US Army Corps of Engineers
Omaha District

NEBRASKA STREAM CONDITION ASSESSMENT PROCEDURE (NeSCAP)

(Interim)

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Nebraska Stream Condition Assessment Procedure

I. Introduction

This procedure has been developed for interagency use in the evaluation of streams and floodplains/riparian areas. The intent of this assessment methodology is to provide reconnaissance level characterization in order to:

- Document baseline information for a site prior to development activities,
- Develop potential alternatives that may lessen impacts,
- Support analyses in the evaluation of public interest review factors,
- Guide decisions regarding the appropriate amount of compensatory mitigation required for permitted impacts; and,
- Serve as an initial "screen" for determining the need for more detailed assessment or data needs in the evaluation of regulatory or resource management actions.

It is intended for use with "Strahler" stream orders 1 through 4. Hierarchical ordering of natural channels within a watershed was initially developed by Horton (1945). Several modifications of this original stream ordering scheme have been proposed, but the system of Strahler (1957) is probably the most used in resource applications. In this system, the smallest headwater tributaries are called first-order streams. The upper boundary of first-order streams is defined as the point where groundwater first begins to affect surface conditions or the point where the stream features appear. Where two first-order streams meet, a second-order stream is created; where two second-order streams meet, a third-order stream is created; and so on (Figure 1).

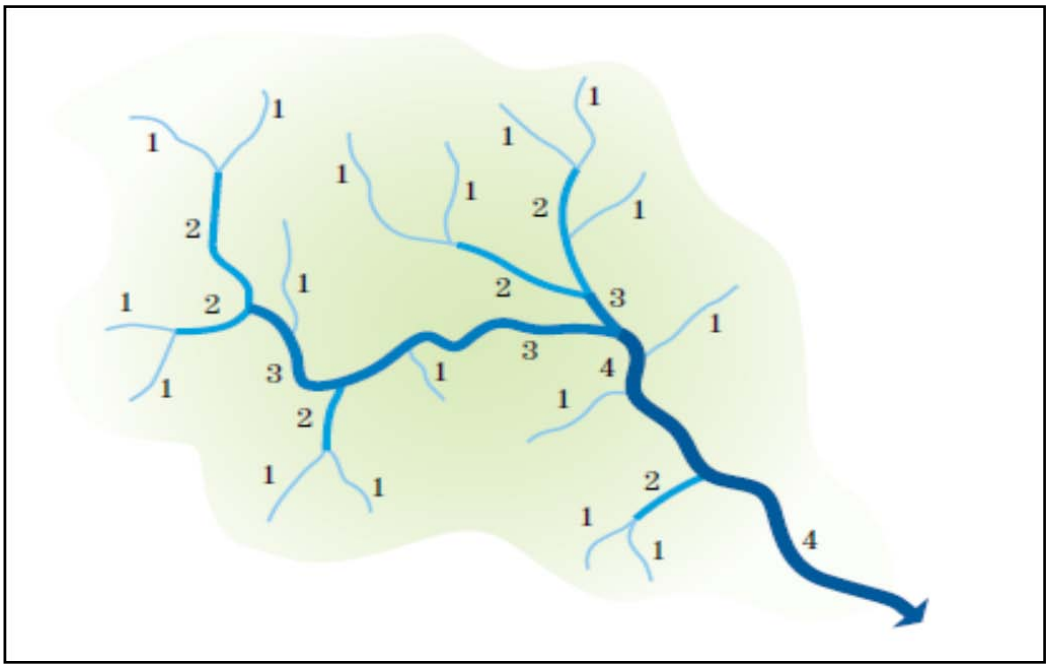

Figure 1. Strahler (1957) stream orders applicable to this assessment procedure. Adapted from FISRWG,1998.

In addition to using stream order to describe the areas of interest for application of this method, stream order is also important because it can be related to the expected functions of a stream corridor system. This is based upon the idea that there are predictable changes in geomorphology and hydrology as you move downstream through the fluvial system. These changes form a template for biotic and abiotic processes that determines the structure and dynamics of stream ecosystems.

A Riparian Context for Stream Assessment

A "riparian" context forms the basis of this assessment methodology. Riparian ecosystems are characterized as landscapes adjacent to drainage ways that exhibit vegetation, soil, and hydrologic mosaics along topographic and moisture gradients that are distinct from the predominant landscape surface types. Riparian ecosystems are corridors of variable width that occur along perennial, intermittent, and ephemeral streams. Two features that distinguish riparian ecosystems are the hydrologic interaction that occurs between the stream channel and adjacent areas through the periodic exchange of surface and ground water and the distinctive geomorphic features and vegetation communities that develop in response to this hydrologic interaction.

The definition of riparian used in this document follows the National Academy of Sciences publication entitled "Riparian Areas: Function and Management" (National Resource Council 2002). This definition is more inclusive than traditional concepts of riparian as it includes lacustrine systems' interface with fringe areas. The definition is as follows:

> *"Riparian areas are transitional between terrestrial and aquatic ecosystems and are distinguished by gradients in biophysical conditions, ecological processes, and biota. They are areas through which surface and subsurface hydrology connect waterbodies with their adjacent uplands. They include those portions of terrestrial ecosystems that significantly influence exchanges of energy and matter with aquatic ecosystems (i.e., a zone of influence). Riparian areas are adjacent to perennial, intermittent, and ephemeral streams, lakes, and estuarine–marine shorelines."*

As illustrated in Figure 2, the aggregated assessment unit selected for this assessment procedure is called the Riparian Reach (RR). The RR is defined laterally as a segment of a mainstem stream channel and adjacent riparian ecosystem that is relatively homogenous in terms of its geomorphology, edaphic conditions (soils), hydrology, channel morphology, vegetation, and cultural alteration characteristics. The RR includes the bankfull stream channel, active floodplain (floodprone area), and the less frequently flooded, historical floodplains and terraces.

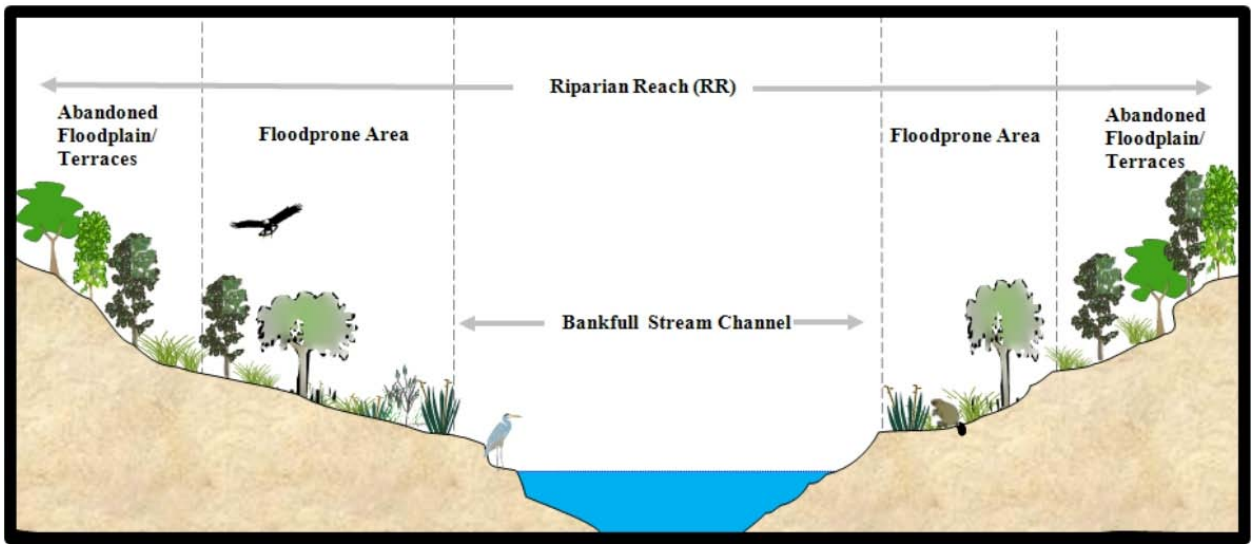

Figure 2. Idealized view of a "Riparian Reach" cross section depicting major zones.

Determining the active floodplain by designating the floodprone area is needed for applying this method. The floodprone area is determined in the field by projecting the elevation corresponding to two times the maximum depth of the bankfull channel until it intersects the surface of the adjacent abandoned floodplain/terrace on both sides of the mainstem channel. Longitudinal boundaries of the RR unit are determined on a case-by-case basis and are a compromise of an individual project's linear extent (i.e. length of riprap) or user defined natural channel units (i.e. meander belt width, alternating riffle –pool complexes). Other considerations that may factor in defining the RR assessment area include:

- Stream channel type or geomorphology,
- Changes in riparian vegetation,
- Changes in management, land use, or ownership where differences are likely to occur,
- A structure that impacts the stream/riparian area, such as a diversion, head gate, bridge, or culvert,
- The confluence of two or more streams,
- A change in stream order, or
- Assessment objectives.

Typically, wetlands within the riparian mosaic would be represented as depressions, oxbows, meander scars, swales, and overflow channels in various stages of terrestrialization. Common to all these features is the role of fluvial dynamics in formation and maintenance of ecosystem functions. Palustrine wetlands embedded within the riparian ecosystem are included as part of this procedure. Assessment for wetlands is limited to characterization of vegetation composition and descriptive information associated with land use mapping. If more detailed wetlands information is needed beyond the information presented in this document, the project investigator is advised to incorporate Hydrogeomorphic (HGM) assessment variables into this assessment method.

Assessment Procedure Overview

Form of this assessment procedure is thematic variables for the major physical, ecological, and anthropogenic factors that can strongly influence the stream and adjacent riparian system. Each variable is designated by a capital "V" and a subscript number. Variables utilized in this method are as follows:

- V_1 Hydraulic Conveyance and Sediment Dynamics
- V_2 In-stream Habitat/Available Cover
- V_3 Floodplain Interaction–Connectivity
- V4 Riparian Vegetation Composition
- V_5 Riparian Buffer Continuity and Width
- V_6 Riparian Land Use

More detail for each variable is provided in subsequent sections. The minimum assessment area is the bankfull stream channel and active floodplain. Abandoned floodplain terraces and wetlands are included if warranted by potential impacts and/or assessment objectives.

Each variable receives a "Condition Index Rating" between 0.1 and 1.0 based on conditions observed or measured at the project site in conjunction with off-site information. The most culturally disturbed condition is assigned a 0.1. The least culturally altered condition is assigned a 1.0 and is considered the "reference standard condition". Intermediate assignments between 0.1 and 1.0 represent the range of variation between the most disturbed and least disturbed condition. If a given variable is not applicable, the field investigator(s) may enter "N/A" (Not Applicable), or "UK"(Unknown). The variables are scored for each individual RR defined. Only those variables scored are included in the final **Stream Condition Index (SCI)**. The SCI is defined as the sum of the scores for the rated variables divided by the maximum sum of the scores for the variables rated where:

$$SCI = \frac{\sum V}{\sum V_{max}}$$

The resultant SCI for a given RR is then multiplied by stream lengths or area for a unit-less weighted score. This number is then used descriptively in pre-construction baseline characterization and for comparative analyses in impact analyses or potential mitigation.

For activities that convert streams to impoundments, the Condition Index Rating for selected variables is assigned a "0" in impact analyses determinations. Also, alternative characterization methods are provided where it is feasible to compare thematic variables for these types of conversions.

Data Needs for Conducting an Assessment

Both off-site and on- site data are utilized in assessments. For application of this methodology, descriptive cover mapping is needed. Pre-field investigation of off-site information should also be consulted in defining the project assessment area. Many sources of information will be useful in defining project boundaries and characterizing the project area. General off-site information commonly available includes:

- Aerial photographs,
- Topographic maps,
- Geomorphic or geologic maps,
- County soil surveys,
- National Wetland Inventory maps; and,
- Flood frequency maps.

Characterizing the assessment area involves describing the geomorphic setting, surface and groundwater hydrology, vegetation, soils, land use, proposed impacts, and any other characteristics and processes that have the potential to influence how a RR performs functions. Narrative should be accompanied by maps and figures that show project area boundaries, jurisdictional wetlands, proposed impacts, roads, ditches, buildings, streams, soil types, plant communities, threatened or endangered species habitat, and other important features.

On-site characterization involves areal or linear measurements of the stream, generalized cross-sections within the RR, general observations of habitat conditions, vegetation composition of the riparian zone, and documentation of surrounding land use. Section III will provide information on each variable regarding the rationale for its use, definition of its assessment area, and associated data collection needs. General concepts to review prior to conducting an assessment involve descriptive terminology for stream and riparian features and familiarity with "c*hannel evolution"* concepts. This information is provided in the following Section II.

II. Important Background Information

Fluvial Geomorphology Terminology

Bankfull channel width is the flow rate that forms and controls the shape and size of the active channel or, simply put, is the stream width at the bankfull discharge. Bankfull discharge or bankfull flow is the flow rate at which the stream begins to move onto its active flood plain, if one is present. On average, the bankfull discharge occurs every 1 to 2 years, depending on local stream channel and weather conditions.

FLUVIAL GEOMORPHOLOGY TERMS AND CONVENTIONS FOR STREAM ASSESSMENTS

- A **stream reach** is the length of channel uniform with respect to discharge, depth, area, and slope.
- ***Bankfull discharge*** is the dominant channel forming flow with a recurrence interval seldom outside the 1 to 2 year range.
- ***Bankfull stage*** is delineated by the elevation point of incipient flooding, indicated by deposits of sand or silt at the active scour mark, break in stream bank slope, perennial vegetation limit, rock discoloration, and root hair exposure.
- ***Bankfull width*** is the channel width at bankfull discharge. The terminology *wetted width* generally refers to observations at the time of the survey. Wetted width is generally less than bankfull width and may sometimes be referred to as the "low flow channel".
- ***Bankfull depth*** is the average depth measured at bankfull discharge.
- **Floodplains** are lands that are actively flooded beyond bankfull (once every 1-2 years), generally with a broad, gently sloped valley floor, often bounded by a **terrace** (abandoned floodplain) or a **scarp** (an encroaching side slope).
- **Floodprone width is** the stream width at a discharge level defined as twice the *maximum* bankfull depth.
- **Floodprone area** is the relatively flat lowland that borders a stream and is covered by its waters at flood stage of twice the maximum bankfull depth.
- **Bank height ratio** is a field measurement that determines the degree of channel incision. It is calculated by dividing the maximum bankfull depth into the height of the lowest bank.
- **Entrenchment** is a measure of the vertical confinement (bank height) of the stream. The entrenchment ratio is determined by dividing the width of the flood prone area by the bankfull width.
- **The width/depth ratio** (w/d) is a relative index of channel shape. Width is the total distance across the channel and depth is the mean depth of the channel.

