United States Department of Agriculture

Wisconsin Agronomy Technical Note 10

Companion Document for Wisconsin Practice Standard 393 Filter Strip

Planning, Design, Management and Maintenance of Vegetative Filter Strips (VFS)

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A filter strip is a strip or area of herbaceous vegetation that removes contaminates from overland flow runoff. The two primary resource concerns are: 1) reduce suspended solids and associated contaminants in runoff, and 2) reduce dissolved contaminants in runoff and leaching of dissolved contaminants to groundwater.


INTRODUCTION

The objective of Wisconsin Agronomy Technical Note 10 is to serve as a companion document to Wisconsin NRCS Practice Standard 393 Filter Strip and provide technical guidance to conservation planners when planning, designing, managing, and maintenance of vegetative filter strips (VFS).

Accurate designs will help ensure that filter strips will achieve a desired level of protection. The width of a filter strip is an important design variable for determining the level of impact and the cost of installation.

CRITERIA FOR VEGETATED FILTER STRIP DESIGN WIDTH

***<u>NOTE:</u>** Filter strips can be strategically located in the upper reaches of the landscape and are not required to be contiguous to Environmentally Sensitive Areas (ESA). See Figures 6-10 for examples of VFSs located adjacent to ESAs.*

Designing Filter Strips:

1. Calculate the size of the contributing area, and average erosion rates. Calculate the average slope and erosion rates occurring within 300 feet of the planned VFS. There is no resource concern when the discharge of surface water to the VFS is 0 or the VFS has no contributing drainage area.
2. The VFS shall be located down slope from the source area of runoff.
3. Overland flow entering the filter strip shall be uniform sheet flow.
4. Areas of concentrated flow in the contributing drainage area shall be evaluated and treated by dispersing concentrated flow conditions, where practical. When dispersing concentrated flow is not possible, the concentrated flow area shall be seeded to perennial vegetation.
5. The drainage area above shall have a slope of 1 percent or greater.
6. The maximum row gradient along the leading edge of the filter strip shall not exceed 5 percent.
7. Noncontiguous filter strips shall be located within 700 feet of the ESA needing protection.
8. For filter strips noncontiguous to the ESA, the following assessment guidance shall be implemented:
   a. The following additional VFS design assessment is required when an existing buffer is not immediately contiguous to the ESA. The Filter Strip cannot be over 700 feet from the ESA.
   b. The soil loss and sediment delivery for the area between the lower edge of the planned

noncontiguous filter strip and the ESA shall be computed using RUSLE2. The upper filter strip must reduce the delivery.

9. The VFS width shall be at least 20 feet or 30 feet if dissolved contaminants in runoff are the resource concern. The minimum width must be equivalent or greater than the 10-year life span width based on the Revised Universal Soil Loss Equation (RUSLE2) computations for the maximum sediment accumulation within the planned VFS.

10. Determine the minimum width based on the following design parameters:
    1. dominant hydrologic soil group within the footprint of the planned VFS,
    2. average slope within 100 feet upstream of the lower edge, and
    3. average slope within 100 to 300 feet upstream of the lower edge of the planned VFS.

    Refer to Table 1 and 2 to determine the minimum VFS width for the identified resource concern by following the steps below:
    1. Determine the point score in category 1, 2 and 3.
    2. Add the points from each of the categories.
    3. The minimum VFS width is based on the composite score for the identified resource concern using Table 2.

Table 1 - Design Parameters for Determining Minimum Filter Strip Width

Table 2 - Minimum VFS Width Requirements

Direct Contributing	Factor Points
1. Hydrologic Soil Group	
A	0
B	10
C	20
D	30
2. Average slope within 100 feet upstream of the low edge of the filter	
0-1%	0
>1-	5
>3-	15
>6-	30
3. Average slope from 100 - 300 feet upstream of the low edge of the filter	
0-1%	0
>1-	5
>3-	10
>6-	15
>12	20

Total Point Range	Minimum Filter Strip Width for Sediment Trapping[1]	Minimum Filter Strip Width for Dissolved Contaminants[1,2]
0-10	20 Feet	70 Feet
15-20	30 Feet	70 Feet
25-30	40 Feet	70 Feet
35	50 Feet	80 Feet
40	60 Feet	80 Feet
45	70 Feet	90 Feet
50	80 Feet	100 Feet
>50	100 Feet	120 Feet

[1]Soil hydrology group designation can be located at http://websoilsurvey.nrcs.usda.gov. Select the dominant hydrologic soil group that occupies the footprint of the planned VFS.

