UNITED STATES DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE

ECOLOGICAL SITE DESCRIPTION

GENERAL SITE INFORMATION

Site Type	Lotic Riparian Complex
Site ID	055BY001ND
Site Name	Central Black Glaciated Plains, Perennial Riparian Complex, (Valley Type VIII, E5 Stream Type)

Major Land Resource Area(s)

Number	Name
55B	Central Black Glaciated Plains

For further information regarding MLRAs, refer to: http://soils.usda.gov/survey/geography/mlra/index.html

Site Concept	This site occurs in MLRA 55B and characterizes streams with perennial flow with sands as the dominate bed material, including James River and portions of the Sheyenne River. The site begins at where the downstream portions of the streams cross crosses the MLRA line for 55B and continues upstream until water surface slopes exceed 2% and/or the flow becomes intermittent. For the James River this encompasses the Upper James River Watershed. Site concepts are based on the E5 stream type (predominantly sandy channel materials) and fluvial surfaces including a floodplain (with a plant community component of stable, bank holding obligate vegetation), a floodplain step plant community (with a plant community component of grasses and forbs) that can trap sediments in high water events, and a low terrace (dominated by grasses with patches of trees and shrubs). The plant community associated with the low terrace has been previously described as a loamy overflow ecological site. The magnitude of the site is limited by the space available at the valley bottoms. The site may also have an associated, disconnected terrace that were established in the floodplain but now are as much as 25-30 feet above the current base level of the stream.

Original Site Description Approval

Site Date	
Site Approval	
Site Authors	M. Meehan, J. Printz, K. Sedivec
Site Contributors	F. Aziz, L. Voigt, G. Sandness, M. Ell, J. Collins
Site Reviewers	J. Repp
Approval Date	

Revisions

Revision Date	
Reviser	
Revision Approval	
Approval Date	
Revision Notes	

REPRESENTATIVE PHYSIOGRAPHIC FEATURES

Narrative	This site occurs within the James River Watershed, located in the young glaciated plain of the Central Lowland province. The James River flows through a large melt-water trench that dissects the glaciated plain. The valley of the James River broadens in the southern part and coalesces with the lake plain of glacial Lake Dakota. The James River valley is steep sided, nearly flat bottomed, and ranges in width from about 500 feet in the northern end of the valley to nearly three miles in the southern part. The Niobrara and Pierre formations of Cretaceous age underlie the glacial drift of Pleistocene age. Glacial drift covers most of the area; however, major alluvial deposits of Holocene age occur on the floodplain of the James River (Christensen and Miller 1988). The floodplain is composed primarily of loams with sands, silts and clays present in the banks.

	Minimum	**Maximum**
Elevation (feet)	1000	2050
Valley Slope (percent)	0	3

Fluvial Surface/Landform 1 [1/]	Floodplain	
	Minimum	**Maximum**
Water Table Depth (inches)	Surface	24
Water Table Duration (days) [2/]	365	365
Water Table Frequency (months) [3/]	January	December
Flooding Frequency	Very Frequent	Very Frequent
Flooding Duration	Long	Very Long
Ponding Depth (inches)	None	12
Ponding Frequency	Frequent	Frequent
Ponding Duration	Long	Very Long
Runoff Class	Negligible	Negligible

[1/] Landforms are numbered as they change laterally away from the channel.
[2/] Enter the number of days the water table is above 6 ft depth.
[3/] Enter the beginning and ending month of elevated water table (above 6 ft depth).

Fluvial Surface/Landform 2 [1/]	Floodplain Step	
	Minimum	**Maximum**
Water Table Depth (inches)	surface	60
Water Table Duration (days) [2/]	365	365
Water Table Frequency (months) [3/]	January	December
Flooding Frequency	Frequent	Frequent
Flooding Duration	Brief	Long
Ponding Depth (inches)	None	0
Ponding Frequency	None	Rare
Ponding Duration	None	None
Runoff Class	Negligible	Negligible

[1/] Landforms are numbered as they change laterally away from the channel.
[2/] Enter the number of days the water table is above 6 ft depth.
[3/] Enter the beginning and ending month of elevated water table (above 6 ft depth).

Fluvial Surface/Landform 3 [1/]	Low terrace (active)	
	Minimum	**Maximum**
Water Table Depth (inches)	surface	>72
Water Table Duration (days) [2/]	365	365
Water Table Frequency (months) [3/]	January	December
Flooding Frequency	Occasional	Frequent
Flooding Duration	Very brief	Brief
Ponding Depth (inches)	None	None
Ponding Frequency	None	None
Ponding Duration	None	None

Runoff Class	Low	Low

[1/] Landforms are numbered as they change laterally away from the channel.
[2/] Enter the number of days the water table is above 6 ft depth.
[3/] Enter the beginning and ending month of elevated water table (above 6 ft depth).

Fluvial Surface/Landform 4 [1/]	High terrace	
	Minimum	**Maximum**
Water Table Depth (inches)	>72	-
Water Table Duration (days) [2/]	0	0
Water Table Frequency (months) [3/]	-	-
Flooding Frequency	Rare	Rare
Flooding Duration	Extremely Brief	Very Brief
Ponding Depth (inches)	None	None
Ponding Frequency	None	None
Ponding Duration	None	None
Runoff Class	Very low	Low

[1/] Landforms are numbered as they change laterally away from the channel.
[2/] Enter the number of days the water table is above 6 ft depth.
[3/] Enter the beginning and ending month of elevated water table (above 6 ft depth).

REPRESENTATIVE CLIMATIC FEATURES

Narrative	MLRA 55B is considered to have a continental climate – cold winters and hot summers, low humidity, light rainfall, and much sunshine. Extremes in temperature are characteristic. The climate is the result of this MLRA's location in the geographic center of North America. There are few natural barriers on the northern Great Plains. The air masses move unobstructed across the plains and account for rapid changes in temperature. Annual precipitation ranges from 16 to 21 inches per year. The normal average annual temperature is about 41.5°F. January is the coldest month with average temperatures ranging from about 2° F (Maddock, ND) to about 11°F (Mellette, SD). July is the warmest month with temperatures averaging from about 67° F (Maddock, ND) to about 73° F (Redfield 2 NE, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 64° F. This large annual range attests to the continental nature of this MLRA's climate. Winds average about 11 miles per hour annually, ranging from about 13 miles per hour during the spring to about 10 miles per hour during the summer. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 50 miles per hour. Growth of native cool-season plants begins in late March and continues to early to mid-July. Native warm-season plants begin growth in mid-May and continue to the end of August. Green up of cool-season plants can occur in September and October when adequate soil moisture is present.

See Climatic Data Sheet for more details (Section II of the Field Office Technical Guide) or reference the following climatic web site: http://www.wrcc.dri.edu/climsum.html

	Minimum	Maximum
Frost-free period (days)	118	140
Freeze-free period (days)	132	161
Annual effective precipitation (inches)	16.0	21.0

Monthly precipitation (inches) and temperature (degrees F) distribution

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Precip. Avg.	0.53	0.42	1.12	2.22	3.04	3.21	2.51	1.70	1.25	0.92	0.42	0.26
Temp. Min	-7.9	-1.4	10.8	28.1	39.1	49.7	54.1	51.9	41.8	31.5	16.7	1.4
Temp. Max.	23.0	28.6	41.0	58.5	70.7	79.8	86.6	85.4	74.9	61.8	42.3	28.7

Climate Stations

Number	Name	State	Period of Records	
			From	To
ND1224	Butte	ND	1948	2007
ND1360	Carrington	ND	1948	2004
ND3117	Forman 5 SSE	ND	1948	2007
ND4013	Harvey	ND	1948	2007
ND4937	LaMoure	ND	1948	2007
ND5434	Maddock	ND	1948	2004
SD5456	Mellette	SD	1896	2007
SD7052	Redfield 2 NE	SD	1949	2007

INFLUENCING WATER FEATURES

Narrative	This site is a lotic, fluvial system that includes the area influenced by the stream and its associated ground water on very low gradients (< 2%) that include adjacent floodplains and terraces. The stream occurs in alluvial valley fill and sediments supplied are sandy and clayey materials from adjacent prairie landscapes. The potential natural channel is the expression that has the best combinations of energy dissipation, sediment transfer, floodplain development and the associated high quality values associated with the system. It is rarely found in this site due to past disturbances and that resulted in entrenchment and widening of the stream system.

Level II Rosgen Stream Type Classification

Valley Type(s)	**Valley Type VIII: Wide, gentle valley slope with well-developed floodplain adjacent to river terraces.** Valley Type VIII is most readily identified by the presence of multiple river terraces positioned laterally along broad valleys with gentle, down-valley elevation relief. Alluvial terraces and floodplains are the predominant depositional landforms which produce a high sediment supply. Soils are developed predominantly over alluvium originating from combined riverine and lacustrine depositional processes. Stream types "C" or "E," which have slightly entrenched, meandering channels that develop a riffle/pool bed-form, are normally seen in the Type VIII valley. However, "F," and "G" stream types can also be found, depending on local stream and riparian conditions.
Reference Stream Type	The E5 stream types are systems with low to moderate sinuosities, gentle to moderately steep channel gradients, and with very low channel width/depth ratios. The E5 stream type is a riffle/pool stream found in broad alluvial valleys with well-developed floodplains. The E5 stream channels within this site are found in valley type VIII.
Channel Material(s)	Sand dominated bed with smaller accumulations of gravel and occasional cobbles in areas of glacial outwash. Streambanks composed of sandy/silt/clay mixture with dense root mat.
Stream Succession Scenario[1/]	E5 →G5c →F5 →B5c →C5→E5
Channel Evolution Stage[1/]	I → II → III → IVa → IVb → V

Delineative Criteria	**Low**	**High**
Entrenchment Ratio (floodprone width / bankfull width)[2/]	1.3	35
Width/Depth Ratio (bankfull width / bankfull depth at riffle)[2/]	5	50
Sinuosity (stream length / valley length) [2/]	1.0	1.5
Slope Range[2/]	0.05	0.2
Channel Materials D_{50} (particle size index, mm)	0.19	4.7
Channel Materials D_{84} (particle size index, mm)	1.0	35

Information from Rosgen, 1996 and modified as needed for site description. Delineative criteria are for the stream type and may represent a larger range of values than exists within the site.

[1/] Describe succession of channel types and their associated channel evolution stage (I – V)

[2/] Expressed as ft/ft.

Stream & Valley Cross-Sections (F5 Channel)

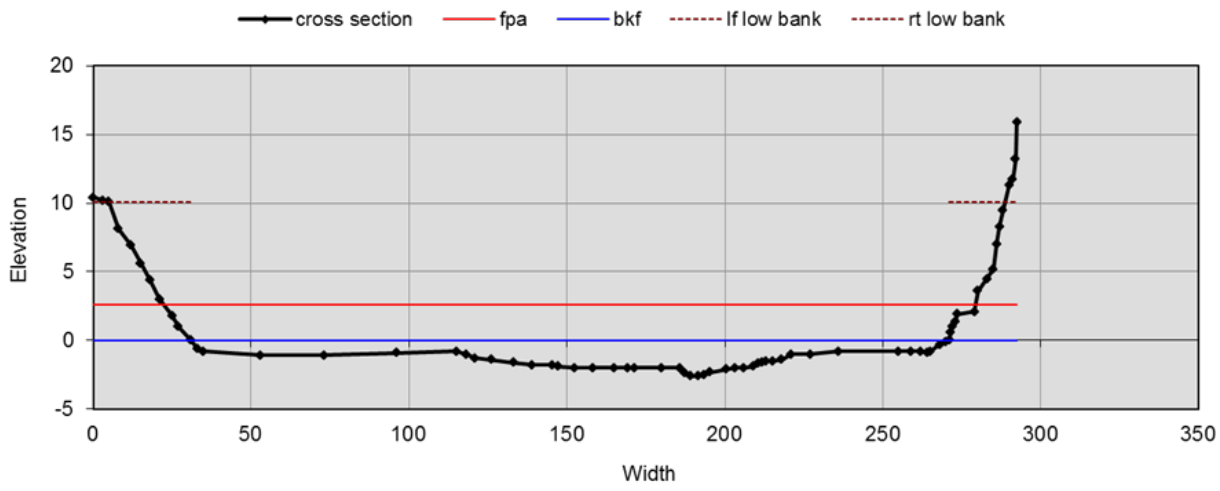


Figure 1 – Typical stream cross-section. *Cross-section of phase 2.2 (F5 channel).*

Stream & Valley Cross-Sections (Bc5 Channel)

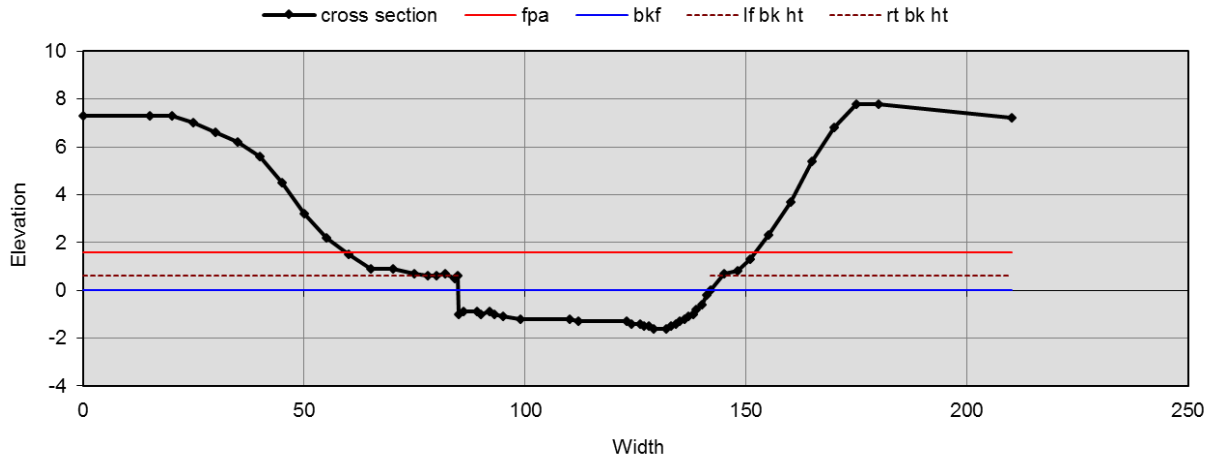


Figure 1 – Typical stream cross-section. *Bc5 channel cross-section (phase 3.1)*

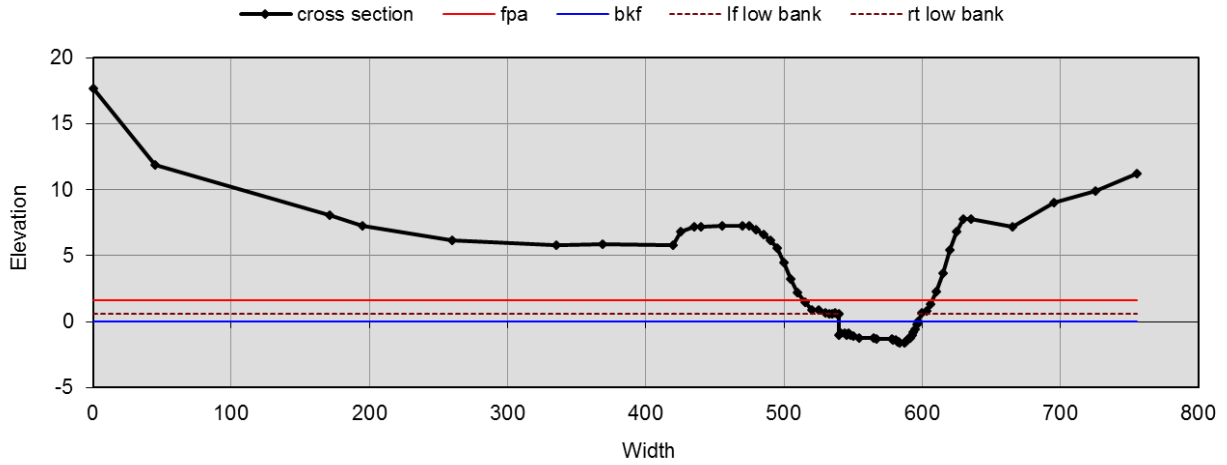


Figure 2 – Typical valley cross-section. *Entrenched Bc5 channel of state 3 phase 1. Note the abandoned floodplain and natural levee on left that indicated incision in the past.*