A critical point of reference in applying this assessment method is locating and describing the bankfull stage. This provides a target elevation from which to separate out the main channel from the lower limit of the active floodplain. From this elevation, additional characteristics can be estimated or measured. Principally, this involves estimating the extent of the active floodplain (the floodprone area) as a means to contrast with the abandoned floodplain or other remnant features (See Figure 3).

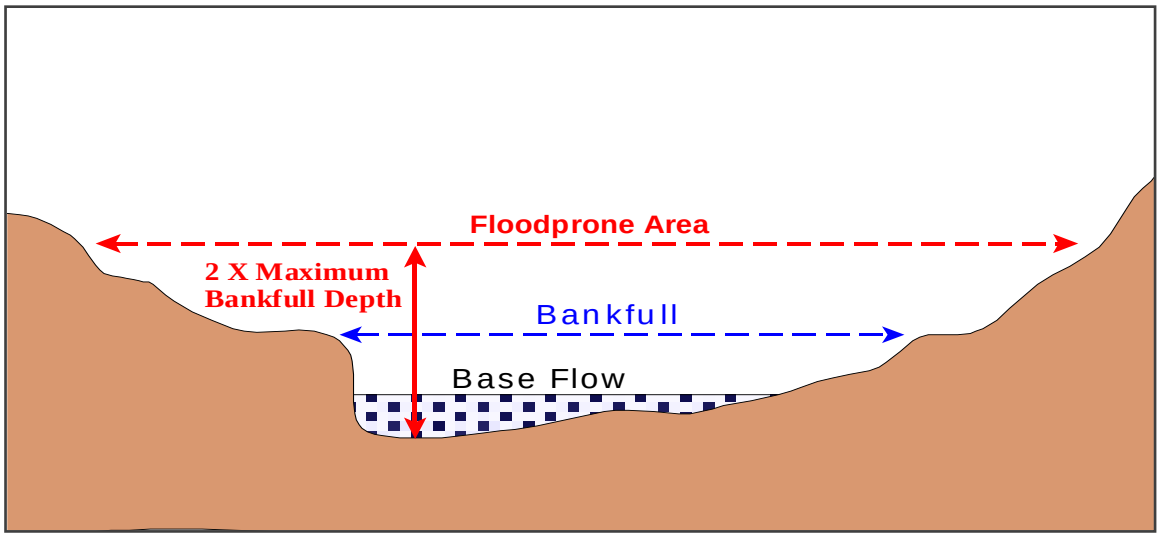

Figure 3. Schematic cross section illustrating conventions for estimating the floodprone area.

There are several visual indicators of the bankfull stage that enable field determination of this important parameter for areas where stream flow records are not available. These indicators vary in their importance and discriminating power for different stream types. Partial listings of these indicators are as follows:

- The presence of a floodplain at the elevation of incipient flooding.
- The elevation associated with the top of the highest active channel depositional features (e.g., point bars, central bars within the bankfull channel). These are especially good indicators for channels in the presence of terraces or channels adjacent to colluvial slopes.
- A break in slope of the banks and/or a change in the particle size distribution, (since finer material is associated with deposition by overflow, rather than deposition of evidence of an inundation feature such as defined benches inside of incised rivers.
- Coarser material within the active channel.
- Exposed root hairs below an intact soil layer indicating exposure to frequent erosive flow.

It is important when utilizing this assessment methodology to recognize scarps, benches and terraces in order to distinguish the active floodplain from the abandoned floodplain. Scarps are steep slopes or cliff, formed by erosion or faulting while a bench is a narrow flat ledge of land, often the remnant of a former bankline. Stream terraces are elevated portions of a floodplain created when the stream down cuts and creates a new floodplain at a lower elevation. Stream terraces are important indicators of environmental change.

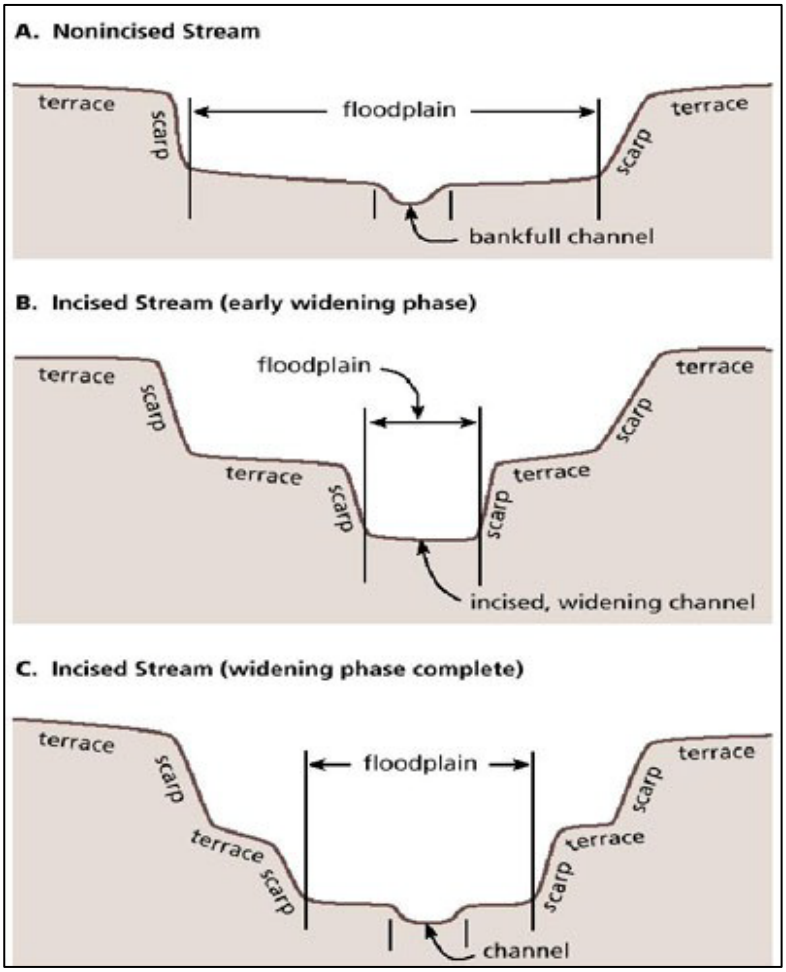

Figure 4. Terrace formation caused by incising or widening streams (modified from FISWRG, 1998).

Cross-section morphology may vary by valley type and degree of incision (Figure 4). In certain scenarios, evaluating entrenchment or bank heights may assist the user in assigning a variable condition index score. Some streams may be entrenched, implying vertical containment of floods.

The degree of entrenchment determines whether the flat area next to the stream is a frequently flooded floodplain, an ancient flood plain, or outside of the flood zone. In contrast, bank heights may be indicative of a stream that is lowering its local base level, but is not yet entrenched.

These characteristics can then be applied as ratios to be used in describing entrenchment, incision or inferences on bank stability or lateral connectivity.

Channel Evolution Models

Channels destabilized by “natural” and anthropogenic disturbances can systematically pass through a sequence of different channel forms over time. Channel evolution models (CEM) describe this sequence of changes a stream undergoes after certain kinds of disturbances such as channel straightening, increase in peak discharges, or changes in sediment load. The geomorphic response can include increases or decreases in the width/depth ratio of the channel and may also involve alterations to the floodplain. The continuum of channel change can be conceptually segmented into discrete phases or stages, each characterized by the dominance of a particular channel adjustment process.

Schumm, Harvey, and Watson (1984) showed that disturbed channels follow a predictable pattern of adjustments through time which varies along the channel longitudinal profile. These adjustments were described by a series of five process oriented stages of development. Schumm’s model was slightly revised by Simon (1989, 1995) who developed a six-stage CEM. This is the CEM that is most typically referenced. The Simon model identifies six stages through

which a stream progresses when subjected to destabilizing influences such as channelization or urbanization in the watershed. Each of these stages is referred to as a Class. Cross-sectional views of each CEM Class are provided in Figure 5. Additional characteristics for each Class are provided in Appendix A.

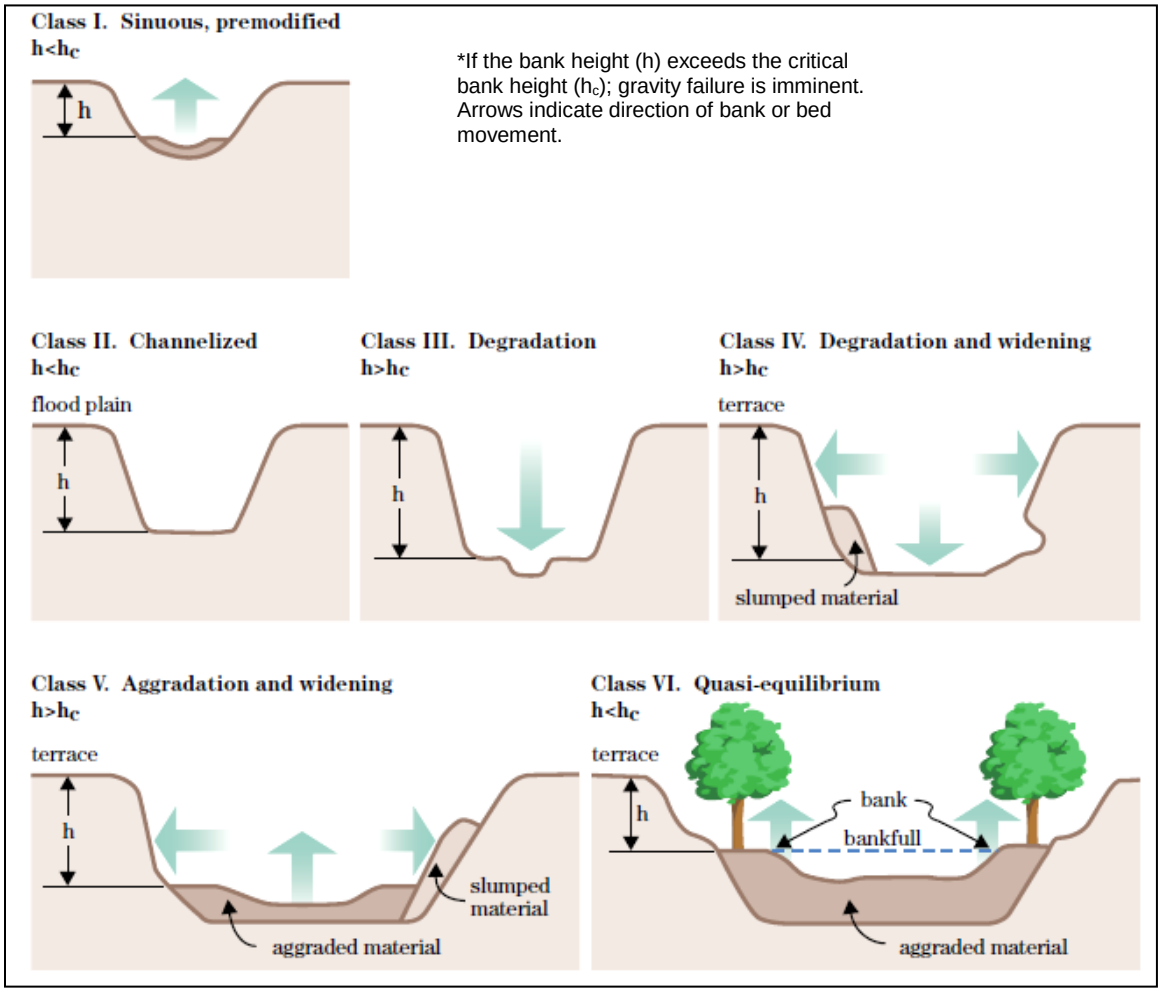

Figure 5. The six stages of channel evolution from Simon (1989).The cross section views have been modified from source materials in: Natural Resources Conservation Service (2010).

The CEM begins with a pre-disturbance condition (Class I, Sinuous, premodified) in which the channel is well vegetated and has frequent interaction with its floodplain. Following a perturbation in the system (i.e. stream straightening, bank stabilization), degradation occurs (Class II, Channelization), usually as a result of excess stream power in the disturbed reach. Channel degradation eventually leads to over steepening of the banks, and when critical bank heights are exceeded, bank failures and mass wasting (the episodic down slope movement of soil and rock) lead to channel widening (Class III, Degradation and Class IV, Degradation and widening). As channel widening and mass wasting proceed upstream, an aggradation phase follows in which a new low-flow channel begins to form in the sediment deposits. Upper banks may continue to be unstable at this time (Class V, Aggradation and widening). The final stage of evolution is the development of a channel within the deposited alluvium with dimensions and

capacity similar to those of the pre-disturbance channel (Class VI, Quasi-equilibrium). The new channel is usually lower than the pre-disturbance channel, and the old floodplain now functions primarily as a terrace.

The Simon CEM model is used in this assessment procedure for documenting stream fluvial dynamics related to connectivity. Thus, it is important that the current class of channel evolution be identified for interpretation and assignment of Condition Index Scores.

III. Model Variables and Defining Assessment Areas

The first two variables assess the channel and bankfull width. Emphasis is on channel stability, sediment transport, the interface of the channel with the immediate overbank area and morphological conditions that influences habitat diversity. These variables are:

- V_1 Hydraulic Conveyance and Sediment Dynamics and;
- V_2 In-stream Habitat/Available Cover

The remaining four variables are used to assess the interaction of fluvial processes as it affects riparian system dynamics. Emphases is on the degree of hydrologic connectivity (both longitudinally and laterally) of the fluvial system, the subsequent vegetation response and influences of land use at the terrestrial-aquatic interface. These variables are:

- V_3 Floodplain Interaction–Connectivity,
- V_4 Riparian Vegetation Composition
- V_5 Riparian Buffer Continuity and Width
- V_6 Riparian Land use

Based upon the stream and floodplain terminology previously described, each variable within a designated RR has a distinct assessment area relative to a cross-section(s). Each RR evaluated should have a diagram depicting the cross-section(s) as observed at the time of assessment. An idealized cross-section of a stream is provided in Figure 6. Included within this Figure are generic views of each variable's assessment area. In applying this method, annotations of the cross-section should include, at a minimum, those terms referenced in the preceding sections and the diagram that follows.

