Appendix D: Stream Classification Field Sheets

Channel Morphology Data Sheet for Stream Classification

Stream Name: _____ Reach Name: _____

Watershed Area _____ Acres _____ Square Miles _____ Observers: _____

Predicted Bankfull Cross Sectional Area (from regional curve): _____ Location: _____

UTM Coordinates: _____ Survey Date:_____

Parameters
Bankfull Width (W_{bkf}) _____(ft) Width of the stream channel at bankfull stage elevation, in a riffle section
Bankfull Max Depth (d_{max}) _____(ft) Maximum depth of the bankfull channel cross section, or difference between the bankfull stage and thalweg elevations, in a riffle section.
Flood Prone Width (W_{fpa}) _____(ft) Twice Bankfull Max Depth or 2 • d_{max} = the stage/elevation at which flood-prone width is determined on a riffle section.
Entrenchment Ratio (ER) _____ The ratio of the width of the flood-prone area divided by Bankfull Width (W_{fpa}/W_{bkf}).
Bankfull Mean Depth (d_{bkf}) _____(ft) Mean depth of the stream channel cross section, at bankfull stage, in a riffle section ($d_{bkf} = A/W_{bkf}$).
Bankfull Cross Sectional Area (A_{bkf}) _____(ft^2) Area of the stream channel cross section, at bankfull stage, in a riffle section.
Width / Depth Ratio (W_{bkf}/d_{bkf}) _____ Bankfull Width divided by Bankfull Mean Depth, in a riffle section
Stream Length _____ (ft)
Valley Length _____ (ft)
Channel Sinuosity (K) _____ Sinuosity is an index of channel pattern, determined from a ratio of Stream Length divided by Valley Length or from a ratio of valley slope divided by water surface slope.
Water Surface Slope (S)_____ (%) Slope = "rise" over "run" for a reach approximately 20-30 bankfull channel widths in length, with the "riffle to riffle" water surface slope representing the slope at bankfull stage.
Channel Bed Material (D_{50}) _____mm The D_{50} particle size index represents the median diameter of channel materials, as sampled from the channel surface, between the bankfull stage and thalweg elevations.
Rosgen Channel Type _____**(see Figures 3-1 and 3-2, page 44)**

Adapted from Rosgen and Silvey 1998.

Particle Size Distribution

Particl Size Class			Particle Count																									
Inches	Particle	Millimeters		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	Silt/Clay	< .062	S/C																									
	Very Fine	.062 - .125	Sand																									
	Fine	.125 - .25																										
	Medium	.25 - .50																										
	Coarse	.50 - 1.0																										
.04 - .08	V. Coarse	1.0 - 2																										
.08 - .16	V. Fine	2 - 4	Gravel																									
.16 - .22	Fine	4 - 5.7																										
.22 - .31	Fine	5.7 - 8																										
.31 - .44	Medium	8 - 11.3																										
.44 - .63	Medium	11.3 - 16																										
.63 - .89	Coarse	16 - 22.6																										
.89 - 1.3	Coarse	22.6 - 32																										
1.3 - 1.8	V. Coarse	32 - 45																										
1.8 - 2.5	V. Coarse	45 - 64																										
2.5 - 3.5	Small	64 - 90	Cobble																									
3.5 - 5.0	Small	90 - 128																										
5.0 - 7.1	Large	128 - 180																										
7.1 - 10.1	Large	180 - 256																										
10.1 - 14.3	Small	256 - 362	Boulder																									
14.3 - 20	Small	362 - 512																										
20 - 40	Medium	512 - 1024																										
40 - 80	Large +	1024 - 2048																										
> 80	**Bedrock**	> 2048																										

Directions: (1) Starting from the left column, fill in one square with an X for each count in each size category until you have measured and tallied 100 particles. (2) Now count 50 filled-in squares, starting from the smallest size class row at the top of the chart. When each row is counted, continue counting in the next row. (3) Draw a horizontal line at this point to read the D_{50}. (4) Turn chart on side to view this as a particle size histogram (Adapted by Van Clothier from Leopold, Silvey, and Rosgen 2000).