Stream & Valley Cross-Sections (C5 Channel)

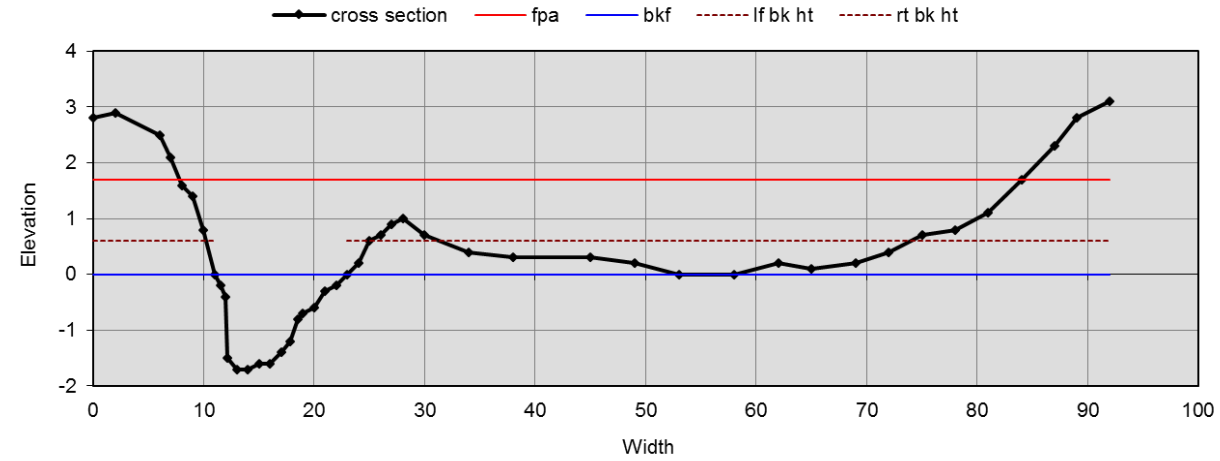


Figure 1 – Typical stream cross-section. *C5 channel cross-section (phase 3.2)*

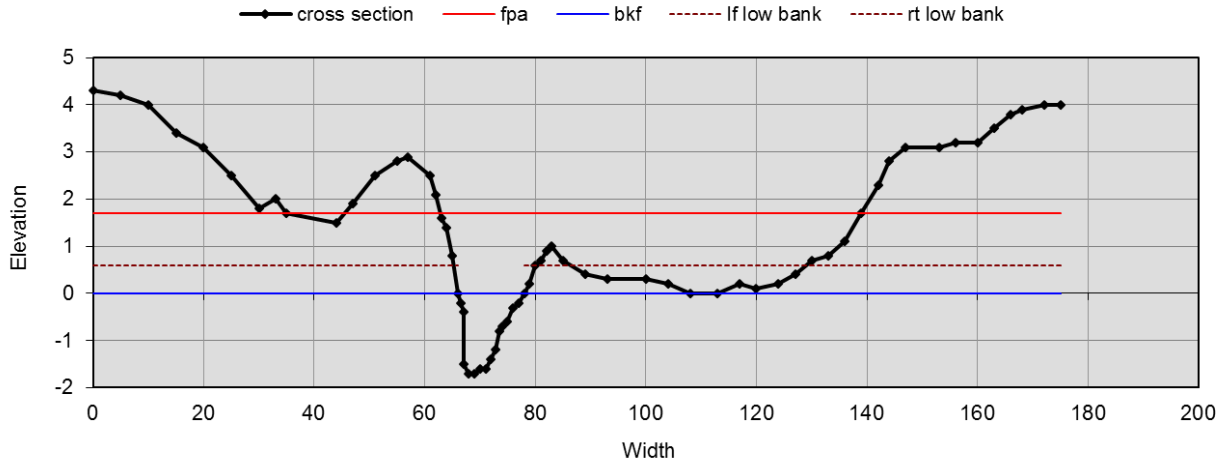


Figure 2 – Typical valley cross-section. *Entrenched C5 channel of state 3 phase 2. Note the multiple terraces with relic channels indicative of past entrenchment and channel evolution.*

Stream & Valley Cross-Sections (E5 Channel – stable analogue)

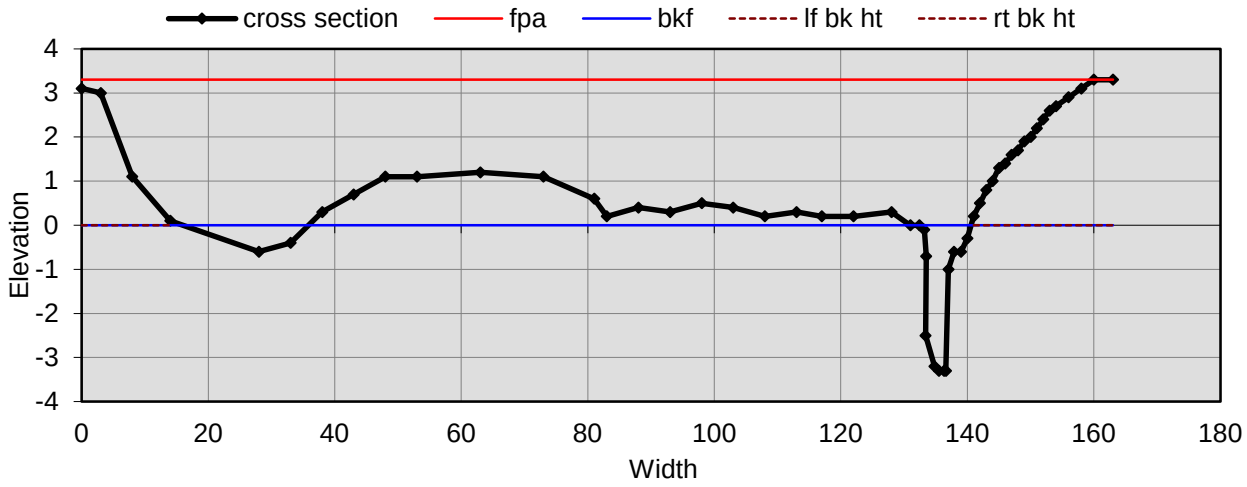


Figure 1 – Typical stream cross-section. *An example of phase 3.3 (E5 entrenched stable analogue) that replicates the features of the potential natural channel phase of state 1.*

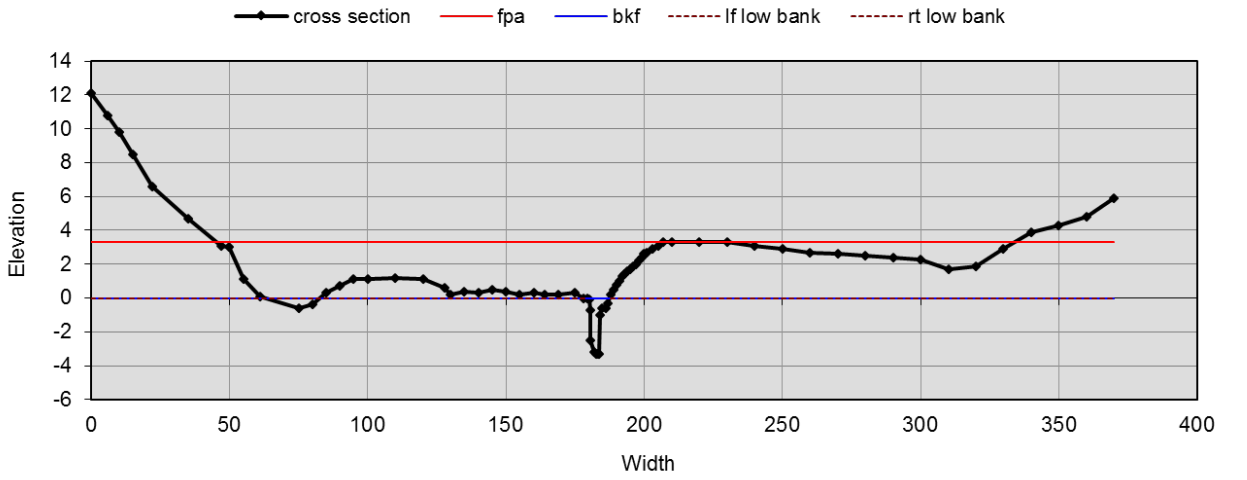


Figure 2 – Typical valley cross-section. *Valley cross-section of phase 3.3. Note the multiple terraces and with relic channels indicative of past entrenchment and channel evolution.*

REPRESENTATIVE SOIL FEATURES

Narrative	The soils in MLRA 55B of the James River floodplain are deposits of glacial drift. These soils are classified as Entisols and Mollisols soil orders. The soils of the flood plain have also been influenced from the sediments of the glacial drift listed above, and other glacial meltwater sediments. Typically the sediments and soils of the river system consist of a mixture of sediments (sands, silts, clays, and gravels) due to the flow events of the river. There is no soil development on the edge of the river channel (floodplain) due to constant re-working of the sediments, time has not allowed soil development; this zone is considered a miscellaneous land type called "Channel". As you increase in elevation from the channel edge, the soils on the primary steps are Fluvaquents and typically the particle size family class is Sandy, Coarse-Loamy or Loamy. There are stratified thin layers of sediments that range from sand to clay loams throughout the soil profile. The soils are frequently flooded and the water table will fluctuate with the depth of water in the river channel. The soils on the primary floodplain are Typic Calciaquolls and the particle size family class is Fine-loamy. The parent material does have stratified thin layers of sediments that range from loamy sands to silty clay loams in the lower profile. These soils are frequently flooded and the water table will also fluctuate with the depth of water in the river channel. The soils of the terrace are Mollic Udifluvents; Cumulic Hapludolls and the particle size family class is Fine-Loamy. These soils are occasionally flooded and do have a lower water table. The soils on the terraces have been on a stable landform for many years.

Fluvial Surface/Landform 1	Floodplain	
Soil Features Narrative	The soil associated with the floodplain are classified as Fluvaquents	
Parent Materials - Kind	Loamy alluvium	
Bedrock - Kind	none	
Typical Surface Texture (<2mm)	Loam	
Surface Texture Modifier	none	
	Minimum	**Maximum**
Surface Fragments ≤10" (% cover)	none	none
% Coarse Fragments >2mm (% volume in 10–20" layer)	0	3
Drainage Class	Very poorly	Very poorly
Saturated Hydraulic Conductivity Class	10	100
Depth to Bedrock (inches)	>72	> 72
Depth to Redoximorphic Features (inches)	2	4
Depth of Fine Roots (1-2mm)	20	30
Electrical Conductivity (mmhos/cm)	0	4
Sodium Adsorption Ratio within 16" Depth	0	0
Calcium Carbonate Equivalent within Surface 10"	0	5
Soil Reaction within Surface 4 Inches	slight	strong
Available Water Capacity (inches)	5.1	16.6

Fluvial Surface/Landform 2	Floodplain Step	
Soil Features Narrative	The soils associated with the primary floodplain step are classified as Fine-loamy, frigid Typic Calciaquolls (Lowe Series) and Aeric Calciaquolls (Moritz Series). These soils are mixed and superactive.	
Parent Materials - Kind	Loamy alluvium	
Bedrock - Kind	none	
Typical Surface Texture (<2mm)	loam	
Surface Texture Modifier	none	
	Minimum	**Maximum**
Surface Fragments ≤10" (% cover)	none	none
% Coarse Fragments >2mm (% volume in 10–20" layer)	0	0
Drainage Class	poorly	Somewhat poorly
Saturated Hydraulic Conductivity Class	1	10
Depth to Bedrock (inches)	>80	>80
Depth to Redoximorphic Features (inches)	3	28

Depth of Fine Roots (1-2mm)	11	25
Electrical Conductivity (mmhos/cm)	0	7.9
Sodium Adsorption Ratio within 16” Depth	0	5
Calcium Carbonate Equivalent within Surface 10”	5	10
Soil Reaction within Surface 4 Inches	slight	strong
Available Water Capacity (inches)	8.4	11.6

Fluvial Surface/Landform 3	Low terrace	
Soil Features Narrative	The soils associated with the Terrace are classified as fine-loamy, frigid, Mollic Udifluvents (Fairdale Series) and Cumulic Hapludolls (LaPrairie Series). They are calcareous and non-calcareous, mixed and superactive.	
Parent Materials - Kind	Loamy alluvium	
Bedrock - Kind	none	
Typical Surface Texture (<2mm)	loam	
Surface Texture Modifier	none	
	Minimum	**Maximum**
Surface Fragments ≤10” (% cover)	0	0
% Coarse Fragments >2mm (% volume in 10–20” layer)	0	0
Drainage Class	Moderately well	Moderately well
Saturated Hydraulic Conductivity Class	1	10
Depth to Bedrock (inches)	> 60	>60
Depth to Redoximorphic Features (inches)	36	60
Depth of Fine Roots (1-2mm)	26	43
Electrical Conductivity (mmhos/cm)	0	2
Sodium Adsorption Ratio within 16” Depth	0	0
Calcium Carbonate Equivalent within Surface 10”	1	8
Soil Reaction within Surface 4 Inches	none	slight
Available Water Capacity (inches)	10.6	18.7

COMMUNITY PHASE INFORMATION

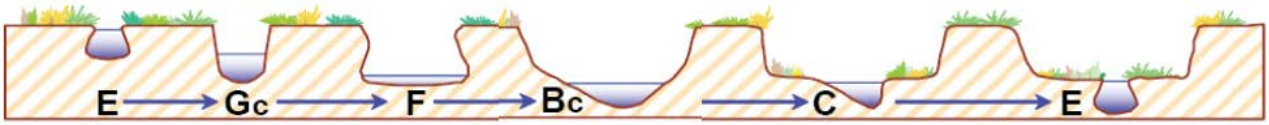
Fluvial Geomorphology, Channel Evolution, and Stream Type Succession of the Site

The site has a potential E5 channel type in an alluvial valley with a broad floodplain, floodplain step, and low terrace fluvial surfaces. The site has a succession scenario (channel evolution) of E5 →G5c →F5 →B5c →C5→E5 (similar to Rosgen scenario #1 with the addition of a Bc channel type in the stable analogue state).