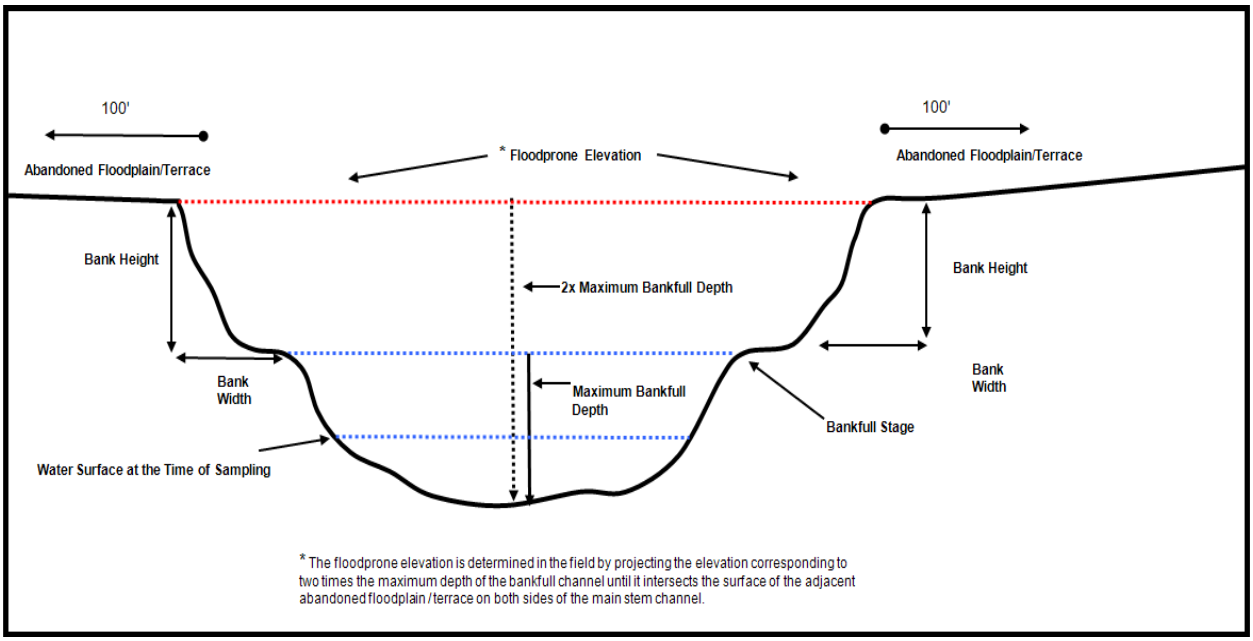

Figure 6. Idealized stream cross section depicting major geomorphological features associated with this assessment procedure.

Each variable listed below has a defined area of assessment corresponding to the above diagram. The assessment area for each variable is as follows:

- V_1 Hydraulic Conveyance and Sediment Dynamics: Below the bankfull width
- V_2 In-stream Habitat/Available Cover: Below the estimated floodprone area
- V_3 Floodplain Interaction–Connectivity: Floodprone area and abandoned floodplain/terraces
- V_4 Vegetation Composition: V_{4a} above the floodprone area with an artificial convention of 100' from the top of each bank; and, V_{4b} below the floodprone area.
- V_5 Riparian Buffer Continuity and Width: An artificial convention of 100' from the top of each bank.
- V_6 Riparian Land Use: An artificial convention of 100' from the top of each bank

Calculation of the bank height ratio and entrenchment ratio can be derived from this descriptive information. These measures may assist interpretations as to overall stream condition and serve as reference data for future applications. The user should also note that in some instances artificial conventions for bounding the assessment area are used (i.e. buffer width is measured perpendicular from the top of the bank for a distance laterally of 100').

V_1 Hydraulic Conveyance and Sediment Dynamics

Background and rationale: Hydraulic conveyance and sediment dynamics addresses fluvial processes for the active channel within the RR. The terminology "Altered Hydraulic Conveyance" (AHC) is used in the description of this variable and indicates the degree to which engineering techniques have been used to "improve" the capacity of channels to convey surface water downstream. The engineering techniques involve reducing the frictional resistance (i.e. roughness) caused by channel substrate, vegetation, woody debris, and other objects in the channel, thus minimizing the wetted perimeter, and/or shortening the length of a channel.

Specific techniques include dredging, straightening, hardening/lining of the stream channel, and the removal of vegetation. This variable is assessed by narrative criteria or measured as a percent of the length of mainstem channel in a riparian reach with (AHC). Aerial photography and field observations are used to estimate the Condition Index Rating of this metric. For impact or mitigation evaluations, the Condition Index Rating is zero when a stream is converted to a lacustrine system.

Table 1. V_1 Hydraulic Conveyance and Sediment Dynamics

Condition Index Rating	Indicator Score or Description of Conditions
1.00	Movement of sediment in the channel is in equilibrium in terms of supply, erosion, and deposition processes. **On most streams** there are alternating point bars; bank erosion occurs, but is stabilized and moderated by vegetation; and channel width, form, and floodplain area is consistent through the reach. **In some streams**, some of these indicators may not be apparent, but overall bank and hill slope erosion is moderated by vegetation and there are no apparent culturally induced catastrophic failures. The channel is stable, no active down-cutting occurring, or; old down-cutting apparent but a new, stable riparian area has formed within the incised channel, OR; ≤5% of active channel within the riparian reach with altered hydraulic conveyance (AHC).
0.75	Movement of sediment in the channel is in equilibrium with the current hydrologic regime, as opposed to a culturally unaltered condition, and exhibits an overall balance in terms of erosion and deposition processes. **On most streams** there are alternating point bars; bank erosion occurs, but is stabilized and somewhat moderated by vegetation; and channel width, form, and floodplain area are consistent through the reach. **In some streams**, some of these indicators may not be apparent, but overall bank and hill slope erosion is somewhat moderated by vegetation and no culturally induced catastrophic failures are apparent. The channel has evidence of old down-cutting that has begun stabilizing, vegetation is beginning to establish, even at the base of the falling banks, soil disturbance is evident, OR; >5 and ≤15% of riparian reach with AHC .
0.50	Sediment disequilibrium is minor and localized within the reach. This includes small, localized areas of bank protection, slumping, or encroachment on the floodplain and channel. This condition class includes previously disrupted reaches on a recovery trajectory, such as deeply entrenched streams where down-cutting has been arrested by structural grade control, and there is sufficient room for lateral channel migration and establishment of a functional floodplain within the incised channel. Head cuts in early stage are present. Immediate action may prevent further degradation, OR; >15 and ≤30% of riparian reach with AHC.
0.25	Sediment erosion and deposition out of equilibrium. Water inflow is sediment rich, poor or accelerated bank erosion exists. Channel not actively incising but extensive disequilibrium is evident. Typical indicators include extensive bank slumping (erosion events that exceed any moderating influence of native vegetation), active gullies feeding into the reach from adjacent hill slopes, or shoaling of sediments rather than deposition in sorted lateral and mid-channel bars. Apparently stable channels should be placed in this category if there is evidence of regular mechanical disruption, such as bulldozing of the channel bottom and clearing of riparian vegetation to improve flood conveyance. Channel with some widening but limiting new floodplain development; the existing floodplain is not well vegetated. The vegetation that is present is mainly pioneer species. Bank failure is common, OR; >30 and ≤50% of riparian reach with AHC.
0.10	Sediment dynamics within most of the reach are seriously disrupted. This includes reaches where no significant storage or recruitment of sediment occurs (i.e., reaches in underground tunnels/culverts, and reaches hardened with rock or concrete). It also includes reaches that are either actively incising or functioning as sediment traps (e.g., sediment basins). This also includes reaches that have been subject to recent changes likely to induce severe disequilibrium, such as extensive floodplain filling, change in slope, channel straightening, or other changes that are likely to cause channel down-cutting during future high-flow events. The channel is deeply incised, resembling a gully, little or no riparian area development, or active down-cutting is clearly occurring. Only occasional or rare flood events access the flood plain. Tributaries will also exhibit signs of down-cutting, OR; >50% of riparian reach with AHC.

V_2 In-stream Habitat/Available Cover

Background and rationale: The biological components of riparian ecosystems have adapted to episodic cycles of disturbance and developed a variety of mechanisms that make it possible to survive and flourish where other organisms cannot. The type, amount and temporal availability of in-stream habitat influences a variety of life history requirements for aquatic organisms such as shelter, food, reproductive areas, as well as increases the number of available niches, thus in turn increasing the biological diversity within a stream. This attribute includes the relative quantity and variety of natural structures in the stream, such as cobble (riffles), large rocks, fallen trees, logs and branches, persistent leaf packs, and undercut banks; available as refugia, feeding, or sites for spawning and nursery functions of aquatic macrofauna. A wide variety and/or abundance of in-stream habitat features in the stream provide a large number of niches, thus increasing habitat diversity. As variety and abundance of cover decreases through anthropogenic influences (including water withdrawals), habitat structure becomes monotonous, diversity decreases, and the potential for recovery following disturbance decreases. This variable is evaluated below the floodprone area. For impact or mitigation evaluations, the Condition Index Rating is zero when a stream is converted to a lacustrine system.

Table 2. V_2 In-stream Habitat / Available Cover

Condition Index Rating	Indicator or Description of Conditions
1.00	Within the flood prone area, there is greater than >50% coverage by diverse habitat features favorable for stream faunal colonization and maintenance of vegetation dynamics for recruitment. Features may include snags, submerged logs, undercut banks, roots, cobble, rocks, persistent leaf packs, pools and glides, or other stable habitat at a stage to allow colonization. No barriers to faunal movement.
0.75	Within the flood prone area there is >30% and ≤50% coverage by habitat features favorable for stream faunal colonization and/or cover. Many habitat features are not transient. Adequate habitat for maintenance of populations is evident.
0.50	Within the flood prone area, there is >10 and ≤30% coverage by habitat features favorable for stream faunal colonization and cover; habitat availability may be less than desirable; substrate may be frequently disturbed. Drop structures, culverts, dams, or diversions are present within the reach, but with minimal effect to the channel gradient or faunal movement. Some channel deepening is noticeable.
0.25	Within the flood prone area, there is ≤10% coverage of habitat features present; lack of habitat is obvious; substrate unstable or lacking; concrete lined channels are present within portions of the stream. Habitat features and pools buried or lacking, channel bottom may be flat. Drop structures, culverts, dams, or diversions are present within the reach with noticeable effects to the channel gradient (deepening) or inhibition of faunal movement.
0.10	Habitat features and pools are buried or lacking, channel bottom may be flat. Channels banks are completely armored or concrete lined.

V_3 Floodplain Interaction–Connectivity

Background and rationale: Floodplain Interaction–Connectivity indicates of the degree to which the hydrologic interaction between the bankfull channel, the active floodplain and terraces of the riparian ecosystem remains intact. Connectivity is the degree to which water, organisms, and suspended elements and compounds can move across the fluvial system landscape. The degree of connectivity is based on the presence or absence of barriers. Barriers are features which interrupt connectivity. They may be natural or human induced. The lost connection could be a result of channel incision and/or modification to the floodplain. Common observable

features for assigning a Condition Index Rating include ditching, levees, dikes, and/or channelization, and impoundments on tributaries. In assigning the Condition Index Rating, the channel evolution concepts previously presented should be consulted. Previous observations for the V_1 Hydraulic Conveyance and Sediment Dynamics variable and channel cross-section information should be used to assign this Condition Index Rating. The assessment area for this variable is the floodprone area and abandoned floodplain/terraces.

Table 3. V_3 Floodplain Interaction–Connectivity

Condition Index Rating	Indicator or Description of Conditions
1.00	The floodplain has not been physically manipulated. No surface alterations (such as constructed channels, dams, dikes, diversions, dugouts, or fill) or subsurface alterations (such as tile drainage) are present. Natural geomorphic features occur within the floodplain as evidenced by irregular, uneven surfaces (undulating conditions from meander scars, sediment bars, or hummocks). The current stage of the channel would indicate an equilibrium channel corresponding to a Class I condition (sinuous, pre-modified channel).
0.75	Few changes to the floodplain surface. Observable changes in elevation are restricted to only farm roads or bridges with culverts. The current stage of the channel would indicate quasi-equilibrium corresponding to a Class VI condition.
0.50	Multiple geomorphic modifications to the floodplain surface to control flood energy, often with bank control structures, but still permitting flow access via culverts. The current stage of the channel would indicate aggradations and widening, corresponding to a Class V condition.
0.25	Complete geomorphic modification BUT still permits flow access via culverts and occasional overbank flooding. The current stage of the channel would indicate degradation and widening corresponding to a Class IV condition.
0.10	Complete geomorphic modification to the floodprone area. Bank control structures (dikes, etc) are in a continuous structure preventing channel movement and also preventing overbank flow. The current stage of the channel would indicate channelization and/or active bed degradation corresponding to a Class II or III condition.

For those projects involving conversion of a stream to an impounded lacustrine system, an alternate scoring of this Variable is to be used. The metric for this comparison is based upon shoreline lengths of the normal pool as compared to the shoreline lengths of the stream. A “Connectivity Ratio” is then calculated as:

$$\frac{\text{Shoreline length of the normal pool}}{2(\text{length of the RR(s) inundated})}$$

The resultant Connectivity Ratio is then used to assign the Condition Index Rating as follows:

If the Connectivity Ratio is:	Assign the following variable sub-index score:
≥ 1.00	1.00
< 1.00 and ≥ 0.80	0.75
< 0.80 and ≥ 0.60	0.50
< 0.60 and ≥ 0.40	0.25
< 0.40	0.10

V_4 Riparian Vegetation Composition

Background and rationale: Riparian Vegetation Composition is a response variable to both natural and anthropogenic disturbance. Native plant coverage is important to maintaining ecosystem structure and function. Critical background information for scoring this Variable can be found in Terrestrial Ecological Systems and Natural Communities of Nebraska (Rolfsmeier and Steinuaer, 2010). This document describes the natural plant communities of Nebraska; meaning those types that are unmodified or only marginally modified by humans. These descriptions also provide accounts of community classification, environmental context, landscape setting, and vegetation composition.

This information serves as a basis for comparison of relatively undisturbed areas to those communities subject to varying degrees of anthropogenic disturbance. Table 4 is a list of major plant associations for the state of Nebraska corresponding to the wetland and riparian communities of interest for this assessment method. These associations can also be used as descriptors for project mapping. Cowardin et al. (1979) attributes are included in the above referenced document and are presented here verbatim.

Scoring of this variable is determined by comparing the dominant species observed at cross-sections within the RR assessment areas to a list of diagnostic and most abundant species extracted from Rolfsmeier and Steinuaer (2010) plant community associations. Diagnostic species are those key plant species with high constancy that are used to classify a plant association. This may include dominant, characteristic species, or abundant plant species that are consistently present in terms of percentage cover. These species are considered “reference standard” for purposes of this assessment method.

A list of diagnostic species that are to be used as a basis of comparison is provided in Appendix B-1. Appendix B-2 lists each community with its specific vegetation composition. Methodology for determining dominance from field observations should follow the Rapid Test and Dominance Test described in Regional Supplements to the Corps’ 1987 Delineation Manual (U.S. Army Corps of Engineers 2010a, 2010b).

Table 4. Major Riparian and Wetland Plant Associations in Nebraska as adapted from Rolfsmeier and Steinauer (2010).