[1]The minimum VFS width is determined based on the sediment delivery rate in tons per acre, percent trapping efficiency and the ratio of the contributing area to the planned VFS.

[2]Dissolved contaminants include nitrogen, phosphorus, and pesticide active ingredients with high water solubility characteristics and other pollutants identified in runoff as a resource concern.

NOTE: *Minimum VFS design width, may be increased when recommended by the Conservation Planner.*

Verifying the ten year life span:

To verify the designed width does not need to be expanded use RUSLE2 to estimate sediment delivery from the contributing area, trapping efficiency and sediment accumulation in the VFS footprint following the procedure below.

1. Using RUSLE2, compute the soil loss delivered to the upper edge of the planned VFS in units of tons/acre/year (t/ac/yr.). ***NOTE:*** *Soil loss shall not exceed the tolerable rates for all map units in the contributing area.*

2. Compute the amount of sediment trapped in the VFS in t/ac/yr. and percent trapping efficiency.

3. Determine the ratio of the contributing area in acres to the VFS area in acres. ***NOTE:*** *The contributing area only allows for sheet flow entering the VFS.*

4. Determine the time to accumulate 6 inches of sediment in the VFS to verify the 10-year life span complies with the standard criteria.

NOTE: *Refer to APPENDIX 2 "Using RUSLE2 to Design and Estimate Sediment Deposition in the*

Vegetative Filter Strips" for instructions to determine the VFS 10 year life span and Exhibit 2"Excel Spreadsheet for Determining the Lifespan of the VFS".

Identifying the Resource Concern(s)

Identify suspended solids and associated contaminants in surface runoff as a resource concern:

1. Using RUSLE2 to estimate soil losses and a reduction in sediment delivery as a result of the implementation of the VFS. A minimum soil loss of 0.5 t/ac/yr. from the contributing area must exist before suspended solids in surface runoff is identified as a problem.
2. Using Snap Plus to estimate phosphorus delivery amounts and potential reductions as a result of implementing the VFS.
3. Evaluating tillage systems that leave less than 30% surface cover after planting in the contributing area.
4. Evaluating fields or sub-fields with eroding conditions exceeding T.

Identifying dissolved contaminant loadings in surface runoff and leaching to groundwater as a resource concern:

1. Nutrient and pesticide applications are surface applied without incorporation.
2. Winter spreading of manure on frozen or snow-covered ground.
3. Snap Plus computations verify measureable amounts of dissolved phosphorus leaving the field edge.
4. WIN-PST hazard ratings of Intermediate, or higher is an indication of potential pesticide movement in surface runoff and the leaching of pesticides to ground water is highly probable.
5. Fields or sub-fields with eroding conditions exceeding tolerable rates.

USING RUSLE2 TO ESTIMATE SEDIMENT DEPOSITION IN THE VEGETATIVE FILTER STRIP

VFSs are designed to trap sediment and in time will fill with sediment and inhibit the filtering and trapping efficiency. The life span of the VFS for sediment removal purposes is dependent upon: 1) the rate of soil loss or sediment delivery rate to the upper edge of the VFS from the "contributing area", computed by RUSLE2 using the "overland flow slope length" (Figure 1), 2) the ratio of contributing area to the area of the VFS and, 3) sediment trapping efficiency.

NOTE: *An excel spreadsheet is available to compute the VFS life span. See Exhibit 2—Excel Spreadsheet for Determining the Lifespan of the VFS.*

Determine the Sediment Delivery Rate and Sediment Trapping Efficiency

The RUSLE2 VFS design procedure requires the use of the "Summary", or "Science" profile templates. These templates provide the options to input multiple slope segments with changes in slope, soil type, or management change within the "Overland Flow Slope Length" (Figure 1). The "Overland Flow Slope Length" is defined as the slope length from the point of origin of sheet flow to the upper edge of the VFS or to the point where concentrated flow originate.