The state and transition model includes these channel types as phases and depicts the characteristics of potential stream types (E5 in alluvial valleys). The phases are arranged in the order of channel evolution and are grouped by their inherent stability. State 1 is the potential natural channel and has the best expression of vegetative communities, stability, habitat, and resilience. State 2 is the most unstable and apt to change quickly. The Gc channel phase depicted may not always be present in the evolution of the channel when bed materials prevent vertical stability, or with looser materials, it will exist only for a short period before widening into the more characteristic F channel. State 3 phases are considered stable analogues; they have inherent stability, although with a more limited ability to form floodplains and terraces due to the entrenchment of the stream. There is a natural progression from the B5c to the C5 to the E5 channel. Proper management of the uplands is critical to this progression.

Transition 1A occurs in response to severe flooding combined with disturbance to the riparian vegetation that reduce resistance and resilience, allowing the channel to widen and/or deepen resulting in the loss of beneficial and stabilizing banks vegetation (PCC1 is usually completely gone after this transition). Transition 2A occurs when management and conditions facilitate the development of floodplains, rising of the water table, and return of beneficial bank vegetation. The channel bottom changes from flat to parabolic and the entire stream is more capable of transporting water, sediments, and nutrients and is more capable of dispersing energy from high flows. There is also a significant increase in water storage in the adjacent soils.

The end point of channel evolution is the entrenched E5 channel with floodplains, floodplain step, and low terrace that support appropriate plant community components. The phase has high stability (if bank vegetation is maintained) and is in balance with energy, water, and sediment supplied by the catchment. Transition 3A is similar to 1A where the stable analogue is disturbed enough that high flow events scour out the channel resulting in a further entrenched version of the phases in state 2. Removal of disturbances and reestablishment of beneficial vegetation will facilitate the transition back to state 3 and the development of stable channels through the community pathways.



Ecological Dynamics of the Site

The site occurs on low gradient, alluvial valleys, with sandy channel materials with perennial flow in MLRA 55B; including the James River and portions of the Sheyenne River. The potential (or reference) reach consists of an E5 channel with a broad relatively flat floodplain that has a low terrace. The potential channel is slightly entrenched (entrenchment ratio 10-40, considerably more floodplain than stream bankfull width), has a narrow and deep channel (width/depth ratio <12), and moderate to high sinuosity. Channel materials are predominately sands with a small amount of gravels and very few cobbles. Due to low gradient of the valley and stream wetlands are common in the floodplain, some of which are connect to the stream through surface flow, these wetlands help maintain the plant communities, trapping sediments, and maintaining grade levels and local water tables.

The entire system has experienced historic and anthropogenic disturbances (drought, flood, fire, overgrazing, and crop production). These disturbances resulted in the system becoming entrenched, thus true reference areas cannot be located. The best examples of reference for this site are found in the stable analogues of E5 channels that are moderately confined, but adequately express the plant community components.

Plant Communities and Fluvial Surfaces:

The site exhibits 2-4 plant community components. There is no significant instream plant community associated with these streams. The first plant community is a herbaceous community associated with the floodplain. The floodplain, floodplain step, low terrace, and high terrace plant community are herbaceous. Trees and shrubs are present on some high and low terraces, but are not a dominant lifeform. The floodplain, floodplain step, and low terrace are

hydrologically influenced by the stream; whereas, the high terrace is an abandoned floodplain that is no longer influenced by the stream.

PCC1: The greenline plant community, which occurs at the water's edge (PCC1) consists of prairie cordgrass (*Spartina pectinata*) and water sedge (*Carex* aquatilis), a native obligate sedge. The greenline community generally occurs within the bankfull elevation (or slightly higher) and is maintained by seasonal flows and a local water table. Considerable scouring occurs in this portion of the floodplain on an annual basis so the plants in this community are adapted to this frequent disturbance and function to protect and stabilize banks. The native sedges and the prairie cordgrass serve to protect and bind the bank materials and can maintain bank integrity in most high flow events.

This plant community is subject to damage by natural forces that include extreme flooding and drought, and anthropogenic actions including channel modification (bridges, fords, crossings, straightening, etc.), overgrazing, and crop production. Disturbance can result in the plant community being replaced by shallow rooted upland species that are not capable of protecting and stabilizing banks; resulting in the formation of tensile cracks, bank sloughing, accelerated lateral and vertical movement (unstable state). In the unstable channel phases PCC1 has been lost and the stream is subject to extreme bank and bed erosion.

PCC2: The next plant community component (moving away from the channel) occurs on a floodplain step and consists of a herbaceous plant community dominated by woolly sedge (*Carex pellita*) and prairie cordgrass. The primary species that comprise this community have facultative wetland and facultative indictor statuses and are common in meadow ecosystems. This community is subject to scouring in high flow events and sediment deposition. The plant species in this community have adaptations to withstand highflow events that dissipate energy and trap sediments.

This plant community is also susceptible to flooding, drought, channel modification (bridges, fords, crossings, straightening, ect.), overgrazing, and crop production. Similarly, disturbance can result in the plant community being replaced by shallow rooted upland species, especially Kentucky bluegrass (*Poa pratensis*). When the plant community dominants are replaced by shallow-rooted grasses and forbs the site is susceptible to scouring and avulsion and the energy reduction and sediment trapping abilities are severely limited. In unstable channels phases (2.1 and 2.2) PCC2 is either severely reduced in size or eliminated.

PCC3: This component is a transitional plant community between the riparian complex and the adjacent uplands and occurs on the low terrace. The low terrace plant community is subject to flooding, but not on an annual basis. The plant community associated with the low terrace is dominated by big bluestem (*Andropogon gerardii*) and green needlegrass (*Nassella viridula*) and has been described as a Loamy Overflow ecological site.

PCC4: This component is actually PCC3 that is no longer connected to the stream as a result of massive erosion and the subsequent entrenchment of the stream. These high terraces occur where there has been significant entrenchment of the stream channel. The majority of this entrenchment happened since European agricultural practices became widespread in the region. The plant communities associated with this feature are upland plant communities, the most common being community is a western wheatgrass (*Pascopyrum smithii*) and green needlegrass (*Nassella viridula*) community and has been described as a Loamy ecological site. It may be incorporated into the riparian complex or left as an associated site that was formerly part of the riparian complex.

These disconnected components now have their own states, phases, and transitions and function as loamy sites and other upland ecological sites. Only the remaining alluvial soils testify to the former floodplain attributes of this community.

Disturbances:
The site has endured many disturbances that have altered the form and function of the stream. Historic records do not describe local conditions well but there is evidence that years of drought and changes in land use within the watershed followed by above-average rainfall caused entrenchment of the stream channel: in many cases the former nature of the gradually sloping, highly sinuous E type stream has been replaced by multiple terraces created by streams actively downcutting then widening and flattening over time. In some places, rehabilitation of the stream has rebuilt floodplains and floodplain steps that support riparian vegetation within the entrenchment.

The absence of fire from the adjacent ecosystem has also altered the natural fire frequency. The riparian areas probably burned less often than the surrounding uplands, but fire was undoubtedly a factor in creating and maintaining the plant communities.

Decades of unmanaged livestock grazing (and overgrazing) have denuded streambanks and led to the entrenchment of several reaches and the total replacement of critical riparian species within the floodplain that are necessary for maintaining the integrity of the banks, trapping sediments, and reducing the energy of high flows. Overgrazing tends to facilitate the invasion of Kentucky bluegrass, a shallow rooted upland species, within the riparian complex resulting in decreased bank stability and increased erosion and runoff. However, the absence of grazing within the Northern Great Plains makes sites susceptible to invasion by smooth brome another shallow rooted upland species.

Farming is the primary use of uplands within the watershed, and in many instances field edges encroach on the riparian complex. In addition floodplains in the area are often located near farmsteads and are commonly used as wintering areas for livestock. Both these activities have resulted in increased nutrient levels, which has facilitated the invasion of reed canarygrass and smooth brome within the riparian complex.

Hydrologic Modifications:
Most of the direct hydrologic alteration has come from roads, livestock grazing, and farming. There are some reaches that have been disturbed by channel straightening, bridge, and dam construction. Changes to the uplands have disrupted the hydrology of the watersheds: invasions of reed canarygrass and smooth brome due to nutrient inputs from farming and animal agriculture and invasions of smooth brome and Kentucky bluegrass on rangelands are likely causes. The effects of climate change are unknown but should be monitored in the future.

Invasive Species: PCC1 is susceptible to invasion by reed canarygrass (*Phalaris arundinacea*) and quackgrass (*Elymus repens*). Invasive species observed within PCC2 include: leafy spurge (*Euphorbia esula*), quackgrass, smooth brome (*Bromus inermis*), Kentucky bluegrass (*Poa pratensis*), and reed canarygrass. Species invasions of these plant community are generally a result of overgrazing or increased nutrient inputs from the uplands. Overgrazing tends to promote the growth of Kentucky bluegrass; whereas, reed canarygrass and smooth brome capitalize on increased nutrient inputs.

Water Quality:
The waters associated with this site should have superior water quality and low sediment loads. At times when sediments enter the system from background bank erosion they will be occluded but should clear up rapidly if the wetlands are in place where they can trap the sediments. Where agriculture is present runoff can add contaminants to the stream, increases nutrient loads, pesticide residues, and fertilizers. Animal waste can be a problem where animals are allowed access to the stream. Besides wastes entering the waters, livestock can break down banks (especially where the stabilizing bank vegetation has been removed) and cause excess erosion and increased sediment loads.

The primary beneficial uses identified in the State's water quality standards are aquatic life and recreation. Protection for aquatic life means surface waters should be suitable for the propagation and support of fish and other aquatic biota, including aquatic macroinvertebrates, and that these waters will not adversely affect wildlife in the area. Protection of surface waters for recreation means waters should be suitable for direct body contact activities such as bathing and swimming and for secondary contact activities such as boating, fishing, and wading. Other beneficial uses identified in the State's water quality standards are municipal and domestic water (e.g., water suitable for drinking after appropriate treatment), agriculture (e.g., stock watering and irrigation), and industrial (e.g., washing and cooling). These uses apply to all classified rivers, streams, lakes, and reservoirs.

Based on the 2012 Section 303(d) List of Impaired Waters Needing Total Maximum Daily Loads (TMDLs), the North Dakota Department of Health (NDDoH) has identified seven segments, totaling 107 miles, of the James River as impaired for fish and other aquatic Biota and recreation due to dissolved oxygen, benthic macroinvertebrate assessments and Escherichia coli. The primary sources of the impairments include but are not limited to; runoff from unconfined animal feeding operations, livestock grazing in riparian areas, runoff erosion from agricultural lands and instream habitat degradation. The following table provides specific 303(d) listing information.

Listed Section	Total Miles	Designated Use	Use Support	Impairment
James River downstream from Jamestown Reservoir to its confluence with Pipestem Creek.	3.3	Fish and Other Aquatic Biota	Fully Supporting, but Threatened	Benthic-Macroinvertebrate Bioassessments
James River from Arrowwood Lake, downstream to Mud Lake.	3.01	Fish and Other Aquatic Biota	Fully Supporting, but Threatened	Dissolved Oxygen
James River from Jim Lake, downstream to Jamestown Reservoir. The length of this segment may be open for interpretation, depending upon how far the Jamestown Reservoir backs up on full pool.	7.1	Recreation	Fully Supporting, but Threatened	Escherichia coli
James River from its confluence with Big Slough, downstream to its confluence with Rocky Run.	20.27	Recreation	Fully Supporting, but Threatened	Escherichia coli
James River from its confluence with Rocky Run, downstream to its confluence with Lake Juanita.	21.94	Recreation	Fully Supporting, but Threatened	Escherichia coli
James River from its confluence with Pipestem Creek, downstream to its confluence with Seven Mile Coulee.	13.04	Recreation	Fully Supporting, but Threatened	Escherichia coli
James River from its confluence with Bone Hill Creek, downstream to its confluence with Cottonwood Creek.	38.65	Recreation	Fully Supporting, but Threatened	Escherichia coli

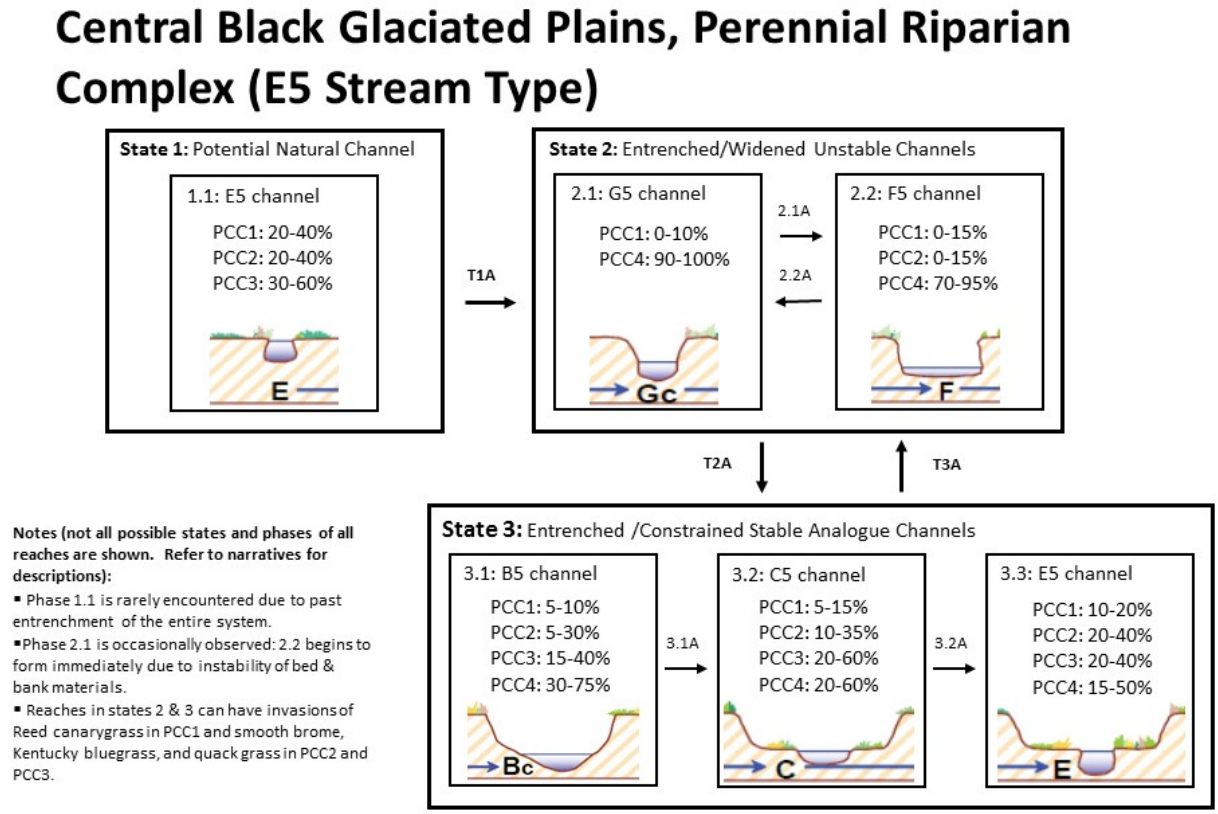
Plant Communities and Transitional Pathways (Narrative)

A State and Transition Model (STM) for the Rolling Soft Shale Plain Perennial Riparian Complex E5 ecological site (055BY001ND) is depicted in Figure 1. Thorough descriptions of each state, transition, plant community, and pathway follow the model. This model is based on available experimental research, field observations, and interpretations by experts. It is likely to change as knowledge increases.