Classification	**Cowardin description**
Wetland Forest and Woodland Communities	--
Eastern Riparian Forest	Palustrine forested, temporarily flooded
Eastern Cottonwood-Dogwood Riparian Woodland	Palustrine forested, temporarily flooded
Cottonwood-Peachleaf Willow Riparian Woodland	Palustrine forested, temporarily flooded
Cottonwood Riparian Woodland	Palustrine forested, temporarily flooded
Cottonwood-Diamond Willow Woodland	Palustrine forested, temporarily flooded
Peachleaf Willow Woodland	Palustrine forested, temporarily flooded
Wetland Shrubland Communities	--
Riparian Dogwood-False Indigo bush Shrubland	Palustrine scrub-shrub, intermittently flooded
Sandbar Willow Shrubland	Palustrine scrub-shrub temporarily and seasonally flooded
Wetland Herbaceous Communities	--
Freshwater Seep	Palustrine emergent, saturated
Prairie Fen	Palustrine emergent, saturated
Sandhills Fens	Palustrine emergent, saturated
Eastern Cordgrass Wet Prairie	Palustrine, temporarily to seasonally (depressions) flooded
Eastern Sedge Wet Meadow	Palustrine emergent, seasonally and semi-permanently flooded
Eastern Saline Meadow	Palustrine emergent, temporarily flooded
Northern Cordgrass Wet Prairie	Palustrine emergent, temporarily flooded
Sandhills Wet Meadow	Palustrine emergent, temporarily to seasonally flooded
Western Alkaline Meadow	Palustrine emergent, temporarily flooded
Western Sub-irrigated Alkaline Meadow	Palustrine emergent, temporarily flooded
Wheatgrass Playa Grassland	Palustrine emergent, temporarily flooded
Western Sedge Wet Meadow	Palustrine emergent, temporarily to seasonally flooded
Playa Wetland	Palustrine emergent, temporarily and seasonally flooded
Eastern Bulrush Deep Marsh	Palustrine emergent, semi-permanently flooded
Spikerush Vernal Pool	Palustrine emergent, temporarily to seasonally flooded
Cattail Shallow Marsh	Palustrine emergent, seasonally to semi-permanently flooded
Eastern Saline Marsh	Palustrine emergent, seasonally to semi-permanently flooded
Sandhills Hardstem Bulrush Marsh	Palustrine emergent, semi-permanently flooded
Reed Marsh	Palustrine emergent, temporarily to seasonally flooded
Western Alkaline Marsh	Palustrine, emergent, seasonally to semi-permanently flooded
Eastern Pondweed Aquatic Wetland	Palustrine aquatic bed, permanently and semi-permanently flooded
American Lotus Aquatic Wetland	Palustrine aquatic bed, seasonally to semi-permanently flooded
Northern Pondweed Aquatic Wetland	Palustrine aquatic bed, permanently and semi-permanently flooded
Water-Lily Aquatic Wetland	Palustrine aquatic bed, permanently and semi-permanently flooded
Saline/Alkaline Aquatic Wetland	Palustrine aquatic bed, permanently to semi-permanently flooded
Wetland Sparsely Vegetated Communities	--
Perennial Sandbar	Palustrine emergent, temporarily and seasonally flooded
Sandbar/Mudflat	Riverine unconsolidated bottom, temporarily to seasonally flooded

As appropriate, cover types can be tied to morphological characteristics (i.e., terrace, scarp, bench or abandoned floodplain). The process for scoring this variable is as follows:

- Vegetation is evaluated at the same location as channel cross-section descriptions.
- Within a given cross-section, vegetation characterizations are stratified by observations above the floodprone area (V_{4a}) and below the floodprone area (V_{4b}).
- For each vegetation cover type evaluated within the V_{4a} and V_{4b} assessment areas, a determination of dominant species should be recorded.
- The percent concurrence of these dominant species is then compared to the list of diagnostic species.
- A unique Condition Index Rating is provided for V_{4a} and V_{4b} per each cross-section. The Condition Index Rating is based on the percentage intervals provided in Table 5.
- Each RR identified will have a unique final Condition Index Rating specific for V_{4a} and V_{4b}.

In addition to the percent concurrence of dominant species observed as compared to diagnostic species, narrative is also provided for assignment of this Condition Index Rating (Table 5).

Table 5. V_4 Riparian Vegetation Composition (V_{4a} and V_{4b})

Condition Index Rating	**Indicator or Description of Conditions**
1.00	The percent concurrence of dominant plants observed with diagnostic species is ≥ 95 %. Existing riparian habitat is of high caliber; if this site were to be preserved, minimal management would be necessary due to natural processes still being in effect. Vegetation represents the reference standard condition with no chronic anthropogenic disturbances; or, the site has recovered from historical anthropogenic disturbance.
0.75	The percent concurrence of dominant plants observed with diagnostic species is ≥75 and < 95%. Existing riparian habitat is only slightly degraded; preservation and/or improvement are likely with moderate management effort. Native vegetation is on a recovery trajectory with compatible management practices that mimic natural disturbances (i.e., low intensity grazing). Presences of areas disturbed through natural processes (i.e., fire and flood) are still evident.
0.50	The percent concurrence of dominant plants observed with diagnostic species is ≥50% and < 75%. Existing riparian habitat somewhat degraded; preservation and/or improvement possible but would require significant management effort. Native vegetation present for some representative communities, but invasive or ruderal species are prevalent. Disturbance is largely anthropogenic and natural processes influencing the plant community are rare.
0.25	The percent concurrence of dominant plants observed with diagnostic species is ≥ 25% or < 50%. Existing riparian habitat degraded; preservation not desirable or attainable; improvements are not likely or would require significant and costly management effort. Native vegetation is localized within the assessment area. Presence of areas disturbed through natural processes is not evident. Vegetation composition is dominated by invasive or ruderal species.
0.10	The percent concurrence of dominant plants observed with diagnostic species is ≥ 5% or < 25%. Existing riparian habitat is severely degraded. Native vegetation is largely absent, area is hardened (i.e., paved, urban, etc.) or graded.

V_5 Riparian Buffer Continuity and Width

Background and rationale: Riparian ecosystems typically form a relatively continuous corridor along the stream channel and floodplain. Intact vegetated corridors allow animals to move to locations throughout a watershed on a daily, seasonal, or annual basis. Gaps in the continuous riparian corridor can occur as a result of natural fluvial processes during large magnitude flow events. However, gaps are more frequently created as a result of cultural alterations such as roads, power and pipeline corridors, agriculture activities, and urban/industrial development.

Riparian buffer continuity and width are interrelated as shown in Table 6. Continuity is the estimated percentage of the perimeter which is bordered by permanent vegetation. Average width should be estimated based only on those areas where a buffer of permanent vegetation is present. This variable is measured perpendicular from the top of the bank for a distance laterally of 100'. Both banks of the stream channel are measured and then averaged for determination of the summary rating and subsequent Condition Index Rating assignment. Aerial photography can be used for estimation of this variable but should be verified in the field.

The point on the table at which these figures intersect is the summary rating. Next, correlate the summary rating to the 0-1 condition index rating.

Table 6. V_5 Riparian Buffer Continuity and Width

	Continuity (%)	100	80-99	60-79	40-59	20-39	5-19	<5
Width(ft)	≥100	1.00	0.90	0.70	0.50	0.30	0.15	0.00
	75-99	0.80	0.75	0.60	0.40	0.25	0.10	0.00
	50-74	0.60	0.50	0.50	0.30	0.20	0.10	0.00
	25-49	0.40	0.30	0.30	0.20	0.15	0.05	0.00
	10-24	0.20	0.20	0.15	0.10	0.10	0.05	0.00
	5-9	0.10	0.10	0.10	0.05	0.05	0.01	0.00
	<5	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Corresponding Summary Rating with Variable score:

If summary rating is between :	Assign the following Condition Index Score:
0.80 - 1.00	1.00
0.60 - 0.79	0.75
0.40 - 0.59	0.50
0.20 - 0.39	0.25
0.01 - 0.19	0.10
0.00 - OR No buffer of permanent vegetation is present = 0	

V_6 Riparian Land Use

Background and rationale: Land use indicates the way in which a tract of land is utilized, has been developed, or the type of vegetation present. Rationale for this metric is that land use types can determine potential runoff rates and potential impacts to water quality. A number of studies have related land use to water quality. While it has been consistently shown that the water quality decreases as natural land cover becomes culturally altered, the specific relationships and causative factors vary widely. Land use maps are typically developed through

the interpretation of aerial photographs. In some instances land use mapping data may be available from government or other sources. All mapping should have appropriate documentation as to methods/meta-data and is subject to on-site verification. The assessment area for this variable is defined as a distance of 100' laterally from the top of each bank.

General land use classes are provided in Table 7. Land use classes are arranged from most intensive to the least intensive land use. Each land use category has a weight that is multiplied by its corresponding area within the project area (weighted score). A weighted average is then calculated. Each bank will be assigned a Condition Index Rating which is then averaged and assigned to the entire RR. This number will fall within the intervals provided below and a corresponding Condition Index Rating is then assigned. In determining the land use assessment area in a reservoir situation, the emergency spill way elevation is defined first. This elevation is then projected across the reservoir to form an area of interest for assessing this Variable. This boundary convention is considered synonymous with the upper extent of the floodprone area of stream systems.

Table 7. V_6 Riparian Land Use

	Land Use Category	Land Use Weight		Area of Land Use		Weighted score (WS) for each land use category
Most Intense ↓	Impermeable surface	1	X		=	
	Feed lot	1	X		=	
	Row crop or Small grain	3	X		=	
	Farmstead	6	X		=	
	Woodlot/shelterbelt	6	X		=	
	Perennial Cover of any type	8	X		=	
Least Intense	Managed for native vegetation cover and diversity	10	X		=	
				Total area	=	
	*User notes: ∑ WS is the sum of the Weighted Scores WA is the Weighted Average as defined by ∑Weighted Scores /Total area					∑ WS = WA =

If the Land Use Weighted Average is:	Assign the following Condition Index Score:
≥8	1.00
7-8	0.75
5-6	0.50
2-4	0.25
< 1	0.10

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Appendices

Appendix A - Characteristics of Channel Evolution Classes Useful in Assessing Channel Condition and Connectivity.

Appendix B-1 – Diagnostic Plant Species List for Assessing Riparian Vegetation Composition

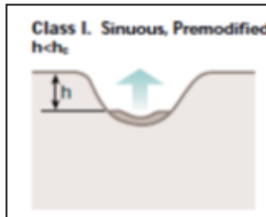
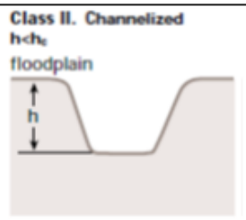
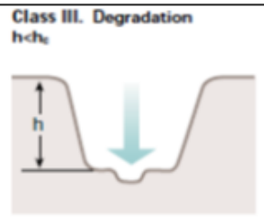
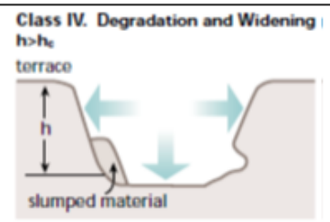
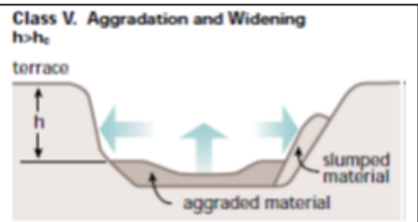
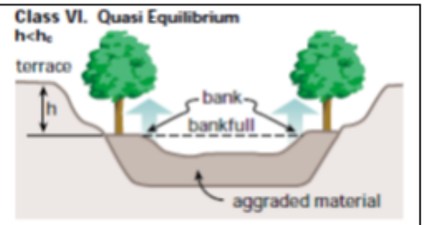
Appendix B-2 - Major Plant Associations for Nebraska Riparian and Wetland Communities

Appendix C – Forms for Field Use

Appendix D – Sample pages of Calculations spreadsheet

APPENDIX A

Characteristics of Channel Evolution Classes Useful in Assessing Channel Condition and Connectivity.

					
FLUVIAL					
Sediment transport; mild aggradations; basal erosion on outside bends; deposition on inside bends.	---	Incising channel, basal erosion on banks	Degradation; basal erosion on banks.	Aggradation; development of meandering thalweg; initial deposition of alternate bars; reworking of failed material on lower banks.	Aggradation; further development of meandering thalweg; further deposition of alternate bars; reworking of failed material; some basal erosion on outside bends; deposition of flood plain and bank surfaces.
HILL SLOPE					
---	---	Pop-out failures	Slab, rotational and pop-out failures.	Slab, rotational and pop-out failures; low-angle slides of previously failed material.	Low-angle slides; some pop-out failures near flow line.
CHARACTERISTIC FORMS					
Stable, alternate channel bars convex top bank shape, flow line high relative to top bank, channel straight or meandering	Trapezoidal cross section, linear bank surfaces, flow line lower relative to top bank	Heightening and steepening of banks; alternate bars eroded; flow line lower relative to top bank.	Large scallops and bank retreat; vertical face and upper bank surfaces; failure blocks on upper bank; some reduction in bank angles; flow line very low relative to top bank.	Large scallops, bank retreat; vertical face, upper bank and slough line; flattening of bank angles; flow line low relative to top bank; development of new flood plain (?).	Stable, alternate bars; convex short vertical face on top bank; flatten-of bank angles; development of new flood plain (?); flow line higher relative to top bank.
GEO-BOTANICAL EVIDENCE					
Vegetated banks to the flow line	Removal of vegetation, hardened channel features	Riparian vegetation high relative to the flow line	Tilted and fallen riparian vegetation.	Tilted and fallen riparian vegetation; re-establishing vegetation on slough line; deposition of material above root collars of slough-line vegetation.	Re-establishing vegetation extends up slough line and bank; deposition of material above root collars of slough-line and upper-bank vegetation; vegetation establishing on bars.

APPENDIX B-1

Diagnostic Plant Species List for Assessing Riparian Vegetation Composition (adapted from Rolfsmeier and Steinauer, 2010).

Species Name	Common Name	Stratum	
Acer negundo	box-elder	T	T=Tree
Acer saccharinum	silver maple	T	S=Shrub
Ageratina altissima	white snakeroot	H	H=Herbaceous
AGROSTIS GIGANTEA	REDTOP	H	V=Vine
Alisma triviale	northern water-plantain	H	ALL CAPS = Invasive species
alkali cordgrass	woolly sedge	H	
Ambrosia artemisiifolia	annual ragweed	H	
Amorpha fruticosa	false indigobush	S	
Amphicarpaea bracteata	hog peanut	H	
Amphiscirpus nevadensis	Nevada bulrush	H	
Atriplex dioica	salt-marsh spearscale	H	
Bacopa rotundifolia	water-hyssop	H	
Berula erecta	fen water parsnip	H	
Bidens spp.	beggarticks	H	
Boehmeria cylindrica	false nettle	H	
Bolboschoenus maritimus	salt-marsh bulrush	H	
Bolboschoenus fluviatilis	river bulrush	H	
Brasenia schreberi	water shield	H	
BROMUS INERMIS	SMOOTH BROME	H	
Calamagrostis canadensis	bluejoint	H	
Calamagrostis stricta	northern reedgrass	H	
Callitriche palustris	water starwort	H	
Caltha palustris	marsh marigold	H	
Carex aquatilis	water sedge	H	
Carex cristatella	crested sedge	H	
Carex emoryi	Emory's sedge	H	
Carex emoryi and others	sedges	H	
Carex hystericina	porcupine sedge (bottlebrush)	H	
Carex interior	inland sedge	H	
Carex lacustris	ripgut sedge	H	
Carex laeviconica	Smoothcone sedge	H	
Carex lasiocarpa	woolly fruit sedge	H	
Carex limosa	mud sedge	H	
Carex nebrascensis	Nebraska sedge	H	
Carex pellita	woolly sedge	H	
Carex praegracilis	clustered field sedge	H	
Carex prairea	prairie sedge	H	

Species Name CONT.	Common Name	Stratum	
Carex sartwellii	Sartwell's sedge	H	T=Tree
Carex scoparia	pointed broom sedge	H	S=Shrub
Carex spp.	sedges	H	H=Herbaceous
Carex stipata	saw-beak sedge	H	V=Vine
Carex vulpinoidea	fox sedge	H	ALL CAPS = Invasive species
Celtis occidentalis	hackberry	H	
Ceratophyllum demersum	coontail	H	
Chara spp.	stonewort	H	
Cicuta maculata	water hemlock	H	
Cleomella angustifolia	eastern cleomella	H	
Coreopsis tinctoria	plains coreopsis	H	
Cornus drummondii	roughleaf dogwood	T	
Cornus sericea	red-osier dogwood	T	
Cyperus acuminatus	shortpoint flatsedge	H	
Cyperus diandrus	umbrella flatsedge	H	
Cyperus erythrorhizos	redroot flatsedge	H	
Cyperus spp.	flatsedges	H	
Cyperus squarrosus	awned flatsedge	H	
Desmodium paniculatum	Panicled-Leaf Tick-Trefoil	H	
Distichlis spicata	inland saltgrass	H	
Doellingeria umbellata	flat-top aster	H	
Dulichium arundinaceum	pond-sedge	H	
Echinochloa crusgalli	barnyard grass	H	
ECHINOCHLOA CRUS-GALLI	LARGE BARNYARD GRASS	H	
Echinochloa muricata	rough barnyard grass	H	
Echinochloa spp.	barnyard grass	H	
ELAEAGNUS ANGUSTIFOLIA	RUSSIAN-OLIVE	T	
Elatine rubella	common waterwort	H	
Eleocharis acicularis	needle spikerush	H	
Eleocharis compressa	flat-stem spikerush	H	
Eleocharis elliptica	bog spikerush	H	
Eleocharis erythropoda	bald spikerush	H	
Eleocharis macrostachya	largespike spikerush	H	
Eleocharis obtusa	blunt spikerush	H	
Elodea canadensis	common waterweed	H	
Elymus canadensis	Canada wildrye	H	
Elymus trachycaulus	slender wheatgrass	H	
Elymus virginicus	Virginia wildrye	H	
Epilobium spp.	willow herb	H	
Equisetum arvense	field horsetail	H	

Species Name CONT.	Common Name	Stratum	
Equisetum hyemale	common scouringrush	H	T=Tree
Equisetum laevigatum	smooth scouringrush	H	S=Shrub
Eragrostis hypnoides	teal lovegrass	H	H=Herbaceous
Eragrostis pectinacea	tuffed lovegrass	H	V=Vine
Eragrostis pectinacea	Carolina lovegrass	H	ALL CAPS = Invasive species
Eriophorum angustifolium	tall cotton grass	H	
Eriophorum gracile	slender cotton grass	H	
Eupatorium perfoliatum	common boneset	H	
Festuca subverticillata	nodding fescue	H	
Fraxinus pennsylvanica	green ash	T	
Galium aparine	annual bedstraw	H	
Galium triflorum	sweet-scented bedstraw	H	
Geum canadense	white avens	H	
Gleditsia triacanthos	honey-locust	T	
Glyceria striata	fowl mannagrass	H	
Glycyrrhiza lepidota	wild licorice	H	
Heteranthera limosa	mud-plantains	H	
Heteranthera rotundifolia	mud-plantains	H	
Hordeum jubatum	foxtail barley	H	
Impatiens capensis	orange jewelweed	H	
Iva annua	annual marsh-elder	H	
Juncus arcticus var. balticus	Baltic rush	H	
Juncus nodosus	knotted rush	H	
Juncus torreyi	Torrey's rush	H	
Laportea canadensis	wood nettle	H	
Leersia oryzoides	rice cutgrass	H	
Leersia virginica	whitegrass	H	
Lemna aequinoctialis	lesser duckweed	H	
Lemna spp.	duckweeds	H	
Lemna trisulca	star duckweed	H	
Lemna turionifera	turion duckweed	H	
Leptochloa fusca	bearded sprangletop	H	
Limosella aquatica	mudwort	H	
Lindernia dubia	false pimpernel	H	
Lipocarpha micrantha	small-flower dwarf-bulrush	H	
Lycopus americanus	common water-horehound	H	
Maianthemum stellatum	starry false Solomon's seal	H	
Marchantia polymorpha	liverwort	H	
Marsilea vestita	water clover	H	
MELILOTUS spp.	SWEETCLOVERS	H	

Species Name CONT.	Common Name	Stratum	
Menyanthes trifoliata	bog buckbean	H	T=Tree
Mimulus glabratus	round leaf monkey flower	H	S=Shrub
Mollugo verticillata	carpetweed	H	H=Herbaceous
MORUS ALBA	WHITE MULBERRY	T	V=Vine
Morus rubra	red mulberry	T	ALL CAPS = Invasive species
Muhlenbergia asperifolia	scratchgrass	H	
Muhlenbergia glomerata	bog muhly	H	
Muhlenbergia spp.	muhlys	H	
Myriophyllum sibiricum	Siberian water milfoil	H	
Najas flexilis	slender naiad	H	
Najas guadalupensis	southern naiad	H	
Nassella viridula	green needlegrass	H	
NASTURTIUM OFFICINALE	WATERCRESS	H	
Nelumbo lutea	American lotus	H	
Nuphar variegata	yellow pond-lily	H	
Nymphaea odorata	white water-lily	H	
Onoclea sensibilis	sensitive fern	H	
Ophioglossum pusillum	northern adder's-tongue	H	
Osmorhiza longistylis	aniseroot	H	
Panicum virgatum	switchgrass	H	
Parthenocissus quinquefolia	Virginia creeper	V	
Parthenocissus vitacea	woodbine	V	
Pascopyrum smithii	western wheatgrass	H	
Pedicularis lanceolata	swamp lousewort	H	
Persicaria amphibia	water smartweed	H	
Persicaria amphibia (Polygonum amphibium)	water smartweed	H	
Persicaria bicornis (Polygonum bicorne)	pink smartweed	H	
Persicaria coccinea (Polygonum coccineum)	swamp smartweed	H	
Persicaria lapathifolia (Polygonum lapathifolium)	nodding smartweed	H	
Persicaria spp. (Polygonum spp.)	smartweeds	H	
PHALARIS ARUNDINACEA	REED CANARYGRASS	H	
Phragmites australis	common reed	H	
Phyla lanceolata	northern fog-fruit	H	
Plagiobothrys scouleri	popcorn flower	H	
Plantago eriopoda	alkali plantain	H	
Poa arida	plains bluegrass	H	
POA PRATENSIS	KENTUCKY BLUEGRASS	H	
Polygonum prolificum (P. ramosissimum)	dwarf bushy knotweed	H	
Populus deltoides	plains cottonwood	T	
Potamogeton diversifolius	pondweed water-thread	H	

Species Name CONT.	Common Name	Stratum	
Potamogeton foliosus	leafy pondweed	H	T=Tree
Potamogeton gramineus	variable pondweed	H	S=Shrub
Potamogeton illinoensis	Illinois pondweed	H	H=Herbaceous
Potamogeton natans	floating-leaf pondweed	H	V=Vine
Potamogeton nodosus	longleaf pondweed	H	ALL CAPS = Invasive species
Potamogeton pusillus	dwarf pondweed	H	
Potamogeton pusillus	small pondweed	H	
Potamogeton richardsonii	clasping-leaf pondweed	H	
Potamogeton spp.	pondweeds	H	
Potamogeton zosteriformis	flat-stem pondweed	H	
Primula pauciflora	northern shooting-star	H	
Prunus americana	wild plum	T	
Prunus virginiana	chokecherry	T	
Puccinellia nuttalliana	Nuttall's alkali grass	H	
Ranunculus longirostris	longbeak water crow's-foot	H	
Ribes missouriense	Missouri gooseberry	S	
Ribes odoratum	buffalo currant	H	
Rorippa spp.	bog yellowcress	H	
Rudbeckia laciniata	goldenglow	H	
Rumex spp.	docks	H	
RUMEX STENOPHYLLUS	NARROWLEAF DOCK	H	
Ruppia maritima	spiral ditchgrass	H	
Ruppia occidentalis	western widgeon-grass	H	
Sagittaria brevirostra	short-beak arrowhead	H	
Sagittaria calycina	hooded arrowhead	H	
Sagittaria cuneata	duck-potato arrowhead	H	
Sagittaria latifolia	common arrowhead	H	
Salicornia rubra	saltwort	H	
Salix amygdaloides	peachleaf willow	T	
Salix exigua var. sericans	sandbar willow	T	
Salix famelica	diamond willow	T	
Salix interior	sandbar willow	T	
Salix petiolaris	meadow willow	T	
Salix spp	willows	T	
Sanicula canadensis	Canada sanicle	H	
Sanicula canadensis	Canandian sanicle	H	
Sanicula odorata	clustered sanicle	H	
Schizachyrium scoparium	little bluestem	H	
Schoenoplectus acutus	hardstem bulrush	H	
Schoenoplectus heterochaetus	slender bulrush	H	

Species Name CONT.	Common Name	Stratum	
Schoenoplectus pungens	three-square bulrush	H	T=Tree
Schoenoplectus spp.	bulrushes	H	S=Shrub
Schoenoplectus tabernaemontani	softstem bulrush	H	H=Herbaceous
Scirpus atrovirens	dark-green bulrush	H	V=Vine
Scirpus pallidus	pale bulrush	H	ALL CAPS = Invasive species
Shepherdia argentea	buffaloberry	S	
Solidago gigantea	late goldenrod	H	
Solidago spp.	goldenrods	H	
Sparganium eurycarpum	large-fruit bur-reed	H	
Sparganium eurycarpum	large-fruit burreed	H	
Sparganium eurycarpum	large-fruit bur-reed	H	
Spartina gracilis	alkali cordgrass	H	
Spartina pectinata	prairie cordgrass	H	
Spartina pectinata	prairie cordgrass	H	
Spirodela polyrhiza	greater duckweed	H	
Sporobolus airoides	alkali sacaton	H	
Sporobolus cryptandrus	sand dropseed	H	
Sporobolus texanus	Texas dropseed	H	
Stachys pilosa var. pilosa	common hedge-nettle	H	
Stuckenia pectinata	sago pondweed	H	
Suaeda calceoliformis	seablite	H	
Symphoricarpos occidentalis	wolfberry	S	
Symphoricarpos orbiculatus	coralberry	S	
Symphyotrichum boreale	bog aster	H	
Symphyotrichum lanceolatum	panicled aster	H	
Thelypodium integrifolium	thelypody	H	
Thelypteris palustris	marsh fern	H	
Toxicodendron radicans	eastern poison ivy	H	
Triadenum fraseri	marsh St. John's-wort	H	
Triglochin maritima	alkali arrowgrass	H	
TYPHA ANGUSTIFOLIA	NARROWLEAF CATTAIL	H	
Typha latifolia	broadleaf cattail	H	
Typha spp.	cattails	H	
Ulmus americana	American elm	T	
Ulmus rubra	slippery elm	T	
Urtica dioica	stinging nettle	H	
Utricularia macrorhiza	greater bladderwort	H	
Verbena hastata	blue vervain	H	
Viola spp.	violets	H	
Vitis riparia	riverbank grape	V	

Species Name CONT.	Common Name	Stratum	
Wolffia columbiana	common watermeal	H	T=Tree
Wolffia spp.	watermeal	H	S=Shrub
Xanthium strumarium	cocklebur	H	H=Herbaceous
Zannichellia palustris	horned pondweed	H	V=Vine
Zizania palustris	northern wild-rice	H	ALL CAPS = Invasive species

APPENDIX B-2

Major plant associations with diagnostic and most abundant species (Rolfsmeier and Steinauer, 2010).

Note: Invasive species are not counted in the calculations for the riparian reach variable.