NOTE: *Overland flow slope length differs from the slope length used for conservation planning.*

The slope length used for conservation planning purposes are usually shorter. Figure 1 demonstrates the difference between slope length for conservation planning purposes and overland flow slope length on a convex/concave slope.

Figures 2, 2A, 2B, 2C, 3 and 3A represent RUSLE2 screen shots that illustrate the use of the "Profile" view in the "Science" template. Figures 2 and 3A illustrate the overland flow slope length of 350 feet. This is the length from the point of overland flow until the slope reached the VFS or overland flow changes to concentrated flow. The slope is broken into 3 segments for this example. The number of slope segment breaks will vary depending on the site condition. See figure 3A.

The soil loss for this example is 3.0 t/ac/yr., where the slope enters the VFS and the estimated sediment yield leaving the lower (exit) portion of the VFS is 1.6 t/ac/yr. The results in fig. 3B, the planner can calculate the amount of sediment trapped (3.0 tons entering minus (-) 0.65 tons leaving the VFS lower edge, equates to 2.3 t/ac/yr. trapped in the VFS). The trapping efficiency can be calculated by dividing the "sediment trapped" by the "soil loss rate entering the VFS". The sediment trapped (2.3) divided by soil loss (3.0) equals a 77% trapping efficiency.

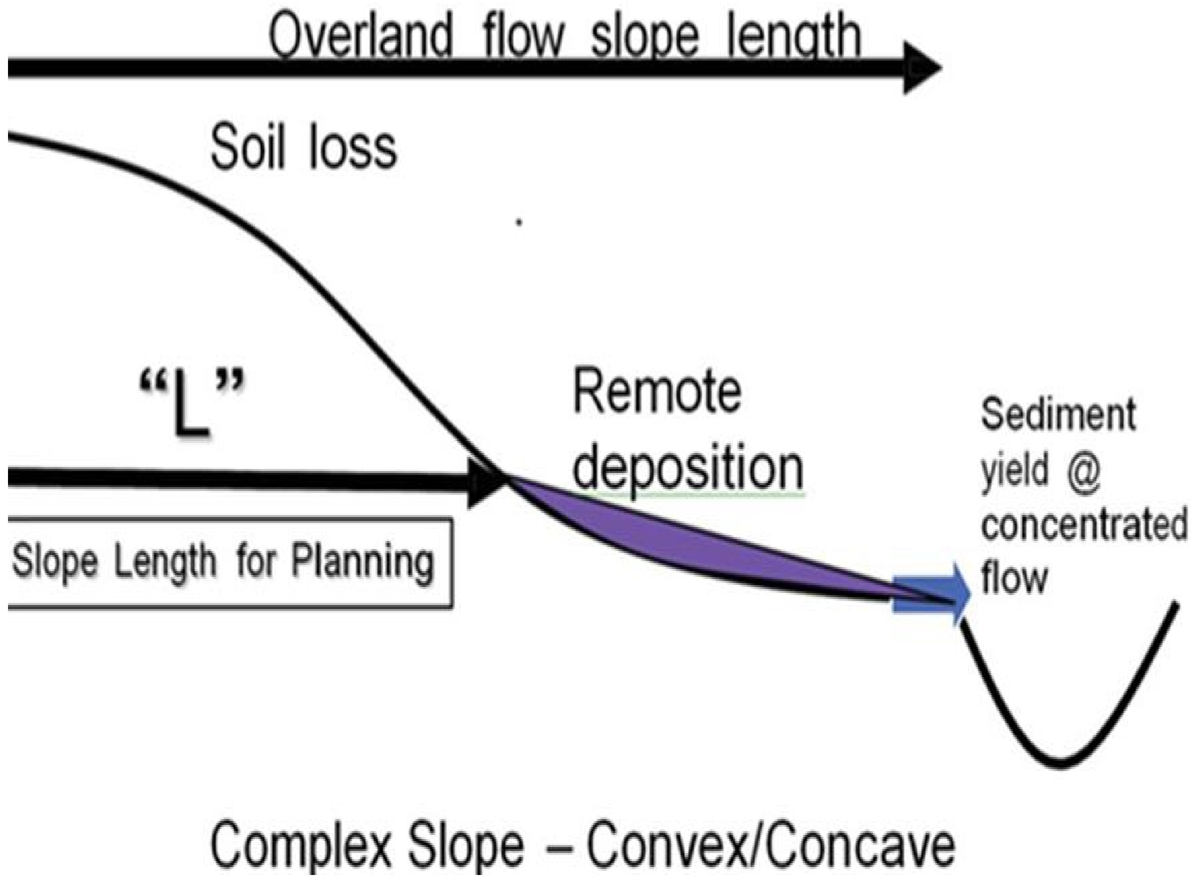
Figures 1, 2, 2A-2C, 3, and 3A illustrates and clarify the procedures for designing VFSs and verifying the 10 yr. lifespan of the practice. Below is a brief explanation of the following figures:

- Fig.1—Comparison of "L" for conservation planning vs. slope segments for VFS designs.
- Fig. 2—Example RUSLE2 calculation with a slope topography consisting of 3 segments

and computations used to design the VFS for this example.

- Fig. 2A—RUSLE2 computation for segment 1 of fig. 2.
- Fig. 2B—RUSLE2 computation for segment 2 of fig. 2.
- Fig. 2C—RUSLE2 computation for segment 3 of fig. 2.
- Fig. 3—RUSLE2 computation for sediment delivered to the end of “L” with a 30 ft., VFS designed at the mid-point of “L”.
- Fig. 3A—No RUSLE2 input changes; slope topography consisting of 5 segments, including two additional segments as a result of the 30 ft. VFS designed at the end of “L”.

Figure 1 - Overland Flow Slope Length versus Slope Length used for Conservation Planning.



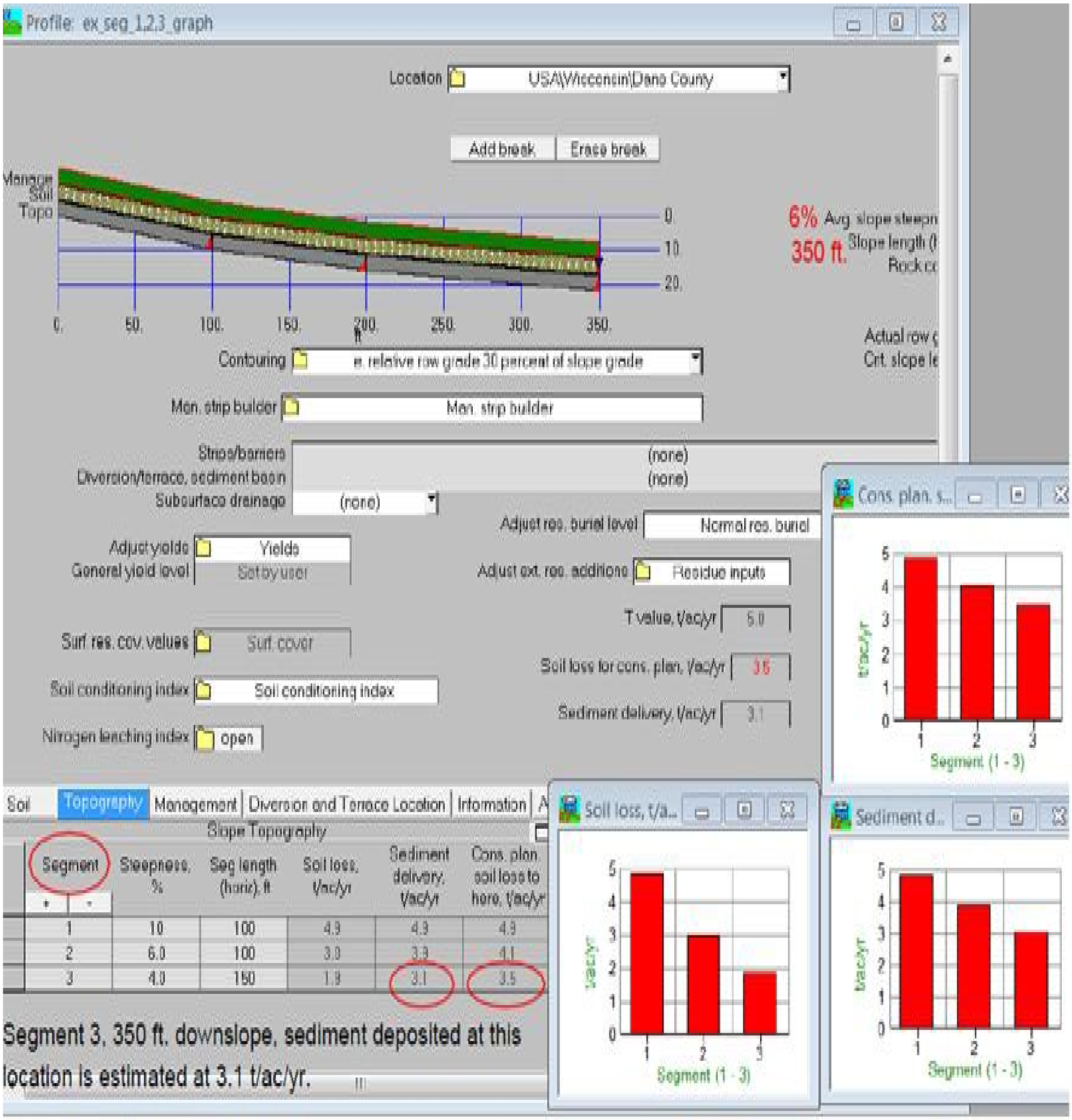
The terms and definitions below will help clarify the RUSLE2 computations output data in Figure 2 through 3A.

