

III. Field Guide for Application of HGM

A PROCEDURE FOR ASSESSMENT OF NORTHERN PRAIRIE POTHoles, LOW PERMEABILITY SUBSTRATE, TEMPORARY AND SEASONAL, DOMINANTLY RECHARGE, DEPRESSIONS

A. INTRODUCTION: This guide is meant to be user friendly and to be taken to the field to assess the functional capacity of Northern Prairie Potholes, Low Permeability Substrate, Temporary and Seasonal, Dominantly Recharge, Depressions. Information recorded can be used as the basis for impact assessment and mitigation requirements associated with the project loss of a wetland.

Before using this field guide a person should become familiar with the Guidebook for this subclass of wetlands. Reviewing the guidebook and the Hydrogeomorphic Subclass placement will help determine if this model is applicable to the wetland to be assessed. The following sections in this Field Guide are: Tools for Functional Assessment, Preferred Order of Assessing Variables and Detailed Instructions on Measurements of Indicators, and Data Recording Procedures.

Prior to proceeding with the office review of the functional assessment an initial review of the project or site proposal needs to be done to fully understand the reason for doing the functional assessment and the scope of assessment needed.

B. GUIDELINES FOR ASSESSING WETLAND FUNCTIONS

OFFICE PREPARATION/REVIEW:

1. Review the tools list and assure needed tools are available to do the assessment.
2. Prior to performing the office review, it is important to collect the documents and information that is relevant to the site. Pay particular attention to the land use of the assessment site noting any differences in land use within or surrounding the wetland.
3. Gather and record information on variables V_{out} , V_{pit} , V_{source} , V_{subout} , $V_{wetarea}$, $V_{proximity}$ and V_{wden} in the office. Prepare the tools needed for the field assessment.
4. Take recorded comments and data to the field with you.

FIELD ASSESSMENT:

1. HGM Assessment Bounding – In field:
 - a. Separate upland from wetland
 - b. Separate HGM wetland subclasses on the project site into Wetland Assessment Areas (WAA)
 - c. Separate disturbance regimes
2. Walk the perimeter of the wetland
 - a. Look for buffer, outlet, source intercept and sediment delivery.
 - b. Look for representative areas to assess variables in temporary and seasonal zones.
 - c. Visually determine zones and confirm where plant, soils and hydrology data is gathered. Verify bounding of Wetland Assessment Area (WAA).

Guide to help in estimating % area of circular zones:

| | | | | | | | | | | |
|-----------------------------------|--|-----|-----|-----|-----|-----|-----|-----|-----|------|
| % Radial distance(center to edge) | 10% | 20% | 30% | 40% | 50% | 60% | 70% | 80% | 90% | 100% |
| center point→ | -----)-----)-----)-----)-----)-----)-----)-----)-----)-----) | | | | | | | | | |
| % Area within that radius | 1% | 4% | 9% | 16% | 25% | 36% | 49% | 64% | 81% | 100% |

3. Follow the steps for on-site measurement of indicators in the field as explained in the Preferred Order of Assessing Variables and the Detailed Instructions for Determination and Measurement of Indicators.
4. Score the variable index scores on worksheet Table C-1 along with measurements and comments.
5. Calculate Functional Capacity Index's (FCI's) using Table C-2 or computer program.
6. Check to insure you have all needed field data collected and recorded. Review the data collected to see if it makes sense and recheck data appearing questionable.

C. TOOLS FOR FUNCTIONAL ASSESSMENT

OFFICE TOOLS:

- USGS QUAD MAPS
- NWI WETLAND MAPS
- JURISDICTIONAL DELINEATION DOCUMENTS
- PHOTO MAPS OF WETLAND AND THE AREA WITHIN ONE MILE RADIUS
- METHOD/TOOLS FOR ACREAGE CALCULATION
- SOIL SURVEY
- MAP SCALE
- DUGOUT VOLUME TABLES

FIELD TOOLS:

- NORTHERN PRAIRIE FUNCTIONAL ASSESSMENT MODEL
- PHOTO MAP OF WETLAND AND LANDSCAPE
- BASIC SURVEY EQUIPMENT; HAND, ABNEY OR TRANSIT LEVEL, ROD, SURVEY OR STADIA
- PLANT IDENTIFICATION HANDBOOKS
- CAMERA, FILM, TRIPOD, ETC.
- SPADE, SOIL PROBE OR AUGER FOR SOILS WORK
- HAND LENS
- CLIPBOARD, PAPER, PEN-PENCIL
- FIELD RECORDING SHEETS
- SOIL SURVEY
- SOILS FIELD KIT - SPATULA, ACID, MUNSELL COLOR BOOK, TAPE MEASURE, WATER BOTTLE, HYDRIC SOIL INDICATORS BOOK,
- FLAGS - VARIOUS COLORS OR LATH AND FLAGGING TAPE
- MARKING PENS (TO WRITE ON FLAGS)
- 100 FOOT CHAIN
- ACREAGE SCALE/RULER
- CALCULATOR WITH SQUARE ROOT CAPABILITY
- TILE PROBE
- TOOLS FOR STEM DENSITY COUNT IN THE BUFFER
- MEASUREING WHEEL

OTHER CONSIDERATIONS:

**NOTIFY OWNER/OPERATOR
INSECT REPELLENT
SUN SCREEN
WADERS, HIP-CHEST-IRRIGATION
BINOCULARS
GENERAL LAND USE KNOWLEDGE OF THE BASIN
M.A.R.S.H. PLANT ID PROGRAM IN A LAPTOP
GPS PLGR
BAGS, CARDBOARD AND NEWSPAPER FOR PLANT COLLECTIONS**

D. PREFERRED ORDER OF ASSESSING VARIABLES

1. Vwden

When approaching the wetland(s), examine area within 1320 feet (1/4 mile) radius. Verify location of wetlands found in office review. Check wetland basins noted as suspect during the office review. Formulate plans for an on-site check if needed (for larger wetlands a radius of 2980 feet (640 acres) or 1 mile radius may be needed to accurately assess the Vwden variable).

2. Vwetarea

The measurement of this variable is the ratio of temporary and seasonal wetlands to semi-permanent wetlands or wetter within a 1 mile radius of the assessed wetland's center point. Until a map depicting this variable is made for rapid assessment, the duck breeding pairs map is an acceptable surrogate and can be substituted for the variable Vwetarea in the Habitat function. (Large project type activity may require the measurement of the ratio at the 1 mile radius.)

3. Vproximity

The measurement of this variable is the mean distance in feet from the assessed wetland to the nearest 5 wetlands in any direction, measured edge to edge. When verifying office data for number of basins, note any changes that affect the measurement of the nearest 5 wetlands. If changes are made based on field observation, make adjustments to measurement of this variable.

4. Vsource

Review USGS quad sheets of the area, noting the watershed drawn out in the office review. Observe and note drainage work (ditches, subsurface drains) in and outside of the wetland and within the catchment area of the wetland. Eyeball the subject wetland and note land use and any alterations such as drains or tile, watershed size and any source impacts such as roads, irrigation, etc. Also note any indicators of high water marks such as trash lines, detritus hanging in standing vegetation, sediment stains, etc.

5. Vupuse

Observe and record dominant land use(s) from the wetland edge to the catchment perimeter, and the proportion of each land use as % of total catchment area.

6. Vsubout

Observe and verify office review of drainage work (ditches, subsurface drains) in and outside of the wetland and within 200 feet of the wetland. Record any length, width or other measurements you feel are appropriate. Using survey equipment, measure the following: Distance to or spacing of tile drain or ditch and depth of tile drain or ditch. Verify tile size.

7. Vbdensity

Grassland buffer density is observed on the upland within 50 feet of the wetland. The measurement of this variable is stem density. Secondary measurements are

Percent Ground Cover and Visual Obstruction Measurement (VOR). Until reference standards are assigned indicators will be used.

8. Vbwidth

Use a measuring wheel, box tape, or pacing to measure the width across the most representative span of existing buffer. Exclude segment(s) with no buffer when considering the average width.

9. Vbcontinuity

Visually estimate the % of the wetland perimeter that has a buffer. Then look at an aerial photo of the wetland to check if the estimate appears to be reasonable.

10. Vpore

Using soil survey tools, locate wetland edge and wetland zones. Within the wetland observe soil structure, presence of an Ap horizon, evidence of tillage, evidence of roots growing horizontally, presence of a plow pan, soil pores, and rupture resistance.