The plant communities will differ across the MLRA due to the naturally occurring variability in the extent of fluvial surfaces, soils, and influence of surface water and ground water in the hyporheic zone. The biological processes on this site are complex; therefore, representative values are presented in a land management context. The species lists are representative and are not botanical descriptions of all species occurring, or potentially occurring, on this site. They are not intended to cover every situation or the full range of conditions, species, and responses for the site.

Both percent species composition by weight and percent canopy or foliar cover are used in this ESD. Most observers find it easier to visualize or estimate percent canopy for woody species (trees and shrubs). Species composition by dry weight remains an important descriptor of the herbaceous community and of the community as a whole. Woody species are included in species composition for the site.

This STM includes only native communities and states. The converted communities are described in the Ecological Dynamics section above.



I.D.	Plant Association	Fluvial Surface/Landform
1	Prairie Cordgrass/ Water Sedge	Floodplain
2	Wooly Sedge/ Prairie Cordgrass	Floodplain Step
3	Big bluestem/ Green needlegrass	Low Terrace
4	Western wheatgrass/ Green needlegrass	High Terrace

Draft 1: 4/2015

Figure 3: *State and Transition Model*

STATE 1 SECTION

State Number	1
State Name	Potential Natural Channel
State Narrative	This state includes the phase and plant community components believed to be the potential natural channel and incorporates the natural channel for the gradient and valley fill materials (E5) and fluvial surfaces that are freshened intermittently in order to produce the characteristic types of vegetation. This stream type is suited to handle the energy, water, and sediments supplied by the watershed and promote the plant community components that provide stability to the system. If undisturbed, this phase can supply the highest benefits and services from the riparian complex including, but not limited to: diverse, resilient plant community components that can withstand high flow events, significant fish and wildlife habitat, resistance to invasive species invasions, highest potential water quality and quantity, and ground water recharge and release. The natural disturbance regime within this state would have included wetland complexes which slowed stream flow rates, elevated water tables and reduced sediment loads; infrequent fires usually associated with periods of prolonged drought which, due to the fire tolerant nature of the plant species occupying these sites. Fire frequency would have been less on these sites as compared to the adjoining upland ecological sites due to increased fuel moisture associated with the greener vegetation; grazing by native herbivores which would have been attracted to these areas by the greener vegetation and reliable water supply, especially during periods of below normal precipitation or late summer months when upland vegetation is less palatable.

State 1Photos

Photo 1. *Characteristic E5 channel type for this site. Due to decades of disturbances to this system, the best references were found in state 3, phase 3.3 in the upper segments of the watersheds.*

Photo 2. *The characteristic valleys are gently sloping and slightly parabolic. Reference streams develop large floodplains. Wetlands are common in the floodplain, helping to raise the water table, allowing for the development of favorable wetland vegetation, and collect and trap sediments.*

Photo 3. *Wetlands are common in the floodplain, helping to maintain the water table, allowing for the development of favorable wetland vegetation, collect and trap sediments, and help dissipate energy during flood events.*

Photo 4. *The floodplain is characterized by water sedge and prairie cordgrass that receive water and trap sediments from bankfull events*

Photo 5. *The floodplain step is dominated by prairie cordgrass and wooly sedge, these species are deep rooted and help stabilize banks.*

Photo 6. *The floodplain step supports the establishment of sandbar willow and other shrub species.*

State 1 Community Phases

Community Phase Number	1.1
Community Phase Name	E5 Potential Natural Channel
Community Phase Narrative	This channel and its associated fluvial surfaces and plant community components represent the highest expression of functioning and ecological services of the site. Streambanks have high percentages of stabilizing vegetation and channels are narrow and relatively deep with continuous flow connecting to downstream sites. Habitat for amphibians and fish is very good. Wetlands are common in the floodplain. Elevated the water table which permits an expansion of plant community components PCC2 (Wooly sedge/Prairie cordgrass) and PCC1 (Prairie cordgrass/ Water sedge). The uplands adjacent to the riparian complex are dominated by big bluestem and green needlegrass.

Plant Community Components

PCC	Plant Association	Fluvial Surface/Landform[1/]	Composition (%)
1	Prairie cordgrass/ Water sedge	Floodplain	20-40
2	Wooly Sedge/ Prairie cordgrass	Floodplain Step	20-40

3	Big bluestem/ Green needlegrass	Low Terrace (Loamy Overflow)	30-60

[1/] Corresponds to fluvial surfaces/landforms in the Physiographic Features and Representative Soil Features sections.

T1A Transition to Entrenched/Widened Unstable Channels State (State 2) from Reference State (State 1)

Entrenchment of reference E channel due to loss of vegetation (obligate and facultative wet plant functional groups), increased bank erosion, and down cutting. This transition may be initiated by overgrazing and changes in upland management likely following European settlement.

STATE 2 SECTION

State Number	2
State Name	Entrenched and/or Widened, Unstable Channels
State Narrative	This state represents a set of degraded channels (G5c – F5) that have crossed a threshold by becoming vertically and laterally unstable resulting in moderately deep entrenchment and loss of floodplain and floodplain step connectivity and vegetation. They are difficult, if not impossible to restore without changing profile, pattern, and dimension of the stream. These channels have little value for wildlife, fish, and water quality unless residual pools are deep enough between recharge or storm events.

2.1A Community Phase Change to 2.2

Lateral movement with significant bank erosion, increased sediment load and increase in width/depth ratio.

2.2A Community Phase Change to 2.1

Increased vertical instability and entrenchment from further loss of vegetation (similar to T1A). This may be caused by disturbances that remove stabilizing vegetation, natural flooding, ice or beaver dam failure. Significant increase in bank erosion although some stabilizing vegetation may increase

State 2 Photos

Photo 1. *Loss of connectivity to the floodplain results in riparian plants being replaced by upland species, which contributes to bank instability.*

Photo 2. *Bank instability resulting from high bank height ratio. Slumping of banks provides material for floodplain development need to transition to State 3.*

Photo 3. *F5 channel (Phase 2.2). This site has a wide shallow channel with no floodplain.*

Photo 4. *Aerial view of phase 2.2, F5, showing arrangement of community components.*

State 2 Community Phases

Community Phase Number	2.1
Community Phase Name	G5Channel (active entrenchment)
Community Phase Narrative	This channel phase is the result of loss of floodplain connectivity and vegetation (PCC1 and possibly PCC2) resulting in rapid vertical instability and deep entrenchment. The forces which cause the entrenchment continue to shape the channel into the next phase (F5) through bank sloughing and accelerated lateral movement.

Plant Community Components

PCC	Plant Association	Fluvial Surface/Landform[1/]	Composition (%)
1	Prairie cordgrass/ Water sedge	Floodplain	0-10
4	Western wheatgrass/ Green needlegrass	High Terrace (Loamy)	90-100

[1/] Corresponds to fluvial surfaces/landforms in the Physiographic Features and Representative Soil Features sections.

Community Phase Number	2.2
Community Phase Name	F5Channel (Entrenched/ Widened)
Community Phase Narrative	This channel continues the lateral expansion of phase 2.1 resulting in an F5channel. These channels are highly unstable and further disturbances can force these quickly transform these back into vertically unstable G5 channels. Floodplain vegetation is non-existent and water tables in terraces are further lowered. Fish and wildlife habitat and water quality values are significantly lowered or absent. If carefully managed, these channels can begin to build new floodplains and re-establish floodplain vegetative communities.

Plant Community Components

PCC	Plant Association	Fluvial Surface/Landform[1/]	Composition (%)
1	Prairie Cordgrass/ Water sedge	Floodplain	0-15
2	Wooly sedge/ Prairie cordgrasss	Floodplain Step	0-15
4	Western wheatgrass/ Green needlegrass	High Terrace (Loamy)	70-95

[1/] Corresponds to fluvial surfaces/landforms in the Physiographic Features and Representative Soil Features sections.

T2A Transition to Entrenched/Constrained Stable Analogue Channels State (State 3) from Entrenched/Widened Unstable Channels State (State 2)

Rehabilitation of entrenchment with stabilizing herbaceous vegetation (increased connectivity and/or formation of new flood plain and return to better energy and sediment balance). Multiple plant community components present on fluvial surfaces. May be significant decreases in bank height ratios.

T3A Transition to Entrenched/Widened Unstable Channels State (State 2) from Entrenched/Constrained Stable Analogue Channels State (State 3)

Disturbance results in entrenchment of stable analogue channels (Bc, C, or E) due to loss of vegetation (obligate and facultative wet plant functional groups), increased bank erosion, and down cutting.

STATE 3 SECTION

State Number	3
State Name	Entrenched / Constrained Stable Analogue Channels
State Narrative	This state includes channels that, after experiencing vertical and lateral instability and entrenchment, develop new floodplains within the entrenchment. Floodplain plant community components return to the incipient floodplains and streams develop new connectivity. Channel forming processes at bankfull are better able to handle the energy, flow, and sediments. Channels begin as B5c channels and with careful management, are able to develop E5 morphology with associated (although truncated) floodplains and terraces. Water tables are elevated and expand laterally. There is increased connectivity of upstream and downstream habitats resulting in improved fish and wildlife habitat and enhanced water quality. Some streams that have had the riparian vegetation removed and/or significantly changed may not develop the native plant community components. Where Kentucky bluegrass (*Poa pratensis*) or other shallow rooted grasses have taken over as dominant on the floodplain marginal bank stabilization will occur.

3.1A Community Phase Change to 3.2

The B5/6c channel will eventually (with proper management that increases bank stabilizing vegetation and normal flow variability) develop a small floodplain within the entrenched area, forming point bars and slight cut banks. This pathway may require particularly long time periods to complete due to the stability of phase 3.1.

3.2A Community Phase Change to 3.3

Increase of desirable greenline vegetation, sediment trapping, expansion of water table, and widening of flood plain (increased sinuosity, energy, and sediment transport balance). Stream narrows and deepens. Increased connectivity to floodplain. Bank height ratio decreases (3.3).

State 3 Photos

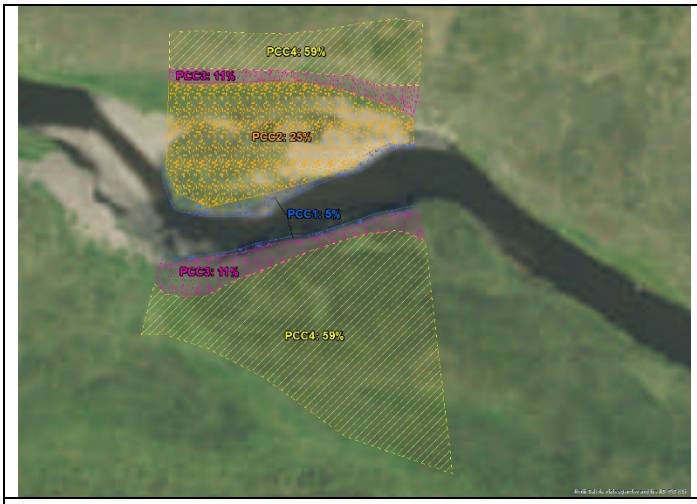


Photo 1. *Aerial view of phase 3.1, Bc, showing arrangement of community components.*

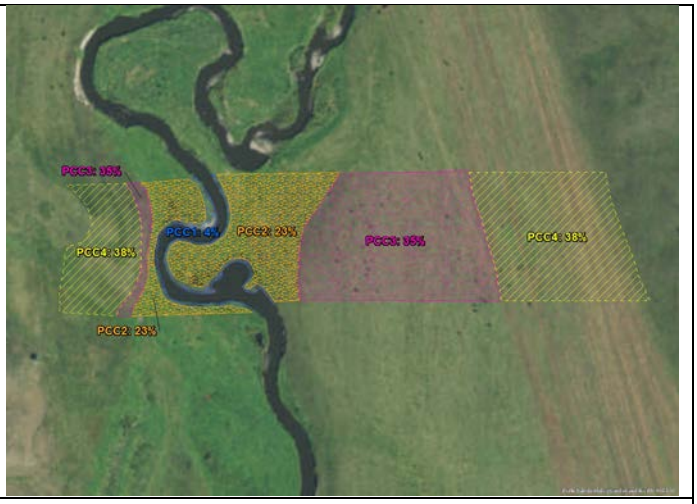


Photo 2. *Aerial view of C5channel (phase 3.2), showing arrangement of community components.*

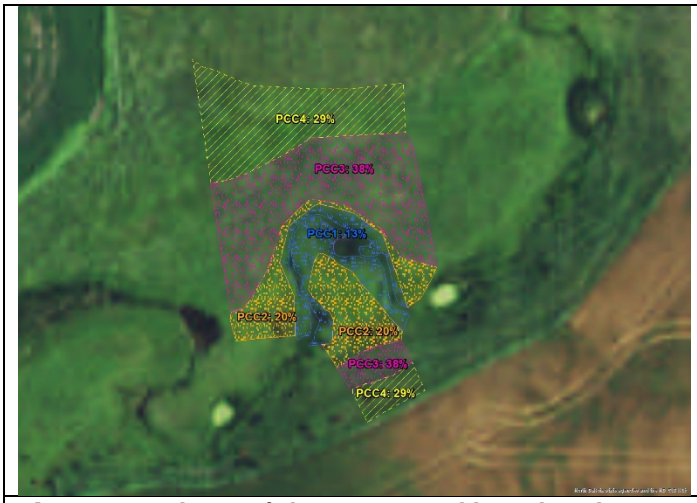


Photo 3. *Aerial view of phase 3.3, E5 stable analog, showing arrangement of community components.*

Photo 4. *View of Bc5 channel (phase 3.1). This site has a parabolic channel with a narrow floodplain.*

Photo 5. *Veiw of C5 channel in phase 3.2. this channel is slightly entrenched with a moderate width to depth ratio.*

Photo 6. *View of E5channel (phase 3.3). This site has an entrenchment ratio of 6.5 and low width to depth ratio. .*

Photo 7. *PCC1 and PCC2 in state 3 subject to invasion by reed canarygrass contributing to bank instability and placing the site "at-risk" of transitioning to State 2.*

Photo 8. *PCC1 occupies the floodplain, at or just above bankfull elevation, and PCC2 is found on the floodplain step.*

State 3 Community Phases

Community Phase Number	3.1
Community Phase Name	B5c Channel – first stable analogue (at-risk)
Community Phase Narrative	This phase represents the channel evolution from F5 to B5c resulting from a reduction in the near vertical, unstable banks associated with the F5 channel to somewhat more stable, parabolic shaped B5c channel. The lack of an established floodplain and associated stabilizing vegetation makes this phase unstable "At-Risk" phase which can quickly transition to the F5 channel via transitional pathway T3A. Further rehabilitation of this phase may be limited by intense farming activities (to the stream's edge), inappropriate livestock grazing, invasive species, or other disturbances (drought, large floods). If the native vegetation is not present or sources are not locally available, the phase is considered to be at-risk of crossing a threshold (T3A) to state 2.