Appendix F: Field Worksheet for Reading the Landscape

Site Identification:

Name: _____ Location: _____

Ownership: _____ Date: _____ Observer:_____

Sizing up the landform

Landform: _____

(hillslope, terrace, mesa, ridge, canyon, valley bottom, floodplain, alluvial fan)

Geographic province: _____ Geology (*geologic period or formation*):_____

Geologic process:_____
(*uplift, volcanic, glacial etc.*)

Topography: elevation:_____ aspect:_____ (southerly or northerly) slope (%)_____

position on slope_____ relief_____

What types of stream channels, wetlands and riparian areas are characteristic of this geographical province or setting?

Is the landform typical or atypical of this geographical province or setting? What is similar, what is different?

Sizing up the watersheds: Hydrology, Soils and Climate

Watershed size_____ Precipitation zone_____

Valley type (Rosgen): _____ Hydro-physiographic province (Moody) _____

Recent meteorological history _____ Type of basin: _____ (open or closed)

Hydrologic condition of watershed: _____

Soils: _____
(*texture, origin, depth, residual, colluvial or alluvial; high, moderate, low or very low infiltration rates*)

What are the indicators of the water quality and the need for restoration?

Where is the surface water coming from? Where is it going? Where should it be going?

What is the status and condition of tributary channels?

How is this water resource classified under Water Quality Standards?
What are the limitations? Deficiencies?

Do any factors of water quantity, availability or seasonality indicate a need for protection or place limitations on restoration potential?

Sizing up the stream or water body

Type:_____
Lotic (*river, creek, arroyo, etc.) or Lentic (lake, pond, salt flat, slope wetland, wet meadow, ciénega, bog, playa, etc.*)

Type of flow: _____(*surface runoff or groundwater discharge*)

Discharge_____ Cross section area_____ Mean depth_____

Natural or artificial in origin?_____ Natural or artificial by location?_____

Hydrologic regime: _____ Hydroperiod:_____
(*ephemeral, intermittent, perennial, perennial interrupted*) (*season and duration of flow*)

Source of dominant annual discharge:_____
(*snowmelt runoff, summer monsoonal, winter precipitation, springflow, proportionate distribution by season*)

Stream Gradient_____ Accessible floodplain present?_____

Rosgen channel type(s):_____ Sediment: _____
[*composition, source and transportation rate (high / low*)]

Is the floodplain inundated at relatively frequent intervals (1-3 years)?

Are sinuosity, width/depth ratio, and gradient in balance with the landscape setting (i.e. landform, geology, bio-climate setting)?

Is the wetland saturated at or near the surface?

Is hydroperiod sufficient to create or maintain hydric soils?

Is the hydroperiod sufficient to sustain wetland vegetation?

Is stream discharge depleted or affected by agricultural, municipal or industrial diversions?

What is the apparent depth to water table? Indicators?_____
(*plant species composition, ant mounds, seasonal ponding*)

Is the water course aggrading? Degrading? How recent?

Sizing up the Vegetation

Upland plant community_____

Wetland / Riparian plant community_____

Dominant upland species, woody and herbaceous (*relative proportions*) _____

Dominant wetland species diversity and patterns of distribution (*banding, patchiness)* _____

Plant community successional stage: early, mid, or late seral, upland and wetland_____

Age class distribution among dominant species, adequate reproduction to sustain stand?_____

Apparent vigor based on foliage color, growth rates, decadence and mortality_____

What is the expected dominant native vegetation for this site? Upland, riparian, wetland?_____

Do species present indicate maintenance of riparian / wetland soil moisture conditions? _____

Based on vegetation, what is the present hydrologic regime? (Sizing Up the Water body) _____

Based on species composition, distribution, and vigor, is the site getting wetter? Drier? Is it stable? _____

Are wetland species replacing upland species or vice versa? Apparent? Not Apparent? _____

Natural Disturbances

Browsing by deer and elk, impacts of herbivory on streambank vegetation, species composition or vigor? _____

Beaver activity or abandoned beaver dams or territories, impact on composition, condition or trends in riparian vegetation? Affect on channel stability?