11. Vsom

Within the wetland, observe hydric soil indicators, soil color, evidence and frequency of cropping and degree of drainage.

12. Vout

Using survey equipment, establish the following elevations: Wetland bottom, natural threshold outlet, constructed outlet and hydric line. Observe and verify from office review drains in and outside of the wetland. Record any length, width or other measurements you feel are appropriate.

13. Vpit

Determine volume of the pit in the wetland and compare it to the volume of the wetland.

14. Vpcover

Survey plant cover in each wetland zone.

15. Vpratio

Inventory the plant population and record the relative abundance of the dominant species, based on the expected % of canopy that each comprises for the season. For a higher quality assessment, record the proportions of all species found. If any purple loosestrife is found, record the amount.

16. Vsed

Observe and note evidence of current and historic sediment delivery to the wetland; evidence of tillage within the catchment area and tillage in and through the buffer and wetland. Note the slope of the catchment area and the thickness of the A horizon, especially along the edge of the temporary zone. Check sediment depths in temporary zone and seasonal zone and record.

17. Vdetritus

Measure thickness of litter in both the temporary and seasonal zone if present. Variability will dictate the number of measurements to be taken to obtain a representative thickness.

18. Vwetuse

Observe and record dominant land uses within the wetland. If the assessment is made by a team confer with team members in scoring this variable.

E. DETAILED INSTRUCTIONS ON MEASUREMENTS OF INDICATORS AND DATA RECORDING

Vwden

Where to measure: This variable accounts for the actual number count of wetland basins on the landscape within ¼ and 1 mile radius of the center of the assessed wetland.

When to measure: The data for this variable can be gathered in conjunction with the variable Vwetarea and initially is done in the office. Always verify results in the field.

What and how to measure: In the office, review the NWI and FSA wetland inventory maps and inscribe a circle scaled to ¼ mile radius from the center of the assessed wetland. Count the number of wetlands within or intercepted by the inscribed circle. Verify the number count in the field. (For larger wetlands a radius of 2980 feet (640 acres) or the 1 mile radius (2000.3 acres) may be needed to confirm the Vwden variable). If a wetland is bisected by a road count it as one wetland.

When approaching the site in the field review, verify location of wetlands found in office review of the area within the 1/4 mile radius (1320 feet). Check wetland basins noted as suspect during the office review. Formulate plans for an on-site check if needed.

What to Record: Number of wetland basin(s) within ____ mile radius of the center of the assessed wetland _____.

Definition and Measurement of Variable Condition V_{WDEN}

| Model Variable | Measurement or Condition | Index |
|--|--|--------------|
| V_{WDEN}: Density of Wetlands in the Landscape Definition: The number of wetland basins on the landscape within a defined radius from the WAA. (Data reported at 1 mile and 1/4 mile scale). Logic: | Density of wetlands within the defined radius from the center of the assessment wetland is >75% of reference standard based on physiographic region (e.g., Glaciated Plains -vs.- Missouri Coteau). | 1.0 |
| | Density of wetlands within the defined mile radius from the center of the assessment wetland is 50% - 75% of reference standard based on physiographic region (e.g., Glaciated Plains -vs.- Missouri Coteau). | 0.75 |
| | Density of wetlands within the defined radius from the center of the assessment wetland is 25% - 50% of reference standard based on physiographic region (e.g., Glaciated Plains -vs.- Missouri Coteau). | 0.5 |
| | Density of wetlands within the defined radius from the center of the assessment wetland 10% - 25% of reference standard based on physiographic region (e.g., Glaciated Plains -vs.- Missouri Coteau). | 0.25 |
| | Density of wetlands within the defined radius from the center of the assessment wetland >0% - 10% of reference standard based on physiographic region (e.g., Glaciated Plains -vs.- Missouri Coteau). | 0.1 |
| | No other wetlands within 1 mile radius. | 0.0 |

Vwetarea

Where to measure: The measurement of this variable is the ratio of temporary and seasonal wetlands to semi-permanent wetlands or wetter within a 1 mile radius of the assessed wetland's center point and captures the relationship of wetland diversity within a given assessment area. Until a map depicting this variable is made for rapid assessment, the duck breeding pairs map is an acceptable surrogate and can be substituted for the variable Vwetarea in the habitat function. More information on this variable can be found in the reference standards listing. (Large project type activity may require the measurement of the ratio at the 1 mile radius.) The duck breeding pairs indexing will be included with the reference standard information

When to measure: This variable is most conveniently measured in the office using NWI and FSA wetland inventory maps. A measuring device such as dot counter scale or planimeter will be used. Verify the wetland(s) in the field. This data can be gathered at the same time as Vwden and Vproximity data.

The duck breeding pairs map surrogate can be scored in the office. There will be no temporal variability in this measurement and it can be scored anytime during the assessment. The indexing was done using best professional judgment and applies to North Dakota. Indexing for other states should be done by local experts using their best professional judgment. The variable lacks sensitivity in that it does not count basins, nor is it able to detect instant change. This does not, however detract from its use. If a wetland is being assessed due to a planned alteration that requires mitigation, then mitigation should be performed in an area of the same or higher index score. It may take a policy decision to determine if mitigation will be basin for basin, function for function, in the same watershed, etc.

How and what to measure: Use the NWI maps to locate the assessed wetland and inscribe a circle scaled to a 1 mile radius around its center point. Measure the acreage of all wetland area within the inscribed circle. Total the acreage of temporary (PEMA) and seasonal (PEMC) wetlands.

Total the acreage of the semi-permanent (PEMF) or wetter wetlands. Divide the total acreage for the PEMA and PEMC wetlands by the total of the PEMF and wetter wetlands. The result is the ratio of temporary and seasonal wetland area to semi-permanent and wetter wetland area.

The evaluator only needs to know the location of the wetland being assessed and have access to U. S. Fish and Wildlife Service Waterfowl Breeding Pairs Distribution map. The location is found on the breeding pairs map and, using the color-coded index legend on the map, the number of breeding pairs predicted to use this location is noted.

What to record: Measurement(s):

Area of temporary and seasonal wetlands within the _____ mile radius assessment area _____.

Area of semi-permanent or wetter wetlands within the _____ mile radius assessment area _____.

Ratio of temporary and seasonal area to semi-permanent or wetter wetland area _____.

Indicator(s):

The density of breeding pairs indicated by the map _____.

Definition and Measurement of Variable Condition V_{WAREA}

| Model Variable | Measurement or Condition | Index |
|---|--|--------------|
| <p>V_{WETAREA}: Wetland Diversity In The Landscape</p> <p>Definition: The ratio of total <u>area</u> (acres) of temporary and seasonal wetlands to the total area of semi-permanent and permanent wetlands within a defined radius of the assessment site.</p> <p>Logic:</p> | Ratio 75% to 125% of reference standards based on physiographic region (<i>e.g.</i> , Glaciated Plains -vs.- Missouri Coteau). | 1.0 |
| | Ratio 50% to 75% of reference standards based on physiographic region (<i>e.g.</i> , Glaciated Plains -vs.- Missouri Coteau). | 0.75 |
| | Ratio 25% to 50% or >125% of reference standards based on physiographic region (<i>e.g.</i> , Glaciated Plains -vs.- Missouri Coteau). | 0.5 |
| | Ratio 10% to 25% of reference standards based on physiographic region (<i>e.g.</i> , Glaciated Plains -vs.- Missouri Coteau). | 0.25 |
| | Ratio >0% to 10% of reference standards based on physiographic region (<i>e.g.</i> , Glaciated Plains -vs.- Missouri Coteau). | 0.1 |
| | No other wetlands within a 1 mile radius | 0.0 |

Vproximity

Where to measure: The density of wetland basins in a landscape is captured by this variable. The measurements are made from the boundary edge of the wetland being assessed to the nearest boundary edge of the five nearest wetlands in any direction in the landscape.

When to measure: Distance measurements for this variable can be made while gathering the data for Vwetarea and Vwden. Initial measurements are more easily performed in the office and the wetland boundaries verified in the field.

How and what to measure: Identify the assessed wetland on NWI and/or FSA wetland inventory maps. On a scaled map measure the distance from the edge of the assessed wetland to the closest edge/boundary of the five nearest wetlands. Measure in any direction needed. Record distances in feet and total the five distances and divide by five to determine the average or mean distance. Regard a basin bisected by a road as one wetland.

What to record:

Distance to the five nearest wetlands _____ Sum of distances _____

Sum / 5 = _____ ft. (mean)

Definition and Measurement of Variable Condition V_{PROXIMITY}

| Model Variable | Measurement or Condition | Index |
|--|---|-------|
| V_{PROXIMITY}: Proximity to Other Wetlands Definition: The mean distance to the nearest 5 wetlands in any direction from the WAA as measured edge-to-edge. Logic: | Distance to adjacent wetlands < or = 125% of reference standard based on physiographic region (e.g., Glaciated Plains -vs.- Missouri Coteau). | 1.0 |
| | Distance to adjacent wetlands > 125% to 150% of reference standard based on physiographic region (e.g., Glaciated Plains -vs.- Missouri Coteau). | 0.75 |
| | Distance to adjacent wetlands > 150% to 175% of reference standard based on physiographic region (e.g., Glaciated Plains -vs.- Missouri Coteau). | 0.5 |
| | Distance to adjacent wetlands > 175% to 200% of reference standard based on physiographic region (e.g., Glaciated Plains -vs.- Missouri Coteau). | 0.25 |
| | Distance to adjacent wetlands > 200% of reference standard based on physiographic region (e.g., Glaciated Plains -vs.- Missouri Coteau). | 0.1 |
| | No other wetlands within 1 mile radius. | 0.0 |

Vsource

Where to measure: This variable reflects the catchment or watershed of the wetland. Measurement of this variable will be measured against the unaltered catchment area of the wetland.

When to measure: These measurements can be taken at any time during the assessment, but for efficiency, they could be done in the office and checked in the field. If small wetlands on flatter topography do not show contour lines on the USGS maps for delineating catchment area, sketch the catchment area on an aerial photo in the field.

How and what to measure: Review aerial photography, USGS quad sheets, scope and effect maps and NWI maps. Note and document any surface alterations (roads, surface ditches, terraces, etc.), irrigation systems, and subsurface alterations (tile, wells, etc.) within 500 feet of the catchment area of the wetland. Note and document wetland subclass. From the USGS quad map, delineate the original catchment area.

Note: If the office review can determine that the catchment area has been altered, determine the amount of catchment area that has been structurally altered to prevent flow to the wetland. In most cases, Variable Index is calculated based on % of catchment from which water is prevented from reaching wetland. (If 10% of the catchment has been “cut off” the Index rating would be a 0.9). Also note areas added to the watershed due to road ditches or drainage.

In the field, verify all alterations noted during the off-site review and document any additional alteration found during the field investigation.

What to record: Type and effect of surface alteration(s) _____

Type and effect of subsurface alteration(s) _____

Change in NWI wetland subclass (YES or NO) _____

Percent catchment area remaining _____

Definition and Measurement of Variable Condition V_{SOURCE}

| Model Variable | Measurement or Condition | Index |
|---|--|-------|
| V_{SOURCE}: Source Area of Flow Interception Definition: The source area is the area surrounding a wetland that defines the catchment or watershed of that wetland. This includes surface and sub-surface flow paths. Structural alterations to the landscape divert and/or add water flow to the wetland. Logic: | No alteration of upland watershed source area through structural surface alterations (e.g., terraces, road ditches, etc.), subsurface alterations (e.g., tile drains, ditches,) or additions (e.g., irrigation). <=90% of catchment area is intact. | 1.0 |
| | Surface alterations of upland watershed source area which impacts overland flow into wetland (e.g. terraces, road ditches), however, no subsurface alterations (e.g., tile drains), or additions. 75 to <90% of catchment area is intact. | 0.75 |
| | Upland watershed source area is changed to alter the dominant surface and subsurface flow path of water to the wetland (e.g., draining or irrigation return). However alteration does not change the wetland class. 25 to <75% of catchment area is intact. | 0.5 |
| | Upland watershed source area is changed to alter the dominant surface and subsurface flow path of water to the wetland (e.g., drainage or irrigation return) -and- alteration changes the wetland water regime class.(e.g. a seasonal wetland has been changed to a semi-permanent). <25% of catchment area is intact. | 0.1 |
| | Upland watershed source area extremely altered such that almost all water flow to wetland eliminated (e.g., urbanization). | 0.0 |

Vupuse

When to measure: Information on present land use is needed to accurately measure and determine the condition of this variable. The land use within the upland watershed of the wetland can be checked in the office from land use maps, but must be verified in the field. The observation of some land use conditions will vary by season and are subject to Best Professional Judgment during some time periods.

Where to measure: The variable Vupuse refers to land use within the wetland catchment area but outside of the wetland itself. The catchment area that is outlined to assess the Vsource variable can be used as a guide in defining the area to determine the dominant upland land use. When possible, an assessment of the entire catchment area is recommended; however, when not possible a 500 foot perimeter from the outer wetland edge is recommended.

What and how to measure: This variable is intended to measure the impact that the catchment area condition & management will have on the wetland. It includes a disturbance gradient that ranges from native prairie to hard surface parking lot. Type of tillage, cropping system, haying, intensity level of grazing, amount of bare ground, and proportion of native and non-native species present will need to be observed. Thickness of sediment near the wetland edge may give a clue to past management of the catchment area. Information on best management practices will be noted. Gaging the amount of disturbance, (i.e., evapo-transpiration, infiltration/runoff, sediment yield, chemical runoff) compared to well-managed range land will assure an accurate measurement or assessment of this variable.

Upland land use categories & management factors considered in this variable are as follows:

- Grazing land: proper use or over-utilized to slight, moderate, or severe degree-dominance of native or non-native plant species
- Permanent hay land
- Idle grass land
- Cropland: residue production & removal and type of tillage
- Other disturbances: described such as pavement or parking lot.

What to record:

Dominant land use(s) information _____, _____, _____

List Best Management Practices used _____

Definition and Measurement of Variable Condition V_{UPUSE}

| Model Variable | Measurement or Condition | Index |
|---|---|--------------|
| <p>V_{UPUSE}: Upland Land Use</p> <p>Definition: Dominant land use or condition of upland watershed that contributes to the wetland. When possible, an assessment of the entire catchment is recommended. When not possible, an assessment of a 500 foot perimeter from the outer wetland edge is recommended.</p> <p>Logic:</p> | <p>Native prairie which allows for adequate plant recovery time between vegetation removal events.</p> | 1.0 |
| | <p>Dominated by non-native species under some type of management. -OR- Native species with fair grazing management such as season-long grazing at slight or moderate intensity. -OR- Idle grassland cover. (Includes idle native range & CRP). -OR- “Permanent” hay land.</p> | 0.75 |
| | <p>Native or non-native species often overgrazed, some bare ground, low plant vigor. -OR- No-till small grain/ high residue crops -OR- Minimum till in a grass/legume rotation.</p> | 0.5 |
| | <p>Native or non-native species is usually severely overgrazed, high amount of bare ground, low plant vigor and evidence of soil erosion (e.g., gullies, rills, etc.) -OR- No-till row crop, conservation tillage small grain</p> | 0.25 |
| | <p>Row crop or conventional tillage small grain.</p> | 0.1 |
| | <p>Urban, semi-pervious, or impervious surface. (This condition will result in maximum overland flow; a high rate of delivery to wetland.) If best management practices employed, the impact may be somewhat less.</p> | 0.0 |

Vsubout

Where to measure: This variable reflects the effects of subsurface drainage features on the wetland. Measurement of this variable will be made out to a distance of 200 feet.

When to measure: These measurements can be taken at anytime during the assessment, but for efficiency, could be performed in conjunction with the delineation procedure. Distances to drainage features may be measured from aerial photography prior to going to the field.

How and what to measure: Elevations and distances will be determined by approved surveying methods and equipment. Hydrology alterations are typically in the form of lateral removal of subsurface flow or saturation, surface water removal and / or fill placed in the wetland.

Preferred method:

Lateral Removal of Subsurface Flow

- 1) Elevations of buried subsurface drainage features (tile) should be determined as follows:
 - a. Determine the tile size from scope & effect or local information.
 - b. Determine the shortest distance between the tile and the wetland.
 - c. Determine the depth the tile is below the ground surface with the tile probe.
 - d. Shoot the elevation at this location and subtract the depth to tile and the tile diameter from the ground elevation.
- 2) Elevations of surface drainage features (road ditches, etc.) should be determined as follows:
 - a. Determine the shortest distance between the surface drainage feature and the wetland.
 - b. Shoot the elevation of the lowest point in the surface drainage feature at this distance.

What to record:

Elevation of bottom of temporary zone _____

Type of surface alteration(s) _____

Distance from wetland edge to surface alteration _____

Invert elevation of surface alteration _____

Type of subsurface alteration(s) _____

Distance from wetland edge to subsurface alteration _____

Invert elevation of subsurface alteration _____

Definition and Measurement of Variable Condition V_{SUBOUT}

| Model Variable | Measurement or Condition | Index |
|--|--|--------------|
| <p>V_{SUBOUT}: Constructed Subsurface/Surface Outlet</p> <p>Definition: Presence of a constructed subsurface outlet and/or a surface outlet. Changes in depth of the subsurface or surface drain and distance from the wetland impacts wetland groundwater surface elevation.</p> <p>Logic:</p> | <p>Subsurface flow is not impacted or if there is a nearby subsurface/surface drainage feature it is greater than 150 feet from the wetland edge. (Lateral effect distances based upon Hamerly-Tonka soils).</p> <p align="center">- OR -</p> <p>Wetland has been restored to practice standards</p> | 1.0 |
| | <p>Subsurface/surface drainage feature is between 75 and 150 feet from the wetland edge and is greater than 3 feet below the top of the temporary zone.</p> <p align="center">-OR-</p> <p>Wetland has been restored with the use of a ditch plug and there is no evidence of subsurface flow (i.e. hydrophytic vegetation) within 50 feet of the downstream toe of the ditch plug.</p> | 0.75 |
| | <p>Subsurface/surface drainage feature is between 75 feet and 25 feet from the wetland edge and is greater than 2 feet below the temporary zone.</p> <p align="center">-OR-</p> <p>Wetland has been restored with the use of a ditch plug and there is evidence of subsurface flow (i.e. hydrophytic vegetation) within 50 feet of the downstream toe of the ditch plug.</p> | 0.5 |
| | <p>Subsurface/surface drainage feature is within 25 feet of the wetland edge and is greater than 2 feet below the temporary zone.</p> <p align="center">-OR-</p> <p>Wetland has a poorly functional tile within the wetland basin (i.e. saturation conditions still exist within the basin).</p> | 0.25 |
| | <p>Surface ditch within the basin but less than 1 foot below the bottom elevation of the wetland.</p> <p align="center">-OR-</p> <p>Single tile within the basin. Some saturation conditions remain.</p> | 0.1 |
| | <p>Properly functioning tile or pattern tile within the basin</p> <p align="center">-OR-</p> <p>Surface ditch 1 foot or greater below the bottom of the wetland. No saturation conditions remain.</p> | 0.0 |

Vbdensity

Where to measure: The buffer zone is the upland area immediately adjacent to the perimeter of a wetland and extending outward a maximum width of 50 feet.

When to measure: This measurement is done when measuring Vbwidth, Vbcontinuity, Sediment Delivery and Outlet.

What and how to measure: The measurement of this variable is stem density. Secondary measurements are Percent Ground Cover and Visual Obstruction Measurement (VOR). Until reference standards are assigned, indicators will be used. The effectiveness of the buffer is partly determined by the density of stems at the ground level. The density of stems reduces water flow velocity and allows for runoff infiltration, sediment and particulate removal and provides cover for the faunal inhabitants (Keep this in mind when evaluating and scoring this variable).

Walk the perimeter of the wetland and observe the stem density of the grassland buffer. If reference standards are available, use them; otherwise use the following indicators.

What to record:

Indicators:

Land use of the Buffer Area _____

Are Best Management Practices Used _____

No-till agriculture next to buffer _____

Secondary Measurements:

Percent Ground Cover _____

Visual Obstruction Reading _____

Measurement:

Measured stem density _____

Definition and Measurement of Variable Condition V_{BDENSITY}

| Model Variable | Measurement or Condition | Index |
|--|--|--------------|
| <p>V_{BDENSITY}: Grassland Buffer Density</p> <p>Definition: Stem density of buffer zone. Measured within 50 feet of the outer most edge of the wetland.</p> <p>Logic: This variable is based on the structural physical characteristic of the buffer area to trap sediment, absorb nutrients, promote infiltration, etc.</p> | <p>Measured - Stem Density 76 to 125% of reference standard.</p> <p>Secondary Measures – Ground cover is 75 to 125% of reference standard. -OR- Visual Obstruction Measurement (VOR) is 75 – 125% of reference standard.</p> <p>Indicator – Buffer zone is perennial herbaceous vegetation, properly managed.</p> | 1.0 |
| | <p>Measured – Stem Density is 51 to 75% or > 125% of reference standard</p> <p>Secondary Measures – Ground cover is 51 to 75% or > 125% of reference standard -OR- VOR is 51 to 75 or >125% of reference standard</p> <p>Indicators - None developed for this sub-index.</p> | 0.75 |
| | <p>Measured – Stem Density is 26 to 50% of reference standard</p> <p>Secondary Measures – Ground Cover is 26 to 50% of reference standard -OR- VOR is 26 to 50% of reference standard.</p> <p>Indicators - Buffer is perennial herbaceous vegetation, heavily grazed or frequently hayed (>50%)</p> | 0.5 |
| | <p>Measured - Stem Density is 10 to 25% of reference standard.</p> <p>Secondary Measures – Ground Cover is 10 to 25% of reference standard -OR- VOR is 10 to 25% of reference standard.</p> <p>Indicators - None developed for this sub-index.</p> | 0.25 |
| | <p>Measured - Stem Density is < 10% of reference standard.</p> <p>Secondary Measures – Ground Cover is <10% of reference standard, -OR- VOR is <10% of reference standard.</p> <p>Indicators - No buffer but Best Management Practices (BMP's) are used in area adjacent to wetland. i.e., no buffer and no till agriculture on area adjacent to wetland.</p> | 0.1 |
| | <p>No buffer and no BMP's used in area adjacent to wetland.</p> | 0.0 |

Vbwidth

Where to measure: The buffer zone is the upland area immediately adjacent to the perimeter of a wetland and extending outward a maximum width of 50 feet.

What and how to measure: A grassland buffer is seldom continuous around a wetland and even more seldom, fifty feet wide. The grassland buffer should be measured on site, and at several locations around the wetland determined by how much width variation there is. Width can be measured by pacing. Dividing the perimeter into pie like segments may make it easier to determine a percentage of the perimeter at a certain width. Some mental weighting should also be done when one looks at the landscape and decides how much runoff enters the wetland at various locations, such as an incoming channel. Divide the number of measurements made into the sum of the measurements to come up with a mean or average width. Only take measurements where there is a buffer as Vbcontinuity will measure buffer absence.

What to record:

Mean buffer width _____

Definition and Measurement of Variable Condition V_{BWIDTH}

| Model Variable | Measurement or Condition | Index |
|--|---|-------|
| V_{BWIDTH}: Grassland Buffer Width Definition: Mean Width of grassland buffer surrounding outermost wetland edge (≤ 50 feet from wetland edge). Logic | Mean buffer width is greater than 50 feet wide. | 1.0 |
| | Mean buffer width is between 37.5 and 50 feet wide. | 0.75 |
| | Mean buffer width is between 25 and 37.5 feet wide. | 0.5 |
| | Mean buffer width is between 12.5 and 25 feet wide. | 0.25 |
| | Mean buffer width is between 0 and 12.5 feet wide. | 0.1 |
| | There is no buffer. | 0.0 |

Vbcontinuity

Where to measure: The buffer zone is the upland area adjacent to the outermost edge of the assessed wetland. Continuity means how continuous is the grassland buffer with the wetlands perimeter.

What and how to measure: Walk the perimeter of the wetland and observe if the grassland buffer is adjacent to the wetland. Visually dividing the wetland into pie like segments will allow the observer to estimate what percent of the wetland actually has a grassland buffer. This measurement can be done while assessing buffer width. Measure from map or pace distances.

What to record:

The observed percentage of the wetland perimeter in contact with a grassland buffer.

Definition and Measurement of Variable Condition V_{BCONTINUITY}

| Model Variable | Measurement or Condition | Index |
|---|---|--------------|
| V_{BCONTINUITY}: Grassland Buffer Continuity Definition: Continuity of grassland within 50 feet of the outermost edge of the wetland. Logic: | Continuity is >75% to 100% | 1.0 |
| | Continuity is >50% to 75% | 0.75 |
| | Continuity is >25% to 50% | 0.5 |
| | Continuity is >10% to 25% | 0.25 |
| | Continuity is >0% to 10%. Variable is recoverable and sustainable through natural processes under current conditions. | 0.1 |
| | Continuity is >0% to 10%. Variable is not recoverable and sustainable through natural processes under current conditions. (Parking Lot) | 0.0 |
| | | |

Vpore

Where to measure: The wetland will be scouted and the measurement recorded will be representative for the temporary or seasonal zone assessed in the wetland. The percent of each zone will be recorded. This information will then be used to calculate the index for all or the portion of the wetland that is needed for the assessment.

When to measure: These measurements can be taken anytime during the assessment, but for efficiency, could be performed in conjunction with the delineation procedure. These measurements can be recorded when checking for soil organic matter, sediment or detritus thickness.

How and what to measure: In assessing this variable look for micro-topographical highs and lows in the wetland that may be associated with past evidence of tillage.

With the use of a spade (sharpshooter) take a vertical slice of soil to a depth of 16 inches. Examine in good sunlight. Apply a moderate thud to the back of the spade to help show the natural structure cleavage of the soil. Record presence or absence of an Ap horizon or evidence of past tillage.

Pay special notice to the 4 to 10 inch layer checking for a plow pan. Note, look for horizontal layer(s) in the 4 to 10 inch zone which could be a plow layer. Look for horizontal root growth as an indicator of a highly compacted layer (plow pan). Record findings.

Examine the slice and note the size, shape and grade (distinctness) of the soil peds in the A horizon. Note if the structure parts to medium and fine granular and the size of blocks and prisms. Record the size, grade, and type of structure for the A horizon. If sampling site is under water the use of a soil probe (preferably one with a 1.5" diameter coring tube) could be used to obtain a sample, however, coarser structure and grade of structure may not be evident.

Examine horizontal surfaces for tubular pores. Concentrate on the layer with the least amount of pores and the most compaction if an Ap is present. Count the number of very fine and fine pores in a square centimeter and the number of medium and coarse pore in a square decimeter and record. Also examine the pores to determine their continuity. Record the number of pores and their continuity. Note: Roots are a surrogate for pores.

To determine rupture resistance in the upper 16 inches of the soil, take a soil ped (about 1 inch cube) that has not been compressed or deformed in getting the slice and crush it between your forefinger and thumb, noting the strength needed to deform or rupture the ped. Note this estimation as very friable (very slight force), friable (slight force), firm (moderate force) or very firm (strong force). Then record the most resistant measurement found within the upper 16 inches. (Hint; If tilled this will probably be in a 4 inch thick layer found just below the tillage zone which may extend to 12 inches below the surface.) For determining the Soil Quality Index (SQI) see page 18 of the the Draft Guidebook.

What to record:

INDICATORS:

Evidence of past tillage: Temp Zone (yes or no)_____ Seas Zone (yes or no) _____

Ap horizon present: Temp Zone (yes or no)_____ Seas Zone (yes or no) _____

Plow pan with roots growing horizontally along pan: Temp Zone (yes or no) _____ Seas Zone (yes or no) _____

SECONDARY MEASUREMENTS:

| | | | |
|------------------------|-----------------------|----------------------|------------|
| Soil Structure: | Temporary zone | Seasonal zone | SQI |
| Size: | _____ | _____ | |
| Type: | _____ | _____ | |
| Grade: | _____ | _____ | _____ |
| Soil Pores: | | | |
| Number: | _____ | _____ | |
| Continuity: | _____ | _____ | _____ |
| Rupture | | | |
| Resistance: | _____ | _____ | _____ |

Definition and Measurement of Variable Condition V_{PORE}

| Model Variable | Measurement or Condition | Index |
|---|--|--------------|
| <p>V_{PORE}: Soil Porosity</p> <p>Definition: The ability of the soil to allow movement of liquids, gases, etc. into, and through, the upper part of the soil. As indicated by the physical integrity of the upper part of the soil. This includes the number and continuity of pores, the type, grade, and size of soil structure, and the soils rupture resistance.</p> <p>The preferred method of calibrating this variable are soil physical properties as assessed by soil quality field testing which is not practical for rapid assessment. We are seeking assistance in collecting additional data to calibrate this variable.</p> <p>Logic: Wetland soils regulate and partition water flow at many scales within and outside the wetland. Wetland soils function as the matrix for biological, chemical, and physical ecosystem processes.</p> | <p>Primary Measure - A continuous variable scaled by collecting soil infiltration / permeability measurements in the upper 12" of the soil.</p> <p>Secondary Measure - Many very fine and fine, continuous pores. The upper (12") soil horizons have compound structure, i.e. the A1 has wk to moderate sbk parting to moderate granular structure. The A2 has weak or moderate prismatic parting to moderate fine and medium subangular blocky parting to moderate granular structure. Consistence is friable to very friable.</p> <p>SQI=> 7</p> <p>Indicator - No evidence of an Ap within hydric soil boundary.</p> | 1.0 |
| | <p>Common very fine and fine, continuous and discontinuous pores.</p> <p>Fine to medium subangular blocky parting to granular structure.</p> <p>Consistence is friable to firm.</p> <p>SQI =>4, <7</p> <p>Indicator - Ap horizon is present. Wetland is partially tilled or restored (cropland) < 20 years</p> | 0.5 |
| | <p>Few very fine and fine discontinuous pores. Massive or coarse subangular blocky structure (coarse, cloddy) -OR- Plow pan evidenced by roots growing horizontally along pan. Consistence is very firm or harder.</p> <p>SQI <4</p> <p>Indicator - Ap horizon present. Wetland is tilled throughout most years.</p> | 0.1 |
| | <p>The substrate is a non-porous medium, i.e., asphalt, concrete, etc.</p> | 0.0 |

Vsom

Where and when to measure: The wetland will be scouted and the measurement recorded will be representative for the temporary or seasonal zone assessed in the wetland. The percent of each zone will be recorded. This information will then be used to calculate the index for all or the portion of the wetland that is needed for the assessment. These measurements can be recorded when delineating or checking for porosity, sediment or detritus thickness.

How and what to measure: Upon examining the soils and the wetland basin, note the evidence and effectiveness of drainage (not drained, partially drained, and effectively drained), and evidence of cropping and frequency of cropping. Also record age of restoration if known.

With the use of a spade (sharpshooter) take a vertical slice of soil to a depth of 16 inches. Examine in good sunlight. This should be done when the soil is moist and not when wet or dry. Wet soils glisten which interferes with reading colors. If sampling site is under water the use of a soil probe (preferably one with a 1.5" diameter coring tube) could be used to obtain a sample.

Using the Munsell Soil Color Chart, examine the colors of the A horizon. Record the hue, chroma and value. (Note; check for Neutral Colors in the A horizon.)

Note the hydric soil indicator used to identify the hydric soil if found in the Field Indicator of Hydric Soils Publication.

What to record:

INDICATORS:

| | Temporary Zone | Seasonal Zone |
|---|----------------|---------------|
| Evidence and effectiveness of drainage: | _____ | _____ |
| Evidence and frequency of cropping: | _____ | _____ |
| Age of Restoration: | _____ | |
| Soil Color | | |
| Hue: | _____ | _____ |
| Chroma: | _____ | _____ |
| Value: | _____ | _____ |
| MEASUREMENTS: | | |
| Percent Organic Matter: | _____ | _____ |

Definition and Measurement of Variable Condition V_{SOM}

| Model Variable | Measurement or Condition | Index |
|--|---|-------|
| <p>V_{SOM}: Soil Organic Matter</p> <p>Definition: Organic Matter Content of the A horizon.</p> <p>Logic: Soil organic matter (SOM) contributes to biological and chemical processes at ecosystem and global scales.</p> <p>SOM is one of the most impact responsive soil properties.</p> | <p>A continuous variable based upon soil organic matter content of the A horizon in comparison to reference standard conditions. e.g. if reference standard is 6% SOM, a soil with 5% SOM would be a variable index of .83.</p> <p>Indicators - A horizon color is Neutral 2/, 3/ or value <= 2 and chroma <=1. Site has no evidence of drainage or cropping.</p> | 1.0 |
| | <p>Indicators - Preliminary analysis of lab. data indicates that restorations which are more than 20 years old should be scored here.</p> | 0.75 |
| | <p>Indicators - A horizon color has value >2 <=3 and chroma <=1.5 Site has been partially drained and/or there is evidence of frequent cropping in some zones or rarely throughout .</p> | 0.5 |
| | <p>Indicators - Site is partially drained and/or frequently cropped.</p> | 0.25 |
| | <p>Indicators - A horizon color has value >3 and chroma >1.5. Site has been "effectively" drained and frequently cropped throughout and/or partially filled.</p> | 0.1 |
| | <p>Wetland soil has been replaced by upland fill, asphalt, concrete, etc.</p> | 0.0 |

Vout

Where to measure: This variable will be measured from the bottom (lowest elevation) of the wetland up to the elevation where water would flow out of the basin under natural conditions. Elevation shots will be taken at the lowest elevation of the wetland, at the control section of the outlet (highest point of a natural outlet or a man made outlet) and at the wetland boundary.

When to measure: These measurements can be taken at any time during the assessment. Scope and effect documentation may be used to determine extent of drainage in conjunction with field verification.

How and what to measure: Elevations and distances will be determined by approved surveying methods and equipment.

Preferred method:

- a. Shoot the elevations of the surface outlet (natural and man made).
- b. Shoot the elevation of the wetland bottom.
- c. Compare the two elevations to determine if site ponds water.

What to record:

Elevation of natural outlet _____

Elevation of surface outlet _____

Elevation of wetland bottom _____

Depth of ponding _____

Definition and Measurement of Variable Condition V_{OUT}

| Model Variable | Measurement or Condition | Index |
|---|--|-------|
| V_{OUT}: Wetland Outlet Definition: Presence or absence of a natural or constructed outlet. Change in outlet elevation modifies wetland water surface elevation. Logic: | Natural condition present, no physical alteration of the relief between the top elevation of the temporary zone and the natural outlet elevation. - OR - Wetland has been restored to practice standards. | 1.0 |
| | 50% or more reduction in relief between top elevation of temporary zone and natural outlet elevation. - OR - Natural outlet at the upper most elevation of the temporary zone and the outlet has annual crop with only seasonal roughness. | 0.75 |
| | Constructed outlet at upper most elevation of the temporary zone. | 0.5 |
| | Constructed outlet above lowest elevation of wetland with full capacity ditch - OR - Undersized tile surface inlet is present within the wetland. Or full sized with restricted outlet. Indicator - Wetland still ponds some water. | 0.25 |
| | Constructed outlet at lowest elevation of wetland; constructed outlet is a full capacity ditch. - OR - Full sized tile surface Inlet with functional outlet. Indicator - Saturated condition still remains. | 0.1 |
| | Constructed outlet at or below wetland bottom elevation. Wetland completely drained. | 0.0 |

V_{pit}

Where to measure: This variable will be measured within the wetland basin. Elevation shots will be taken within the wetland to determine the volume of the wetland, and a second set of shots to determine volume of the pit or excavation.

When to measure: These measurements can be taken any time during the assessment.

How and what to measure: Elevations will be determined by approved surveying methods and equipment.

Preferred method:

- a. Shoot enough elevations in the wetland to estimate an overall average depth.
- b. Measure perimeter of wetland and use to calculate a surface area.
- c. Calculate volume of storage within the wetland.
- d. If excavation is a standard sized NRCS dugout determine dimensions of dugout and compare volume from dugout charts to volume of wetland. If excavation is a non-standard dugout repeat steps a, b, and c for the excavation.

What to record:

Volume of wetland _____

Volume of excavation _____

Percent difference in wetland and excavation _____

Definition and Measurement of Variable Condition V_{PIT}

| Model Variable | Measurement or Condition | Index |
|---|--|-------|
| V_{pit}: Excavation DEFINITION: Presence of an excavation within the wetland i.e. dugouts, level ditches, sumps, concentration pits, etc. Excavations concentrate surface water, reduce surface area of ponding, and change the evapotranspiration process. LOGIC: Excavation lowers the local groundwater table and changes surface water elevations, thereby impacting the performance of dynamic surface water storage, groundwater recharge, and maintenance of saturated conditions throughout the wetland. | No excavation within the wetland basin | 1.0 |
| | Volume of excavation is less than 25 percent of the volume of the wetland. | 0.75 |
| | Volume of excavation 25 to 50 percent of the volume of the wetland. | 0.50 |
| | Volume of excavation is 51 to 75 percent of the volume of the wetland. | 0.25 |
| | Volume of excavation is 76 to 90 percent of the volume of the wetland. | 0.1 |
| | Volume of excavation is 91 to 100 percent of the volume of the wetland. | 0.0 |

Vpcover

Where to measure: This variable will be measured within each wetland zone present (temporary and seasonal) and the findings will be recorded. The information will be used to assign an index score that is representative for the assessment area.

When to measure: This variable is usually easiest to determine near the end of the growing season if vegetation is not altered. If possible, coordinate with the owner/operator to avoid assessing after tillage, haying, fire, or other hindrances. During the assessment, Vpcover can be assessed concurrently with the Vpratio variable.

How and what to measure: Record information about the expected average conditions for the wetland. Record the factors that are currently affecting the site and are likely causing atypical condition(s). Record the % ground cover of the most current year's growth in each wetland vegetative zone. (In early spring before growth has started, look at residue but not 2 year-old detritus.)

Preferred method:

1. Flag the perimeter of the assessment area. Evaluate the plant cover on the entire assessment area, but not beyond it. Avoid being "thrown off" by tillage lines or other pseudo-boundaries.
2. Look at the wetland from a high point to identify areas with significantly more or less cover than the predominant situation. Determine the relative size of each such area by visual estimation or by measurement such as pacing, and record findings. Assess the plant cover on each portion individually. Then, a weighted index score can be assigned for the wetland.
3. Walk through the wetland in a zig-zag or cross-sectional pattern that will provide a representative view of the vegetation present on the entire wetland. Keep in mind that the outer points of a radial transect across a wetland represent a greater proportion of its area. For example, the outer 20% of a radial transect represents 36% of a round wetland, while the inner 20% represents only 4% of the total wetland area. Accurate determination of the proportion of different conditions on the outer portion of a wetland is essential.

Guide to help in estimating % area of circular zones:

| % Radial distance (center to edge) | 10% | 20% | 30% | 40% | 50% | 60% | 70% | 80% | 90% | 100% |
|------------------------------------|--|-----|-----|-----|-----|-----|-----|-----|-----|------|
| center point → | -----)-----)-----)-----)-----)-----)-----)-----)-----)-----)-----) | | | | | | | | | |
| % Area within that radius | 1% | 4% | 9% | 16% | 25% | 36% | 49% | 64% | 81% | 100% |

4. If the wetland has been cultivated or otherwise disturbed in a manner that reduces vegetative growth, observe the amount of plant matter present on the surface. Using a spade, also check for plant residue and roots below the surface. Root mass is a good indicator of recent years' vegetative growth. Record observations for each vegetative zone present, (wet meadow and shallow marsh). A mental comparison of the assessment site and a comparable native site in excellent condition is helpful. Wet meadow can produce 4000# of forage per acre annually; shallow marsh can produce 7000#. These production levels require a vigorous sod.
5. Consider the temporal aspect of vegetative cover. While native wetlands in excellent condition "green up" quickly in spring and are usually covered with growing vegetation for most of the growing season, plant cover on cultivated sites are often thin in spring. Cultivated sites are widely variable. Some wetlands are left idle for years at a time; others have a good crop cover most years; and some are intensively cultivated and compacted resulting in little growth anytime. Cultivated wetlands are often covered by species that are prone to drowning- an intra-seasonal consideration. Best professional judgment is critical for assigning the index score that represents the inter- and intra-seasonal average for the wetland. Utilize the knowledge of reliable persons familiar with the site. The proper index score may not correspond to the

conditions observed at the time of assessment; written documentation for the decision is essential for accurate assessment.

What to record:

Average conditions of the wetland _____
 Factors causing conditions to vary from average _____
 % vegetative cover (including crops and invaders) in temp. zone _____ and in seasonal zone _____
 % of wetland area that is temporary zone _____ and % that is seasonal zone, if present _____

Definition and Measurement of Variable Condition V_{PCOVER}

| Model Variable | Measurement or Condition | Index |
|--|--|--------------|
| V_{PCOVER}: Plant Cover Definition: The abundance of woody and herbaceous plants in all vegetation zones within the wetland. Logic: | Canopy coverage 75% to 125% of reference standard. Indicator - All wetland zones are intact, no tillage | 1.0 |
| | No standard for this score. | 0.75 |
| | Canopy coverage 25% to 75% or >125% of reference standards. Indicator - Temporary zone tilled, wetter zones intact. | 0.5 |
| | Canopy coverage 10% to 25% of reference standard. Indicator - All zones tilled, residual wetland vegetation evident | 0.25 |
| | Canopy coverage >0% to 10% of reference standard Indicator - All zones frequently tilled, limited perennial vegetation clods in furrows, etc. | 0.1 |
| | Perennial plants absent, no canopy coverage. | 0.0 |

Vpratio

Where and when to measure: This variable will be measured within each wetland zone present (temporary and seasonal). The wetland will be scouted and the measurement recorded separately for each zone. Late summer is the preferred time to measure Vpratio.