Plant Community Components

PCC	Plant Association	Fluvial Surface/Landform[1/]	Composition (%)
1	Prairie cordgrass/ Water sedge	Floodplain	5-10
2	Wooly Sedge/ Prairie cordgrass	Floodplain Step	5-30
3	Big bluestem/ Green needlegrass	Low Terrace (Loamy Overflow)	15-40
4	Western wheatgrass/Green needlegrass	High Terrace (Loamy)	30-75

[1/] Corresponds to fluvial surfaces/landforms in the Physiographic Features and Representative Soil Features sections.

Community Phase Number	3.2
Community Phase Name	C5 Channel (stable analogue)
Community Phase Narrative	This phase represents the channel change from B5 to C5 post-entrenchment that develops a new floodplain, moves laterally creating cut banks, and depositional areas on the insides of channel bends. Riparian vegetation is able to return to the newly cut/deposited floodplain. Incipient vegetation which does not have superior bank holding attributes makes can make this an "At-Risk" channel. Disturbances that remove vegetation and affect bank stability (i.e. excessive trampling, farming practices, and prolonged flood) can result in a transition to one of the phases in State 2. Careful management allowing natural forces to shape the channel and adequate seed sources for more desirable, deep rooted riparian bank vegetation can move this phase towards the stable analog, phase 3.3. If the native vegetation is not present or sources are not locally available, the phase is considered to be at-risk of crossing a threshold (T3A) to state 2.

Plant Community Components

PCC	Plant Association	Fluvial Surface/Landform[1/]	Composition (%)
1	Prairie cordgrass/ Water sedge	Floodplain	5-15
2	Wooly Sedge/ Prairie cordgrass	Floodplain Step	10-35
3	Big bluestem/ Green needlegrass	Low Terrace (Loamy Overflow)	20-60
4	Western wheatgrass/Green needlegrass	High Terrace (Loamy)	20-60

[1/] Corresponds to fluvial surfaces/landforms in the Physiographic Features and Representative Soil Features sections.

Community Phase Number	3.3
Community Phase Name	Entrenched E5 Channel (stable analogue)
Community Phase Narrative	This phase represents the best combination of attributes and values possible after the original E5 channel and floodplain have been altered by entrenchment and accelerated lateral movement. This phase almost always forms from Phase 3.2 (C5 entrenched channel). The original plant community components of the floodplain are rehabilitated, although constrained by the entrenchment, limiting their lateral

	extension. The local water table is able to rise and extend the groundwater influence laterally to the terraces. This rehabilitated channel is probably not possible without careful management of livestock grazing, limiting water diversions, and conservation farming practices.

Plant Community Components

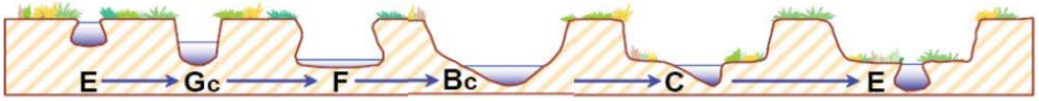
PCC	Plant Association	Fluvial Surface/Landform[1/]	Composition (%)
1	Prairie cordgrass/ Water sedge	Floodplain	10-20
2	Wooly Sedge/ Prairie cordgrass	Floodplain Step	20-40
3	Big bluestem/ Green needlegrass	Low Terrace (Loamy Overflow)	20-40
4	Western wheatgrass/Green needlegrass	High Terrace (Loamy)	15-50

[1/] Corresponds to fluvial surfaces/landforms in the Physiographic Features and Representative Soil Features sections.

Community Phase Comparisons – Geomorphic Evaluation Criteria

Narrative

James River (and other sand dominated perennial streams in MLRA 55B) comparison of states and phases. E → G → F → Bc →C → E succession scenario (phases 1.1, 2.1, 2.2, 3.1, 3.2, and 3.3). Phase 1.1 is the reference.



The metric in the Table below demonstrate the degree of departure from reference condition (Phase 1.1) for each phase and is designed to aid in the identification of threshold.

*Generalizations were made for the metrics of phases 1.1 and 2.1for stream type within MLRA 55B, since these phases have not been observed in the field.

Phase	ER	Degree of Channel Incision (BHR)		W/D Ratio State (W/D / W/Dref)			Degree of Confinement (MWR / MWRref)		
		BHR	Rating	W/D	Ratio	Rating	MWR	Ratio	Rating
1.1*	8	1.0	Stable	5	1.0	Stable	20	1.0	Un-confined
2.1*	1.1	2.0	Deeply Incised	13	0.38	Highly Unstable	1	0.05	Confined
2.2	1.3	1.8	Deeply Incised	48.3	9.66	Highly Unstable	2.7	0.14	Confined
3.1	1.6	1.5	Mod. Incised	19.1	3.82	Highly Unstable	4.5	0.23	Confined
3.2*	4.4	1.3	Slightly Incised	12.3	2.46	Mod. Unstable	6.3	0.32	Mod. Confined
3.3	7.2	1.0	Stable	5.3	1.06	Stable	16.4	0.82	Un-confined

PLANT COMMUNITY COMPONENTS

Narrative	Plant community components described for this site represent the closest approximation to the characteristic plant communities associated with fluvial surfaces. Plant communities on new sand bars, floodplains or recently scoured areas develop incipient and pioneer vegetation that can subsequently develop into more stabilizing and characteristic plant communities. These plant communities exist on specific fluvial surfaces (PCC1 On floodplains, PCC2 on floodplain steps, PCC3 on low terraces, and PCC4 on high terraces). These communities exist over the entire length of the site and vary slightly to moderately in plant community composition; however, dominant plant associations can always be identified. Plant community components are numbered from stream side outward to edge of riparian complex.

PCC	Plant Association	Fluvial Surface/Landform	Phases
1	Prairie cordgrass/ Water sedge	Floodplain	1.1, 2.2, 3.1, 3.2, 3.3
2	Wooly Sedge/ Prairie cordgrass	Floodplain Step	1.1, 2.1, 2.2, 3.1, 3.2, 3.3
3	Big bluestem/ Green needlegrass	Low Terrace (Loamy Overflow)	1.1, 3.1, 3.2, 3.3
4	Western wheatgrass/Green needlegrass	High Terrace (Loamy)	2.1, 2.2, 3.1, 3.2, 3.3

Plant Community Component 1

Narrative	This plant community is critical to maintaining the characteristic E channel morphology. The fibrous rooted functional groups (grasses and grass-likes) provide bank stability and a measure of shading to the narrow, deep channels. Most plants in potential condition are obligates or facultative wet; the soils are saturated most of the growing season on the floodplain immediately adjacent to the channel. Non-native species such as Kentucky bluegrass, smooth brome, quackgrass, and reed canarygrass may also be present. These non-native species replace the native sedges and grasses that comprise the fibrous rooted functional groups within the reference plant community. Wetland indicator status is from the PLANTS database (http://plants.usda.gov/wetland.html) for USFWS Region 4 (ND, SD, MT - eastern, WY - eastern).

[PCC1] Plant Type – Woody Plant Overstory/Understory **0% of Community Composition**

Plant Symbol	Common Name	Scientific Name	Over-story (%)	Avg. DBH (in.)	Percent Canopy Cover		Avg. Canopy Height (feet)	
					Low	High	Bottom	Top
	none							

[PCC1] Plant Type - Grass/Grasslike **90-100% of Community Composition**

Group		Plant Symbol	Common Name	Scientific Name	Wetland Indicator Status	Annual Production (Lbs./Acre)		Percent Foliar Cover	
No.	Name					Low	High	Low	High
1	Perennial grasses	SPPE	Prairie cordgrass	*Spartina pectinata*	FACW	2,000	8,000	20	80
		HOJU	Foxtail barley	*Hordeum jubatum*	FACW	0	50	0	5
		PHAR3	Reed canarygrass	*Phalaris arundinacea*	FACW	0	3,000	0	75
		ECCR	Barnyard grass	*Echinochloa crus-galli*	FAC	0	50	0	5
2	Grass-likes	CAAQ	Water sedge	*Carex aquatilis*	OBL	1,000	8,000	20	80
		CAPE42	Woolly sedge	*Carex pellita*	OBL	10	200	10	50
		SCPU10	Common threesquare	*Schoenoplectus pugens*	OBL	0	50	0	10
		SCFL11	River bulrush	*Schoenoplectus fluviatilis*	OBL	0	150	0	10
		ELPA5	Dwarf spikerush	*Eleocharis parvula*	OBL	0	50	0	5
		ELPA3	Common spikerush	*Eleocharis palustris*	OBL	0	50	0	5
		SCTA2	Softstem bulrush	*Schoenoplectus tabernaemontani*	OBL	0	50	0	5

[PCC1] Plant Type - Forbs **5-10% of Community Composition**

Group		Plant Symbol	Common Name	Scientific Name	Wetland Indicator Status	Annual Production (Lbs./Acre)		Percent Foliar Cover	
No.	Name					Low	High	Low	High
1	Forbs	LYAM	American water horehound	*Lycopus americanus*	OBL	0	50	0	5
		POAM8	Water knotweed	*Polygonum amphibium*	OBL	0	100	0	5
		MEAR4	Wild mint	*Mentha arvensis*	FACW	0	50	0	5
		SYLAL4	White panicle aster	*Symphyotrichum lanceolatum*	FACW	0	500	0	10
		PLMA2	Common plantain	*Plantago plantain*	FAC	0	50	0	5
		ASIN	Swamp milkweed	*Asclepias incarnata*	FACW	0	50	0	5
		URDI	Stinging nettle	*Urtica dioica*	FAC	0	50	0	5
		MELU	Black medick	*Medicago lupulina*	FACU	0	50	0	10
		SOAR2	Field sowthistle	*Sonchus arvensis*	FAC	0	50	0	5
		XAST	Rough cocklebur	*Xanthium strumarium*	FAC	0	200	0	10
		CHAL7	Lambsquarters	*Chenopodium album*	FACU	0	50	0	1
		CIAR4	Canada thistle	*Cirsium arvense*	FACU	0	50	0	5

[PCC1] Plant Type - Shrubs **0-5% of Community Composition**

Group		Plant Symbol	Common Name	Scientific Name	Wetland Indicator Status	Annual Production (Lbs./Acre)		Percent Foliar Cover	
No.	Name					Low	High	Low	High
1	Shrubs	SYOC	Western snowberry	*Symphoricarpos occidentalis*	UPL	0	50	0	5
		ROWO	Woods' rose	*Rosa woodsia*	FACU	0	50	0	5

[PCC1] Plant Type – Other; Ferns, Mosses, etc **0% of Community Composition**

Group		Plant Symbol	Common Name	Scientific Name	Wetland Indicator Status	Percent Canopy Cover		Percent Foliar Cover	
No.	Name					Low	High	Low	High

[PCC1] Annual Production by Plant Type Table

	Annual Production (air-dry lbs/ac) [1/]		
Plant Type	**Low**	**RV**	**High**
Grass/Grasslikes	3,010	8,500	12,400
Forbs	50	350	750
Shrubs/Vines	0	25	50
Trees	0	0	0
Totals	3,060	8,875	13,200

[1/] NI = Not Inventoried: annual weight not determined.

[PCC1] Percent Canopy and Ground Cover by Material Type

Summary Category	Low	High
Foliar Cover	95	100
Bare Ground	0	5
Basal Cover	0	5
Total Ground Cover	95	100
Ground Cover Between-Plant Cover	0	5
Ground Cover Under-Plant Cover	50	95
Total Litter	50	95
Litter Under-Plant Cover	50	95

[PCC1] Soil Surface Cover

Soil Surface Category	Low	High
Bedrock	0	0
Boulders	0	0
Cobbles	0	0

Duff	0	5
Embedded Litter	0	5
Gravel	0	5
Visible Lichen	0	0
Moss	0	5
Rock Fragment	0	5
Soil	90	100
Stones	0	0

Plant Community Component 2

Narrative	This plant community is on floodplain steps only slightly higher in elevation than the saturated plant community, PCC1. This community is dominated by facultative wet and facultative with some facultative upland plants. Dominant graminoid species include prairie cordgrass, woolly sedge, and western wheatgrass with lesser amounts of switchgrass, big bluestem, porcupinegrass, northern reedgrass and mountain rush; various forbs include manyflowered aster, Norwegian cinquefoil, silverweed cinquefoil, and Canada goldenrod. In areas where the floodplain step is more developed and the soils are suitable there is establishment of shrub species including sandbar willow and Woods' rose. Non-native species such as Kentucky bluegrass, smooth brome, quackgrass, reed canarygrass, leafy spurge, and white clover may also be present. The non-native grass species replace the native sedges and grasses that comprise the fibrous rooted functional groups within the reference plant community. Wetland indicator status is from the PLANTS database (http://plants.usda.gov/wetland.html) for USFWS Region 4 (ND, SD, MT - eastern, WY - eastern).

[PCC2] Plant Type – Woody Plant Overstory/Understory **0% of Community Composition**

Plant Symbol	Common Name	Scientific Name	Over-story (%)	Avg. DBH (in.)	Percent Canopy Cover		Avg. Canopy Height (feet)	
					Low	High	Bottom	Top
	None							

[PCC2] Plant Type - Grass/Grasslike **80-95% of Community Composition**

Group		Plant Symbol	Common Name	Scientific Name	Wetland Indicator Status	Annual Production (Lbs./Acre)		Percent Foliar Cover	
No.	Name					Low	High	Low	High
1	Warm-season perennial grasses	SPPE	Prairie cordgrass	*Spartina pectinata*	FACW	250	500	25	50
		PAVI2	Switchgrass	*Panicum virgatum*	FAC	50	250	5	15
		CASTI3	Northern reedgrass	*Calamagrostis stricta*	FACW	0	50	0	5
		ANGE	Big bluestem	*Andropogon gerardii*	FACU	50	250	5	15
2	Cool-season perennial grasses	ELCA4	Canada wildrye	*Elymus Canadensis*	FACU	0	50	0	5
		PASM	Western wheatgrass	*Pascopyrum smithii*	FACU	100	500	10	50
		NAVI4	Green needlegrass	*Nassella viridula*	UPL	10	50	5	15
		ELTRS	Slender wheatgrass	*Elymus trachycaulus*	FACU	0	250	0	5
		ELRE4	Quackgrass	*Elymus repens*	FAC	0	500	0	25
		HESP11	Porcupinegrass	*Hesperostipa spartea*	FACU	10	250	0	5
		HECO26	Needle-and-thread	*Hesperostipa comate*		10	50	0	5
		BRIN2	Smooth brome	*Bromus inermis*	UPL	0	250	0	20
		POPR	Kentucky bluegrass	*Poa pratensis*	FACU	100	300	25	75
3	Grass-likes	CAPE42	Woolly sedge	*Carex pellita*	OBL	750	2000	20	80
		SCPU10	Common threesquare	*Schoenoplectus pugens*	OBL	0	10	0	1
		JUARL	Mountain rush	*Juncus arcticus*	OBL	0	250	0	5
		ELPA3	Common spikerush	*Eleocharis palustris*	OBL	0	10	0	1

[PCC2] Plant Type - Forbs **5-15% of Community Composition**

Group		Plant Symbol	Common Name	Scientific Name	Wetland Indicator Status	Annual Production (Lbs./Acre)		Percent Foliar Cover	
No.	Name					Low	High	Low	High
1	Forbs	ARAN7	Silverweed cinquefoil	*Argentina anserina*	FACW	5	150	0	10
		GLLE3	American licorice	*Glycyrrhiza lepidota*	FACU	0	50	0	5
		SOCA6	Canada goldenrod	*Solidago canadensis*	FACU	0	50	0	5
		PONO3	Norwegian cinquefoil	*Potentilla norvegica*	FAC	5	150	0	250
		SYERP2	Manyflowered Aster	*Symphyotrichum ericoides*	FAC	0	50	0	5
		SYLAL4	White panicle aster	*Symphyotrichum lanceolatum*	FACW	5	100	0	5

		CIFL	Flodman's thistle	*Cirsium flodmanii*	FAC	0	25	0	5
		POAM8	Water knotweed	*Polygonum amphibium*	OBL	0	50	0	2
		EUES	Leafy spurge	*Euphorbia esula*		0	50	0	10
		CIAR4	Canada thistle	*Cirsium arvense*	FACU	0	50	0	5
		TRRE3	White clover	*Trifolium repens*	FACU	0	50	0	1

[PCC2] Plant Type - Shrubs **0-5% of Community Composition**

Group		Plant Symbol	Common Name	Scientific Name	Wetland Indicator Status	Annual Production (Lbs./Acre)		Percent Foliar Cover	
No.	Name					Low	High	Low	High
1	Shrubs	SAIN3	Sandbar willow	*Salix interior*	FACW	0	100	0	25
		ROWO	Woods' rose	*Rosa woodsii*	FACU	0	100	0	25

[PCC2] Plant Type – Other; Ferns, Mosses, etc **0% of Community Composition**

Group		Plant Symbol	Common Name	Scientific Name	Wetland Indicator Status	Percent Canopy Cover		Percent Foliar Cover	
No.	Name					Low	High	Low	High
	none								

[PCC2] Annual Production by Plant Type Table

	Annual Production (air-dry lbs/ac) [1/]		
Plant Type	**Low**	**RV**	**High**
Grass/Grasslikes	1,450	3,200	4,700
Forbs	15	450	875
Shrubs/Vines	0	100	200
Trees	0	0	0
Totals	1,465	3,750	5,775

[1/] NI = Not Inventoried: annual weight not determined.

[PCC2] Percent Canopy and Ground Cover by Material Type

Summary Category	Low	High
Foliar Cover	95	100
Bare Ground	0	5
Basal Cover	0	5
Total Ground Cover	95	100
Ground Cover Between-Plant Cover	0	5
Ground Cover Under-Plant Cover	95	100
Total Litter	95	100

Soil Surface Category	Low	High
Organic Litter	0	5
Soil	95	100

Plant Community Component 3

Narrative	The plant community occurs on low terraces adjacent to PCC2 and has been described as a loamy overflow ecological site. This community is dominated by big bluestem and green needlegrass. Non-native species such as Kentucky bluegrass, smooth brome, quackgrass, reed canarygrass, black medick, leafy spurge, and sweetclover (both yellow and white) may also be present. The non-native grass species replace the native sedges and grasses that comprise the fibrous rooted functional groups within the reference plant community. Wetland indicator status is from the PLANTS database (http://plants.usda.gov/wetland.html) for USFWS Region 4 (ND, SD, MT - eastern, WY - eastern).

[PCC3] Plant Type – Woody Plant Overstory/Understory **0-5% of Community Composition**

Plant Symbol	Common Name	Scientific Name	Over-story (%)	Avg. DBH (in.)	Percent Canopy Cover		Avg. Canopy Height (feet)	
					Low	High	Bottom	Top
ACNE2	Boxelder	*Acer negundo*						
CEOC	Common hackberry	*Celtis occidentalis*						
FRPE	Green Ash	*Fraxinus pennsylvanica*						
OSVI	Hophornbeam	*Ostrya virginiana*						
PODE3	Eastern cottonwood	*Populus deltoids*						
SALIX	Willow	*Salix*						
TILIA	Basswood	*Tilia*						
ULAM	American elm	*Ulmus americana*						

[PCC3] Plant Type - Grass/Grasslike **90% of Community Composition**

Group		Plant Symbol	Common Name	Scientific Name	Wetland Indicator Status	Annual Production (Lbs./Acre)		Percent Foliar Cover	
No.	Name					Low	High	Low	High
1	Tall Warm-season Grasses	ANGE	Big bluestem	*Andropogon gerardii*	FACU	760	1520		
		PAVI2	Switchgrass	*Panicum virgatum*	FAC	76	380		
		SONU2	Indiangrass	*Sorghastrum nutans*	FACU	76	380		
2	Needlegrass	ELCA4	Canada wildrye	*Elymus canadensis*	FACU	38	190		
		HESP11	Porcupine grass	*Hesperostipa spartea*	UPL	38	380		
		NAVI4	Green needlegrass	*Nassella viridula*	UPL	114	570		
3	Mid Cool-season Grasses	CASTI3	Northern reedgrass	*Calamagrostis stricta ssp. inexpansa*	FACW	0	190		
		ELTR7	Slender wheatgrass	*Elymus trachycaulus*	FACU	76	380		
		ELTRS	Bearded wheatgrass	*Elymus trachycaulus spp. Subsecundus*	FACU	76	380		
		PASM	Western wheatgrass	*Pascopyrum smithii*	FACU	76	380		
4	Warm-season Grasses	BOCU	Sideoats grama	*Bouteloua curtipendula*	UPL	0	190		
		SCSC	Little bluestem	*Schizachyrium scoparium*	FACU	0	190		
		SPHE	Prairie dropseed	*Sporobolus heterolepis*	UPL	0	190		
5	Other Native Grasses	BOGR2	Blue grama	*Bouteloua gracilis*	UPL	38	114		
		KOMA	Junegrass	*Koeleria macrantha*	UPL	0	38		
		2GRAM	Other Grasses			0	114		
6	Grass-likes	CAREX	Sedge	*Carex*		38	152		
		2GL	Other Grass-likes			0	76		

[PCC3] Plant Type - Forbs **5% of Community Composition**

Group		Plant Symbol	Common Name	Scientific Name	Wetland Indicator Status	Annual Production (Lbs./Acre)		Percent Foliar Cover	
No.	Name					Low	High	Low	High
7	Forbs	ACMIO	Western yarrow	*Achillea millefolium*	FACU	38	76		
		AMPS	Cuman ragweed	*Ambrosia psilostachya*	FAC	38	76		
		ANCA8	Canadian anemone	*Anemone canadensis*	FACW	0	76		
		ARLU	White sagebrush	*Artemisia ludoviciana*	FACU	38	76		

		CIUN	Wavyleaf thistle	*Cirsium undulatum*	FAC	38	76		
		COTI3	Golden tickseed	*Coreopsis tinctoria*	FAC	0	38		
		DAPU5	Purple prairie clover	*Dalea purpurea*	UPL	38	76		
		GLLE3	American licorice	*Glycyrrhiza lepidota*	FACU	38	114		
		HEMA2	Maximilian sunflower	*Helianthus maximiliani*	FACU	38	114		
		HEPA19	Stiff sunflower	*Helianthus pauciflorus*	UPL	38	76		
		LIPH	Wood Lily	*Lilium philadelphicum*	FAC	0	38		
		ONBEB	Soft-hair marbleseed	*Onasmodium bejariense var. bejariense*	UPL	0	38		
		POTEN	Cinquefoil	*Potentilla*		38	76		
		PEAR6	Silverleaf Indian breadroot	*Pediomelum argophyllum*	UPL	38	76		
		RACO3	Upright prairie coneflower	*Ratibida columnifera*	UPL	38	76		
		SENEC	Ragwort	*Senecio*		38	76		
		SOLID	Goldenrod	*Solidago*		38	76		
		SOMI2	Missouri goldenrod	*Solidago missouriensis*	UPL	0	38		
		SYER	White heath aster	*Symphyotrichum ericoides*	FACU	38	76		
		VIAM	American vetch	*Vicia Americana*	NI	38	76		
		2FN	Native Forb			38	190		

[PCC3] Plant Type - Shrubs **5% of Community Composition**

Group		Plant Symbol	Common Name	Scientific Name	Wetland Indicator Status	Annual Production (Lbs./Acre)		Percent Foliar Cover	
No.	Name					Low	High	Low	High
8	Shrubs	AMCA6	Leadplant	*Amorpha canescens*		38	76		
		CRATA	Hawthorn	*Crataegus*		0	38		
		PRAM	American plum	*Prunus Americana*	UPL	38	114		
		PRVI	Chokecherry	*Prunus virginiana*	FACU-	0	114		
		ROAR3	Prairie rose	*Rosa arkansana*	NI	38	76		
		SYMPH	Snowberry	*Symphoricarpos*		38	190		
		2SHRUB	Shrub (>.5m)			0	190		

[PCC3] Plant Type – Other; Ferns, Mosses, etc **0% of Community Composition**

Group		Plant Symbol	Common Name	Scientific Name	Wetland Indicator Status	Percent Canopy Cover		Percent Foliar Cover	
No.	Name					Low	High	Low	High
	None								

[PCC3] Annual Production by Plant Type Table

	Annual Production (air-dry lbs/ac) [1/]		
Plant Type	**Low**	**RV**	**High**
Grass/Grasslikes	2470	3173	3775
Forbs	165	285	450
Shrubs/Vines	165	285	450
Trees	0	57	125
Totals	2800	3800	4800

[1/] NI = Not Inventoried: annual weight not determined.

[PCC3] Percent Canopy and Ground Cover by Material Type

Summary Category	Low	High
Foliar Cover	95	100
Bare Ground	0	5
Basal Cover	95	100
Total Ground Cover	95	100
Ground Cover Between-Plant Cover	95	100
Ground Cover Under-Plant Cover	0	5
Total Litter	85	95

[PCC3] Soil Surface Cover

Soil Surface Category	Low	High
Embedded Litter		
Rock Fragment		
Soil	95	100
Stones		

Plant Community Component 4

Narrative	The plant community occurs on high terraces that are disconnected from the riparian complex due to past entrenchment. The most common upland site documented on the high terraces is a loamy ecological site. The plant community associated with the loamy ecological site is dominated by western wheatgrass and green needlegrass.

ECOLOGICAL SITE INTERPRETATIONS

Management Implications

The potential natural channel or reference channel that is documented in Sate 1 is rarely found due to past disturbances and the extreme level of entrenchment and widening of the stream system. To recover State 1 connectivity between the channel and the original floodplain would need to be reestablished. This will not happen naturally within this site and would only be accomplished through a significant input of time and resources that is not economically feasible. Thus, management goals should be directed at maintaining the stable channels documented in State 3 and not at recovering the reference state.

Grazing management to maintain stable analogue channels found in State 3. Control the timing, frequency, and intensity of grazing animals. When developing a plan timing needs to consist of shorter grazing periods, and allow for adequate periods of rest to maintain sufficient stubble height and riparian vegetation to shield and stabilize banks during high flow events. Another aspect of timing that needs to be addressed in a plan is season of use. Spring grazing can be beneficial to riparian ecosystems when located in pastures that also include upland ecological sites, as upland vegetation is more palatable at this time, resulting in more uniform utilization. Fall and winter grazing also promotes the health of riparian ecosystems as bank compaction is not generally a concern at this time since banks are either dry or froze. When grazing in the fall and winter it is critical to monitor utilization to maintain adequate stubble height. It is important to monitor utilization of woody species when grazing in the fall and winter as use of these species is increased due to increased palatability. To mitigate for soil compaction and other negative impacts to riparian ecosystems when in pastures with upland ecological sites off site water and supplements need to be included in the management plan. It is important to understand that overgrazing results in reduced root mass of native species and shifts the competitive advantage to shallow rooted introduced graminoid species: including Kentucky bluegrass and quackgrass. This invasion results in decreased bank stability and infiltration, increasing sedimentation and runoff. Exclusion of grazing from riparian ecosystems also favors shallow rooted introduced graminoid species: including smooth bromegrass, reed canarygrass, and Kentucky bluegrass.

Grazing management to facilitate the transition from State 2 (unstable channels) to State 3 (stable analogue channels). Utilizing a high intensity low frequency grazing system helps break down the streambanks of the F channel and facilitates the development of a new floodplain within the entrenchment. Spring grazing is recommended to aid in the development of the new floodplain. It is critical to manage grazing during new floodplain development to promote the growth of riparian species and the return of PCC1 to stabilize banks. Sufficient recover period is essential to allow for the return of riparian species. This could be achieved through deferment, rest, or the creation of separate riparian pastures. However, it is important to maintain grazing activity within the adjacent uplands to prevent the spread of introduced species.

Animal Community

The channels that make up both State 1 and State 3 (the stable analogues) are utilized by a variety of terrestrial and aquatic wildlife species. The channels in States 1 and 3 have a well-developed floodplain that supports riparian plant communities comprised of a variety of plant lifeforms including graminoids, shrubs, and occasionally trees. The diversity in plant species and communities associated with these sites provides higher value habitat for a greater diversity of wildlife species. Terrestrial species utilize the site for water, food, and cover. The healthy riparian community associated with this site supports obligate sedges and prairie cordgrass which hang over the narrow E channel providing instream cover and habitat for aquatic species. In State 3 PCC1 is susceptible to invasion by reed canarygrass or smooth bromegrass when excess nutrients are present or by Kentucky bluegrass when overgrazed, resulting in bank destabilization and loss of instream habitat. The uplands associated with State 3 are vulnerable to invasion by the non-native graminoid species Kentucky bluegrass and smooth bromegrass, which have been linked to a decrease in plant community diversity and a decline in wildlife habitat. When these species become established within the floodplain there is a decrease in bank stability and water quality, resulting in decreased suitable habitat for aquatic species. In addition these non-native grasses tend to outcompete native species forming a monoculture, compromising wildlife habitat by decreasing habitat structure and available food sources.

The following species have been observed utilizing channels in State 3 associated with this site:

- Avian: great egret, Franklin's gull, blue-winged teal, mallard, northern pintail, northern flicker, western meadow lark, western flycatcher, grasshopper sparrow, horned lark, American robin, red-tailed hawk, and killdeer
- Mammals: white-tailed deer, raccoon, muskrat, American mink, and coyote.

- Insects: mayflies
- Crustaceans: crayfish
- Mollusks: freshwater mussels, freshwater snails
- Reptiles: western painted turtle, plain garter snake
- Amphibians: northern leopard frog
- Fishes: fathead minnow, carp

The State 2 stream channels have lost connectivity with the floodplain making them difficult for terrestrial wildlife species to access. PCC1 is lost in State 2; the loss of PCC1 is accompanied by a loss of instream habitat due to decreased shading. Channels in State 2 Phase 2 which are classified as a F channel have shallow stream beds providing less usable habitat for fish and other aquatic species. There is no floodplain associated with these sites; thus there is little to no shading of the stream from the adjacent plant community. The shallow water depths and loss of shade contribute to elevated water temperatures and a decline in suitable habitat for aquatic species.

For additional information on wildlife species that utilize riparian ecosystems in North Dakota please refer to the following resources:

- Grondahl, C. and S. Gomes. No Date. Songbirds of North Dakota. NorthDakota Game and Fish Department, Bismarck, ND. Jamestown, ND: NorthernPrairie Wildlife Research Center Online. http://www.npwrc.usgs.gov/resource/birds/songbird/songbird.htm
- Gomes, Scott. No Date. Marshbirds and shorebirds of North Dakota. North Dakota Game and Fish Department, Bismarck, ND. Jamestown, ND: Northern Prairie Wildlife Research Center Online. http://www.npwrc.usgs.gov/resource/birds/marshbrd/index.htm
- Gomes, Scott. No Date. Hawks, eagles, and falcons of North Dakota. North Dakota Game and Fish Department, Bismarck, ND. Jamestown, ND: Northern Prairie Wildlife Research Center Online. http://www.npwrc.usgs.gov/resource/birds/hawks/index.htm
- North Dakota Game and Fish Department. 1986. Fishes of North Dakota. North Dakota Game and Fish Department, Bismarck, ND. Northern Prairie Wildlife Research Center Online. http://www.npwrc.usgs.gov/resource/fish/ndfishes/index.htm
- Hoberg, Ted and Cully Gause. 1992. Reptiles and amphibians of North Dakota. North Dakota Outdoors 55(1):7-19. Jamestown, ND: Northern Prairie Wildlife Research Center Online. http://www.npwrc.usgs.gov/resource/herps/amrepnd/index.htm
- Seabloom, Robert W., Richard D. Crawford, and Michael G. McKenna. 1978. Vertebrates of southwestern North Dakota: Amphibians, reptiles, birds, mammals. Institute for Ecological Studies, University of North Dakota, Grand Forks, ND. Jamestown, ND: Northern Prairie Wildlife Research Center Online. http://www.npwrc.usgs.gov/resource/mammals/mammswnd/index.htm
- http://www.mammalsociety.org/mammals-north-dakota
- http://gf.nd.gov/wildlife/fish-wildlife/id/mammals
- Hagen, Sandra K., Patrick T. Isakson, and Steve R. Dyke. 2005. North Dakota Comprehensive WildlifeConservation Strategy. North Dakota Game and Fish Department. Bismarck, ND. 454 pp. http://gf.nd.gov/gnf/conservation/docs/North-Dakota-Wildlife-Action-Plan.pdf

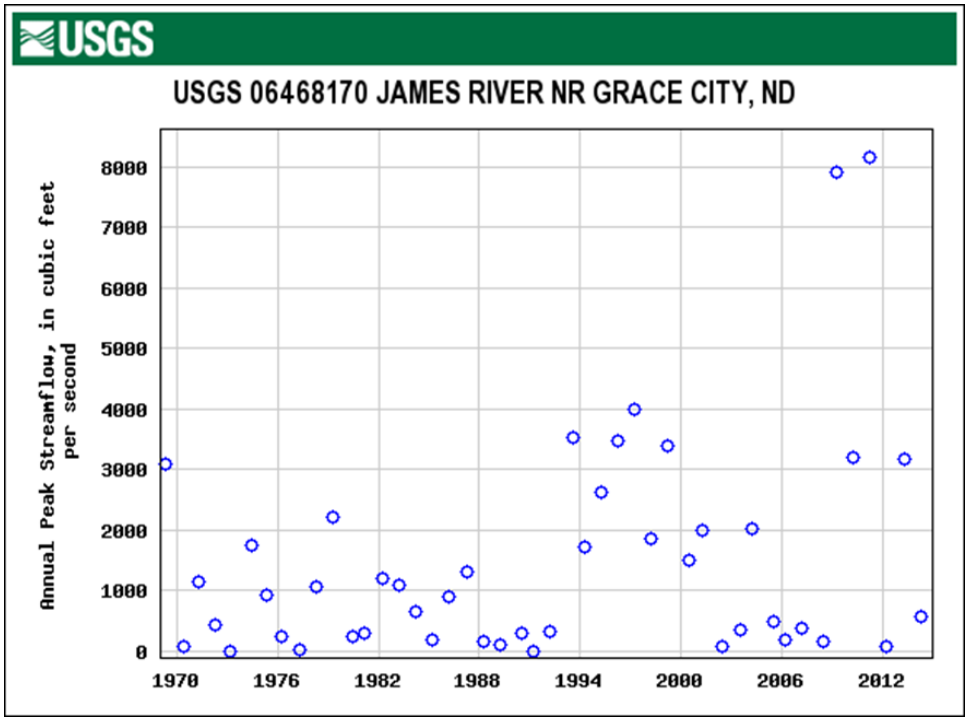
Hydrologic Regime

The James River watershed encompasses an area of 14,080 acres. The headwaters of the James River are located in Wells County in central North Dakota, the rivers runs approximately 710 miles before entering the Missouri River near Yankton, South Dakota. The James River is a prairie stream fed primary by ground-water and runoff from the adjacent uplands. Changes in climate, landuse, and the construction of dams has resulted in a reduction of peak flows over the last 60 years that has significantly impacted the hydrology of the system altering timing and frequency of peak flows, floodplain development, composition riparian plant communities. Peak flows typically occur from late March into early May in concurrence with snow-melt, ice breakup, and spring rain. The system is currently recovering from the last major flood that occurred in 2009. Floods of this magnitude occur approximately every 20 to 40 years within this system with smaller magnitude floods recur once every 5 to 10 years.

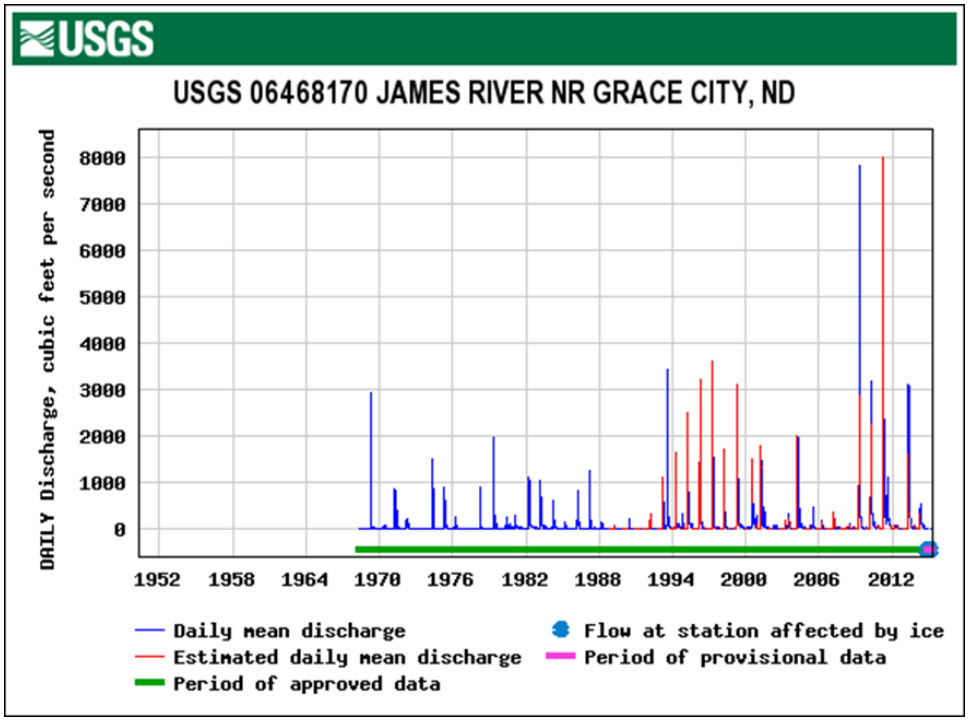
USGS Streamflow Data is available for the upper portion of the James River near Manfred, ND (0646760, 06467650), at New Rockford, ND (06468000), near Grace City, ND (06468170) near Pingree, ND (06468500), at Jamestown, ND

(06470000), at Lamoure, ND (06470500), at ND-SD state line (06470878). Additional information is available at the USGS National Water Information Website: http://waterdata.usgs.gov/nwis/ .

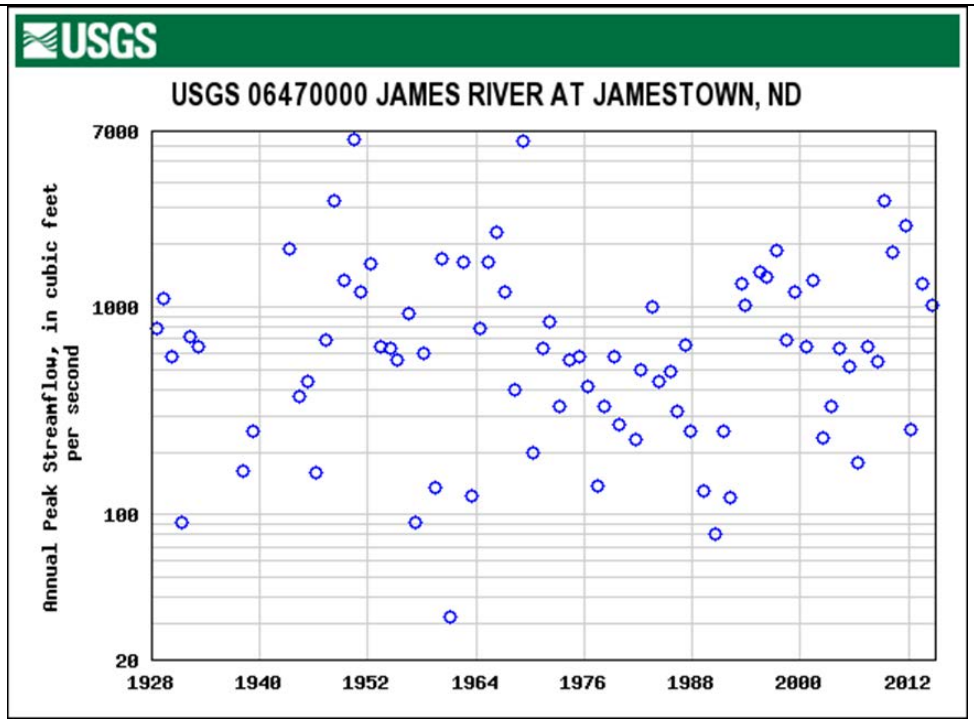
The following graphs depict long and short changes in the peak and daily flows at gauges located on the upper portions of the James River (Grace City, ND; Jamestown, ND; Lamoure, ND).



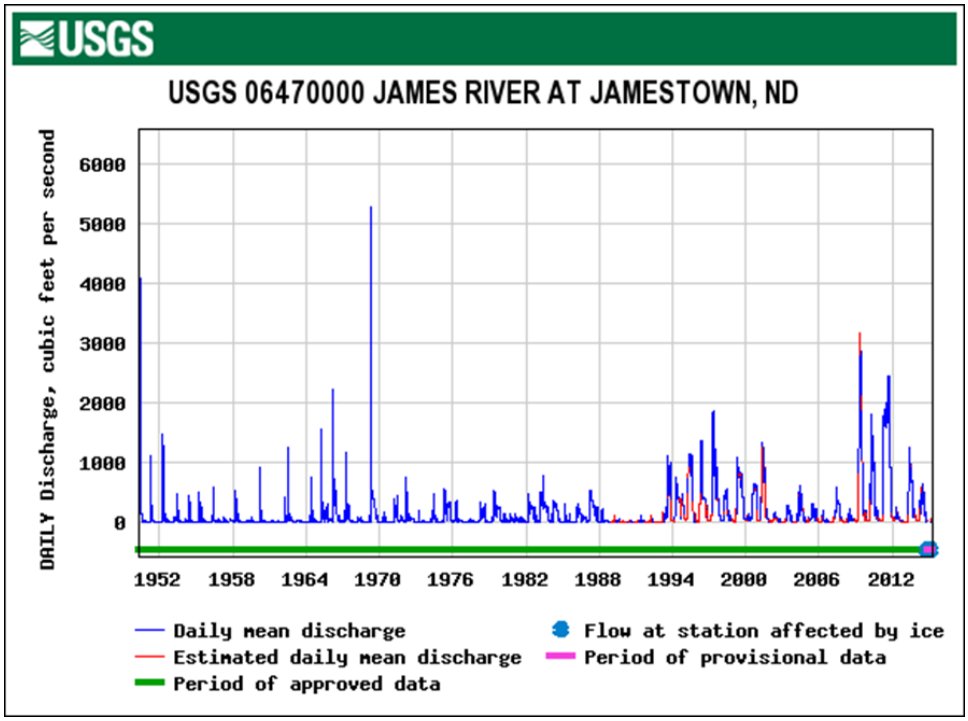
Grace City, ND annual peak streamflow.



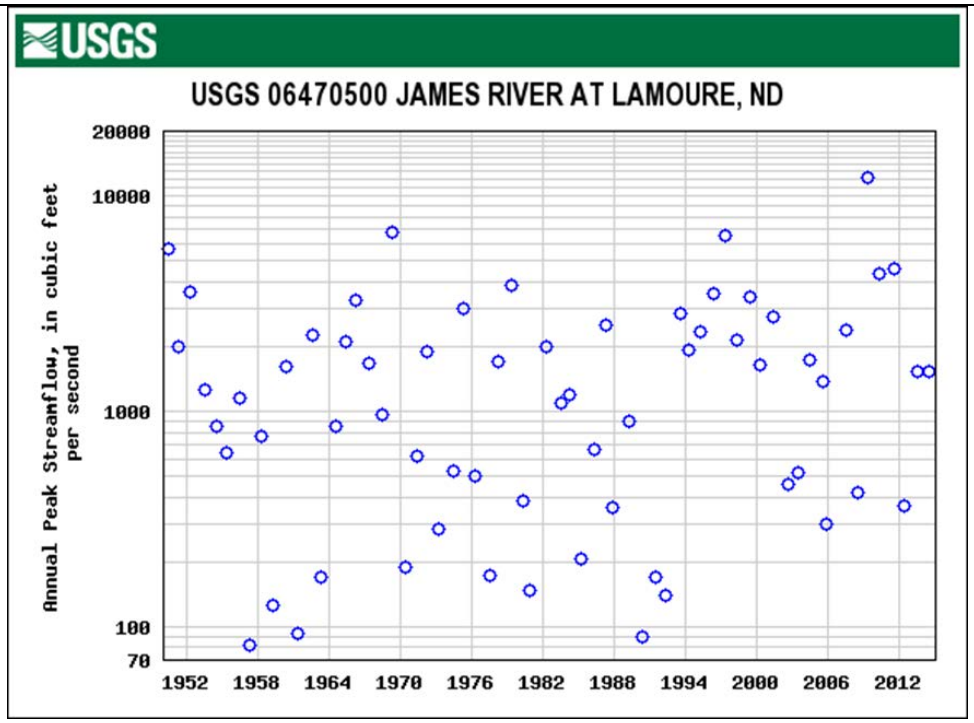
Grace City, ND daily discharge (cfs).