_____

Impact of gopher, voles, muskrats, impact on subsurface water movement, water features, plant species composition?

_____

Wildlife trailing (*active, recent*), trampling, compaction, bank collapse? _____

Fire (size, intensity, season of burn, site recovery vegetation response)? _____

Floods, avalanche, debris slides? Evidence of wind storms, ice flows? _____

Insect infestations? _____Other?_____

Anthropogenic influences

What is the dominant land use? _____
(*industrial, agricultural, rangeland, forestland, wilderness, park or recreation, urban, rural, exurban, other*)

What cultural impacts have altered the drainage pattern or hydrology? _____
(*water impoundments; artificial lakes and reservoirs; ground water pumping; wells; active roads and highways, abandoned roads or wagon roads, "2-Track" roads; pipelines, power lines, roofs, parking areas, driveways, culverts; bridges or stream crossings; roadside drainage ditches; waste areas and dumps; floodplain encroachment; mines/quarries; flood control infrastructure; wetland drainage*)

What agricultural uses or practices have altered drainage pattern or hydrology? _____
(*irrigation diversions, ditches and acequias; field or pasture management; land shaping or berms; fence lines; terraces, contoured plowing; stock enclosures, pens, feedlots; stock watering facilities; logging or woodcutting; burns*)

What percent of watershed area has been rendered impermeable or less permeable? _____

Do cultural or agricultural features tend to intercept, divert, redirect, concentrate, or accelerate surface or subsurface

runoff? _____ If so, where and to what extent? _____

Have such activities resulted in unnatural wetting or drying of the landform, changing the vegetation community?

_____What are the indicators? _____

What are the apparent impacts (if any) of cultural or agricultural influences on wetlands (extent, character or productivity)?

Are impacts beneficial? _____ Detrimental? _____ Not apparent? _____

Have land or resource uses affected the water table? How? _____

Are there opportunities for wetland or riparian restoration in response to identified influences?

What sorts of treatments are indicated based on this assessment?_____

_____

Socio-Economic and Political Realities

What social, political, legal, or economic considerations might preclude or constrain restoration?

What social, political, or economic forces would enable, support, or sustain a restoration effort?

What are the relevant land ownership or jurisdictional issues or concerns, if any, that might influence restoration?

Appendix G: Induced Meandering Implementation Field Sheets

Channel Morphology Field Sheet For Induced Meandering

Project Name	Reach	Date

Notes:

Parameter	Existing	Design Goal	Change
Watershed Area (mi^2)		**N/A**	**N/A**
Bankfull Width, $\mathbf{W_{bkf}}$ (ft)			
Bankfull Max Depth, $\mathbf{d_{Max}}$ (ft)			
Flood Prone Width (ft)			
Flood Prone Area (ft)			
Entrenchment Ratio, **ER**			
Bankfull Mean Depth, $\mathbf{d_{bkf}}$ (ft)			
Width/Depth, **W/d**			
Cross Sectional Area (ft^2)			
Channel Length (ft)			
Valley Length (ft)		**N/A**	**N/A**
Sinuosity			
Channel Slope (%)			
Bank Composition			
Channel Bed Composition, $\mathbf{D_{50}}$			
Rosgen Channel Type			
# of Meanders			
Meander Length, **L**			
Average Channel Length per Meander (ft)			

Induced Meandering Design

Project Name	Reach	Date

Plan Form

Start at Station				
End at Station				
Control Points & Locations				
Meander Length (ft.)				
1/2 Meander Length (ft)				
Existing Channel Length	Total:		Per Meander:	
Planned Channel Length	Total:		Per Meander:	
Number of Meanders				

Profile

Elevation, first riffle	
Elevation, last riffle	
Slope	
Change in elevation per meander	
Change in elevation per riffle	
Bed Control features (location and elevation)	

Dimensions

	Existing	Design
Channel Width		
Max Depth		
Mean Depth		
Flood Prone Width		
Width:Depth		
Entrenchment Ratio		
Meander Radius		

