2014

Field Assessment Manual

Zumbro River Watershed

Restoration Prioritization

This document has been prepared in partial fulfillment of a work plan approved 6/23/2011. Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR). A multifaceted team led by the Zumbro Watershed Partnership was assembled to identify and prioritize areas in the Zumbro River Watershed that are critical for restoring and protecting water quality. Team members consisted of Barr Engineering, University of Minnesota, and various Soil & Water Conservation District (SWCD) and municipal staff throughout the Zumbro River watershed. Some document content has been adapted from Final Project Report prepared for Minnesota Department of Agriculture for Identifying Priority Management Zones for Best Management Practice Implementation in Impaired Watersheds.

Cover photo courtesy of USDA NRCS Photo Gallery http://photogallery.nrcs.usda.gov/

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Manual Overview

This document provides data collection protocols and forms for conducting field assessments associated with the ZWP Priority Management Zone (PMZ) and Critical Source Area (CSA) project. The project is seeking to determine the feasibility of using existing LiDAR data and other GIS data to identify and rank a preliminary list of the top 50 CSAs for the Zumbro River watershed. The areas from the list will then be targeted for best management practices (BMPs) implementation as they will have more significant, larger-scale, water-quality benefits. For this project, GIS software is used to perform a terrain analysis, which uses elevation data to characterize the physical features of the landscape. Terrain analysis can be used to identify locations with a high potential for erosion and pollutant runoff. These identified source areas then can be assessed for further evaluation. Additional spatial analyses also are incorporated, including soil erosion risk and source proximity to a water body. Terrain analysis and other spatial analyses do not eliminate the need for field assessments. However, they can reduce the amount of time spent in the field and enhance data collection efforts by enabling technicians to select potentially sensitive sites.

For this part of the project, field procedures are conducted to both complement and evaluate the performance of the GIS analysis. The field assessments can be used to assess the adequacy of the spatial analysis in predicting critical source areas. These results, though mainly qualitative, can also be used to provide substantial insight into locating bank-related PMZ and CSA sites of concern. In addition, the GIS analysis can be enhanced using field data to generate an inventory of streambank locations in need of stabilization. Field collection methods used to develop the inventory are designed to inform managers regarding the extent of sensitive banks and provide efficient information transfer to subsequent evaluation teams.

It is important to note that many of the sites identified as sensitive by the GIS analysis will already have appropriate management and operation. Thus, these tools also provide an important opportunity to recognize producer accomplishments and track program progress necessary for supporting basin management and Total Maximum Daily Load efforts.

This document is divided into three sections. As field technicians gain experience with the tools over time, they have the flexibility to carry only the sections needed. The three sections are as follows:

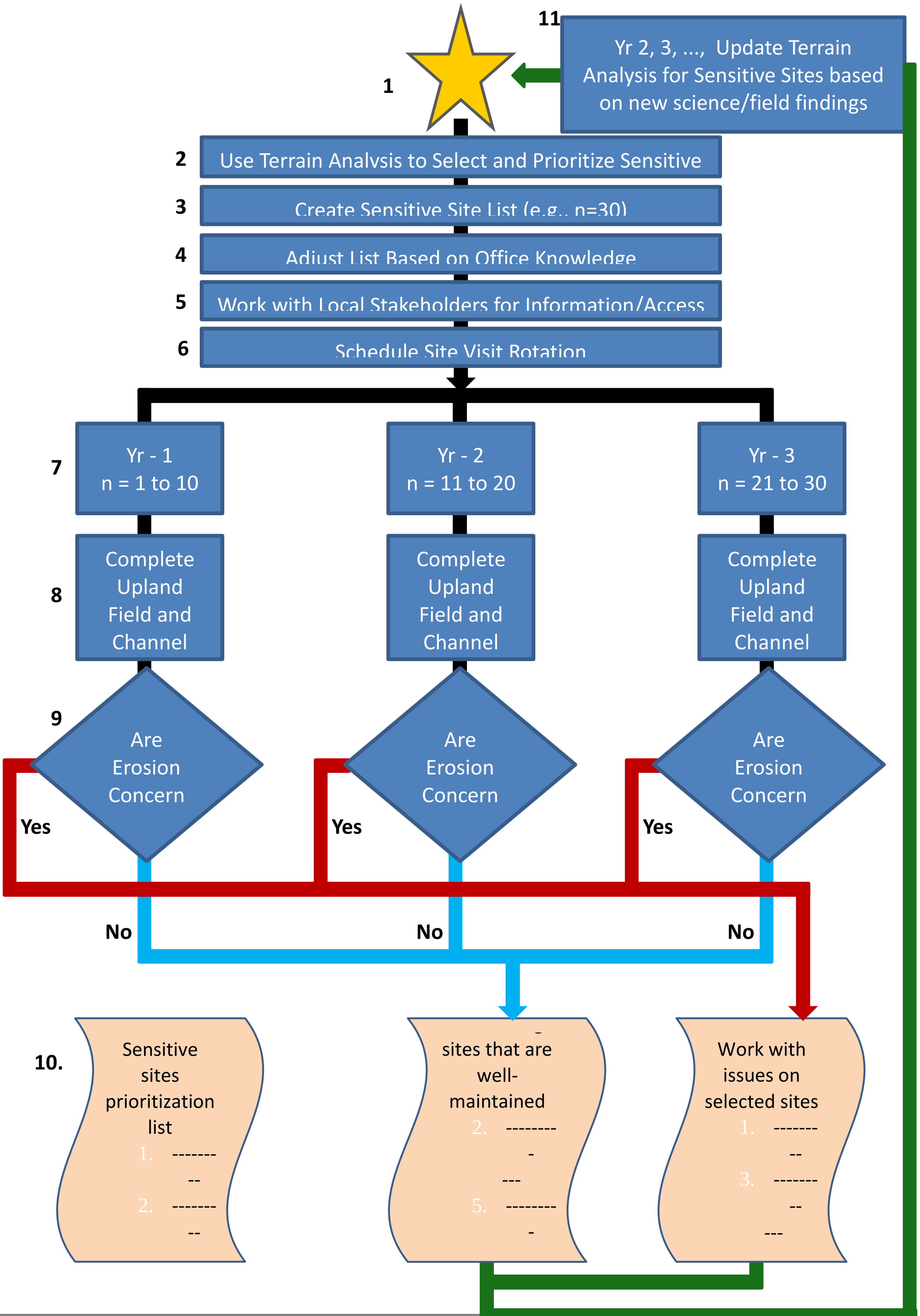
1) Section one provides a decision flow chart that provides guidance for selecting sites and tools, as well as conducting field assessments.

2) Section two provides the data collection forms to be used when conducting the field assessments. This section is intended to become all that experienced field staff will need to perform a PMZ or CSA lead implementation plan and/or targeting a site's implementation needs.

3) Section three provides detailed protocols for collecting data associated with the field survey data and streambank erosion assessment forms.

Watershed practitioners will use the following forms to record field data:

- Field Survey Data Sheet: On this forms, staff will record general site information, including site location and general Ag field and channel conditions. Staff will walk the field edge and riparian corridor and note any pour points, defined as channelized flow from the field to an outlet, such as surface water. Tile intakes also are considered pour points.
- Streambank Erosion Assessment Form. While walking in or near the channel, staff will note any stream bank erosion and record information using the Streambank Erosion Assessment Form. The Field Survey Data Sheet may also be used in lieu of the assessment form if only minor to moderate slumping is evident.


11
Yr 2, 3, ..., Update Terrain Analysis for Sensitive Sites based on new science/field findings
1
2
Use Terrain Analvsis to Select and Prioritize Sensitive
3
Create Sensitive Site List (e.g., n=30)
4
Adiust List Based on Office Knowledge
5
Work with Local Stakeholders for Information/Access
6
Schedule Site Visit Rotation
7
Yr - 1
n = 1 to 10
Yr - 2
n = 11 to 20
Yr - 3
n = 21 to 30
8
Complete Upland Field and Channel
Complete Upland Field and Channel
Complete Upland Field and Channel
9
Are Erosion Concern
Are Erosion Concern
Are Erosion Concern
Yes
Yes
Yes
No
No
No
10.
Sensitive sites prioritization list
1. ---------
2. ---------
sites that are well-maintained
2. ---------
5. ---------
Work with issues on selected sites
1. ---------
3. ---------

1 Start
- Determine management objectives (PMZ and CSA)
- Select terrain analysis tools that fit with identified objectives

2 Use Terrain Analysis to Select and Prioritize Sensitive Sites
- Run selected tools
- Use analysis results to identify high-priority sites

3 Create Sensitive Site List
- Determine an appropriate number of sites to select for further examination
- Base the list length on management objectives and available resources
- Determine the number of sites that can be visited each year
- Populate site list using highest-ranked sites from terrain analysis results