How and what to measure: The Vpratio measurement needs to take into account the typical inter-seasonal and intra-seasonal conditions of the wetland. Events such as fire, tillage, extended wet or dry periods, and abrupt changes in precipitation can change the species composition on part or all of a wetland. In these cases, seek additional information and use best professional judgment. Document observations from aerial color slides, infra-red photography, and the knowledge of reliable persons familiar with the site.

After extended high-water conditions, a draw-down phase may enable numerous early-succession species to germinate. This may result in a wetland having a very good native community to temporarily have a lower index score. A sound understanding of recent conditions and plant succession may justify assigning an index score that does not match the plant community found at the time of assessment. Documenting the rationale for such cases is essential.

Preferred method:

1. Flag the perimeter of the assessment area. Evaluate the plant cover on the entire assessment area, but not beyond it. Avoid being thrown off by tillage lines or other pseudo-boundaries.
2. If the wetland has a seasonal zone, flag its boundary. Look at the wetland from a high point to identify areas with significantly different vegetation types. Determine the relative size of each such area by visual estimation or by measurement such as pacing, and record findings. Refer to the chart for estimating area within circular rings. Examine the plant cover on each portion individually. Then, a weighted index score can be assigned for the wetland.
3. Walk through the wetland in a zig-zag or cross-sectional pattern that will provide a representative view of the vegetation present on the entire wetland. Keep in mind that the outer points of a radial transect across a wetland represent a greater proportion of its area. For example, the outer 20% of a radial transect represents 36% of a round wetland's area, while the inner 20% represents only 4% of the total wetland area. Accurate determination of the proportion of different conditions on the outer portion of a wetland is essential.

Guide to help in estimating % area of circular zones:

| | | | | | | | | | | |
|-----------------------------------|--|-----|-----|-----|-----|-----|-----|-----|-----|------|
| % Radial distance(center to edge) | 10% | 20% | 30% | 40% | 50% | 60% | 70% | 80% | 90% | 100% |
| center point → | -----)-----)-----)-----)-----)-----)-----)-----)-----)-----) | | | | | | | | | |
| % Area within that radius | 1% | 4% | 9% | 16% | 25% | 36% | 49% | 64% | 81% | 100% |

4. Considering the expected growth for the entire season, estimate the % of total vegetation mass that the dominant species will produce in each zone present, (wet meadow and shallow marsh). Keep in mind that warm-season species such as Prairie cordgrass and yellow foxtail are slow starters with rapid growth later in the growing season. Growth measurements could be done by weighing clipped samples late in the growing season. At other times, the decision must be based on Best Professional Judgment, with knowledge of the growth capabilities of each species. Record observations on a data sheet. After ascribing a % of total production to each of the dominants in each zone, look over the wetland again to mentally check if the assigned proportions are reasonable. Make adjustments if needed.
5. After determining which species comprise the dominants in each zone, classify them as native or non-native. Then assign the appropriate Vpratio index score.

Note: While only the dominant species need to be evaluated for Vpratio, it is desirable to base the Vpratio measurement on an extensive species survey.

Future measurement method: Databases will probably be developed that will enable the computer to determine the Vpratio index score, based on the plant survey of the assessor. Extensive species surveys would provide a better resource assessment.

What to record:

% of the total vegetative cover comprised by each species, or % of total vegetation comprised by each of the dominants in temporary zone _____ and in seasonal zone _____

% of vegetative cover, if any, that is Purple loosestrife _____

Comments on plant succession factors and /rationale for the assigned Vpratio index score, if the decision appears to differ from current conditions _____

Definition and Measurement of Variable Condition V_{PRATIO}

| Model Variable | Measurement or Condition | Index |
|---|--|-------|
| <p>V_{PRATIO}: Ratio of Native:Non-Native Plant Species</p> <p><u>Definition:</u> The ratio of native to non-native plant species present in wetland as indicated by an extensive species survey.</p> <p><u>Secondary Measure:</u> The 50:20 method from the 1987 Delineation Manual.</p> <p>Dominants are the most abundant species that immediately exceed 50% of the total dominance for a given stratum when the species are ranked in descending order of abundance and cumulatively totaled.</p> <p>Dominants also include any additional species comprising 20% or more of the total.</p> <p>Logic:</p> | <p>76 to 100% of the species in the wetland are native species. (as per extensive species survey)</p> <p style="text-align: center;">-OR-</p> <p>100% of the <u>dominant</u> species in the wetland are native species.</p> | 1.0 |
| | <p>51 to 75% of the species in the wetland are native species.</p> <p style="text-align: center;">-OR-</p> <p>75 to 99% of the <u>dominant</u> species in the wetland are native species.</p> | 0.75 |
| | <p>26 to 50% of the species in the wetland are native species.</p> <p style="text-align: center;">-OR-</p> <p>50 to 74% of the <u>dominant</u> species in the wetland are native species.</p> | 0.5 |
| | <p>10 to 25% of the species in the wetland are native species.</p> <p style="text-align: center;">-OR-</p> <p>< 50% of the <u>dominant</u> species in the wetland are native.</p> | 0.25 |
| | <p>Native species comprise <10% of the wetland.</p> <p style="text-align: center;">-OR-</p> <p>All <u>dominants</u> in the wetland are non-native species.</p> <p style="text-align: center;">-OR-</p> <p>If <i>Lythrum salicaria</i> (Purple Loosestrife) is among the dominant species.</p> <p style="text-align: center;">-OR-</p> <p>A single dominant plant species (native or non-native) comprises a monotypic invasive stand within wetland (e.g. cattail, reed canary grass, etc.).</p> | 0.1 |
| | Wetland unvegetated. | 0.0 |

Vsed

Where to measure: A representative site will be selected by scouting and measurements will be made in both the temporary and seasonal zone of the wetland. The percent of each zone which makes up the wetland will be recorded. This information will then be used to calculate the index for all or the portion of the wetland that is needed for the assessment.

For this variable, it is necessary to predict the most likely place to find sediment in the wetland, which will enable an accurate measurement with the least amount of effort. The most likely place for the thickest sediment would be in the temporary zone along the edge where sediment is deposited by flowing water from an ephemeral drain entering the wetland from cropland. Another potential source of sediment would likely be along the edge where a steep slope adjacent to the wetland is cropped. On oval-shaped wetlands with the thickest sediment, deltas can often be seen on aerial photos or colored slides, especially if active deltas are forming.

The emphasis is on the condition (amount) of sediment in the wetland, not the current trend. For example, restored wetlands in CRP may not have current evidence of sediment delivery; however, past practices may have led to excessive sediment delivery. Soil observations along wetland edge can be used to estimate the amount of sediment delivered. Over-thickened A horizons are excellent evidence but must be calibrated to local reference standard A horizon thickness'. Another method of assessing this variable is predictively using a simplified USLE approach. (Slopes and Land Use).

When to measure: These measurements can be recorded when delineating or checking for detritus, porosity and soil organic matter content.

How and what to measure: With the use of a spade (sharpshooter) take a vertical slice of soil to a depth of 16 inches or greater if sediment is expected. Examine in good sunlight. If sampling site is under water the use of a soil probe (preferably one with a 1.5" diameter coring tube) could be used to obtain a sample. An auger can be used, but sediment is harder to detect in an auger sample.

Preferred method:

- a. Use a color difference in the dark colored A horizon to indicate sediment. If a slightly lighter color is found over a darker A horizon, this is an indicator of sediment. The thickness can be recorded as sediment delivered to the wetland.
- b. If the sediment is calcareous with a color change and the source of carbonates from higher landscapes is evident, it strengthens the validity of sediment depth recorded.
- c. If the suspected sediment feels more gritty than the underlying material, this can be an indicator of sediment. In this case, fines were removed by the water and the coarser material was left behind causing the sediment to feel gritty. This method may have more application on larger wetlands where wave action washes out the fine particles, leaving the coarser particles behind.