Structure Inventory

Existing Channel Width: _____ Date: _____

Planned Channel Width: _____ Crew: _____

Existing Max Depth: _____ Project: _____ Reach: _____

Planned Max Depth: _____

Channel Type: _____ Valley Length: _____ Number of Meanders: _____

Planned Channel Type: _____

Planned Meander Length: _____ % Slope: _____ Elevation drop per riffle: _____ Baffle width: _____

Site	Station	Feature	Elevation	Length (b)	Width (a)	Height (d)	Skew (L/R)	Comments

Dredge and Fill Inventory

Project: _____ Reach: _____ Date: _____ Crew: _____

Site	Structure	Length (b)	Width (a)	Hypotenuse (c)	Height (d)	Area (ft^2)	Volume (ft^3)	Comments

For weirs: Area (ft^2) = Length • Width; Volume (ft^3) = Length • Width • Height

For baffles: Area (ft^2) = 1/2 Length • Width; Volume (ft^3) = 1/2 Length • Width • Height

For number of posts in a vane: Hypotenues (ft) / Post Spacing (ft) + 1

Materials Inventory

Project: _____ Reach: _____ Date: _____ Crew: _____

Site #	Structure	Posts (each)	Pickets (each)	Wicker (ft)	Rock (ft^3)	Boulders (each)	Other	Comments
TOTAL								

Appendix H: Project Planning and Implementation Checklist

Preliminary Assessment

- Walk the area / watershed
- Perform an assessment and overview of the impaired wetland/riparian system from upstream to downstream
- Read the landscape and identify impacts (see Field Worksheet for Reading the Landscape)
- Describe the problems, solutions, and possible treatments
- Prepare or acquire maps and watershed data

Select Project Reach or Reaches

- Determine upstream and downstream limits of the project using natural morphological boundaries or ownership boundaries.
- What is the likely evolutionary path to the dynamically stable potential channel type?
- What are the physical constraints/characteristics of the reach?
- Are there physical constraints: fences, property boundaries, outcrops, irrigation ditches?
- How steep is the channel?
- What is the main sediment source? Is there too little or too much sediment?
- What is the composition of bank material? Bed material?
- What is the primary water source? Snow melt, summer precipitation, storm water? Groundwater?
- What is the flow regime? Perennial, intermittent, or ephemeral?
- What is the hydroperiod?
- Affected resources, archeological sites, endangered species?
- What are the political, economic, and social realities and constraints regarding possible treatment?
- Optional: Conduct a Proper Functioning Condition (PFC) survey. Is the riparian area functional or nonfunctional?
- Decide: To Treat or Not to Treat?

Select a Reference Reach

Choices (in descending order of preference):

- Within the project reach
- Upstream or downstream from project reach
- Nearby or distant stream. Must have same valley type, appropriate stream type
- Mathematically determine desired stream channel dimensions

Conduct appropriate Surveys

- Rosgen Level II survey, reference reach to determine reference parameters and ratios
- Rosgen Level II survey of project reach (Appendix D)
- Vegetation Survey and Monitoring
- Establish geomorphic goals for the project reach or reaches and compare to current parameters (Appendix G)

Develop a Vision for Restored Reach

- Describe your vision of the restored reach 5 and 10 years after project completion. Base the vision on your interpretation of findings from the Rosgen Level II survey, and Proper Functioning Condition survey as tempered by the political, social, economic and physical constraints affecting the project reach and the wishes of the landowner. In other words, what is the best you can hope for?
- Channel Morphology Field Sheet for Induced Meandering (Appendix G)
- Vegetation community and ecology
- Long term potential
- Aesthetic considerations

Consider Additional Treatment Options and Site Requirements

- Additional treatments and practices to use
- Design and sizing of structures to fit the stream or wetlands
- Any special requirements; special design criteria
- Walk the creek again and stake possible sites for structures
- Collect UTM coordinates or prepare map or sketch of work sites
- ***Identify:***
  - ♦ access roads
  - ♦ quarry sites
  - ♦ material & equipment sites
  - ♦ refueling and maintenance sites
  - ♦ areas to be disturbed and in need of archeological clearance