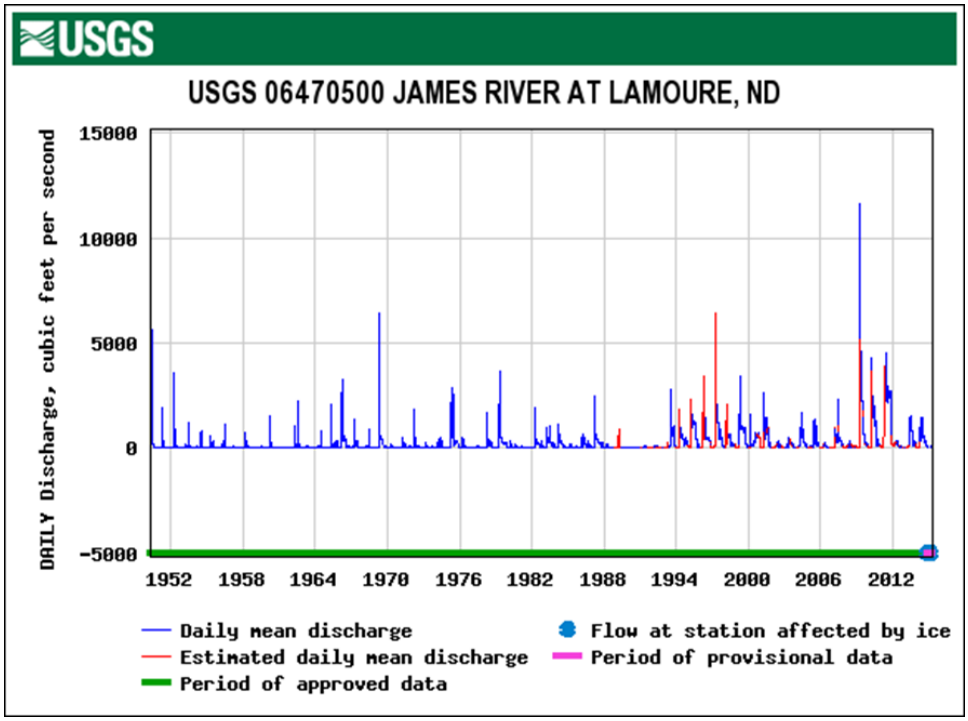
Jamestown, ND annual peak streamflow.



Jamestown, ND daily discharge (cfs).



Lamoure, ND annual peak streamflow.



Lamoure, ND daily discharge (cfs).

Recreational Uses

Due to the location of the majority of these streams on privately owned lands recreational uses are limited. However, areas along the stream are utilized for hunting, fishing, and canoeing.

SUPPORTING INFORMATION

Associated Sites

Site Name	Site Number	Narrative
Central Black Glaciated Plains, Intermittent Riparian Complex, Valley Type VIII, E5/6 Stream Type	055BY000ND	This site is associated with intermittent streams with a reference E channel and a bimodal substrate of silt/clay and sand.
Central Black Glaciated Plains, Intermittent Riparian Complex, Valley Type VIII, E5 Stream Type	055BY002ND	This site is associated with intermittent streams associated with this site that have a reference E channel and sand as the dominant channel material.
Loamy Overflow	R055BY059ND	This site develops on the low terraces associated with this site that are subject to flooding during high flow events.
Loamy	R055BY064ND	This site develops on the high terraces that are adjacent to the site but are no longer hydrologically influenced by the stream.

Similar Sites

Site Name	Site Number	Narrative
Central Black Glaciated Plains, Intermittent Riparian Complex, Valley Type VIII, E5/6 Stream Type	055BY000ND	This site is associated with intermittent streams with a reference E channel and a bimodal substrate of silt/clay and sand.
Central Black Glaciated Plains, Intermittent Riparian Complex, Valley Type VIII, E5 Stream Type	055BY002ND	This site is associated with intermittent streams associated with this site that have a reference E channel and sand as the dominant channel material.

Inventory Data References (Narrative)

Information presented was derived from NRCS clipping data, literature, field observations (based on 6 sampled sites and observations from numerous others), and personal contacts with range-trained personnel (i.e., used professional opinion of agency specialists, observations of land managers, and outside scientists).

Inventory Data References

Data Source	# of Records	Sample Period	State	County
Carlson McCain/NRCS	2	10/01/14	ND	Stutsman/Wells

State Correlation

State	Date	Narrative
		Not yet correlated

Type Location

State	ND	Township	Range	Section
County	Foster	147N	65W	11
General Description	Reference for phase 3.1 transitioning from 2.2			

State	ND	Township	Range	Section
County	Foster	146N	64W	15
General Description	Reference for phase 3.1			

State	ND	Township	Range	Section
County	Foster	147N	64W	26
General Description	Reference for phase 3.2, entrenched			

State	ND	Township	Range	Section
County	Eddy	149N	66W	35
General Description	Reference for phase 3.2			

State	ND	**Township**	**Range**	**Section**
County	Wells	148N	72W	15
General Description	Reference for phase 3.2			

State	ND	**Township**	**Range**	**Section**
County	Wells	147N	72W	10
General Description	Reference for phase 3.3			

Relationship to Other Established Classifications

Utilizing Rosgen's Classification of Natural Channels to determine states, community phases, and the stream succession scenario.

Other References

Bestelmeyer, B., J.R. Brown, K.M. Havstad, B. Alexander, G. Chavez, J.E. Herrick. 2003. *Development and use of state and transition models for rangelands.* J. Range Manage. 56(2):114-126.

Bestelmeyer, B.,A.J. Tugel, G.L. Peacock, D.G. Robinett, P.L. Shaver, J.R. Brown, J.E. Herrick, H. Sanchez, and K.M. Havstad. 2009. *State-and-Transition Models for Heterogeneous Landscapes: A Strategy for Development and Application.* Rangeland Ecology and Management 62:1-15.

Briske, D. D., S. D. Fuhlendorf, and F. E. Smeins. 2006. *A Unified Framework for Assessment and Application of Ecological Thresholds*. Rangeland Ecology and Management 59:225–236.

Briske, D. D., B. T. Bestelmeyer, T. K. Stringham, and P. L. Shaver. 2008. *Recommendations for Development of Resilience-Based State-And-Transition Models*. Rangeland Ecology and Management 61:359–367.

Harrelson C. C., Rawlins, C. L. and Potyondy J. P. 1994. *Stream Channel Reference Sites: An Illustrated Guide to Field Technique*, General Technical Report RM-245, USDA - Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado, 61 pages. Available at: http://www.stream.fs.fed.us/publications/documentsStream.html

Herrick, J.E. J.W. Van Zee, K.M. Havstad, L.M. Burkett, and W.G. Whitford. 2005. *Monitoring Manual for Grassland, Shrubland and Savanna Ecosystems. Volume I Quick Start.* USDA - ARS Jornada Experimental Range, Las Cruces, New Mexico. Available at: http://usda-ars.nmsu.edu/monit_assess/monmanual_main.php.

Herrick, J.E. J.W. Van Zee, K.M. Havstad, L.M. Burkett, and W.G. Whitford. 2005. *Monitoring Manual for Grassland, Shrubland and Savanna Ecosystems. Volume II: Design, Supplementary Methods and Interpretation.* USDA - ARS Jornada Experimental Range, Las Cruces, New Mexico. Available at: http://usda-ars.nmsu.edu/monit_assess/monmanual_main.php.

Kovalchik, B.L. and L.A. Chitwood, 1990. *Use of Geomorphology in the Classification of Riparian Plant Associations in Mountainous Landscapes of Central Oregon, U.S.A.* Forest Ecology and Management 33/34:405-418.

Poole, G.C. and C.H. Berman, 2001. *An Ecological Perspective on In-Stream Temperature: Natural Heat Dynamics and Mechanisms of Human-Caused Thermal Degradation.* Environmental Management 27:787-802.

Pringle, C.M., R.J. Naiman, G. Bretschko, J. R. Karr, M.W. Osgood, J.R. Webster, R.L. Welcomme, and M.J. Winterbourn. 1988. *Patch Dynamics in Lotic Systems: the Stream as Mosaic*. The North American Benthological Society 7(4):503-524

Rosgen, D.L., 1994. *A Stream Classification System.* Catena, 22 169199. Elsevier Science, Amsterdam.

Rosgen, D.L., 1996. *Applied River Morphology*. Wildland Hydrology Books, Pagosa Springs, Colorado, and Ft. Collins, CO.

Rosgen, D.L., 2006. *A Watershed Assessment for River Stability and Sediment Supply (WARSSS)*. Wildland Hydrology Books, Fort Collins, CO.

Schoeneberger, P.J., D.A. Wysocki, E.C. Benham, and W.D. Broderson (editors). 2002. *Field Book for Describing and Sampling Soils, Version 2.0*. Natural Resources Conservation Service, National Soil Survey Center, Lincoln, NE.

Stringham, T.K., W.C. Krueger, and P.L. Shaver. 2003. *State and Transition Modeling: An Ecological Process Approach.* J. Range Manage 56: 106-113.

USDA, NRCS. 2008. (Electronic) *Field Office Technical Guide*. Available online at: http://efotg.nrcs.usda.gov/efotg_locator.aspx.

USDA, Natural Resource Conservation Service. 2004. *National Forestry Handbook*. Available online at: http://soils.usda.gov/technical/nfhandbook/

USDA, NRCS. 2007. *The PLANTS Database*. National Plant Data Center, Baton Rouge, LA 70874-4490 USA. Available online at: http://plants.usda.gov

USDA, NRCS. 2003. *National Range and Pasture Handbook*. Available online at: http://www.glti.nrcs.usda.gov/technical/publications/nrph.html

USDA, NRCS *Soil Survey Manuals* for appropriate counties within MLRA 54.

USDA, NRCS, 2007. Southerland, W. B., *Technical Supplement 3E, National Engineering Handbook 654, Rosgen Stream Classification Technique – Supplemental Materials.*

USDA, USFS, 2010. *Fire Effects Information System Database*. Available online at: http://www.fs.fed.us/database/feis/

USDI, USGS, 2010. *National Water Information System*. Available online at: http://waterdata.usgs.gov/nwis/

Stream Visual Assessment Protocol Ver. 2 (SVAP2) Reference Worksheet

Author(s)/Participant(s)	M. Meehan, J. Printz				
Contact For Lead Author	North Dakota State University – Fargo, ND				
Date	8/20/15	**Approval Date**		**Approved By**	
Notes	Assessment is based on best example of stable analogue (phase 3.3).				

Stream Assessment Reach. These descriptions apply to multiple reaches and represent the nominal reference or stable analogue conditions for the entire lotic riparian complex ecological site. Evaluate as many reaches as necessary to arrive at an assessment. The SVAP2 assessment for a reach should be completed during base flows when habitat feature limitations are likely to be most visible.

Stream Assessment Elements. These descriptions of assessment elements present a description of the potential of the site (either the reference or stable analogue state and community phase) and represent a score of 9 or 10 (excellent). Deviation from these conditions will indicate a lower score.

1. Channel Condition	Active channel and floodplain are connected throughout reach and flooded at regular intervals. CEM Stage I = 10, CEM Stage V = 9
2. Hydrologic Alteration	Bankfull or higher flows occur according to the flow regime that is characteristic of the site, generally every 1 to 2 years and no dams, dikes, or development in the flood plain, or water control structures are present and natural flow regime prevails.
3. Bank Condition (score left and right banks separately)	Banks are stable; protected by roots of natural vegetation, wood, and/or rock: No fabricated structures present on bank. No excessive erosion or bank failures. No uncontrolled or unprotected recreational or livestock access
4. Riparian Area Quantity (score left and right banks separately)	Natural plant community extends at least two bankfull widths or more than the entire active flood plain and is generally contiguous throughout property. (Streams in narrow, steep valleys with limited floodplains will have narrower riparian areas.).
5. Riparian Area Quality (score left and right banks separately)	Natural and diverse riparian vegetation with composition, density and age structure appropriate for the site. No invasive species or concentrated flows through area. Plant community has expected mix of native species (grasses, shrubs, and trees) of multiple age classes. In non-forested complexes, native grasses provide root masses that contribute to formation of undercut but stable banks; non-native invasive species are absent or small percentage of total cover
6. Canopy Cover	**Warm Water Streams** -> 0% to 5% of water surface shaded within the length of the stream in landowner's property. (Do not score this element if the lotic riparian complex does not include woody shrubs and/or trees as components of the reference plant community.
7. Water Appearance	Water is very clear, or clarity appropriate to site (e.g., Plains and Southwestern streams contain relatively high loads of suspended sediments, thus streams are generally turbid during seasonal high flows. Similarly glacial-fed streams are naturally turbid. In such cases, water clarity should be scored according to suspended sediment conditions appropriate for the reference site. If streams have clear water under non-stormy conditions, submerged features in stream (rocks, wood) are visible at depths of 3 to 6 feet. No motor oil sheen on surface; no evidence of metal precipitates in streams.
8. Nutrient Enrichment	Clear water, or clarity appropriate to site, along entire reach, and moderate algal growth present.
9. Manure or Human Waste Presence	Livestock access to stream is controlled to protect site conditions and no discharge of animal waste or sewage enters stream directly. Note over-use of deer, elk or other wildlife as evidenced by loss of vegetation, especially willows and herbaceous species.
10. Pools	**Low-gradient streams (<2%)** - More than two deep pools/reach, each separated by riffle or fast water and with greater than 30% of the pool bottom obscured by depth, wood, or other cover. Shallow pools also present.
11. Barriers to Aquatic Species Movement	No artificial barriers that prohibit movement of aquatic organisms during any time of the year.
12. Fish Habitat Complexity	Ten or more habitat features available, at least one of which is considered optimal in reference sites (single logs, wood accumulations or jams, deep pools, secondary pools, overhanging vegetation, large boulders, clusters of small boulders, turbulent water, undercut banks, thick root mats, aquatic plants, side-channels, floodplain wetlands, alcoves).
13. Aquatic Invertebrate Habitat	At least nine types of habitat present A combination of wood with riffles should be present and suitable in addition to other types of habitat (If woody debris is not a component, consider reference site's optimal habitat type needed for high score, such as cobble substrates, boulder clusters, turbulent water, undercut banks, root mats, aquatic plants, leaves and other plant material deposited in stream).
14. Aquatic Invertebrate Community	Invertebrate community is diverse and well represented by group I or intolerant species. One or two species do not dominate. (Mayflies, caddis flies, stoneflies, riffle beetles).
15. Riffle Embeddedness	Not applicable for sand-bed or naturally silty/clayey streams, characteristic of lowlands, prairies, and bottomlands.
16. Salinity (if applicable)	No wilting, bleaching, leaf burn or stunting of native riparian vegetation. No streamside salt-tolerant vegetation present unless naturally saline soils are present in the floodplain or terraces.