4 Adjust List Based on Office Knowledge
- Review site list for obvious errors in terrain analysis results
- Move sites with known management practices that address issues to Acknowledgement List

5 Work with Local Stakeholders for Information and Access
- Reach out to local producers to share project goals
- Gather information on site practices to refine target list
- Identify producers who are willing to allow site access

6 Schedule Site Visit Rotation
- Work with producers to schedule site access (a portion of the sites may be visited in a given year)
- Establish a longer-term schedule rotation for re-visiting sites

7 Visit Sites Selected for Given Year
- Conduct assessments of the identified sites
- Ensure assessor has permission to access site prior to conducting examinations

8 Complete Upland Field and Channel Forms
- Record the findings on the assessment protocol forms, communicating institutional memory
- Compare field assessments to terrain analysis results

9 Are Erosion Concerns Present?
- Use field assessment to identify presence of erosion concerns
- Note whether concerns are being addressed by management practices

10 Generate Acknowledgement and Issue Lists
- Place well-maintained fields on acknowledgement list
- Place fields in need of additional management practices on list of concerns
- Work with landowners to increase management on sites of concern
- Maintain master list that includes sites of concern and acknowledgement sites

11 Update Terrain Analysis for Sensitive Sites
- Revisit sensitive site list periodically
- Add new sensitive sites as evaluated sites move to acknowledgement list
- Conduct new terrain analyses as necessary to update sensitive site identification when:
  - When critical land use changes occur (e.g., regional decline in CRP)
  - Improved terrain analysis methods are developed (e.g., LiDAR)
  - Newly identified watershed stressors emerge (e.g., biotic impairments)

Field Survey Data Sheet

Site ID#	Streambank Location	Discharges to…	Feature	Flow Orientation	Photo #	Land Use	Tillage Direction	Tile Style	% Crop Residue
 Date (xx/xx/xxxx)	Left bank Right bank Note: while looking downstream	Perennial stream Intermittent stream Grassed waterway Other: ____________	Culvert Drop structure Gully Grassed waterway Open intake Side inlet Slumping Explosed tile Ravine Other: ________________	N NE E SE S SW W NW	# __________ Describe location & direction taken; provide drawing if necessary	Corn Soybean Alfalfa Wheat Pasture Forest Other: ____________	N NE E SE S SW W NW	Clay Corrugated metal pipe Plastic	0-15% 15-30% >30%
Vegetative Buffer	**Buffer Condition**	**Buffer Width (ft)**	**Sediment Delivery Potential (1-3)**	**Gully/Slumping Width (ft)**	**Gully/Slumping Depth (ft)**	**Gully/Slumping Length (ft)**	**Intake Distance (ft)**	**Intake Size (in)**	**Tile Size (in)**
Yes No	0 1 2 3 4	**Manure App Evidence** Yes No	**BMP Recommendations**	**Comments:**					

Streambank Erosion Assessment Form

For detailed procedures on completing this worksheet, please see Manual page 10

Field ID:						
GPS:						
Date:						
Prepared By:						
Field Conditions (e.g. weather):						
Length and Height of Eroding Bank (ft)		L: H:	L: H:	L: H:	L: H:	L: H:
Impacted by Livestock Access		Yes No	Yes No	Yes No	Yes No	Yes No
Impacted by Equipment Access		Yes No	Yes No	Yes No	Yes No	Yes No
Riparian Cover Type	**Perennial Cover**	Woody Grass	Woody Grass	Woody Grass	Woody Grass	Woody Grass
	Managed Land Uses Within 10 ft of water body	Road Homestead Crop Grazed Livestock heavy use area	Road Homestead Crop Grazed Livestock heavy use area	Road Homestead Crop Grazed Livestock heavy use area	Road Homestead Crop Grazed Livestock heavy use area	Road Homestead Crop Grazed Livestock heavy use area
Riparian Perennial Cover Quality (see key below)		Excellent Good Fair Poor	Excellent Good Fair Poor	Excellent Good Fair Poor	Excellent Good Fair Poor	Excellent Good Fair Poor
Riparian Perennial Cover Buffer Width (ft)		30 ft 10 – 30 ft < 10 ft	30 ft 10 – 30 ft < 10 ft	30 ft 10 – 30 ft < 10 ft	30 ft 10 – 30 ft < 10 ft	30 ft 10 – 30 ft < 10 ft