Eastern Riparian Forest	
Species Name (synonymy)	**Common Name**
Acer saccharinum	**silver maple**
Cornus drummondii	**roughleaf dogwood**
Fraxinus pennsylvanica	**green ash**
Populus deltoides	**plains cottonwood**
Ulmus americana	**American elm**
Acer negundo	box-elder
Ageratina altissima	white snakeroot
Carex spp.	sedges
Celtis occidentalis	hackberry
Cornus drummondii	roughleaf dogwood
Elymus virginicus	Virginia wildrye
Festuca subverticillata	nodding fescue
Galium aparine	annual bedstraw
Galium triflorum	sweet-scented bedstraw
Geum canadense	white avens
Gleditsia triacanthos	honey-locust
Laportea canadensis	wood nettle
Leersia virginica	whitegrass
Maianthemum stellatum	starry false Solomon's seal
MORUS ALBA	WHITE MULBERRY
Morus rubra	red mulberry
Muhlenbergia spp.	muhlys
Osmorhiza longistylis	aniseroot
Parthenocissus quinquefolia	Virginia creeper
Ribes missouriense	Missouri gooseberry
Rudbeckia laciniata	goldenglow
Sanicula canadensis	Canada sanicle
Sanicula odorata	clustered sanicle
Solidago spp.	goldenrods
Symphoricarpos orbiculatus	coralberry
Toxicodendron radicans	eastern poison ivy
Ulmus rubra	slippery elm
Urtica dioica	stinging nettle
Viola spp.	violets
Vitis riparia	riverbank grape

Eastern Cottonwood-Dogwood Riparian Woodland	
Species Name (synonymy)	**Common Name**
Cornus drummondii	**roughleaf dogwood**
Equisetum hyemale	**common scouringrush**
Populus deltoides	**Plains cottonwood**
Ageratina altissima	white snakeroot
Galium triflorum	sweet-scented bedstraw
Parthenocissus quinquefolia	Virginia creeper
Toxicodendron radicans	eastern poison ivy
Urtica dioica	stinging nettle

Cottonwood-Peachleaf Willow Riparian Woodland	
Species Name (synonymy)	**Common Name**
Populus deltoides	**Plains cottonwood**
Salix amygdaloides	**peachleaf willow**
Salix interior	**sandbar willow**
Acer negundo	box-elder
Ageratina altissima	white snakeroot
Ambrosia artemisiifolia	annual ragweed
BROMUS INERMIS	SMOOTH BROME
Carex emoryi	Emory's sedge
Carex pellita	woolly sedge
Cornus drummondii	roughleaf dogwood
ELAEAGNUS ANGUSTIFOLIA	RUSSIAN-OLIVE
Elymus canadensis	Canada wildrye
Equisetum arvense	field horsetail
Equisetum hyemale	common scouringrush
Fraxinus pensylvanica	green ash
Galium triflorum	sweet-scented bedstraw
Glycyrrhiza lepidota	wild licorice
MORUS ALBA	WHITE MULBERRY
Nassella viridula	green needlegrass
Parthenocissus quinquefolia	Virginia creeper
Pascopyrum smithii	western wheatgrass
POA PRATENSIS	KENTUCKY BLUEGRASS
Populus deltoides	Plains cottonwood
Prunus americana	wild plum
Prunus virginiana	chokecherry
Salix amygdaloides	peachleaf willow
Salix interior	sandbar willow
Shepherdia argentea	buffaloberry
Spartina pectinata	prairie cordgrass
Sporobolus cryptandrus	sand dropseed
Symphoricarpos occidentalis	wolfberry
Toxicodendron radicans	eastern poison ivy
Urtica dioica	stinging nettle

Cottonwood Riparian Woodland	
Species Name (synonymy)	**Common Name**
Populus deltoides	**Plains cottonwood**
ELAEAGNUS ANGUSTIFOLIA	RUSSIAN OLIVE
Fraxinus pensylvanica	green ash
Panicum virgatum	switchgrass
POA PRATENSIS	KENTUCKY BLUEGRASS
Schizachyrium scoparium	little bluestem
Shepherdia argentea	buffaloberry
Symphoricarpos occidentalis	wolfberry
Ulmus americana	American elm

Cottonwood-Diamond Willow Woodland	
Species Name (synonymy)	**Common Name**
Amphicarpaea bracteata	**hog peanut**
Boehmeria cylindrica	**false nettle**
Carex emoryi	**Emory's sedge**
Desmodium paniculatum	**Panicled-Leaf Tick-Trefoil**
Equisetum arvense	**field horsetail**
Rudbeckia laciniata	**goldenglow**
Salix famelica	**diamond willow**
Populus deltoides*	**Plains cottonwood**
Carex emoryi and others	sedges
Cornus drummondii	roughleaf dogwood
Cornus sericea	red osier
Fraxinus pennsylvanica	green ash
Galium triflorum	sweet-scented bedstraw
POA PRATENSIS	KENTUCKY BLUEGRASS
Salix amygdaloides	peachleaf willow
Sanicula canadensis	Canandian sanicle
Symphoricarpos occidentalis	wolfberry
Vitis riparia	riverbank grape

Peachleaf Willow Woodland	
Species Name (synonymy)	**Common Name**
Salix amygdaloides	**peachleaf willow**
Salix famelica	**diamond willow**
Cornus sericea	**red-osier dogwood**
Parthenocissus vitacea	woodbine
PHALARIS ARUNDINACEA	REED CANARYGRASS
Ribes odoratum	buffalo currant
Solidago gigantea	late goldenrod
Typha latifolia	common cattail

Riparian Dogwood-False Indigobush Shrubland	
Species Name (synonymy)	**Common Name**
Amorpha fruticosa	**false indigobush**
Cornus drummondii	**roughleaf dogwood**
Cornus sericea	**red osier**
Ambrosia artemisiifolia	annual ragweed
Carex emoryi	Emory's sedge
Carex pellita	woolly sedge
Impatiens capensis	orange jewelweed
Panicum virgatum	switchgrass
PHALARIS ARUNDINACEA	REED CANARYGRASS
Phyla lanceolata	northern fog-fruit
POA PRATENSIS	KENTUCKY BLUEGRASS
Populus deltoides	Plains cottonwood
Salix exigua var. sericans	sandbar willow
Spartina pectinata	prairie cordgrass

Sandbar Willow Shrubland	
Species Name (synonymy)	**Common Name**
Salix interior	**sandbar willow**
AGROSTIS GIGANTEA	REDTOP
Ambrosia artemisiifolia	common ragweed
Amorpha fruticosa	false indigobush
Carex emoryi	Emory's sedge
Carex pellita	woolly sedge
Cornus sericea	red osier
Eleocharis erythropoda	bald spikerush
Equisetum hyemale	common scouringrush
Leersia oryzoides	rice cutgrass
Lycopus americanus	common water-horehound
MELILOTUS spp.	SWEETCLOVERS
Persicaria spp. (Polygonum spp.)	smartweeds
PHALARIS ARUNDINACEA	REED CANARYGRASS
Phyla lanceolata	northern fog-fruit
Populus deltoides	Plains cottonwood
Rumex spp.	docks
Salix amygdaloides	peachleaf willow
Salix famelica	diamond willow
Schoenoplectus pungens	three-square bulrush
Solidago spp.	goldenrods
Spartina pectinata	prairie cordgrass
Symphyotrichum lanceolatum	panicled aster
Urtica dioica	stinging nettle

Freshwater Seep	
Species Name (synonymy)	**Common Name**
Berula erecta	**fen water parsnip**
Carex hystericina	**porcupine sedge (bottlebrush)**
Glyceria striata	**fowl mannagrass**
Equisetum hyemale	**common scouringrush**
Marchantia polymorpha	**a liverwort**
Mimulus glabratus	**round leaf monkey flower**
Carex spp.	sedges
Epilobium spp.	willow herb
NASTURTIUM OFFICINALE	WATERCRESS
Schoenoplectus spp.	bulrushes
Typha spp.	cattails

Prairie Fen	
Species Name (synonymy)	**Common Name**
Carex hystericina	**porcupine sedge (bottlebrush)**
Carex interior	**inland sedge**
Dulichium arundinaceum	**pond-sedge**
Onoclea sensibilis	**sensitive fern**
Thelypteris palustris	**marsh fern**
Carex emoryi	Emory's sedge
Carex pellita	woolly sedge
Cicuta maculata	water hemlock
Eleocharis erythropoda	bald spikerush
Eupatorium perfoliatum	common boneset
Impatiens capensis	orange jewelweed
Leersia oryzoides	rice cutgrass

Sandhill Fens	
Species Name (synonymy)	**Common Name**
Caltha palustris	**marsh marigold**
Carex aquatilis	**water sedge**
Carex interior	**inland sedge**
Carex lasiocarpa	**woolly fruit sedge**
Carex limosa	**mud sedge**
Carex prairea	**prairie sedge**
Doellingeria umbellata	**flat-top aster**
Eriophorum angustifolium	**tall cotton grass**
Eriophorum gracile	**slender cotton grass**
Menyanthes trifoliata	**bog buckbean**
Muhlenbergia glomerata	**bog muhly**
Onoclea sensibilis	**sensitive fern**
Ophioglossum pusillum	**northern adder's-tongue**
Pedicularis lanceolata	**swamp lousewort**
Salix petiolaris	**meadow willow**
Symphyotrichum boreale	**bog aster**

Sandhill Fens CONT.	
Species Name (synonymy)	**Common Name**
Thelypteris palustris	**marsh fern**
Triadenum fraseri	**marsh St. John's-wort**
Carex lacustris	ripgut sedge
Carex nebrascensis	Nebraska sedge
Carex pellita	woolly sedge
Eleocharis elliptica	bog spikerush
Onoclea sensibilis	sensitive fern
Phragmites australis	common reed
Sagittaria latifolia	common arrowhead
Schoenoplectus acutus	hardstem bulrush
Typha latifolia	broadleaf cattail

Eastern Cordgrass Wet Prairie	
Species Name (synonymy)	**Common Name**
Spartina pectinata	**prairie cordgrass**
Carex emoryi	woolly sedge
Carex laeviconica	Smoothcone sedge
Carex pellita	woolly sedge
Carex vulpinoidea	fox sedge
Eleocharis compressa	flat-stem spikerush
POA PRATENSIS	KENTUCKY BLUEGRASS

Eastern Sedge Wet Meadow	
Species Name (synonymy)	**Common Name**
Carex cristatella	**crested sedge**
Carex vulpinoidea	**fox sedge**
Scirpus atrovirens	**dark-green bulrush**
Scirpus pallidus	**pale bulrush**
AGROSTIS GIGANTEA	REDTOP
Carex pellita	woolly sedge
Carex stipata	saw-beak sedge
Hordeum jubatum	foxtail barley
Verbena hastata	blue vervain

Eastern Saline Meadow	
Species Name (synonymy)	**Common Name**
Atriplex dioica	**salt-marsh spearscale**
Distichlis spicata	**inland saltgrass**
Poa arida	**plains bluegrass**
Salicornia rubra	**saltwort**
Sporobolus texanus	**Texas dropseed**
Suaeda calceoliformis	**seablite**
Hordeum jubatum	foxtail barley
Iva annua	annual marsh-elder
Spartina pectinata	prairie cordgrass

Northern Cordgrass Wet Prairie	
Species Name (synonymy)	**Common Name**
Calamagrostis stricta	**northern reedgrass**
Spartina pectinata	**prairie cordgrass**
Carex emoryi	Emory's sedge
Carex pellita	woolly sedge
Equisetum laevigatum	smooth scouringrush
Panicum virgatum	switchgrass
Persicaria coccinea (Polygonum coccineum)	swamp smartweed

Sandhills Wet Meadow	
Species Name (synonymy)	**Common Name**
Calamagrostis canadensis	**bluejoint**
Calamagrostis stricta	**northern reedgrass**
Carex sartwellii	**Sartwell's sedge**
Carex nebrascensis	Nebraska sedge
Carex pellita	woolly sedge
Carex praegracilis	clustered field sedge
Carex scoparia	pointed broom sedge
Eleocharis compressa	flat-stem spikerush
Juncus arcticus var. balticus	Baltic rush
Juncus nodosus	knotted rush
Juncus torreyi	Torrey's rush
Persicaria coccinea (Polygonum coccineum)	swamp smartweed
PHALARIS ARUNDINACEA	REED CANARYGRASS
Stachys pilosa var. pilosa	common hedge-nettle

Western Alkaline Meadow	
Species Name (synonymy)	**Common Name**
Amphiscirpus nevadensis	**Nevada bulrush**
Atriplex dioica	**salt-marsh spearscale**
Cleomella angustifolia	**eastern cleomella**
Distichlis spicata	**inland saltgrass**
Plantago eriopoda	**alkali plantain**
Primula pauciflora	**northern shooting-star**
Sporobolus airoides	**alkali sacaton**
Thelypodium integrifolium	**thelypody**
Carex praegracilis	clustered field sedge
Elymus trachycaulus	slender wheatgrass
Hordeum jubatum	foxtail barley
Muhlenbergia asperifolia	scratchgrass
Poa arida	meadow bluegrass
Suaeda calceoliformis	seablite
Triglochin maritima	alkali arrowgrass

Western Subirragated Alkaline Meadow	
Species Name (synonymy)	**Common Name**
Juncus arcticus var. balticus	**Baltic rush**
Spartina gracilis	**alkali cordgrass**
alkali cordgrass	woolly sedge
Carex praegracilis	clustered field sedge
Distichlis spicata	inland saltgrass
Elymus trachycaulus	slender wheatgrass
Horedum jabatum	foxtail barley
Muhlenbergia asperifolia	scratchgrass
Panicum virgatum	switchgrass

Western Sedge Wet Meadow	
Species Name (synonymy)	**Common Name**
Carex nebrascensis	**Nebraska sedge**
Carex pellita	**woolly sedge**
Schoenoplectus pungens	**three-square bulrush**
AGROSTIS GIGANTEA	REDTOP
Carex hystericina	bottlebrush sedge
Eleocharis erythropoda	bald spikerush

Playa Wetland	
Species Name (synonymy)	**Common Name**
Coreopsis tinctoria	**plains coreopsis**
Echinochloa muricata	**rough barnyard grass**
Limosella aquatica	**mudwort**
Plagiobothrys scouleri	**popcorn flower**
Bacopa rotundifolia	water-hyssop
Cyperus acuminatus	shortpoint flatsedge
Echinochloa spp.	barnyard grass
Elatine rubella	common waterwort
Eleocharis obtusa	blunt spikerush
Heteranthera limosa	mud-plantains
Heteranthera rotundifolia	mud-plantains
Lindernia dubia	false pimpernel
Mollugo verticillata	carpetweed
Persicaria bicornis (Polygonum bicorne)	pink smartweed
Persicaria lapathifolia (Polygonum lapathifolium)	nodding smartweed
RUMEX STENOPHYLLUS	NARROWLEAF DOCK
Sagittaria calycina	hooded arrowhead

Eastern Bulrush Deep Marsh	
Species Name (synonymy)	**Common Name**
Sagittaria latifolia	**common arrowhead**
Schoenoplectus acutus	**hardstem bulrush**
Schoenoplectus tabernaemontani	**softstem bulrush**
Sparganium eurycarpum	**large-fruit bur-reed**

Eastern Bulrush Deep Marsh CONT.	
Species Name (synonymy)	**Common Name**
Typha latifolia	**broadleaf cattail**
Alisma triviale	northern water-plantain
Ceratophyllum demersum	coontail
Eleocharis erythropoda	bald spikerush
Leersia oryzoides	rice cutgrass
Lemna turionifera	turion duckweed
Persicaria coccinea (Polygonum coccineum)	swamp smartweed
Phragmites australis ssp.	common reed
Potamogeton foliosus	leafy pondweed
Potamogeton pusillus	dwarf pondweed
Schoenoplectus pungens	three-square bulrush
Spirodela polyrhiza	greater duckweed
Wolffia columbiana	common watermeal
Zannichellia palustris	horned pondweed

Spikerush Vernal Pool	
Species Name (synonymy)	**Common Name**
Callitriche palustris	**water starwort**
Eleocharis acicularis	**needle spikerush**
Eleocharis macrostachya	**largespike spikerush**
Potamogeton diversifolius	**pondweed water-thread**
Marsilea vestita	water clover

Cattail Shallow Marsh	
Species Name (synonymy)	**Common Name**
Bolboschoenus fluviatilis	**river bulrush**
Schoenoplectus heterochaetus	**slender bulrush**
Typha latifolia	**broadleaf cattail**
Eleocharis macrostyachya	largespike spikerush
Leersia oryzoides	rice cutgrass
Lemna aequinoctialis	lesser duckweed
Lemna turionifera	turion duckweed
Persicaria coccinea (Polygonum coccineum)	swamp smartweed
Sagittaria brevirostra	short-beak arrowhead
Sagittaria cuneata	duck-potato arrowhead
Sparganium eurycarpum	large-fruit burreed
TYPHA ANGUSTIFOLIA	NARROWLEAF CATTAIL

Eastern Saline Marsh	
Species Name (synonymy)	**Common Name**
Bolboschoenus maritimus	**saltmarsh bulrush**
Ruppia maritima	**spiral ditchgrass**
Hordeum jubatum	foxtail barley
Iva annua	annual marsh-elder
Leptochloa fusca	bearded sprangletop

Eastern Saline Marsh CONT.	
Species Name (synonymy)	**Common Name**
Polygonum prolificum (P. ramosissimum)	dwarf bushy knotweed
Spartina pectinata	prairie cordgrass
TYPHA ANGUSTIFOLIA	NARROWLEAF CATTAIL

Sandhills Hardstem Bulrush Marsh	
Species Name (synonymy)	**Common Name**
Schoenoplectus acutus	**hardstem bulrush**
Sagittaria latifolia	**common arrowhead**
Typha latifolia	**broadleaf cattail**
Carex lacustris	ripgut sedge
Ceratophyllum demersum	coontail
Eleocharis erythropoda	bald spikerush
Lemna spp.	duckweeds
Lemna trisulca	star duckweed
Persicaria amphibia	water smartweed
Phragmites australis	common reed
Potamogeton spp.	pondweeds
Sparganium eurycarpum	large-fruit bur-reed
Wolffia spp.	watermeal
Zannichellia palustris	horned pondweed

Reed Marsh	
Species Name (synonymy)	**Common Name**
Phragmites australis	**common reed**

Western Alakaline Marsh	
Species Name (synonymy)	**Common Name**
Amphiscirpus nevadensis	**Nevada bulrush**
Schoenoplectus pungens	**three-square bulrush**
Bolboschoenus maritimus	salt-marsh bulrush
Hordeum jubatum	foxtail barley
Puccinellia nuttalliana	Nuttall's alkali grass

Eastern Pondweed Aquatic Wetland	
Species Name (synonymy)	**Common Name**
Ceratophyllum demersum	**coontail**
Najas guadalupensis	**southern naiad**
Potamogeton foliosus	**leafy pondweed**
Potamogeton nodosus	**longleaf pondweed**
Zannichellia palustris	**horned pondweed**
Chara spp.	stonewort
Lemna turionifera	turion duckweed
Potamogeton pusillus	small pondweed
Stuckenia pectinata	sago pondweed

American Lotus Aquatic Wetland	
Species Name (synonymy)	**Common Name**
Nelumbo lutea	**American lotus**

Northern Pondweed Aquatic Wetland	
Species Name (synonymy)	**Common Name**
Lemna trisulca	**star duckweed**
Myriophyllum sibiricum	**Siberian water milfoil**
Najas flexilis	**slender naiad**
Potamogeton gramineus	**variable pondweed**
Potamogeton illinoensis	**Illinois pondweed**
Potamogeton natans	**floating-leaf pondweed**
Potamogeton zosteriformis	**flat-stem pondweed**
Lemna turionifera	turion duckweed
Ceratophyllum demersum	coontail
Elodea canadensis	common waterweed
Persicaria amphibia (Polygonum amphibium)	water smartweed
Potamogeton pusillus	small pondweed
Potamogeton richardsonii	clasping-leaf pondweed
Ranunculus longirostris	longbeak water crow's-foot
Stuckenia pectinata	sago pondweed
Utricularia macrorhiza	greater bladderwort
Wolffia spp.	watermeal

Water-Lily Aquatic Wetland	
Species Name (synonymy)	**Common Name**
Brasenia schreberi	**water shield**
Nuphar variegata	**yellow pond-lily**
Nymphaea odorata	**white water-lily**
Ceratophyllum demersum	coontail
Lemna spp.	duckweeds
Lemna trisulca	star duckweed
Myriophyllum sibiricum	Siberian water milfoil
Najas flexilis	slender naiad
Persicaria amphibia (Polygonum amphibium)	water smartweed
Potamogeton natans	floating-leaf pondweed
Potamogeton pusillus	small pondweed
Stuckenia pectinata	sago pondweed
Utricularia macrorhiza	greater bladderwort
Wolffia spp.	watermeal
Zizania palustris	northern wild-rice

Saline/Alkaline Aquatic Wetland	
Species Name (synonymy)	**Common Name**
Ruppia maritima	**spiral ditchgrass**
Ruppia occidentalis	**western widgeon-grass**
Stuckenia pectinata	**sago pondweed**

Saline/Alkaline Aquatic Wetland CONT.	
Species Name (synonymy)	**Common Name**
Ceratophyllum demersum	coontail
Eleocharis acicularis	needle spikerush
Myriophyllum sibiricum	Siberian water milfoil
Najas flexilis	slender naiad
Persicaria amphibia (Polygonum amphibium)	water smartweed
Potamogeton pusillus	small pondweed
Potamogeton richardsonii	clasping-leaf pondweed
Ranunculus longirostris	longbeak water crow's-foot
Utricularia macrorhiza	greater bladderwort
Zannichellia palustris	horned pondweed

APPENDIX C

Forms for Field Use

This appendix contains the following information summaries and example sheets:

Summary Sheets (Impact and Mitigation Planning)

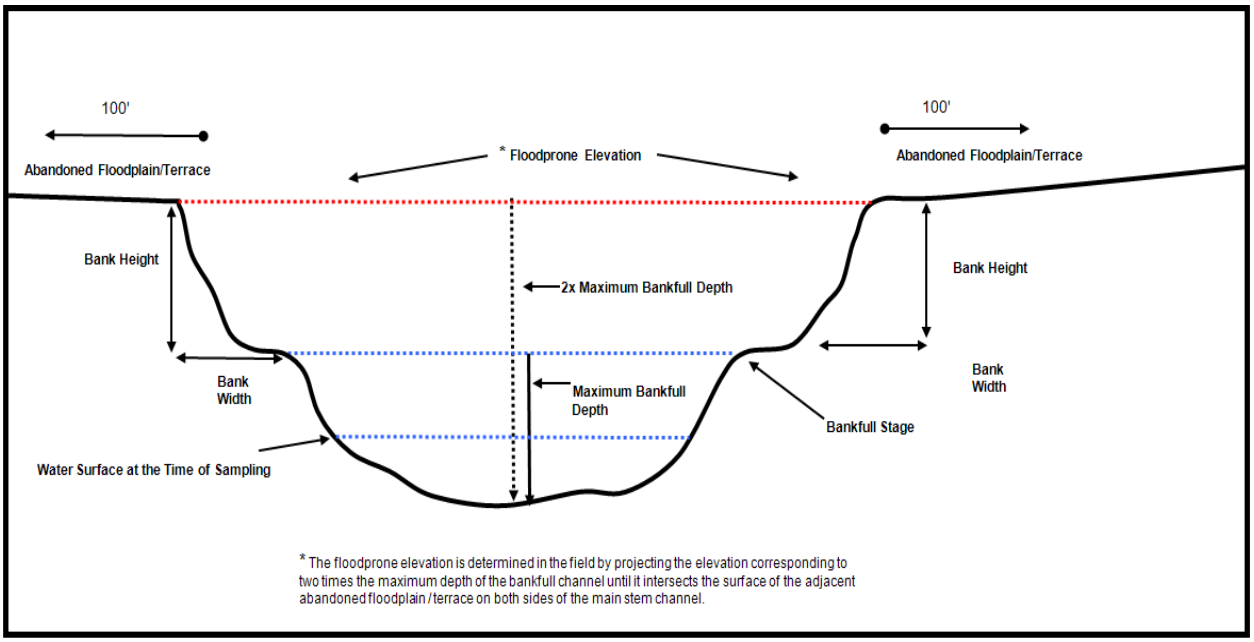
Field site visit data sheets

Electronic copy and Excel spreadsheet for calculations available upon request.

Project Name: _____

Date of site visit: _____

Attendees: _____

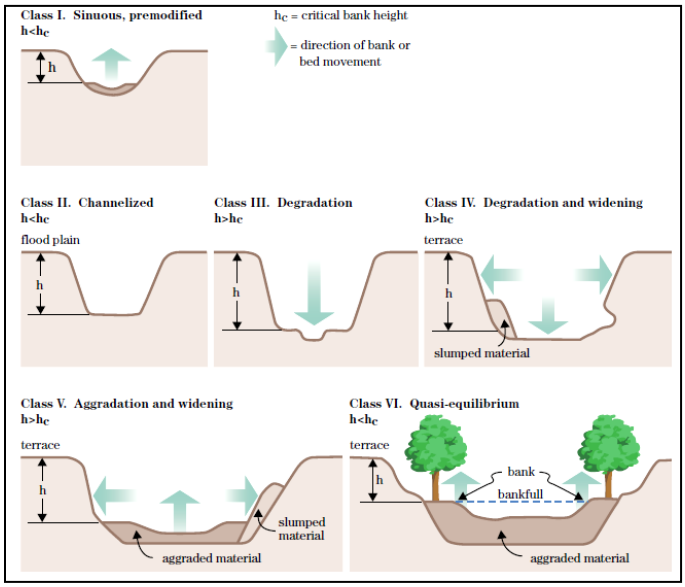


PRILIMINARY DATA FOR SITE ASSESSMENT:

RR boundary length:_ _____ Bankfull depth: _____

Floodprone depth: _____ Width at bankfull: _____

CEM class: _____ Top of bank width: _____



V_1 Hydraulic Conveyance and Sediment Dynamics

User notes: Hydraulic conveyance and sediment dynamics addresses fluvial processes for the active channel within the RR. This indicator is assessed by narrative criteria or measured as a percent of the length of mainstem channel in a riparian reach with (AHC). Aerial photography and field observations are used to estimate the Condition Index Rating of this metric. For impact or mitigation evaluations, **the Condition Index Rating is zero when a stream is converted to a lacustrine system**.

Assessment Area: below bankfull width

Condition Index Rating	Indicator Score or Description of Condition
1.00	__Movement of sediment in the channel is in equilibrium in terms of supply, erosion, and deposition processes. __**On most streams** there are alternating point bars; bank erosion occurs, but is stabilized and moderated by vegetation; and channel width, form, and floodplain area is consistent through the reach. __**In some streams**, some of these indicators may not be apparent, but overall bank and hill slope erosion is moderated by vegetation and there are no apparent culturally induced catastrophic failures. __The channel is stable, no active down-cutting occurring, or; old down-cutting apparent but a new, stable riparian area has formed within the incised channel, OR; __≤5% of active channel within the riparian reach with altered hydraulic conveyance (AHC).
0.75	__Movement of sediment in the channel is in equilibrium with the current hydrologic regime, as opposed to a culturally unaltered condition, and exhibits an overall balance in terms of erosion and deposition processes. __**On most streams** there are alternating point bars; bank erosion occurs, but is stabilized and moderated by vegetation; and channel width, form, and floodplain area are consistent through the reach. __**In some streams**, some of these indicators may not be apparent, but overall bank and hill slope erosion is moderated by vegetation and no culturally induced catastrophic failures are apparent. __The channel has evidence of old down-cutting that has begun stabilizing, vegetation is beginning to establish, even at the base of the falling banks, soil disturbance is evident, OR; __>5 and ≤15% of riparian reach with AHC.
0.50	__Sediment disequilibrium is minor and localized within the reach. __This includes small, localized areas of bank protection, slumping, or encroachment on the floodplain and channel. __This condition class includes previously disrupted reaches on a recovery trajectory, such as deeply entrenched streams where down-cutting has been arrested by structural grade control, and there is sufficient room for lateral channel migration and establishment of a functional floodplain within the incised channel. __Head cuts in early stage are present. Immediate action may prevent further degradation, OR; __ >15 and ≤30% of riparian reach with AHC.
0.25	__Sediment erosion and deposition out of equilibrium. __Water inflow is sediment rich, poor or accelerated bank erosion exists. Channel not actively incising but extensive disequilibrium is evident. __Typical indicators include extensive bank slumping (erosion events that exceed any moderating influence of native vegetation), active gullies feeding into the reach from adjacent hill slopes, or shoaling of sediments rather than deposition in sorted lateral and mid-channel bars. __Apparently stable channels should be placed in this category if there is evidence of regular mechanical disruption, such as bulldozing of the channel bottom and clearing of riparian vegetation to improve flood conveyance. __ Channel with some widening, but limiting new floodplain development; the existing floodplain is not well vegetated. __The vegetation that is present is mainly pioneer species. Bank failure is common, OR; __ >30 and ≤50% of riparian reach with AHC.
0.10	__Sediment dynamics within most of the reach are seriously disrupted. __This includes reaches where no significant storage or recruitment of sediment occurs (i.e., reaches in underground tunnels/culverts, and reaches hardened with rock or concrete). __It also includes reaches that are either actively incising or functioning as sediment traps (e.g., sediment basins). __This also includes reaches that have been subject to recent changes likely to induce severe disequilibrium, such as extensive floodplain filling, change in slope, channel straightening, or other changes that are likely to cause channel down-cutting during future high-flow events. __The channel is deeply incised, resembling a gully, little or no riparian area development, or active down-cutting is clearly occurring. Only occasional or rare flood events access the flood plain. __Tributaries will also exhibit signs of down-cutting, OR; > __50% of riparian reach with AHC.

Field Notes:

V_2 In-Stream Habitat/Available Cover

User Notes: The biological components of riparian ecosystems have adapted to episodic cycles of disturbance and developed a variety of mechanisms that make it possible to survive and flourish where other organisms cannot. This variable is evaluated below the floodprone area. For impact or mitigation evaluations, the Condition Index Rating is zero when a stream is converted to a lacustrine system.

Assessment Area: Below the estimated floodprone area

Condition Index Rating	Indicator or Description of Conditions
1.00	__Within the flood prone area, there is greater than >50% coverage by diverse habitat features favorable for stream faunal colonization and maintenance of vegetation dynamics for recruitment. __Features may include snags, submerged logs, undercut banks, roots, cobble, rocks, persistent leaf packs, pools and glides, or other stable habitat at a stage to allow colonization. __No barriers to faunal movement.
0.75	__ Within the flood prone area there is >30% and ≤50% coverage by habitat features favorable for stream faunal colonization and/or cover. __Many habitat features are not transient. Adequate habitat for maintenance of populations is evident. __Seasonal water withdrawals inhibit faunal movement within the reach.
0.50	__ Within the flood prone area, there is >10 and ≤30% coverage by habitat features favorable for stream faunal colonization and cover; __habitat availability may be less than desirable; __substrate may be frequently disturbed. __Drop structures, culverts, dams, or diversions are present within the reach, but with minimal effect to the channel gradient or __faunal movement. Some channel deepening is noticeable.
0.25	__ Within the flood prone area, there is ≤10% coverage of habitat features present; lack of habitat is obvious; substrate unstable or lacking; concrete lined channels are present within portions of the stream. __Habitat features and pools buried or lacking, channel bottom may be flat. __Drop structures, culverts, dams, or diversions are present within the reach with noticeable effects to the channel gradient (deepening) or inhibition of faunal movement.
0.10	__Habitat features and pools are buried or lacking, channel bottom may be flat. __Channels banks are completely armored or concrete lined.

Field Notes:

V_3 Floodplain Interaction–Connectivity

User Notes: Floodplain Interaction–Connectivity indicates of the degree to which the hydrologic interaction between the bankfull channel and the active floodplain and terraces of the riparian ecosystem remains intact. In assigning the Condition Index Rating, the channel evolution concepts previously presented should be consulted. Previous observations for V1 Hydraulic Conveyance and Sediment dynamics variable and including channel cross-section observations should be used to assign this Condition Index Rating. The assessment area for this variable is the floodprone area and abandoned floodplain/terraces.

Assessment Area: Floodprone area and abandoned floodplain/terraces

Condition Index Rating	Indicator or Description of Conditions
1.00	__The floodplain has not been physically manipulated. __No surface alterations (such as constructed channels, dams, dikes, diversions, dugouts, or fill) or subsurface alterations (such as tile drainage) are present. __Natural geomorphic features occur within the floodplain as evidenced by irregular, uneven surfaces (undulating conditions from meander scars, sediment bars, or hummocks). __The current stage of the channel would indicate an equilibrium channel corresponding to a Class I condition (sinuous, pre-modified channel).
0.75	__Few changes to the floodplain surface. __Observable changes in elevation are restricted to only farm roads or bridges with culverts. __The current stage of the channel would indicate quasi-equilibrium corresponding to a Class VI condition.
0.50	__Multiple geomorphic modifications to the floodplain surface to control flood energy, often with bank control structures, but still permitting flow access via culverts. __The current stage of the channel would indicate aggradations and widening, corresponding to a Class V condition.
0.25	__Complete geomorphic modification BUT still permits flow access via culverts and occasional overbank flooding. __The current stage of the channel would indicate degradation and widening corresponding to a Class IV condition.
0.10	__Complete geomorphic modification to the floodprone area. Bank control structures (dikes, etc) are in a continuous structure preventing channel movement and also preventing overbank flow. __The current stage of the channel would indicate channelization and/or active bed degradation corresponding to a Class II or III condition.

Field Notes:

V_4 Riparian Condition & Vegetation Composition

User Notes: Riparian Vegetation Composition is a response variable to both natural and anthropogenic disturbance. Scoring of this variable is determined by comparing the dominant species observed in cross-sections within the RR assessment area to a list of diagnostic and most abundant species. Field sheets on following page.
Assessment Area: V_{4a} above the floodprone area with an artificial convention of 100' from the top of each bank; and, V_{4b} below the floodprone area.

Condition Index Rating	4a	4b	Indicator or Description of Conditions
1.00			__The percent concurrence of dominant plants observed with diagnostic species is ≥ 95 %. __Existing riparian habitat is of high caliber; if this site were to be preserved, minimal management would be necessary due to natural processes still being in effect. __Vegetation represents the reference standard condition with no chronic anthropogenic disturbances; or, __the site has recovered from historical anthropogenic disturbance.
0.75			__The percent concurrence of dominant plants observed with diagnostic species is ≥75 and < 95%. __Existing riparian habitat is only slightly degraded; preservation and/or improvement are likely with moderate management effort. __Native vegetation is on a recovery trajectory with compatible management practices that mimic natural disturbances (i.e., low intensity grazing). __Presences of areas disturbed through natural processes (i.e., fire and flood) are still evident.
0.50			__ The percent concurrence of dominant plants observed with diagnostic species is ≥50% and < 75%. __Existing riparian habitat somewhat degraded; preservation and/or improvement possible but would require significant management effort. __Native vegetation present for some representative communities, but invasive or ruderal species are prevalent. __ Disturbance is largely anthropogenic and natural processes influencing the plant community are rare.
0.25			__ The percent concurrence of dominant plants observed with diagnostic species is ≥ 25% or < 50%. __ Existing riparian habitat degraded; preservation not desirable or attainable; improvements are not likely or would require significant and costly management effort. __ Native vegetation is localized within the assessment area. __ Presence of areas disturbed through natural processes is not evident. __ Vegetation composition is dominated by invasive or ruderal species.
0.10			__ The percent concurrence of dominant plants observed with diagnostic species is ≥ 5% or < 25%. __ Existing riparian habitat is severely degraded. __ Native vegetation is largely absent, area is hardened (i.e., paved, urban, etc.) or graded.

Field Notes:

V_4 VEGETATION DATA SHEET **Riparian Reach (RR) No.: _____**

V4a Community name: **V4b** Community name:

V4a	Absolute % cover	Dominant Species (Y/N) (50/20 Rule)	Native Species (Y/N)	**V4b**	Absolute % cover	Dominant Species (Y/N) (50/20 Rule)	Native Species (Y/N)
TREE STRATUM				TREE STRATUM			
1				1			
2				2			
3				3			
4				4			
SAPPLING/SHRUB STRATTUM				SAPPLING/SHRUB STRATTUM			
1				1			
2				2			
3				3			
4				4			
HERB STRATUM				HERB STRATUM			
1				1			
2				2			
3				3			
4				4			
5				5			
6				6			
7				7			
8				8			
9				9			
10				10			
WOODY VINE				WOODY VINE			
1				1			
2				2			

PERCENT CONCURRENCE WITH NATIVE SPECIES

Number of dominant species with native origin (A) (A)

Total number of dominant species (B) (B)

Percent concurrence with native species (A/B) = % (A/B)

V_{4A}	V_{4B}

V_5 Riparian Buffer Continuity and Width

User Notes: Riparian ecosystems typically form a relatively continuous corridor along the stream channel and floodplain. This variable is measured perpendicular from the top of the bank for a distance laterally of 100'. Both banks of the stream channel are measured and then averaged for determination of the summary rating and subsequent Condition Index Score assignment. Aerial photography can be used for estimation of this variable but should be verified in the field.

Assessment area: An artificial convention of 100' from the top of each bank

	Continuity (%)	100	80-99	60-79	40-59	20-39	5-19	<5
Width(ft)	≥100	1.00	0.90	0.70	0.50	0.30	0.15	0.00
	75-99	0.80	0.75	0.60	0.40	0.25	0.10	0.00
	50-74	0.60	0.50	0.50	0.30	0.20	0.10	0.00
	25-49	0.40	0.30	0.30	0.20	0.15	0.05	0.00
	10-24	0.20	0.20	0.15	0.10	0.10	0.05	0.00
	5-9	0.10	0.10	0.10	0.05	0.05	0.01	0.00
	<5	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Corresponding Summary Rating with Variable score:

If summary rating is between :	Assign the following Condition Index Score:
0.80 - 1.00	1.00
0.60 - 0.79	0.75
0.40 - 0.59	0.50
0.20 - 0.39	0.25
0.01 - 0.19	0.10
0.0 - OR No buffer of permanent vegetation is present = 0	

Field Notes:

V_6 Riparian Land Use

User Notes: Land use indicates the way in which a tract of land is utilized, has been developed, or the type of vegetation present

Assessment area: An artificial convention of 100' from the top of each bank. For land use assessment in stream to reservoir conversions, the assessment area is defined as 100' from the lateral extent of the floodpool. This boundary convention is considered synonymous with the upper extent of the floodprone area of stream systems.

Land Use Category	Land Use Weight		Area of Land Use		Weighted score (WS) for each land use category
Impermeable surface	1	X		=	
Feed lot	1	X		=	
Row crop or Small grain	3	X		=	
Farmstead	6	X		=	
Woodlot/shelterbelt	6	X		=	
Perennial Cover of any type	8	X		=	
Managed for native vegetation cover and diversity	10	X		=	
			Total area	=	
*User notes: ∑ WS is the sum of the Weighted Scores WA is the Weighted Average as defined by ∑Weighted Scores /Total area					∑ WS = WA =

If the Land Use Weighted Average is:	Assign the following Condition Index Score:
≥8	1.00
7-8	0.75
5-6	0.50
2-4	0.25
< 1	0.10

Field Notes:

APPENDIX D

Sample pages from the Calculation spreadsheet (Calcbook).

Welcome to the Nebraska Stream Assessment and Mitigation Procedure Calculation Spreadsheet (NSAMP Calcbook)

These worksheets are designed to assist with the calculations that follow the Nebraska Stream Assessment and Mititigation Procedures (NSAMP).

The last worksheet (summary) provides numbers from the Impact and Mitigation worksheets and allows for input for credits associated with Mitigation banks or an In-lieu Fee Program.

Some cells are blocked as they contain information that cannot be changed.

Point of Contact. Project specific questions must go through the Project Manager handling that action. General inquiries or comments regarding this document may be addressed to:

Matt Wray, Wehrspann Field Office
Nebraska Regulatory Office - U. S. Army Corps of Engineers, Omaha District
8901 S 154th Street, Omaha NE 68138
Subject: NE-SMP

OR Field Support Staff

Michael Gilbert
Vegetation, assessments

Karen Lawrence
Mitigation, assessments

U. S. Army Corps of Engineers, Omaha District
1616 Capitol Avenue, Ste 9000
Omaha, Nebraska 68102

Sample of the Impact worksheet.

RR_i= Impact reach

	Baseline (Pre project)	RR_i1	RR_i2	RR_i3	RR_i4	RR_i5	RR_i6	RR_i7
1	Hydraulic Conveyance and Sediment Dynamics	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	In-stream Habitat/Available Cover	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Floodplain Interaction-Connectivity	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4a	Riparian Vegetation Composition	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4b	Riparian Vegetation Composition	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	Buffer continuity & Width	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	Land use adjacent to Active Flood plain zone	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Stream Condition Index	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Left descending bank -Length (ft)	0	0	0	0	0	0	0
	Right descending bank -Length (ft)	0	0	0	0	0	0	0
	width (ft)	0	0	0	0	0	0	0
	Area	0	0	0	0	0	0	0
	Stream condition Index * area	0.00	0.00	0.00	0.00	0.00	0.00	0.00

	Post Project (PROPOSED)	RR_i1	RR_i2	RR_i3	RR_i4	RR_i5	RR_i6	RR_i7
1	Hydraulic Conveyance and Sediment Dynamics	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	In-stream Habitat/Available Cover	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Floodplain Interaction-Connectivity	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4a	Riparian Vegetation Composition	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4b	Riparian Vegetation Composition	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	Buffer continuity & Width	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	Land use adjacent to Active Flood plain zone	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Stream Condition Index	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Left descending bank -Length (ft)	0	0	0	0	0	0	0
	Right descending bank -Length (ft)	0	0	0	0	0	0	0
	width (ft)	0	0	0	0	0	0	0
	Area	0	0	0	0	0	0	0
	Stream condition Index * area	0.00	0.00	0.00	0.00	0.00	0.00	0.00

	Change from baseline to post project	RR_i1	RR_i2	RR_i3	RR_i4	RR_i5	RR_i6	RR_i7
1	Hydraulic Conveyance and Sediment Dynamics	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	In-stream Habitat/Available Cover	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Floodpalin Interaction-Connectivity	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4a	Riparian Vegetation Composition	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4b	Riparian Vegetation Composition	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	Riparian Buffer	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	Land use adjacent to Active Flood plain zone	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PROPOSED - BASELINE	0
Multiplier	#DIV/0!

PROJECT IMPACT UNITS	#DIV/0!

Sample of the Mitigation worksheet.

		RR_m= Mitigation reach						
	Baseline (Pre project)	RR_m1	RR_m2	RR_m3	RR_m4	RR_m5	RR_m6	RR_m7
1	Hydraulic Conveyance and Sediment Dynamics	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	In-stream Habitat/Available Cover	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Floodplain Interaction-Connectivity	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4a	Riparian Vegetation Composition	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4b	Riparian Vegetation Composition	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	Buffer continuity & Width	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	Land use adjacent to Active Flood plain zone	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Stream Condition Index	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Left descending bank -Length (ft)	0	0	0	0	0	0	0
	Right descending bank -Length (ft)	0	0	0	0	0	0	0
	width (ft)	0	0	0	0	0	0	0
	Area	0	0	0	0	0	0	0
	Stream condition Index * area	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Post Project (PROPOSED)	RR_m1	RR_m2	RR_m3	RR_m4	RR_m5	RR_m6	RR_m7
1	Hydraulic Conveyance and Sediment Dynamics	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	In-stream Habitat/Available Cover	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Floodplain Interaction-Connectivity	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4a	Riparian Vegetation Composition	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4b	Riparian Vegetation Composition	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	Buffer continuity & Width	0.00	0.00	0.00	0.00	0.00	3.00	0.00
6	Land use adjacent to Active Flood plain zone	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Stream Condition Index	0.00	0.00	0.00	0.00	0.00	0.43	0.00
	Left descending bank -Length (ft)	0	0	0	0	0	0	0
	Right descending bank -Length (ft)	0	0	0	0	0	0	0
	width (ft)	0	0	0	0	0	0	0
	Area	0	0	0	0	0	0	0
	Stream condition Index * area	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Change from baseline to post project	RR,1	RR,2	RR,3	RR,4	RR,5	RR,6	RR,7
1	Hydraulic Conveyance and Sediment Dynamics	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	In-stream Habitat/Available Cover	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Floodpalin Interaction-Connectivity	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4a	Riparian Vegetation Composition	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4b	Riparian Vegetation Composition	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	Riparian Buffer	0.00	0.00	0.00	0.00	0.00	3.00	0.00
6	Land use adjacent to Active Flood plain zone	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	PROPOSED - BASELINE	0						
	Multiplier	#DIV/0!						
	MITIGATION UNITS	#DIV/0!						

Mitigation Summary Worksheet

Project Name: _____

Corps # _____

	(A-Units)
Total Impact Units =	#DIV/0!
Total Proposed Mitigation	#DIV/0!

Proposed Mitigation Credits > Debits	#DIV/0!

MITIGATION BREAKDOWN	
	(A-Units)
Total Proposed Bank Mitigation	0.0
	(A-Units)
Total Proposed ILF Mitigation	0.0
	(A-Units)
Total Proposed Permittee-responsible	0.0
sum=	0.0
	#DIV/0!