1.Soil Loss for Conservation Planning is the average soil loss over the length of the slope, where partial credit is given if deposition occurs on the slope and is the value for slope detachment (mass of sediment produced on the slope) reduced by the credit given for the deposition that occurs on the slope.

2.Sediment Delivery is the amount of sediment delivered to the end of the overland flow slope length, at visible deposition locations or where concentrated flow conditions originate.

3.Soil Loss is the **net loss** computed for the soil/topography management segment (s).

Figure 2 - Example RUSLE2 calculation with a Slope Topography consisting of 3 segments.



Figures 2A, 2B and 2C are example RUSLE2 calculations of each segment individually for tracking sediment deposited along the hill slope. Soil loss and sediment delivery rates displayed in Figure 2A, 2B and 2C will vary when compared to the overland flow slope length RUSLE2 computations displayed in Figure 2.

Figure 2A - RUSLE2 computation for Segment 1 (10% @ 100 feet).

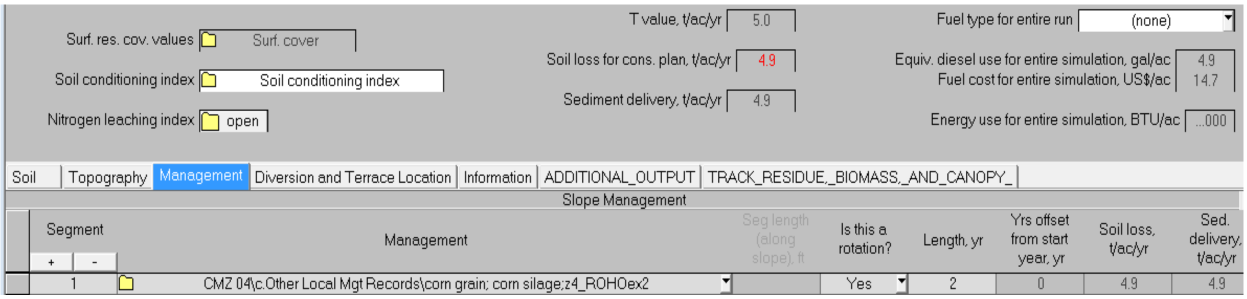


Figure 2B - RUSLE2 computation for Segment 2 (6% @ 100 feet).

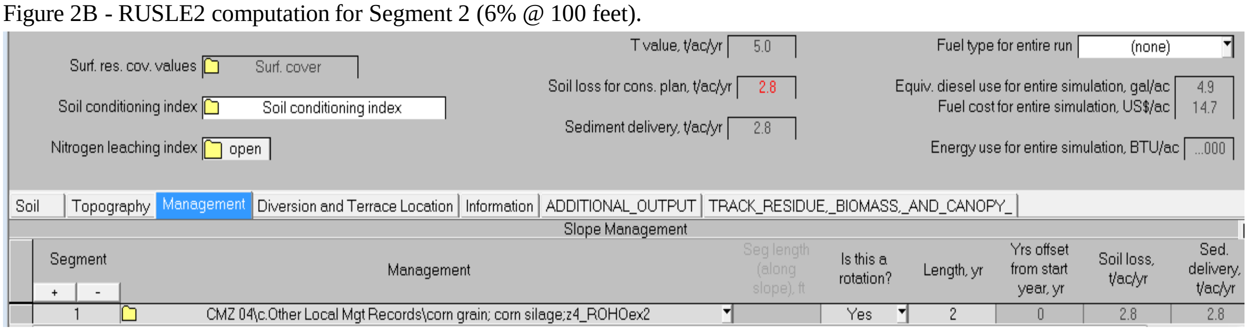


Figure 2C - RUSLE2 computation for Segment 3 (4% @ 150 feet).

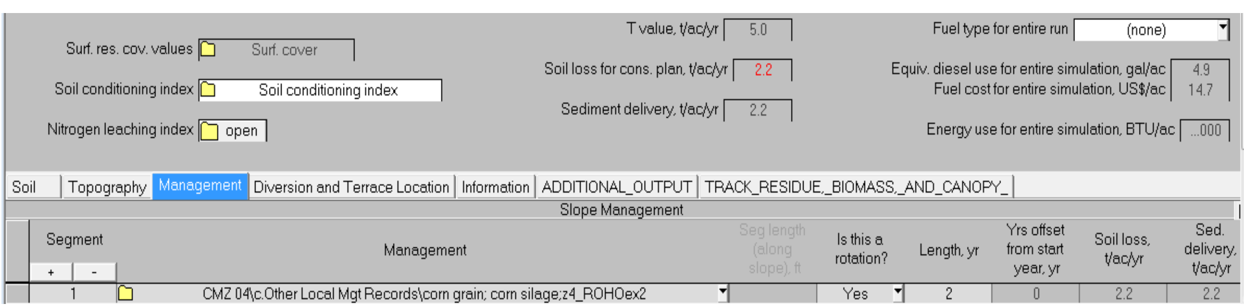
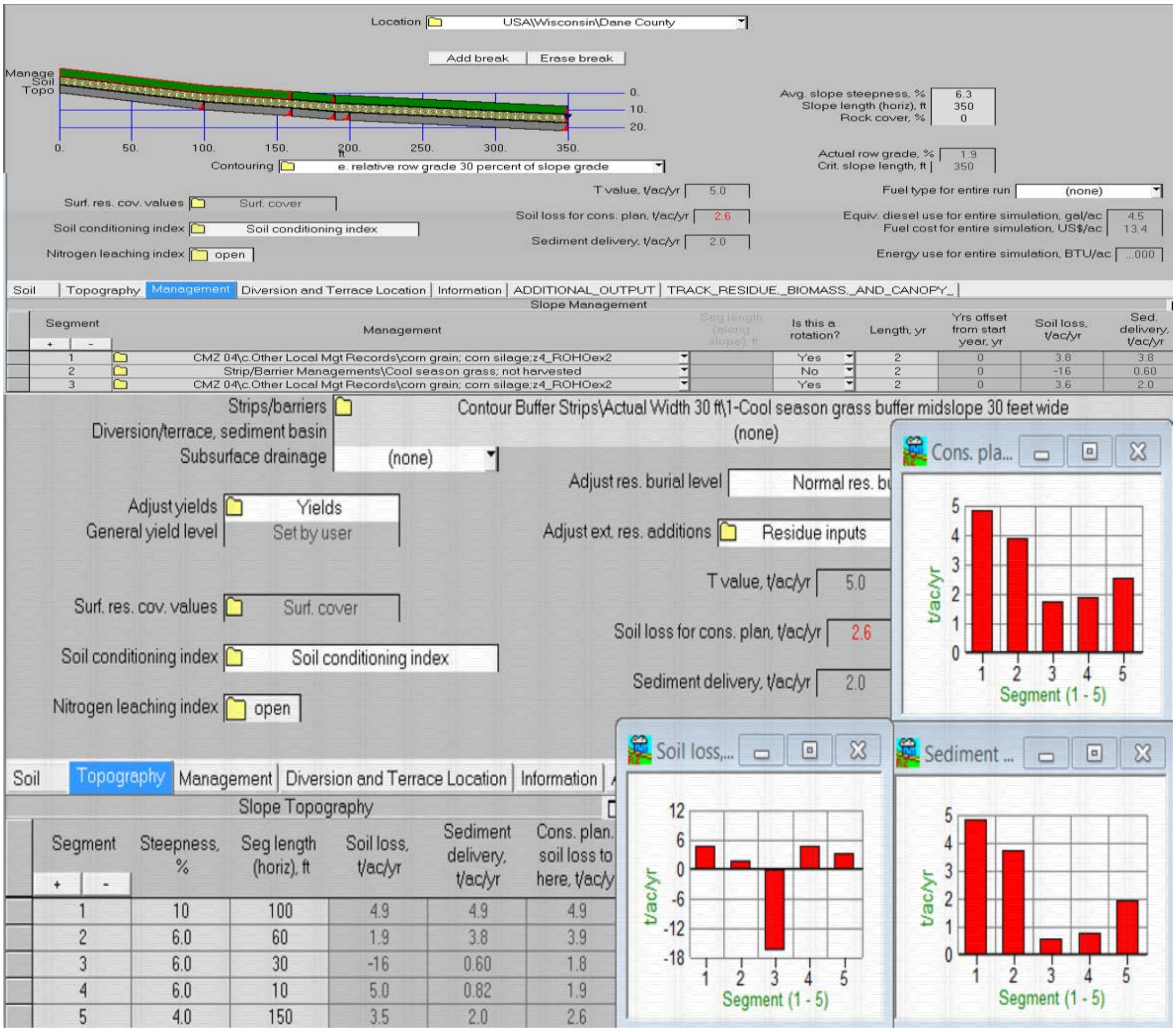
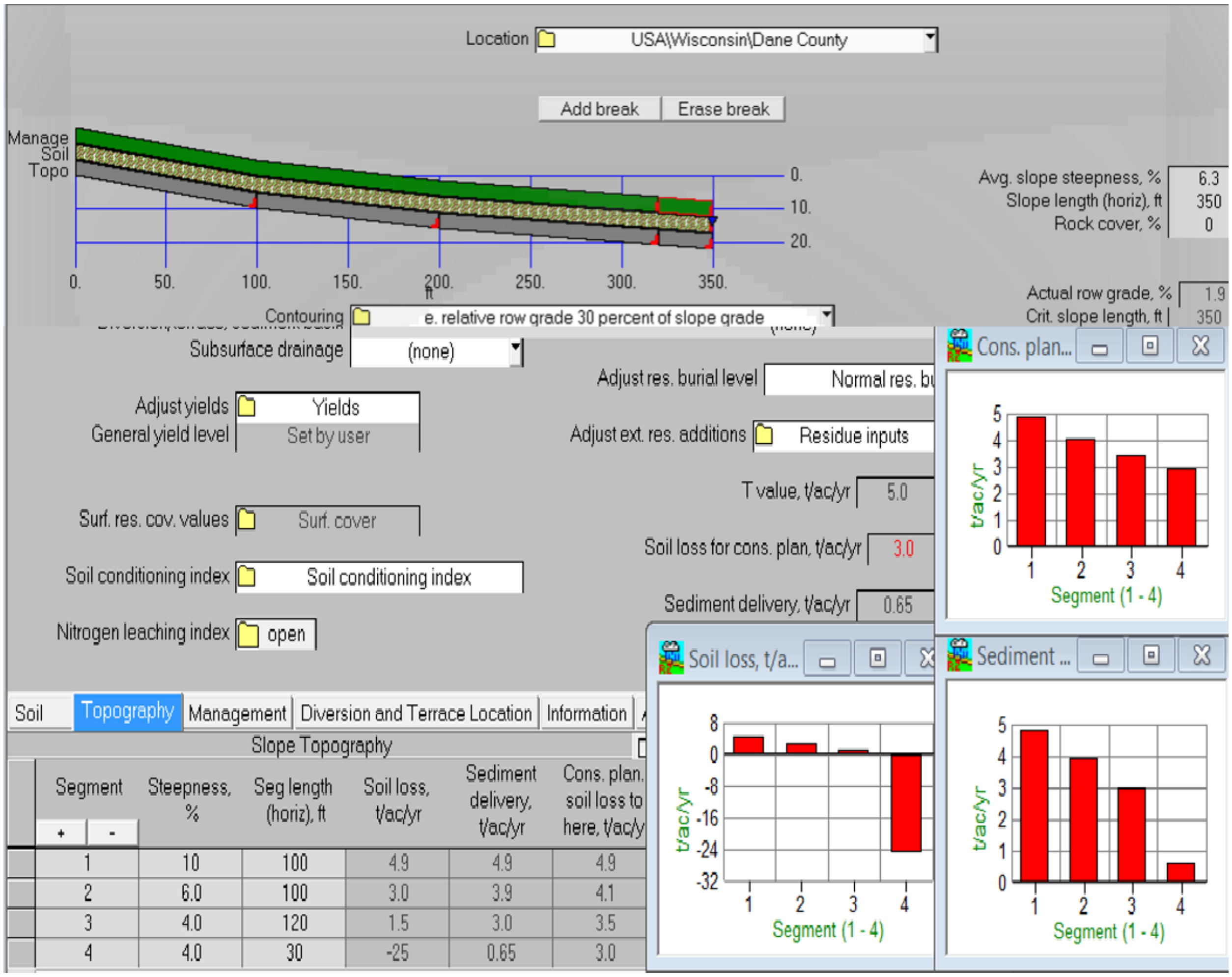