Riparian Perennial Cover Quality

	Woody	Grass
Excellent		Dense, Deep-rooted
Good	Dense, full canopy	> 50% deep-rooted
Fair	> 50% canopy	< 50% deep-rooted, > 50% shallow
Poor	< 50% canopy	< 50%

Note the type of erosion indicators observed (exposed escarpment, exposed tree roots, slumped debris at the toe, etc.) and other erosion concerns:

Field ID: ________	
Field ID: ________	
Field ID: ________	
Field ID: ________	
Field ID: ________	

Field Assessment Manual

Zumbro River Watershed Restoration Prioritization Project

Field Survey Data Sheet Protocol

Overview

The field survey form should be completed when a field technician observes any form of surface erosion that has hydrological connection to surface waterways. The form is also used to document terrain analysis field verification and the presence and condition of existing BMPs. Where erosion is present, the technician should measure the length, depth, and width of the feature when applicable. For features with varying measurements, such as gullies, make an estimate of the overall dimensions. Some qualitative judgments will be necessary for certain parameters, such as the sediment delivery potential, crop residue, and BMP conditions.

Procedure

1. **Identify surface erosion feature** – This is recorded under the feature column. For a basic differentiation of gullies and ravines – a ravine is typically forested and not able to be driven across, whereas a gully can be driven across by farm equipment. A side inlet is a ridged berm structure with tile drain adjacent to a waterway.
    - Determine what type of waterway the feature discharges to, what bank (left or right) the feature is in relation to that waterway, and what cardinal direction the feature discharges.
    - Determine buffer information. If the feature is located in forested land, these can be ignored unless other buffer concerns exist.
2. **Determine upland field characteristics** – These include land use, tillage, and tile information. Also note any evidence or knowledge of recent of current manure application. For % crop residue, see appendix 2 for a visual example of various percentages.
3. **Document feature with picture(s)** – Take as many pictures as necessary to capture the extent of feature. Note spatial references for photos taken at each site (not needed if camera is using built in GPS features for this function). If possible, take photos with field technician standing in/near feature for scale reference.
4. **Make BMP recommendations for feature when applicable** – See appendix section.
5. **Make note of any other observations/concerns in comments section** – For example, if the feature is a gully, these notes would be beneficial to note: whether or not it is actively eroding; if it is advancing into upland field(s); has unique knick points, or has several closely grouped knick points; etc.

Streambank Erosion Assessment Protocol

Overview

A qualitative assessment will be used to document areas where streambank erosion is occurring. The following form should be completed when a field technician observes signs of bank erosion. These signs include the presence of an exposed escarpment, soil cracking near the bank, exposed tree roots and/or obvious slumped debris at the toe, or other signs. Where erosion is present, the technician should measure the length and height of the eroding bank. A qualitative judgment regarding the vegetative cover also should be indicated, along with impacts from livestock or equipment access.

Procedure

1. **Identify indicators of streambank erosion** – This streambank assessment only needs to be performed on sites where indicators of streambank erosion are present.
2. **Compile data** – Gather the information listed to complete the **streambank erosion worksheet** for each location with indicators of streambank erosion.
    - Length and height of eroding bank
    - Impacted by livestock access
    - Impacted by equipment access
    - Riparian cover type
        - Perennial cover, or
        - Managed land uses within 10 feet of water body
    - Riparian perennial cover quality (N/A if managed land uses are within 10 feet of water body)
    - Riparian perennial cover buffer width (N/A if managed land uses are within 10 feet of water body)
3. **Note the type of erosion indicators observed and other erosion concerns**

Appendix 1. Examples of Different Bank Conditions

Figure A. Tributary, Kalamazoo River watershed

Figure A depicts a small stable stream setting.

Completing a streambank erosion inventory form at this site would not be necessary. This stream illustrates well-established perennial vegetative cover. The buffer width is > 30 feet.

Figure B. Kalamazoo River

Figure B depicts a site with noticeable bank erosion.

Exposed roots indicate active erosion. Slumped soils indicate undercutting typical for erosion induced by channel hydrology. This stream has poor perennial vegetative cover (shallow grass roots and sparse woody vegetation density). The buffer width is < 10 feet.

For this site, the evaluation would measure the bank height using the average dimension along the bank that stretches from submerged toe of the slope to grassed soil horizon.

Figure C. Rouge River

Figure C depicts a site with outside bend bank erosion.

For this site, a streambank erosion assessment would be conducted. The erosion illustrated here is typical of erosion induced by channel hydrology. Perennial vegetative cover is poor. The buffer width is < 10 feet.

This site is an interesting example of bank erosion. Grass/woody roots extend to the waterline, but are so few and shallow that they provide minimal bank protection. Also, this site is downstream from a dam (not pictured). Impoundments usually are associated with atypically high erosion due to increased sediment transport capacity as a result of the low sediment concentrations in the water released from the impoundment.

Figure D. Hagar Creek, Ottawa County, MI

Figure D depicts a site with active erosion on at least three bank locations.

The tree root balls shown slumping into the stream (middle of the photo) is typical of erosion inducted by channel hydrology. The near bank to the left has poor woody vegetative cover and poor grass understory cover. Buffer width is < 10 feet.

(Photos and some narrative content were adapted from MI DEQ Standard Operating Procedure – Assessing bank erosion potential using Rosgen's Bank Erosion Hazard Index (BEHI). Available at: [http://search.michigan.gov/search?affiliate=mi-deq&query=stream%20bank%20erosion)](http://search.michigan.gov/search?affiliate=mi-deq&query=stream%20bank%20erosion)

Appendix 2. BMP Recommendation Guidance

Recent advances in precision conservation have led to rethinking the way Best Management Practices (BMPs) are selected for a particular site, with a growing emphasis on big picture benefits rather than spending resources for localized improvements that may not address a given landscape's largest sources of pollution. Identifying CSAs and targeting those areas for BMP implementation help ensure the largest sources are being accounted for mitigation.

Following the CSA identification method presented in the Digital Terrain Analysis Manual, BMP suitability should be carefully considered as the first step in the implementation process. Agroecoregions, as described in the Case Studies section, group physical landscape characteristics, making their use a good starting point for choosing regional conservation practice suitability. County-level location may also influence BMP selection, as conservation districts may have a list of suitable practices established from combinations of landowner equipment and trends, available program funds, cost/benefit analyses, and minimizing the amount of land taken out of production, among others.

A sediment reduction-based BMP suitability by agroecoregion table was created for several agroecoregions found in the Minnesota River Basin (Figure E) for the purpose of informing the upland field survey data sheet. The table was originally based off a statewide Minnesota Phosphorus Index study conducted by UMN researches, though was modified here to include regions located in the Zumbro River Watershed, along with applicable NRCS conservation practices, and was populated with input from district conservationists and NRCS staff throughout the Zumbro River Watershed. A similar series of tables were created for the Zumbro River Watershed in 2008 by NRCS and SWCD staff using Cooperative Conservation Partnership Initiative Farm Bill funds to document general resource concerns and conservation needs at the HUC8 watershed scale (Figure F). The rapid watershed assessment tables provide conservation practice cost estimates and effectiveness for reducing specific resource concerns for cropland, pasture, and forest land use/cover. The reduction effectiveness rating is based on both benchmark conditions and degree of change in conditions by conservation system(s) application. It is represented by a numerical value rated from -5 (most damaging to resources) to 5 (best protection offered by treatment).

Figure E. BMP suitability by agroecoregion. Color coded rows show suitability rated from Low (L) to Highly (H) suitable for a particular agroecoregion in the Zumbro R. Watershed

NRCS CP#	Conservation Practices	Alluvium & Outwash	Blufflands	Level Plains	Rochester Plateau	Rolling Moraine	Steeper Alluvium	Undulating Plains
328	Conservation Crop Rotation	M	H	M	H	H	M	L
329	Conservation Tillage	M	L	M	L	H	M	M
332	Contour Buffer Strip	L	M	M	M	M	L	M
330	Contour Farming	M	H	M	H	H	M	M
340	Cover Crop	M	H	H	H	H	M	L
342	Critical Area Planting	M	L	M	M	M	H	L
362	Diversion	L	M	M	H	L	L	L
554	Drainage Water Management	M	L	M	M	M	M	L
386	Field Border	M	H	H	H	H	M	H
410	Grade Stabilization Structure	L	H	M	H	L	M	L
-	Grass Cover (CRP only)	M	M	H	M	H	L	L
393	Grass Filter Strip	M	M	H	H	H	H	M
412	Grass Waterway	H	H	H	H	M	H	H
590	Nutrient Management	H	H	M	H	M	H	M
512	Pasture & Hayland Planting	M	M	L	H	L	M	L
378	Pond	L	H	M	H	L	M	L
528A	Prescribed Grazing	M	M	M	M	M	M	M
350	Sediment Basin	M	M	M	M	H	M	M
725	Sinkhole Treatment	M	H	L	H	L	M	L
580	Streambank & Shoreline Protection	L	H	L	M	M	M	L
585	Stripcropping	L	H	M	H	M	M	L
600	Terrace	L	H	M	H	L	M	M
645	Upland Wildlife Habitat Management	L	L	L	L	L	L	L
382 / 472	Use Exclusion / Fencing	M	M	L	M	L	H	M
638	Water and Sediment Control Basin	M	H	H	H	H	H	H
614	Watering Facility	L	L	M	L	M	L	M
657	Wetland Restoration	L	L	M	L	L	L	L