Project Design

- Calculate desired meander length
- Calculate the total number of meanders for the project length
- Select a starting point for first (upstream) meander apex
- Create a project treatment map where structures will be located on the ground
- Determine appropriate materials and structure sizes

Complete Treatment Inventory, Permits and Clearances

- Create Structure Inventory Chart
- Create Materials Inventory Chart
- Create Dredge & Fill Inventory Chart
- List required materials, supplies, labor, equipment, etc.
- Create a project time-line and budget
- List funding sources (this may occur earlier in the process)
- Prepare and apply for clearances, permissions and permits
- Notify the neighbors, interest groups, other concerned parties
- Conduct a plans-in-hand walk through with landowner or manager

Implementation

- Mark (stake, flag etc.) meander lengths
- Mark the location of 1/2 meander apices (location of baffles or vanes)
- Mark midway between meander apices (location of weir, riffle or bed control feature)
- Slope: Determine average drop in elevation (feet) per half meander (change in elevation from top of riffle to top of next riffle)
- Create an implementation time-line
- Organize labor, supplies, materials, equipment, hazardous spill abatement kit, safety and fire gear, etc.
- Coordinate calendars with equipment rental company, landowners, subcontractors, material deliveries, etc.
- Review safety procedures with all personnel
- Prepare materials. Stockpile near each work site
- Set up photo points and take “before” photos
- Install treatments and structures
- Using a GPS unit, digitally map location of completed structures

Demobilize Project

- Clean-up work site
- Re-seed and mulch, do erosion control
- Obliterate, revegetate work roads
- Clean and do maintenance, as needed, on tools and equipment
- Return rental tools and equipment
- Conduct field visit with landowner/land manager
- Retake photos at all photo points
- Send notification of completion to agencies and other parties

Monitoring, Maintenance and Modification

- Follow-up on 404/401 permit within a year; plan to do any repairs or updates during this 1 year period
- Follow through on any grant requirements
- Conduct channel response and photo monitoring
- Conduct structure performance monitoring
- Conduct biological, ecological monitoring
- Is the stream responding as anticipated; are your wetland goals being met? Why? Why not?
- Modify the shape, form or size of structures as needed
- Add or remove structures as needed

Permanent Photo Point Record — Initial Take (Form 1)

Photo Point No._____ Project Name_____

Grant/Project Name and Number:_____

Landowner/Property Name: _____

Subject and Purpose of Photo: _____

_____

_____

_____

Retake Frequency:_____ Retake Due:_____

Retake Dates:_____

Photo Point Description (Describe access to point, point vicinity, and specific location; include sketch map below)

Legal Description:_____

USGS Quad Map:_____ UTM Coordinates:_____

Sketch Map: Include background reference points to help with relocation (use additional pages as needed)

Reference Point 1:
Description:

Reference Point 2:
Description

Permanent Photo Point Record — Initial Take (Form 1)

Photo Point No._____ Project Name_____ Date:_____ Time:_____(am/pm)

Camera Make & Model_____ Weather Conditions:_____

View 1
Photo number:

Camera height:

Compass bearing:

F-Stop:

Speed:

ISO:

Focus distance:

View 2
Photo number:

Camera height:

Compass bearing:

F-Stop:

Speed:

ISO:

Focus distance:

View 3
Photo number:

Camera height:

Compass bearing:

F-Stop:

Speed:

ISO:

Focus distance:

Permanent Photo Point Record — Retake (Form 2)

Photo Point No._____ Project Name_____ Date:_____ Time:_____(am/pm)

Camera Make & Model_____ Weather Conditions:_____

View 1
Photo number:

Camera height:

Compass bearing:

F-Stop:

Speed:

ISO:

Focus distance:

View 2
Photo number:

Camera height:

Compass bearing:

F-Stop:

Speed:

ISO:

Focus distance:

View 3
Photo number:

Camera height:

Compass bearing:

F-Stop:

Speed:

ISO:

Focus distance: