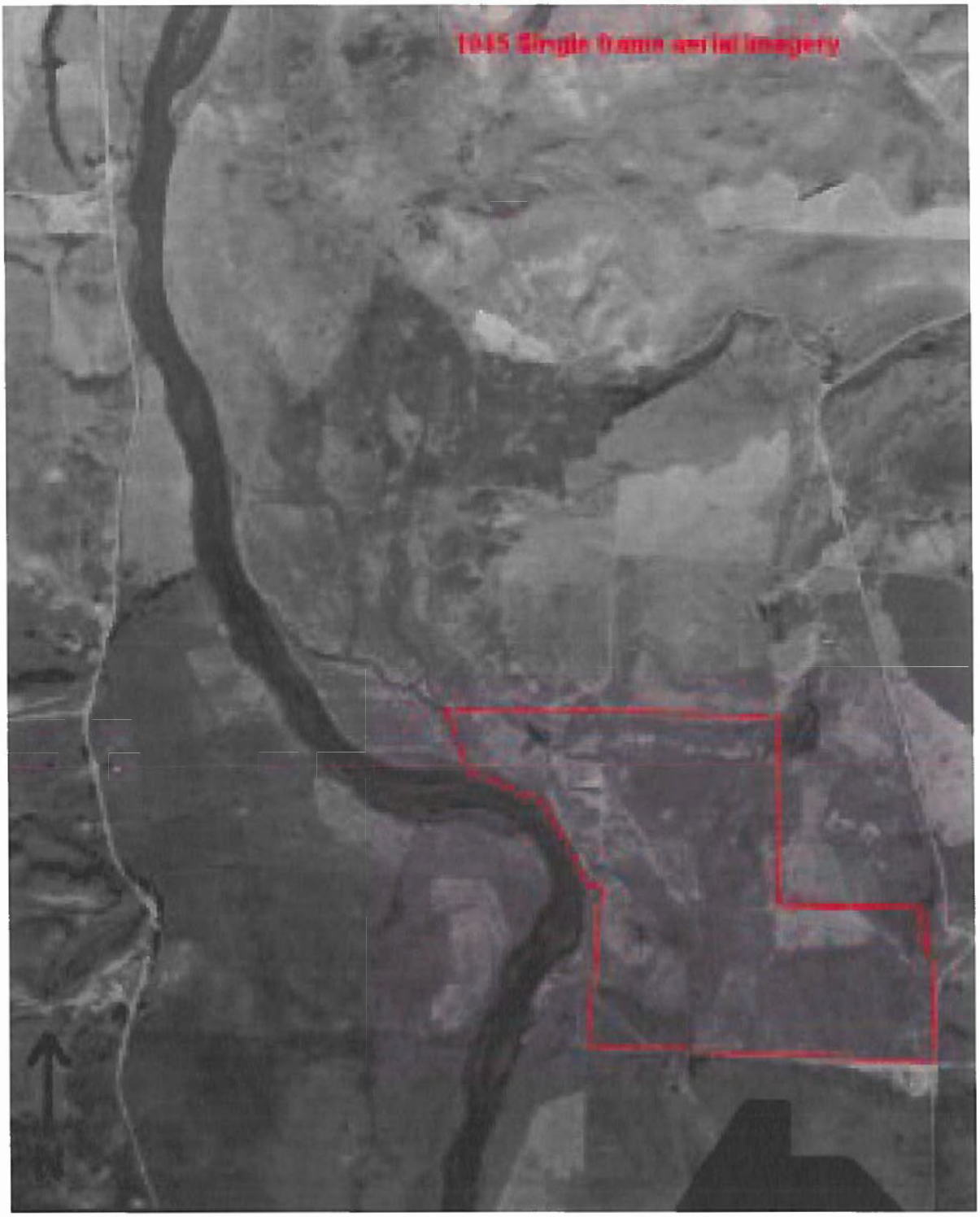
TAPS Station : GRACE, ID3732
Start yr. - 1971 End yr. - 2000
Temperature: 30 years available out of 30 requested in this analysis
Precipitation: 30 years available out of 30 requested in this analysis

	Temperature (Degrees F.)						Precipitation (Inches)				
Month	avg daily max	avg daily min	avg	2 yrs in 10 will have max temp. >than	2 yrs in 10 will have min temp. <than	avg # of grow deg days*	avg	2 yrs in 10 will have less than	2 yrs in 10 will have more than	avg # of days w/.1 or more	avg total snow fall
January	31.2	11.3	21.2	48	-24	0	1.27	0.57	1.80	4	6.3
February	36.4	13.7	25.0	54	-19	2	1.13	0.50	1.63	4	1.7
March	45.6	22.1	33.8	64	-5	24	1.43	0.85	1.98	5	1.2
April	56.3	28.9	42.6	77	12	134	1.41	0.65	2.14	4	1.0
May	66.0	36.2	51.1	83	21	348	2.21	0.94	3.26	5	0.0
June	75.8	42.4	59.1	91	29	572	1.30	0.59	1.98	3	0.0
July	84.2	47.3	65.7	96	35	794	1.09	0.34	1.75	3	0.0
August	83.9	46.2	65.1	96	32	775	1.22	0.46	1.96	3	0.0
September	74.3	38.0	56.1	90	21	485	1.31	0.35	2.23	3	0.0
October	61.5	29.5	45.5	81	11	211	1.37	0.65	2.08	4	0.4
November	42.9	20.9	31.9	65	-9	24	1.14	0.52	1.69	4	2.0
December	32.8	12.4	22.6	52	-20	2	1.10	0.36	1.80	4	6.1
Yearly :											
Average	57.6	29.1	43.3	---	---	---	----	----	----	---	---
Extreme	102	-40	---	97	-29	---	----	----	----	---	---
Total	---	---	---	---	---	3371	15.98	12.02	18.95	46	18.7

Average # of days per year with at least 1 inch of snow on the ground: 20

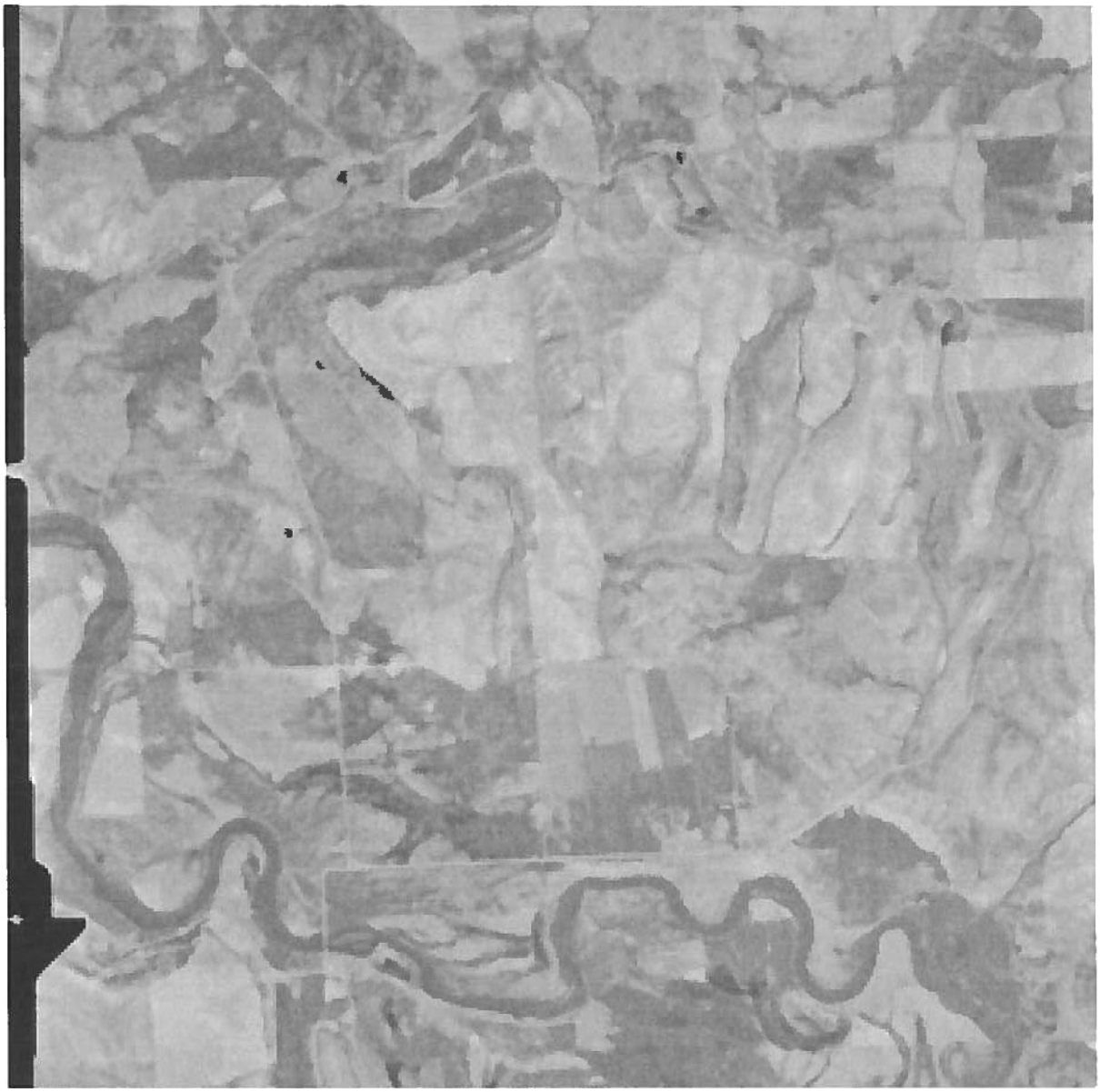
Appendix 8 - Historic aerial photography

1945 (Obtained from USGS EarthExplorer Interactive mapper.)



(In aerial photos, site can be located by finding Bear River 90° (from west to south), followed by downstream river bend from south to east, followed by a north meander.)

1953 (Obtained from USGS EarthExplorer Interactive mapper.)



1968 (Obtained from USGS EarthExplorer Interactive mapper.)

1974 (Obtained from USGS EarthExplorer Interactive mapper.)

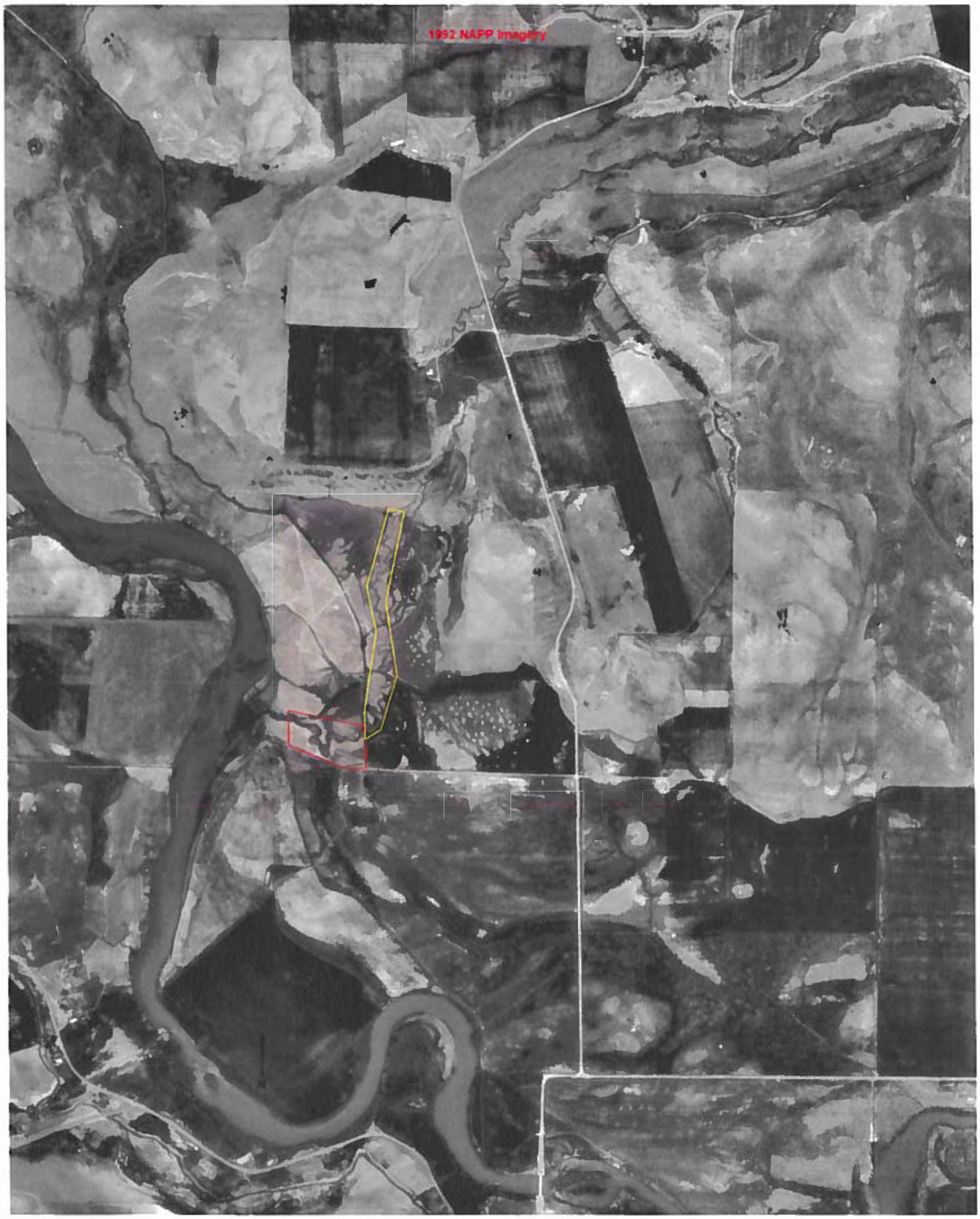
1976 (Obtained from USGS EarthExplorer Interactive mapper.)

1977 (Obtained from USGS EarthExplorer Interactive mapper.)

1980 (Obtained from USGS EarthExplorer Interactive mapper.)

1987 (Obtained as a scanned image from USDA Farm Service Agency hard copy aerial photo.)

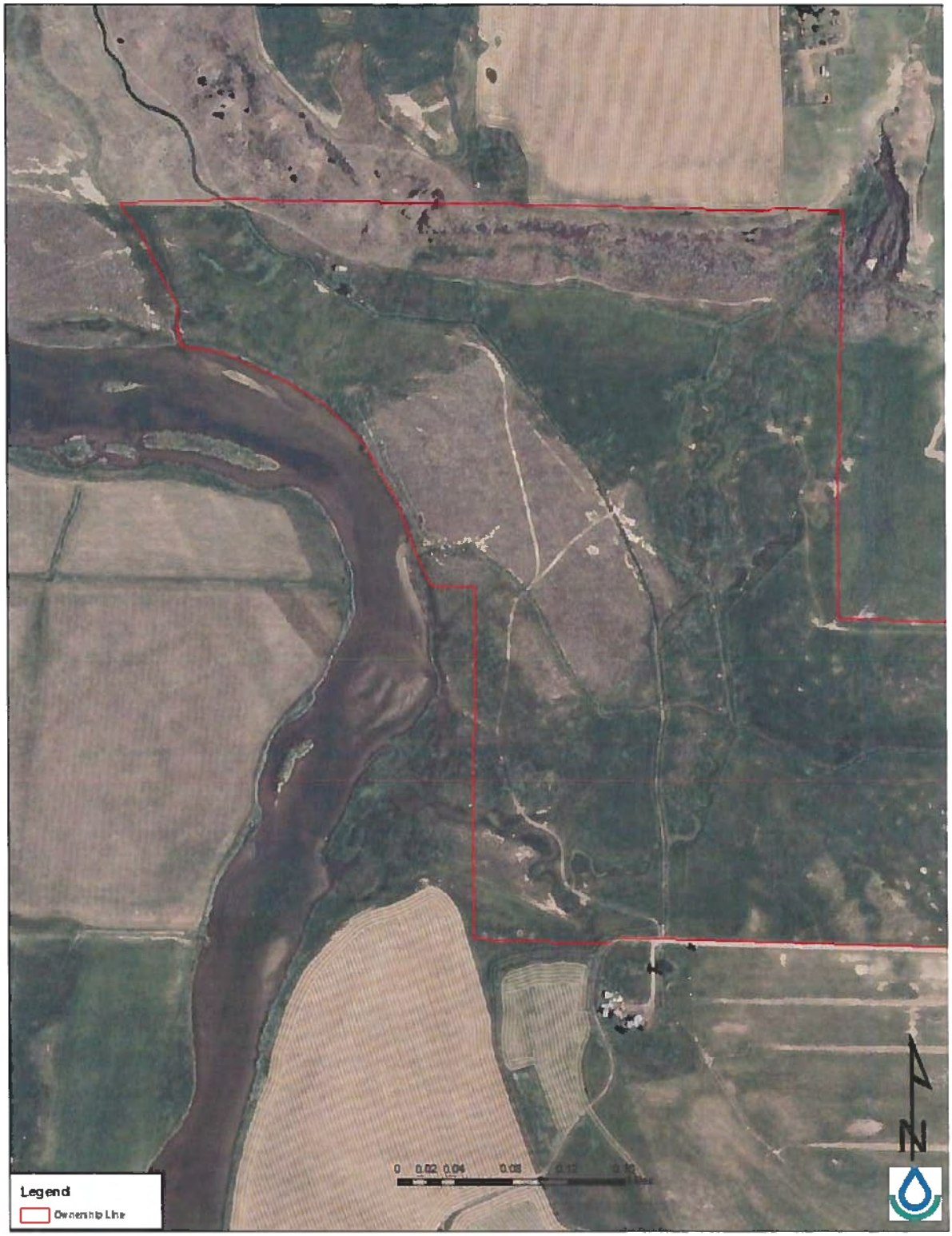
1992 (Obtained from USGS EarthExplorer Interactive mapper.)



1998 (Obtained from USGS EarthExplorer Interactive mapper.)

2004 (From NRCS SID GIS data layer)

2009 (From NRCS SID GIS data layer)



Appendix 9- Idaho Interim Functional Assessment for Riverine Wetlands on the Floodplains of Low to Moderate gradient, 2nd or 3rd Order Streams on Find Textured Substrates data sheets

TECHNICAL NOTES

USDA-Natural Resources Conservation Service

Boise, Idaho

TN Biology No. 25 April, 1999

Idaho Interim Functional Assessment for Riverine Wetlands

on the Floodplains of Low to Moderate gradient,

2nd or 3rd Order Streams on Find Textured Substrates

May 1999

Prepared By The

Idaho Wetland Functional Assessment Committee

Mabel Jankovsky-Jones, Committee Leader

DISCLAIMER

This interim functional assessment model is based upon expert opinion. The model has only limited field testing and has not been calibrated with real data. The model is meant to serve as an interim tool and may be revised based on field use and as other information becomes available.

Idaho Interim Functional Assessment for Riverine Wetlands

on the Floodplains of Low to Moderate gradient,

2nd or 3rd Order Streams on Find Textured Substrates

May 1999

This functional assessment model has been developed to be used as an interim procedure to assess wetland functions pertaining to USDA producer requests for wetland manipulations as they relate to minimal effect and mitigation. Policy is described in the Third Edition, Amendment 2, November 1996 of USDA Natural Resources Conservation Service's National Food Security Act Manual.

This functional assessment model can also be used to assess wetland functions pertainent to applications for Department of the Army permits under Section 404 of the Clean Water Act as the relate to wetland impacts and mitigation.

Preliminary Interim Functional Assessment Idaho

Subclass: Riverine wetlands on the floodplains of low to moderate gradient, 2nd or 3rd order streams on fine textured substrates

Introduction:

This subclass includes montane, low- to moderate-gradient riverine wetlands. The wetlands occur in broad valleys and have fine textured sediments deposited by peak flows in the spring. Examples of this subclass are found along tributaries to Camas Creek in south-central Idaho, the broad valleys of southwest Idaho occupied by streams such as Diamond Creek, Thomas Fork, and Lanes Creek, and low gradient tributaries emptying into Cascade Reservoir in west-central Idaho.

Functional Profile

Geomorphic Setting:

The riverine subclass occurs in nearly level to gently sloping broad valleys on stream terraces, alluvial fans, bottom lands, and outwash plains. Surficial geology includes sand and gravelly sand of incised alluvial fans derived from local bedrock (Worl et al. 1991). Soils are deep, poorly drained and somewhat poorly drained loams, loamy course sands, sandy clay loams, and silty clay loams.

Ecological significance of geomorphic setting:

The water holding capacity of the soils is high within the deep rooting zone (60" or greater). The storage of water in the surface soil results in return of base flow to the stream during August and September providing continuous flows and corridors for aquatic species (fish).

Functions based on geomorphic setting:

The substrata of sands and gravels makes subsurface water storage and moderation of base (groundwater) flows important functions of this subclass.

Water Source and Climatic Setting:

Winter and spring weather patterns are influenced by westerly winds from the Pacific Ocean. This maritime influence weakens during summer months and continental climatic conditions prevail with air masses from the south producing thunderstorm activity. The area is considered semi-arid withy average annual precipitation in the 12-22 inch range. Most of the precipitation is in the form of snow during the winter months. The frost-free period is 70-100 days (U. S. Department of Agriculture Soil Conservation Service. Ross and Savage 1967).

Water enters riverine wetland via run-off events and groundwater inputs. Run-off enters the system via tributaries, and overbank flows; however, most remain saturated for prolonged

COMMENTS FROM THE COMMITTEE

This committee was charged with development of an interim wetland function assessment procedure to implement the Wetland Provisions of the 1996 Federal Agricultural Improvement Reform Act of 1996 and Section 404 of the Clean Water Act. It was the desire of the committee to use Hydrogeomorphic (HGM) Evaluation Principles when developing the interim procedures. It should be understood by users of this model that the committee recognizes that some wetland functions are not adequately represented in this interim model, and thus, limitation on some projects and sites will occur. Furthermore, users should be aware that this is not an HGM model; rather, it is an interim assessment procedure to be utilized by Natural Resources Conservation Service (NRCS) and Army Corp of Engineers (ACOE) until HGM models are developed. However, for the vast majority of conversions within the defined wetland subclass, the committee is confident that this model will adequately assess wetland function losses and provide a basis for determining appropriate mitigation as well as assisting in quantifying threshold limits associated with NRCS minimal effect determinations.

The interim model was developed by an interagency committee consisting of:

Barbara Benge Environmental Resource Specialist Regulatory U.S. Army Corp of Engineers Walla Walla District 201 N. 3rd Avenue Walla Walla, WA 99362	Mabel Jankovsky-Jones Wetland Ecologist Idaho Department of Fish and Game Conservation Data Center P.O. Box 25, 600 South Walnut Boise, ID 83707
Frank Fink Biologist Natural Resources Conservation Service 9177 W. Barnes Drive, Suite C Boise, ID 83709	John Olson Wetlands Specialist U. S. Environmental Protection Agency Idaho Operations Office 1435 North Orchard Boise, ID 83706
Peggy Guillory Wetlands Biologist U. S. Fish and Wildlife Service Snake River Basin Field Office 1387 South Vinnell Way, Suite 368 Boise, ID 83709	

CONTENTS

periods by groundwater. Groundwater enters primarily from stream recharge, but side slope contributions may be significant during run-off periods.

Ecological significance of water source:

The seasonal saturation and subsequent drawdown in wetlands associated with the riverine subclass results in a diverse mosaic of plant communities. Sedges and rushes dominate moist swales (typically created by former channels) and may also occur along channels. Areas which drawdown earlier in the growing season are dominated by tufted hairgrass, tickle grass, and basin wildrye. Somewhat drier hummocks may have alkali sage, silver sage, and grass species which are often associated with uplands. Stands of willow including yellow willow, whiplash willow, and coyote willow are occasional occurrence and become established along channels on bars and banks. The arrangement of plant communities provides habitat for a number of bird species including bank swallows, redwing black birds, fickers, snipes, avocet, phalarope, and killdeer. Shurblands may provide habitat for yellow warblers and other neotropical migrants. Sandhill crane and long-billed curlew may use seasonally saturated grasslands. The meadows and low shrublands often provide foraging areas for falcons, northern harriers, and red tail hawks. The stream corridors and associated willow stands may provide migration corridors and hiding cover for mule deer and other mammal species (Idaho Conservation Data center 1997, Groves et al. 1997).

Functions based on water source and climatic setting:

The presence of these wetlands in relatively arid landscapes make spatial structure of habitat, interspersion and connectivity, and maintenance of the characteristic plant community important habitat functions.

Hydrodynamics:

Peak flows in riverine wetlands occur in spring and early summer. Water moves from valley walls towards the channel, from the channel into the floodplain during overbank events, and downstream via channels or overbank flows. In the case of overbank events water may leave wetlands via surface flow to the channel. Water stored in the subsurface may leave via flows through the substrata zone to the channel, percolation into deeper groundwater aquifers through permeable layers, or by evapotranspiration. Not all wetland of this subclass experience inundation by flood water, but remain saturated for long periods due to groundwater.

Surface runoff is slow. Available water capacity of the soils is moderate to high. Permeability is moderately slow in the subsoil and rapid in the substratum. The water table ranges from 1 to 5 feet below the surface in the summer.

Channels of this subclass with unaltered hydrograph are meandering due to low gradient and the fine textured substrates. Multiple channels may be present. Historically, beaver played a role in channel evolution.

Ecological significance of hydrodynamics:

The natural hydrograph of most riverine wetlands in this subclass has been altered by diversions and small dams. Additionally, wells remove subsurface water from the system. Channelization, placement of fill, and removal of vegetation have altered how water moves across the floodplain. Channel reaches isolated from the natural floodplain are subject to increased velocities and tend to incise due to the fine textured soils. Incision may result in permanent loss of shallow water tables, and streamside and wetland vegetation may be replaced with upland species.

Functions based on hydrodynamics:

The ability of the wetlands in this subclass to receive and store water make long-and short-term surface water storage, dissipation of energy, nutrient cycling, and retention of particulates important functions.

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Table of Functions and Variables for riverine subclass								
	Dynamic surface H2O storage	Long-term surface H2O storage	Dissipation of energy	Sediment and nutrient retention and removal	Maintain characteristic plant community	Maintain detrital biomass	Maintain habitat interspersion and connectivity	Maintain characteristic bird populations
V freq	X		X	X			X	
V inund	X							
V macro	X	X						
V xsec	X	X					X	
V rough	X		X					
V micro	X		X	X			X	
V redvel			X					
V litter				X		X		
V cwd						X		
V totcov				X			X	
V wetuse				X	X		X	X
V buff					X			X
V pdom					X			
V snags						X		
V strata								X
V mosiac								X
V birduse								X
V surwat		X						
V regen					X			
V ration					X			

Variables for assessment of wetland functions in riverine wetlands on the floodplains of low- to moderate gradient, 2nd or 3rd order streams on fine textured substrates

Assessment Area: IMPACT AREA- Farm 2531 Tract 2452, Canbou County Date: 4/15/13 and 5/20/13 site visits

Surveyor (s): Deb Kozlol Purpose: [✓] Conversion [ ] Mitigation

Model Variables	Indicators	Pre-	Post-	Comments and Notes
V freq: frequency of overbank flooding	Soil survey indicates flooding or ponding frequency is frequent or common (occurs, on the average, more than once in 2 years)	1.0	1.0	
	Soil survey indicates flooding or ponding frequency is occasional (occurs, on the average, once or less in 2 years)	0.5	0.5	
	Soil survey indicates flooding or ponding frequency is rare (unlikely but possible under unusual weather conditions)	0.1	0.1	MU 835A - flooding rare, ponding none. All other MU's none for both
	Soil survey indicates flooding or ponding frequency is none (flooding is not probable)	0.0	0.0	
V inund: average depth of inundation	Inundation > 6 inches	1.0	1.0	Irrig. water diverted
	Inundation between surface and 6 inches	0.5	0.5	Irrig. water diverted
	No indication of surface inundation	0.0	0.0	all water to ditches
V macro: macro-topographic relief	Average number of macrotopographic features (large-scale relief in the form of oxbows, meander scrolls, abandoned channels, and backswamps) per cross-section transect across the floodplain is ≥ 2	1.0	1.0	
	Average number of macrotopographic features per cross-section transect across the floodplain is ≥ 1 and < 2	0.5	0.5	
	Average number of macrotopographic features per cross-section transect across the floodplain is > 0 and < 1	0.1	0.1	
	There are no macrotopographic features	0.0	0.0	filled, land leveled
V xsec: ratio of floodplain width (including stream) to bankfull width	Ratio is ≥ 7	1.0	1.0	Varies, avg 14 (aerial photo interp)
	Ratio is ≥ 3 and < 7	0.5	0.5	
	Ratio is >1 and < 3	0.1	0.1	
	Ratio is 1	0.0	0.0	Actually 0

V rough: vegetation roughness	Woody vegetation (including coarse woody debris) comprises greater than 75% of total canopy cover.	1.0	1.0	
	Woody vegetation (including coarse woody debris) comprises between 25 and 75% of total canopy cover.	0.5	0.5	
	Woody vegetation (including coarse woody debris) comprises less than 25% of total canopy cover or dense herbaceous vegetation present.	0.1	0.1	
	No woody vegetation (including coarse woody debris) present.	0.0	0.0	Maintained as part of irrg delivery sys
V micro: structural roughness provided by microtopographic relief (micro topographic features may be present within macrotopographic features)	Greater than 50% of wetland with micro-topography or small depressions (10 ft or less in diameter) which store surface water. Swales or other areas with low topographic relief which allow water to be stored or shrub or ant hummocks which allow water to be stored in vegetated water tracks are present and capable of holding ponded water.	1.0	1.0	
	Wetland with lesser amounts (25-50%) of surface topography which stores surface water. Hummocking accelerated by trampling, water tracks unvegetated, and/or soils compacted.	0.5	0.5	Channel sinuous and meandering, but some altered (moved or straightened) for irrig. Affected grazing
	Wetland is flat and water essentially flows as a sheet.	0.0	0.0	No flow in channel- all water diverted to irrg ditches
V redvel: reduction in velocity	Sediment deposits, silt deposits on vegetation, buried rood collars, stacked wracks of debris, directionally bent vegetation present. Site well vegetated and erosion of soils not evident. Shrubs and trees with significant cover (>25%)	1.0	1.0	
	Sediment deposits, silt deposits on vegetation, buried rood collars, stacked wracks of debris, directionally bent vegetation present. Site well vegetated and erosion of soils not evident. Herbaceous species dominant.	0.5	0.5	

	Sediment scoured from site, coarse woody debris moved about (but not stacked). Some erosion of soil surface indicating less velocity reduction than above. Site well vegetated but a herbaceous layer may be absent due to shading and scouring.	0.1	0.1	
	Strong evidence of site degradation by channel scouring, exposed root masses, or exposure of bare soil. Site may be sparsely vegetated.	0.0	0.0	No channel, but will be planted to pasture grasses
V surwat: Presence of surface water	Frequent flooding or ponding (once or more every two years) as indicated on soil survey, drift lines, direct observation of flooding or ponding, gage data, annual understory absent and hydrologic soil group C or D (low permeability).	1.0	1.0	
	Flooding or ponding occurs less than once in two years as indicated by gage data, soil survey (occasional/common) and hydrologic soil group C or D.	0.5	0.5	
	Flooding or ponding rare (not possible except under unusual weather conditions). Hydrologic soil group not C or D.	0.1	0.1	Soil survey: pond-none. flood-rare, but hydro grp D
	No evidence or indicators of flooding or ponding or hydrologic soil group not C or D.	0.0	0.0	Hydro grp D, but all water diverted to irrig sys
V litter: herbaceous plant detritus	Litter with 50% to continuous cover. (H&C have microbial and include humus stratum, fine woody debris, and floating, submerged, and hervaceous emergents).	1.0	1.0	
	Litter with 10-50% cover	0.5	0.5	based on aerial photo interp and ref. site
	Litter cover present, but sparse (<10% cover)	0.1	0.1	
	No litter present	0.0	0.0	no channel. will be planted to pasture
V totcov: total cover herbaceous, shrub, and tree strata	The combination of herbaceous and shrub cover > 60%	1.0	1.0	no shrub or trees Post- expect pasture grass cover in yr
	The combination of herbaceous and shrub cover 20-60%	0.5	0.5	
	The combination of herbaceous and shrub cover < 20%	0.1	0.1	
	Plants absent or very sparse (<5% cover)	0.0	0.0	

V wet use: landuse within the wetland	Wetland is part of an acre or larger block of land which is non-fragmented and has few non-natural breaks. No evidence of agricultural or physical impacts.	1.0	1.0	
	No tillage in saturated wetlands. Outermost zone minimally impacted by light grazing. If some agricultural uses (e.g. haying, grazing) occur in the wetland and surrounding landscape, no compaction from equipment or evidence of trampling.	0.5	0.5	Grazed- trampling unknown Seldom tilled hayed and/or grazed
	Wetland receives conventional tillage; outermost zone is tilled or grazed.	0.1	0.1	
	Wetland severely disturbed by tillage, grazing, and/or water development. Restoration potential questionable and will require replanting and hydrologic restoration.	0.0	0.0	Filled and land leveled.
V pdom: number of dominant (> 5% cover) wetland plant species	Dominant wetland plant species is > 8	1.0	1.0	
	Dominant wetland plant species is 5-7	0.75	0.75	
	Dominant wetland plant species is 3-4	0.5	0.5	based on ref site
	Dominant wetland plant species is 1-2	0.25	0.25	
	Site devoid of vegetation	0.0	0.0	Planted pasture
V regen: herb and shrub species present as clonal shoots, seedlings, or saplings	Seedlings, saplings, and/or clonal shoots present. Reproduction dominated by native wetland plant species. Active channel bar formation suitable to the establishment of willow species.	1.0	1.0	
	Seedlings, saplings, and/or clonal shoots of both native and non-native species; Active channel bar formation, but bars being pioneered by weedy and/or non-native annuals.	0.5	0.5	
	Significant regeneration by non-native (and/or increase) species due to ground disturbing activities or isolation of floodplain due to channel entrenchment. Minimal channel bar development. Channel entrenched with steep cut banks.	0.1	0.1	Based on reference site
	No seedling/sapling and/or clonal shoots present.	0.0	0.0	

V buff: zone surrounding wetland that protects its structural and functional integrity	Upland buffer (of at least 50 ft) is in native vegetation with almost no disturbance.	1.0	1.0	
	Upland buffer (of at least 50 ft) is in native vegetation with light to moderate grazing.	0.5	0.5	
	Upland buffer (of at least 50 ft) receives conventional tillage or heavy grazing or is in non-native monoculture.	0.1	0.1	based on reference site. The planing to pasture
	Urban, semi-pervious, or impervious surfaces immediately adjacent to the site.	0.0	0.0	
V ratio: ratio of native and non-native plant species	3 of the 4 most abundant plant species in the wetland are native species and/or 74-100% of the species surveyed are native species.	1.0	1.0	based on reference site
	2 of the 4 most abundant plant species in the wetland are native species and/or 50-73% of the species surveyed are native species.	0.75	0.75	
	1 of the 4 most abundant plant species in the wetland is native species and/or 25-50% of the species surveyed are native species.	0.5	0.5	
	None of the 4 most abundant plant species in the wetland are native species; however, at least 1-25% of the species surveyed are native species.	0.1	0.1	
	Riparian corridor and floodplain unvegetated or dominated by planted or escaped cultivars	0.0	0.0	Will be planted to pasture grasses
V snags: number of standing dead trees	Standing dead trees 5 per acre or more.	1.0	1.0	
	Standing dead trees 3 to 5 per acre.	0.5	0.5	
	Standing dead trees 1 to 3 per acre.	0.1	0.1	
	No coarse woody debris	0.0	0.0	none based on aerials
V cwd: coarse woody debris	10 or more logs per acre greater than 6" diameter and longer than 4'.	1.0	1.0	
	5 - 9 logs per acre greater than 6" diameter and longer than 4'.	0.5	0.5	
	1 - 4 logs per acre greater than 6" diameter and longer than 4'.	0.1	0.1	
	No coarse woody debris	0.0	0.0	none based on aerials

V mosiac: number and proportion of cover types within the wetland	Wetland includes 3 or more vegetation classes based on Cowardin's classification or 3 or more cover types within a single vegetation class.	1.0	1.0	
	Wetland includes 2 or more vegetation classes based on Cowardin's classification or 2 or more cover types within a single vegetation class.	0.5	0.5	
	Vegetation absent, a monoculture, or essentially a single plant communtiy with little diversity.	0.1	0.1	Based on ref site-Cowardin PEM1. single plant community & cover type
	Vegetation as above with little possibility of restoration or consisting of planted cultivars.	0.0	0.0	Will be planted to pasture grasses
V strata: number and attributes of vertical strata of vegetation	3 or more vertical strata evenly spaced throughout the wetland.	1.0	1.0	
	2 vertical strata evenly spaced throughout the wetland.	0.5	0.5	
	1 vertical strata dominating wetland area.	0.1	0.1	
	No vertical strata.	0.0	0.0	
V birduse: number of species using the area within the wetland	Wetland used by 10 or more species of birds. Use nests, calls, tracks, feathers, skeletons, and field sightings.	1.0	1.0	
	Wetland used by 5 to 9 species of birds.	0.5	0.5	
	Wetlands used by less than 5 species of birds.	0.1	0.1	Est from ref site veg-cover
	No bird use evident.	0.0	0.0	will be non-wetland. Would expect casual use by geese, etc

DEFINITION OF FUNCTIONS AND FUNCTIONAL INDEX WORKSHEETS

HYDROLOGIC FUNCTIONS

Function: DYNAMIC SURFACE WATER STORAGE

Definition: Capacity of a wetland to detain moving water from overbank flow for a short duration when the stream flow is outside its channel; associated with moving water from overbank flow and/or upland surface water inputs by overland flow or tributaries.

Effects On-Site: Replenishes soil moisture; import/export of materials (i.e., sediments, nutrients, contaminants); import/export of plant propagates; provides conduit for aquatic organisms to access wetland for feeding, recruitment, etc.

Effects Off-Site: Reduces downstream peak discharge; delays downstream delivery of peak discharges; improves water quality through storage and retention of particles and solutes.

Condition	INDICES OF VARIABLES						
	V freq	V inund	V micro	V macro	V xsec	V rough	Index of Function = (V freq x V inund x V xsec x (V macro + V micro + V rough)/3)$^{1/4}$
Pre-project	0.1	0.5	0.5	0.5	1.0	0.0	0.3
Post-project	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Comments Pre-project spring-fed channel with high sinuosity meandered through irrigated and grazed pasture. Post-project channel filled and surrounding field land-leveled.							

HYDROLOGIC FUNCTIONS

Function: DISSIPATION OF ENERGY

Definition: Allocation of the energy of water to other forms as it moves through, into, and out of the wetland as a result of roughness associated with large woody debris, vegetation structure, micro- and macro-topography, and other obstructions.

Effects On-site: Increase deposition of suspended material; increases chemical transformations and processing due to longer residence time.

Effects Off site: Reduction in downstream peak discharge, delays delivery of peak discharges, improves water quality, and reduces erosion to river banks and floodplains.

Condition	INDICES OF VARIABLES				Index of Function = (V micro x V redvel x V freq x V rough)$^{1/4}$
	V micro	V redvel	V freq	V rough	
Pre-project	0.5	0.5	0.1	0.0	0.0
Post-project	0.0	0.0	0.1	0.0	0.0
Comments No channel, with all water diverted to irrigation ditches with increased delivery velocity					

HYDROLOGIC FUNCTIONS

Function: LONG-TERM SURFACE WATER STORAGE

Definition: Capacity of a wetland to temporarily store surface water for long durations. Source of water may be overbank flow, direct precipitation, or upland sources such as overland flow, channel flow, and subsurface flow. Storage is associated with standing water.

Effects On-site: Maintains hydric soils and wetland plant species. Supports utilization of wetland by aquatic species.

Effects Off site: Capture of ground and surface water to maintain delivery of water to downstream sources throughout the growing season. Stores and retains particulates to maintain water quality.

Condition	INDICES OF VARIABLES			Index of Function = (V surwat x (V xsec + V macro)/2)$^{1/3}$
	V sruwat	V xsec	V macro	
Pre-project	1.0	1.0	0.5	0.9
Post-project	0.0	0.0	0.0	0.0
Comments Pre-project channel slowed flow by meandering through pasture. Post-project no channel exists to store water; all is diverted to irrigation ditches.				

BIOGEOCHEMICAL FUNCTIONS

Function: SEDIMENT AND NUTRIENT RETENTION AND REMOVAL

Definition: The ability of the wetland to contribute to local or regional water quality by the removal of imported nutrients, contaminants, and other elements or compounds.

Effects On-site: Nutrients and contaminants in surface and/or ground water that come into contact with sediments and vegetation are either removed over the long term by sedimentation or are transformed into biogeochemically benign compounds. Sediment accumulation contributes to the nutrients capital of an ecosystem. Deposition increases surface elevation and changes topographic complexity. Organic matter may also be retained for decomposition, nutrient recycling, and detrital food web support.

Effects Off site: Constituents that undergo removal and concentration in the wetland, regardless of source, reduce downstream loading. Reduces stream sediment load and entrained woody debris that would otherwise be transported downstream.

Condition	INDICES OF VARIABLES					Index of Function = (V freq + V micro + V litter +V totcover + V wetuse)/5
	V freq	V micro	V litter	V totcover	V wetuse	
Pre-project	0.1	0.5	0.5	1.0	0.5	0.5
Post-project	0.1	0.0	0.0	1.0	0.0	0.22
Comments All waters in irrigation ditches which function to transport water, not to trap and filter sediment and nutrients.						

HABITAT FUNCTIONS

Function: MAINTAIN CHARACTERISTIC NATIVE PLANT COMMUNTIY

Definition: Species composition and physical characteristics of living plant biomass. The emphasis is on the location dynamics and structure of the plant community within the wetland complex. This is evidence by the dominant species of shrubs, seedlings, saplings, and ground cover, and by the physical characteristics and successional status of vegetation.

Effects On-site: Converts solar radiation and carbon dioxide into complex organic compounds that provide energy to drive food webs. Provides seeds and propagules for regeneration. Provides habitat diversity for nesting, resting, refuge, and escape cover for animals. Creates microclimatic conditions that support completion of life histories of plants and animals. Creates roughness that reduces velocity of flood waters. Provides organic matter for soil development and soil related nutrient cycling processes. Created both long-term and short-term habitat for resident or migratory animals.

Effects Off site: Provides a source of seeds and propagules to maintain species composition and/or structure of adjacent wetlands and supplies propagules for colonization of near-by degraded systems. Provides food and cover for animals from adjacent ecosystems. Provides corridors (migratory pathways) between habitats, enhances species diversity and ecosystem stability, and provides habitat and food for migratory and resident animals. Supports primary and secondary production in associated aquatic habitats. Contributes leaf litter and coarse woody debris habitat for animals in associated aquatic habitats.

Condition	INDICES OF VARIABLES					Index of Function = {(V pdomin + V regen + V buff +V wetuse)/4 x (V ratio)}$^{1/2}$
	V pdomin	V regen	V buff	V wetuse	V ratio	
Pre-project	.5	0.1	0.1	0.5	1.0	0.5
Post-project	0.0	0.0	0.1	0.0	0.0	0.0
Comments Even if pasture grasses are established, post-project index score will remain 0.0.						

HABITAT FUNCTIONS

Function: MAINTAIN DETRITAL BIOMASS

Definition: The production, accumulation, and dispersal of dead plant biomass of all sizes. Sources may be on-site or upslope and up-gradient. Emphasis is on the amount and distribution of standing and fallen woody debris.

Effects On-site: Provides the primary resources for supporting detrital based food chains, which support the major nutrient-related processes (cycling, export, import) within wetlands. Provides important resting, feeding, hiding, and nesting sites for animals of higher trophic levels. Provides surface roughness that decreases velocity of floodwaters. Retains, detains, and provides opportunities for *in situ* processing of particulates. Primarily responsible for organic composition of soil.

Effects Off site: Provides sources of dissolved and particulate organic matter and nutrients for downstream ecosystems. Contributes to reduction in downstream water quality through particulate retention and detention.

Condition	INDICES OF VARIABLES			Index of Function = (V snag + V cwd + V litter)$^{1/3}$
	V snag	V cwd	V litter	
Pre-project	0.0	0.0	0.5	0.2
Post-project	0.0	0.0	0.0	0.0
Comments	Pre-project condition was herbaceous riparian wetland no wetland post project			

HABITAT FUNCTIONS

Function: MAINTAIN HABITAT INTERSPERSION AND CONNECTIVITY

Definition: The capacity of a wetland to permit aquatic organisms to enter and leave the wetland via permanent or ephemeral surface channels, overbank flow, or unconfined hyporheic gravel aquifers. The capacity of a wetland to permit access of terrestrial or aerial organisms to contiguous areas of food and cover.

Effects On-site: Provides habitat diversity. Contributes to secondary production and complex trophic interactions. Provides access to and from wetland for reproduction, feeding, rearing, and cover. Contributes to completion of life cycles and dispersal between habitats.

Effects Off site: Provides corridors for wide-ranging or migratory species. Provides refugia for plants and animals. Provides conduits for dispersal of plants and animals to other areas.

Condition	INDICES OF VARIABLES					Index of Function = (V freq + V xsec + V micro +V totcov + V wetuse)$^{1/5}$
	V freq	V xsec	V micro	V totcov	V wetuse	
Pre-project	0 1	1 0	0 5	1 0	0 5	0 6
Post-project	0 1	0 0	0 0	1 0	0 0	0 2
Comments Some habitat provided by permanent pasture, but less than that of the farmed wetland pasture						

HABITAT FUNCTIONS

Function: MAINTAIN CHARACTERISTIC BIRD POPULATIONS

Definition: The abundance and species richness of birds is related to habitat complexity because birds have evolved to fill most available terrestrial niches. The partition habitats temporally (day versus night feeders), spatially (ground feeders, mid- and top-canopy feeders), and trophically (frugivores, insectivores, and piscivores). Birds are sensitive to alterations in the structure and function of wetland ecosystems. Species richness and relative abundance can be measured. Bird richness increases with: vegetation/open water interspersion, increased layers of vegetation, and complexes of small and diverse wetlands.

Effects On-site: Maintain habitat for birds that has characteristic species composition, abundance, and structure containing diversity, nesting, resting, refuge, and escape cover.

Effects Off site: Maintain corridors between habitat islands and landscape biodiversity.

Condition	INDICES OF VARIABLES					Index of Function = (V strata + V mosaic + V birduse +V buff + V wetuse)$^{1/5}$
	V strata	V mosaic	V birduse	V buff	V wetuse	
Pre-project	0 1	0 1	0 1	0 1	0 5	0 2
Post-project	0 0	0 0	0 0	0 1	0 0	0 02
Comments Some habitat provided by permanent pasture, but less than that of the (pre-project) farmed wetland pasture						

Variables for assessment of wetland functions in riverine wetlands on the floodplains of low- to moderate gradient, 2nd or 3rd order streams on fine textured substrates

Assessment Area: MITIGATION AREA- Farm 2531 Tract 2452, Caribou County Date: 4/15/13 and 5/20/13 site visits

Surveyor (s): Deb Koziol Purpose: ☐ Conversion ☑ Mitigation

Model Variables	Indicators	Pre-	Post-	Comments and Notes
V freq: frequency of overbank flooding	Soil survey indicates flooding or ponding frequency is frequent or common (occurs, on the average, more than once in 2 years)	1.0	1.0	
	Soil survey indicates flooding or ponding frequency is occasional (occurs, on the average, once or less in 2 years)	0.5	0.5	
	Soil survey indicates flooding or ponding frequency is rare (unlikely but possible under unusual weather conditions)	0.1	0.1	MU 835A - flooding rare, ponding none
	Soil survey indicates flooding or ponding frequency is none (flooding is not probable)	0.0	0.0	
V inund: average depth of inundation	Inundation > 6 inches	1.0	1.0	
	Inundation between surface and 6 inches	0.5	0.5	will vary
	No indication of surface inundation	0.0	0.0	
V macro: macro-topographic relief	Average number of macrotopographic features (large-scale relief in the form of oxbows, meander scrolls, abandoned channels, and backswamps) per cross-section transect across the floodplain is ≥ 2	1.0	1.0	
	Average number of macrotopographic features per cross-section transect across the floodplain is ≥ 1 and < 2	0.5	0.5	
	Average number of macrotopographic features per cross-section transect across the floodplain is > 0 and < 1	0.1	0.1	
	There are no macrotopographic features	0.0	0.0	
V xsec: ratio of floodplain width (including stream) to bankfull width	Ratio is ≥ 7	1.0	1.0	
	Ratio is ≥ 3 and < 7	0.5	0.5	
	Ratio is >1 and < 3	0.1	0.1	
	Ratio is 1	0.0	0.0	

V rough: vegetation roughness	Woody vegetation (including coarse woody debris) comprises greater than 75% of total canopy cover.	1.0	1.0	
	Woody vegetation (including coarse woody debris) comprises between 25 and 75% of total canopy cover.	0.5	0.5	
	Woody vegetation (including coarse woody debris) comprises less than 25% of total canopy cover or dense herbaceous vegetation present.	0.1	0.1	primarily dense herbaceous to avoid predator perches/traps for mig birds foraging-nesting
	No woody vegetation (including coarse woody debris) present.	0.0	0.0	
V micro: structural roughness provided by microtopographic relief (micro topographic features may be present within macrotopographic features)	Greater than 50% of wetland with micro-topography or small depressions (10 ft or less in diameter) which store surface water. Swales or other areas with low topographic relief which allow water to be stored or shrub or ant hummocks which allow water to be stored in vegetated water tracks are present and capable of holding ponded water.	1.0	1.0	
	Wetland with lesser amounts (25-50%) of surface topography which stores surface water. Hummocking accelerated by trampling, water tracks unvegetated, and/or soils compacted.	0.5	0.5	within and adjecent to mitigated area
	Wetland is flat and water essentially flows as a sheet.	0.0	0.0	
V redvel: reduction in velocity	Sediment deposits, silt deposits on vegetation, buried rood collars, stacked wracks of debris, directionally bent vegetation present. Site well vegetated and erosion of soils not evident. Shrubs and trees with significant cover (>25%)	1.0	1.0	
	Sediment deposits, silt deposits on vegetation, buried rood collars, stacked wracks of debris, directionally bent vegetation present. Site well vegetated and erosion of soils not evident. Herbaceous species dominant.	0.5	0.5	

	Sediment scoured from site, coarse woody debris moved about (but not stacked). Some erosion of soil surface indicating less velocity reduction than above. Site well vegetated but a herbaceous layer may be absent due to shading and scouring.	0.1	0.1	
	Strong evidence of site degradation by channel scouring, exposed root masses, or exposure of bare soil. Site may be sparsely vegetated.	0.0	0.0	
V surwat: Presence of surface water	Frequent flooding or ponding (once or more every two years) as indicated on soil survey, drift lines, direct observation of flooding or ponding, gage data, annual understory absent and hydrologic soil group C or D (low permeability).	1.0	1.0	expect annual ponding and flooding in milligated site and enhancing adjacent wetlands hydro grp D
	Flooding or ponding occurs less than once in two years as indicated by gage data, soil survey (occasional/common) and hydrologic soil group C or D.	0.5	0.5	
	Flooding or ponding rare (not possible except under unusual weather conditions). Hydrologic soil group not C or D.	0.1	0.1	
	No evidence or indicators of flooding or ponding or hydrologic soil group not C or D.	0.0	0.0	
V litter: herbaceous plant detritus	Litter with 50% to continuous cover. (H&C have microbial and include humus stratum, fine woody debris, and floating, submerged, and hervaceous emergents).	1.0	1.0	
	Litter with 10-50% cover	0.5	0.5	based on aerial photo interp of adj wetlands
	Litter cover present, but sparse (<10% cover)	0.1	0.1	
	No litter present	0.0	0.0	
V totcov: total cover herbaceous, shrub, and tree strata	The combination of herbaceous and shrub cover > 60%	1.0	1.0	primarily dense herbaceous to avoid predator perches/traps for mig birds foraging + nesting
	The combination of herbaceous and shrub cover 20-60%	0.5	0.5	Will connect to adjacent and downstream
	The combination of herbaceous and shrub cover < 20%	0.1	0.1	
	Plants absent or very sparse (<5% cover)	0.0	0.0	

V wet use: landuse within the wetland	Wetland is part of an acre or larger block of land which is non-fragmented and has few non-natural breaks. No evidence of agricultural or physical impacts.	1.0	1.0	Will connect to adjacent and downstream wetlands (FWP). No grazing will occur on mitigation site and FWP
	No tillage in saturated wetlands. Outermost zone minimally impacted by light grazing. If some agricultural uses (e.g. haying, grazing) occur in the wetland and surrounding landscape, no compaction from equipment or evidence of trampling.	0.5	0.5	
	Wetland receives conventional tillage; outermost zone is tilled or grazed.	0.1	0.1	
	Wetland severely disturbed by tillage, grazing, and/or water development. Restoration potential questionable and will require replanting and hydrologic restoration.	0.0	0.0	
V pdom: number of dominant (> 5% cover) wetland plant species	Dominant wetland plant species is > 8	1.0	1.0	
	Dominant wetland plant species is 5-7	0.75	0.75	
	Dominant wetland plant species is 3-4	0.5	0.5	based on ref site
	Dominant wetland plant species is 1-2	0.25	0.25	
	Site devoid of vegetation	0.0	0.0	
V regen: herb and shrub species present as clonal shoots, seedlings, or saplings	Seedlings, saplings, and/or clonal shoots present. Reproduction dominated by native wetland plant species. Active channel bar formation suitable to the establishment of willow species.	1.0	1.0	
	Seedlings, saplings, and/or clonal shoots of both native and non-native species; Active channel bar formation, but bars being pioneered by weedy and/or non-native annuals.	0.5	0.5	Veg to natives with mat/plug planting, but no bars
	Significant regeneration by non-native (and/or increase) species due to ground disturbing activities or isolation of floodplain due to channel entrenchment. Minimal channel bar development. Channel entrenched with steep cut banks.	0.1	0.1	
	No seedling/sapling and/or clonal shoots present.	0.0	0.0	

V buff: zone surrounding wetland that protects its structural and functional integrity	Upland buffer (of at least 50 ft) is in native vegetation with almost no disturbance.	1.0	1.0	
	Upland buffer (of at least 50 ft) is in native vegetation with light to moderate grazing.	0.5	0.5	
	Upland buffer (of at least 50 ft) receives conventional tillage or heavy grazing or is in non-native monoculture.	0.1	0.1	Adjacent uplands planted to pasture grasses and grazed
	Urban, semi-pervious, or impervious surfaces immediately adjacent to the site.	0.0	0.0	
V ratio: ratio of native and non-native plant species	3 of the 4 most abundant plant species in the wetland are native species and/or 74-100% of the species surveyed are native species.	1.0	1.0	based on reference site veg (stock)
	2 of the 4 most abundant plant species in the wetland are native species and/or 50-73% of the species surveyed are native species.	0.75	0.75	
	1 of the 4 most abundant plant species in the wetland is native species and/or 25-50% of the species surveyed are native species.	0.5	0.5	
	None of the 4 most abundant plant species in the wetland are native species; however, at least 1-25% of the species surveyed are native species.	0.1	0.1	
	Riparian corridor and floodplain unvegetated or dominated by planted or escaped cultivars	0.0	0.0	
V snags: number of standing dead trees	Standing dead trees 5 per acre or more.	1.0	1.0	
	Standing dead trees 3 to 5 per acre.	0.5	0.5	
	Standing dead trees 1 to 3 per acre.	0.1	0.1	
	No coarse woody debris	0.0	0.0	
V cwd: coarse woody debris	10 or more logs per acre greater than 6" diameter and longer than 4'.	1.0	1.0	
	5 - 9 logs per acre greater than 6" diameter and longer than 4'.	0.5	0.5	
	1 - 4 logs per acre greater than 6" diameter and longer than 4'.	0.1	0.1	
	No coarse woody debris	0.0	0.0	

V mosiac: number and proportion of cover types within the wetland	Wetland includes 3 or more vegetation classes based on Cowardin's classification or 3 or more cover types within a single vegetation class.	1.0	1.0	
	Wetland includes 2 or more vegetation classes based on Cowardin's classification or 2 or more cover types within a single vegetation class.	0.5	0.5	
	Vegetation absent, a monoculture, or essentially a single plant communtiy with little diversity.	0.1	0.1	Based on ref site-Cowardin PEM1. single plant community & cover type
	Vegetation as above with little possibility of restoration or consisting of planted cultivars.	0.0	0.0	
V strata: number and attributes of vertical strata of vegetation	3 or more vertical strata evenly spaced throughout the wetland.	1.0	1.0	
	2 vertical strata evenly spaced throughout the wetland.	0.5	0.5	
	1 vertical strata dominating wetland area.	0.1	0.1	
	No vertical strata.	0.0	0.0	
V birduse: number of species using the area within the wetland	Wetland used by 10 or more species of birds. Use nests, calls, tracks, feathers, skeletons, and field sightings.	1.0	1.0	
	Wetland used by 5 to 9 species of birds.	0.5	0.5	
	Wetlands used by less than 5 species of birds.	0.1	0.1	Est from ref site veg cover
	No bird use evident.	0.0	0.0	

DEFINITION OF FUNCTIONS AND FUNCTIONAL INDEX WORKSHEETS

HYDROLOGIC FUNCTIONS

Function: DYNAMIC SURFACE WATER STORAGE

Definition: Capacity of a wetland to detain moving water from overbank flow for a short duration when the stream flow is outside its channel; associated with moving water from overbank flow and/or upland surface water inputs by overland flow or tributaries.

Effects On-Site: Replenishes soil moisture; import/export of materials (i.e., sediments, nutrients, contaminants); import/export of plant propagates; provides conduit for aquatic organisms to access wetland for feeding, recruitment, etc.

Effects Off-Site: Reduces downstream peak discharge; delays downstream delivery of peak discharges; improves water quality through storage and retention of particles and solutes.

Condition	INDICES OF VARIABLES						Index of Function = (V freq x V inund x V xsec x (V macro + V micro + V rough)/3)$^{1/4}$
	V freq	V inund	V micro	V macro	V xsec	V rough	
Pre-project							
Post-project	0.1	0.5	0.5	0.5	0.1	0.1	0.3
Comments Pre-project spring-fed channel with high sinuosity meandered through irrigated and grazed pasture. Post-project channel filled and surrounding field land-leveled.							

HYDROLOGIC FUNCTIONS

Function: DISSIPATION OF ENERGY

Definition: Allocation of the energy of water to other forms as it moves through, into, and out of the wetland as a result of roughness associated with large woody debris, vegetation structure, micro- and macro-topography, and other obstructions.

Effects On-site: Increase deposition of suspended material; increases chemical transformations and processing due to longer residence time.

Effects Off site: Reduction in downstream peak discharge, delays delivery of peak discharges, improves water quality, and reduces erosion to river banks and floodplains.

Condition	INDICES OF VARIABLES				Index of Function = (V micro x V redvel x V freq x V rough)$^{1/4}$
	V micro	V redvel	V freq	V rough	
Pre-project					
Post-project	0.5	0.5	0.1	0.1	0.22
Comments No channel, with all water diverted to irrigation ditches with increased delivery velocity					

HYDROLOGIC FUNCTIONS

Function: LONG-TERM SURFACE WATER STORAGE

Definition: Capacity of a wetland to temporarily store surface water for long durations. Source of water may be overbank flow, direct precipitation, or upland sources such as overland flow, channel flow, and subsurface flow. Storage is associated with standing water.

Effects On-site: Maintains hydric soils and wetland plant species. Supports utilization of wetland by aquatic species.

Effects Off site: Capture of ground and surface water to maintain delivery of water to downstream sources throughout the growing season. Stores and retains particulates to maintain water quality.

Condition	INDICES OF VARIABLES			Index of Function = (V surwat x (V xsec + V macro)/2)$^{1/2}$
	V sruwat	V xsec	V macro	
Pre-project				
Post-project	10	01	05	09
Comments Pre-project channel slowed flow by meandering through pasture. Post-project no channel exists to store water; all is diverted to irrigation ditches.				

BIOGEOCHEMICAL FUNCTIONS

Function: SEDIMENT AND NUTRIENT RETENTION AND REMOVAL

Definition: The ability of the wetland to contribute to local or regional water quality by the removal of imported nutrients, contaminants, and other elements or compounds.

Effects On-site: Nutrients and contaminants in surface and/or ground water that come into contact with sediments and vegetation are either removed over the long term by sedimentation or are transformed into biogeochemically benign compounds. Sediment accumulation contributes to the nutrients capital of an ecosystem. Deposition increases surface elevation and changes topographic complexity. Organic matter may also be retained for decomposition, nutrient recycling, and detrital food web support.

Effects Off site: Constituents that undergo removal and concentration in the wetland, regardless of source, reduce downstream loading. Reduces stream sediment load and entrained woody debris that would otherwise be transported downstream.

Condition	INDICES OF VARIABLES					Index of Function = (V freq + V micro + V litter +V totcover + V wetuse)/5
	V freq	V micro	V litter	V totcover	V wetuse	
Pre-project						
Post-project	01	05	05	10	10	062
Comments All waters in irrigation ditches which function to transport water, not to trap and filter sediment and nutrients.						

HABITAT FUNCTIONS

Function: MAINTAIN CHARACTERISTIC NATIVE PLANT COMMUNTIY

Definition: Species composition and physical characteristics of living plant biomass. The emphasis is on the location dynamics and structure of the plant community within the wetland complex. This is evidence by the dominant species of shrubs, seedlings, saplings, and ground cover, and by the physical characteristics and successional status of vegetation.

Effects On-site: Converts solar radiation and carbon dioxide into complex organic compounds that provide energy to drive food webs. Provides seeds and propagules for regeneration. Provides habitat diversity for nesting, resting, refuge, and escape cover for animals. Creates microclimatic conditions that support completion of life histories of plants and animals. Creates roughness that reduces velocity of flood waters. Provides organic matter for soil development and soil related nutrient cycling processes. Created both long-term and short-term habitat for resident or migratory animals.

Effects Off site: Provides a source of seeds and propagules to maintain species composition and/or structure of adjacent wetlands and supplies propagules for colonization of near-by degraded systems. Provides food and cover for animals from adjacent ecosystems. Provides corridors (migratory pathways) between habitats, enhances species diversity and ecosystem stability, and provides habitat and food for migratory and resident animals. Supports primary and secondary production in associated aquatic habitats. Contributes leaf litter and coarse woody debris habitat for animals in associated aquatic habitats.

Condition	INDICES OF VARIABLES					Index of Function = ((V pdomin + V regen + V buff +V wetuse)/4 x (V ratio))$^{1/2}$
	V pdom	V regen	V buff	V wetuse	V ratio	
Pre-project						
Post-project	0 5	0 5	0 1	1 0	1 0	0 72
Comments Even if pasture grasses are established, post-project index score will remain 0.0.						

HABITAT FUNCTIONS

Function: MAINTAIN DETRITAL BIOMASS

Definition: The production, accumulation, and dispersal of dead plant biomass of all sizes. Sources may be on-site or upslope and up-gradient. Emphasis is on the amount and distribution of standing and fallen woody debris.

Effects On-site: Provides the primary resources for supporting detrital based food chains, which support the major nutrient-related processes (cycling, export, import) within wetlands. Provides important resting, feeding, hiding, and nesting sites for animals of higher trophic levels. Provides surface roughness that decreases velocity of floodwaters. Retains, detains, and provides opportunities for *in situ* processing of particulates. Primarily responsible for organic composition of soil.

Effects Off site: Provides sources of dissolved and particulate organic matter and nutrients for downstream ecosystems. Contributes to reduction in downstream water quality through particulate retention and detention.

Condition	INDICES OF VARIABLES			Index of Function = (V snag + V cwd + V litter)/3
	V snag	V cwd	V litter	
Pre-project				
Post-project	0.0	0.0	0.5	0.16
Comments	Pre-project condition was herbaceous riparian wetland. no wetland post project			

HABITAT FUNCTIONS

Function: MAINTAIN HABITAT INTERSPERSION AND CONNECTIVITY

Definition: The capacity of a wetland to permit aquatic organisms to enter and leave the wetland via permanent or ephemeral surface channels, overbank flow, or unconfined hyporheic gravel aquifers. The capacity of a wetland to permit access of terrestrial or aerial organisms to contiguous areas of food and cover.

Effects On-site: Provides habitat diversity. Contributes to secondary production and complex trophic interactions. Provides access to and from wetland for reproduction, feeding, rearing, and cover. Contributes to completion of life cycles and dispersal between habitats.

Effects Off site: Provides corridors for wide-ranging or migratory species. Provides refugia for plants and animals. Provides conduits for dispersal of plants and animals to other areas.

Condition	INDICES OF VARIABLES					Index of Function = (V freq + V xsec + V micro +V totcov + V wetuse)/5
	V freq	V xsec	V micro	V totcov	V wetuse	
Pre-project						
Post-project	0 1	0 1	0 5	1 0	1 0	0 54
Comments Some habitat provided by permanent pasture, but less than that of the farmed wetland pasture						

HABITAT FUNCTIONS

Function: MAINTAIN CHARACTERISTIC BIRD POPULATIONS

Definition: The abundance and species richness of birds is related to habitat complexity because birds have evolved to fill most available terrestrial niches. The partition habitats temporally (day versus night feeders), spatially (ground feeders, mid- and top-canopy feeders), and trophically (frugivores, insectivores, and piscivores). Birds are sensitive to alterations in the structure and function of wetland ecosystems. Species richness and relative abundance can be measured. Bird richness increases with: vegetation/open water interspersion, increased layers of vegetation, and complexes of small and diverse wetlands.

Effects On-site: Maintain habitat for birds that has characteristic species composition, abundance, and structure containing diversity, nesting, resting, refuge, and escape cover.

Effects Off site: Maintain corridors between habitat islands and landscape biodiversity.

Condition	INDICES OF VARIABLES					Index of Function = (V strata + V mosaic + V birduse +V buff + V wetuse)/5
	V strata	V mosaic	V birduse	V buff	V wetuse	
Pre-project						
Post-project	0 1	0 1	0 1	0 1	1 0	0 28
Comments Some habitat provided by permanent pasture, but less than that of the (pre-project) farmed wetland pasture						

Worksheet for Calculating Mitigation Acres Required

Assessment area: Farm 2531 Tract 2452 Date: 5/22/13 Surveyor (s) Deb Koziol

Function	Loss due to conversion			~~Mitigation~~ site: before construction/ restoration/ manipulation				Mitigation site: after construction/ restoration/ manipulation				(12) Uncertainty Factor (must be ≥ 1)	(13) Final Acreage
	(1) FCI	(2) Area	(3) FCU	(4) Initial FCI	(5) Area	(6) FCU	(7) Target FCU = (Col. 3 + Col. 6)	(8) Planned FCI	(9) Area	(10) FCU	(11) FCU Gained = (Col. 10 - Col. 7)		2.8
Dynamic surface water storage	0.3	2.8	0.8				0.8	0.3	2.8	0.8	0.0		
Long term surface water storage	0.9	2.8	2.5				2.5	0.9	2.8	2.5	0		
Dissipation of energy	0.0	2.8	0.0				0.0	0.2	2.8	0.6	0.6		
Sediment and nutrient retention and removal	0.3	2.8	0.8				0.8	0.6	2.8	1.7	0.9		
Maintain characteristic plant communtiy	0.5	2.8	1.4				1.4	0.7	2.8	2.0	0.6		
Maintain detrital biomass	0.2	2.8	0.6				0.6	0.2	2.8	0.6	0.0		
Maintain habitat interspersion and connectivity	0.4	2.8	1.1				1.1	0.5	2.8	1.4	0.3		
Maintain characteristic bird populations	0.2	2.8	0.6				0.6	0.3	2.8	0.8	0.2		

CHART NOTES

FCI = Functional capacity Index; FCU = Functional Capacity Units

Column 1: FCI after conversion = (Pre-project FCI - Post-project FCI)

Columns 4,8: FCI for mitigation site for pre- and post-mitigation. For column 4, FCI = 0 if creation site.

Columns 2,5,9: Area of the wetland or mitigation site being assessed.

Column 7: Target FCU = Column 3 + Column 6; this is your project goal to create or restore a wetland equal to this FCU

Column 11: Column 10 - Column 7; if this = 0 then functions are replaced; if > 0 then functions are exceeded; if < 0 then functions are not replaced and mitigation site is not adequate. If mitigation is inadequate choose another site (or additional acres) and begin calculation in column 4.

Column 12: Option to include Uncertainty factor (≥ 1) to account for lag time and scientific uncertainty.

Column 13: Final mitigation acreage = Mitigation Area X Uncertainty Factor (Column 9 x Column 12).