Figure F. Rapid watershed assessment for the Zumbro River Watershed row crop land use. Courtesy of USDA-NRCS[1].

Conservation Practice	Code	Units	Installation Cost	Life	O&M Factor	Total Annual Cost	Resource Concerns: Soil Erosion – Sheet and Rill	Soil Erosion – Ephemeral Gully	Water Quality – Excessive Nutrients and Organics in Surface Water	Water Quality – Excessive Suspended Sediment and Turbidity in Surface Water
Contour Buffer Strips (ac.) 332	332	Ac	$157.22	10	0.02	$23.51	4	3	3	3
Contour Farming (ac.) 330	330	Ac	$7.00	1	0.00	$7.00	3	3	3	3
Cover Crop (ac.) 340	340	Ac	$48.44	1	0.01	$48.92	4	3	3	3
Critical Area Planting (ac.) 342	342	Ac	$186.30	10	0.03	$29.72	5	5	3	3
Field Border (ft.) 386	386	Ft	$0.08	10	0.01	$0.01	3	3	2	3
Filter Strip (ac.) 393	393	Ac	$77.80	10	0.02	$11.63	2	0	4	4
Grade Stabilization Structure (no.) 410	410	No	$15,000.00	10	0.01	$2,092.57	0	4	0	3
Grassed Waterway (ac.) 412	412	Ac	$1,895.68	10	0.02	$283.41	0	5	2	4
Nutrient Management (ac.) 590	590	Ac	$5.50	1	0.00	$5.50	1	1	5	0
Pest Management (ac.) 595	595	Ac	$5.50	1	0.00	$5.50	1	0	0	0
Residue and Tillage Management, Mulch Till (ac.) 329B	329B	Ac	$15.00	1	0.00	$15.00	4	2	3	3
Residue Management, No-Till/Strip Till/Direct Seed (ac.) 329A	329A	Ac	$30.00	1	0.00	$30.00	5	3	3	3
Restoration and Management of Declining Habitats (ac.) 643	643	Ac	$778.34	15	0.01	$82.77	3	3	2	2
Riparian Forest Buffer (ac.) 391	391	Ac	$414.04	15	0.01	$44.03	1	0	2	2
Streambank & Shoreline Protection (ft.) 580	580	Ft	$2,350.00	10	0.10	$539.34	0	2	1	4
Stripcropping (ac.) 585	585	Ac	$50.00	5	0.01	$12.05	4	2	1	3
Subsurface Drain (ft.) 606	606	Ft	$9.00	20	0.03	$0.99	2	2	-2	1
Terrace (ft.) 600	600	Ft	$3.50	10	0.00	$0.45	3	3	2	2
Underground Outlet (ft.) 620	620	Ft	$40.54	10	0.03	$6.47	3	5	-3	1
Upland Wildlife Habitat Management (ac.) 645	645	Ac	$196.70	3	0.00	$72.23	0	0	0	0
Waste Utilization (ac.) 633	633	Ac	$15.00	1	0.00	$15.00	1	0	3	2
Water & Sediment Control Basin (no.) 638	638	No	$6,000.00	10	0.03	$957.03	1	4	3	3
Well Decommissioning (no.) 351	351	No	$685.00	10	0.00	$88.71	0	0	0	0
Wetland Restoration (ac.) 657	657	Ac	$6,000.00	15	0.01	$638.05	2	2	1	3

[11] http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_022493.pdf, accessed March, 2014

Appendix 3. Examples of Different Crop Residue Percentages

Figure G. Visual crop residue examples

The images in the vertical columns show crop residues for corn (left) and soybean (right) – From top to bottom: 25%, 50%, 75%, 90%

Courtesy of Iowa State University, University Extension–Integrated Crop Management, http://www.ipm.iastate.edu/ipm/icm/node/1792/print.