Alternative Method:

- a. If the thickness of the A horizon is used to indicate the thickness of sediment delivered to the wetland, this should be measured in the temporary zone. Some soils such as Tonka have E horizons which are light colored, making the A horizon boundary abrupt and easy to see. Typically, Tonka soils in the Prairie Pothole Region have a horizons that are 6 to 8 inches in thickness. Measuring the depth of the darker colored material over the E horizon and subtracting from 8 inches would be a method of determining sediment thickness. (The use of the 8 inch depth allows for natural sedimentation not accelerated by man-made actions in or around the wetland, and also allows for some range in A horizon thickness). This is an indirect way and will not work well if the natural lower boundary does not have a contrasting abrupt boundary, but is gradual and diffuse, which usually happens in the seasonal zone.

What to record:

INDICATORS:

Read variable description for indicators to evaluate.

Temporary Zone

Seasonal Zone

Thickness of sediment in inches: _____

Thickness of A horizon in inches: _____

Definition and Measurement of Variable Condition V_{SED}

| Model Variable | Measurement or Condition | Index |
|---|---|--------------|
| <p>V_{SED}: Sediment Delivery to Wetland</p> <p>Definition: Extent of sediment delivery to wetland from anthropogenic sources including agriculture.</p> <p>Logic:</p> | <p>No evidence of sediment delivery to wetland.</p> <p>Indicators – No evidence of tillage in wetland or buffer area. Surrounding upland is native prairie with no observable evidence of erosion.</p> <p>A horizon of Tonka soil is < 8” thick. (Stutsman County)</p> | 1.0 |
| | <p>Evidence of historic and/or culturally accelerated sediment delivery in the form of stabilized deltas, sediment fans, etc. Most of basin not affected by sediment, small areas of concentrated flow into basin, i.e. sediment delivery is limited to small area.</p> <p>Indicators – Principal surrounding land use is cropland or severely eroded perennial cover. No evidence of tillage in the wetland or the buffer area. Catchment area is < 2% slope.</p> | 0.75 |
| | <p>Sediment delivery to the wetland basin evidenced by sediment staining of detritus and/or slight accumulations of sediment along plant stems in the temporary zone.</p> <p>Indicators - Conventional tillage through buffer to the outer edge of temporary zone (i.e. No Buffer). Catchment area 2 – 6% slopes. A horizon of Tonka soil is 8 to 12” thick (Stutsman County, ND) Surface horizon of soil at hydric / non-hydric boundary has overthickened A, lighter colored overwash, or calcareous overwash.</p> | 0.5 |
| | <p>Sediment delivery to the wetland basin evidenced by sediment staining of detritus and accumulations of sediment along plant stems in the temporary zone.</p> <p>Indicators – Conventional tillage through buffer into wetland. Catchment area 6 – 9% slopes. Surface horizon of soil in Temporary zone overthickened, lighter colored overwash, or calcareous overwash.</p> | 0.25 |
| | <p>Sediment delivery as evidenced by buried detritus and/or vegetation along outer edge of temporary zone. Recent deltas, sediment plumes, etc. in areas of concentrated flow. Indicators - Best management practices lacking to control sediment delivery. Catchment area >9% slopes.</p> <p>A horizon of Tonka soil >12” thick (Stutsman County)</p> | 0.1 |
| | <p>As above with pronounced sedimentation and raising of bottom elevation in wetland due to sedimentation, and/or infilling due to tillage, and/or filling. Topographic shape of basin severely altered (no longer a “bowl”)</p> | 0.0 |

Vdetritus

Where to measure: A representative site will be scouted, selected and measured in both the temporary and seasonal zone of the wetland. The percent of each zone will be recorded. This information will then be used to calculate the index for all or the portion of the wetland that is needed for the assessment.

When to measure: These measurements can be taken any time during the assessment, but for efficiency it could be performed in conjunction with the delineation procedure or in conjunction with collecting the sediment, porosity, and organic matter content measurements.

How and what to measure:

Preferred method:

1. The index finger can be used to measure the thickness of detritus (undecomposed brown litter or dead plant material) and the thickness noted on the finger can be measured with a ruler and recorded. A slippery or smooth feeling on your finger tip indicates you have gone through the detritus layer. If finger method fails, use of probe or spade is an alternative described below.
2. Care should be taken not to compact the detritus and not to measure the current year's growth. Previous years' growth is what to measure. If different land uses exist in the assessment area, a number of measurements need to be taken and averaged to assign the representative condition of the wetland if the wetland assessment area is not split.
3. Measurement will be recorded in both the temporary and seasonal zones.

Alternate method:

1. With the use of a spade (sharpshooter) take out a plug of soil deep enough to penetrate beyond the detrital layer. Account for disturbance by compaction, measure and record depth in inches to nearest 1/10 inch.
2. If sampling site is under water the use of a soil probe instead of a spade (preferably one with a 1.5" diameter coring tube) could be used to obtain a sample. Compare the cored samples to the detrital mass in the wetland. Coarse or fibrous material may slide around the probe tip. If the core samples do not match the source area, then use other sampling techniques.

WHAT TO RECORD:

Representative thickness of detritus in the Temporary Zone _____inch(s)

Representative thickness of detritus in the Seasonal Zone _____inch(s)

Definition and Measurement of Variable Condition V_{DETRITUS}

| Model Variable | Measurement or Condition | Index |
|--|--|--------------|
| V_{DETRITUS}: Detritus Definition: The presence of litter in several stages of decomposition (e.g., litter). Logic: | 75% to 125% of reference standard. | 1.0 |
| | 50% to 75% or >125% of reference standard. | 0.75 |
| | 25% to 49% of reference standard. | 0.5 |
| | Litter layer 10% to 25% of reference standard. | 0.25 |
| | Litter layer >0% to 10% of reference standard. | 0.1 |
| | Litter absent. | 0.0 |
| | | |

Vwetuse

Where to measure: The variable Vwetuse refers to land use within the jurisdictional boundary of the wetland assessment area. Land use will be noted for both the temporary and seasonal zone if present.

When to measure: Information on past and present land use is needed to accurately measure and determine the condition of this variable. Past or historical land use within the wetland should be checked in the office by viewing current and old land use maps. Other avenues of information for determining past land use would be from the producer or owner of the tract of land. Current land use will be determined in the field. The observation of some conditions vary by season and are subject to Best Professional Judgment during some time periods.

What and how to measure: This variable considers a disturbance gradient from native prairie to hard surface parking lot. Evidence of tillage in the past or present, and its impact in each zone may be needed. Frequency of haying, level of grazing, and evidence of compaction or ruts from machinery or livestock needs to be determined and recorded. The time in years of current and past land uses/changes, if available, can help explain condition. Examining the soil may reveal tillage layers in some cases. Also, the detrital biomass may be a clue to past use.

Land use will be noted in both the temporary and seasonal zone if they differ and as needed to measure or determine the condition of the wetland. Information on the amount of disturbance compared to well-managed range land will assure an accurate measurement or assessment of this variable.

Wetland land use categories considered in this variable are as follows:

- Grazed: proper utilization, somewhat over-utilized, and heavily over-utilized
- Hayed: frequency and where
- Idle
- Small grains: residue produced and intensity and frequency of tillage, amount of pesticide
- Row crops: residue produced and intensity and frequency of tillage, amount of pesticide
- Other disturbances: parking lot feed lot, etc.

What to record:

Land use & condition(s) in various years in temporary zone _____

Land use & condition(s) in various years in seasonal zone, if present _____

Definition and Measurement of Variable Condition V_{WETUSE}

| Model Variable | Measurement or Condition | Index |
|---|--|--------------|
| V_{WETUSE}: Wetland Land Use Definition: Dominant land use or condition of wetland. Logic: | No evidence of tillage in wetland. -OR- If previously tilled, outermost (temporary) wetland zone intact. -AND/OR- If some use in the wetland (e.g., haying, grazing), little evidence of compaction or rutting by equipment or excessive trampling by livestock. | 1.0 |
| | No evidence of tillage in zones wetter than the temporary (wet meadow) zone. -AND- Temporary zone minimally impacted by moderate grazing, haying, or tillage. | 0.75 |
| | Temporary zone tilled or heavily grazed in most years. -AND- Zones wetter than temporary zone are rarely tilled or are intact. | 0.5 |
| | Temporary wetland zone tilled most years. -AND- Zones wetter than temporary wetland zone are frequently (50% or more of years) tilled. | 0.25 |
| | Wetland receives conventional tillage in all zone(s) most years; if recently tilled, evidence of vegetation clods in furrows, etc. | 0.1 |
| | Wetland more severely disturbed than indicated above; (e.g., no vegetation, rutted, pig farm, feed lot, urban fill). | 0.0 |