Figure 3 - RUSLE2 computation for sediment delivery at the end of “L” with a 30 foot VFS designed at the mid-point of “L”.



Slope topography consisting of 5 segments, including two additional segments as a result of the 30 foot VFS designed at the mid-point of "L.

Figure 3A 1RUSLE2 computation for sediment delivery to the end of "L" with a 30 foot (non-harvested) VFS designed at the bottom of "L" or 350 feet downslope.



Segment	Steepness, %	Seg length (horiz), ft	Soil loss, t/ac/yr	Sediment delivery, t/ac/yr	Cons. plan. soil loss to here, t/ac/y
1	10	100	4.9	4.9	4.9
2	6.0	100	3.0	3.9	4.1
3	4.0	120	1.5	3.0	3.5
4	4.0	30	-25	0.65	3.0

Multiple vegetative filter strips management files were developed to include various harvesting intervals. These management files include the following harvesting frequencies: 1) vegetation removed once per year, every other year, 2) vegetation removed once per year, 3) non-harvested VFS, 4) vegetation removed May 24th, July 7th and September 2nd per year, and 5) vegetation removed May 24th, July 7th and September 2nd every other year. These VFS management files are located in the crop management zone 1 and 4 templates in the c: folder of RUSLE2.

Calculate the ratio of "Contributing Area" (CA) to "VFS Area"

Figure 4 is a display of several "contributing areas" above the VFS that contributes sheet flow to the VFS.

NOTE: *Acres that reach the VFS as concentrated flow are excluded from the CA acres.*

The ratio can be calculated using the following method: (Ratio of C area to VFS area)

- Measure the CA that sheet flows VFS.
- Measure the area of the planned VFS.
- Divide the CA by the planned VFS— (20 acre CA / 0.8 acre VFS). The ratio of the CA to the VFS is 25:1.

VFSs are designed to have a minimum life span of ten (10) years. To maintain the VFS, the rate of sediment accumulation should not exceed 0.6 inches per year (Dillaha and Hayes). At this rate of accumulation, vegetation should be able to adjust and survive. When the accumulation reaches six (6) inches in depth, the VFS may require re-grading/shaping and reseeding.

Figure 4 - Example illustration showing the contribution area, VFS area, and ratio of contributing area to VFS area

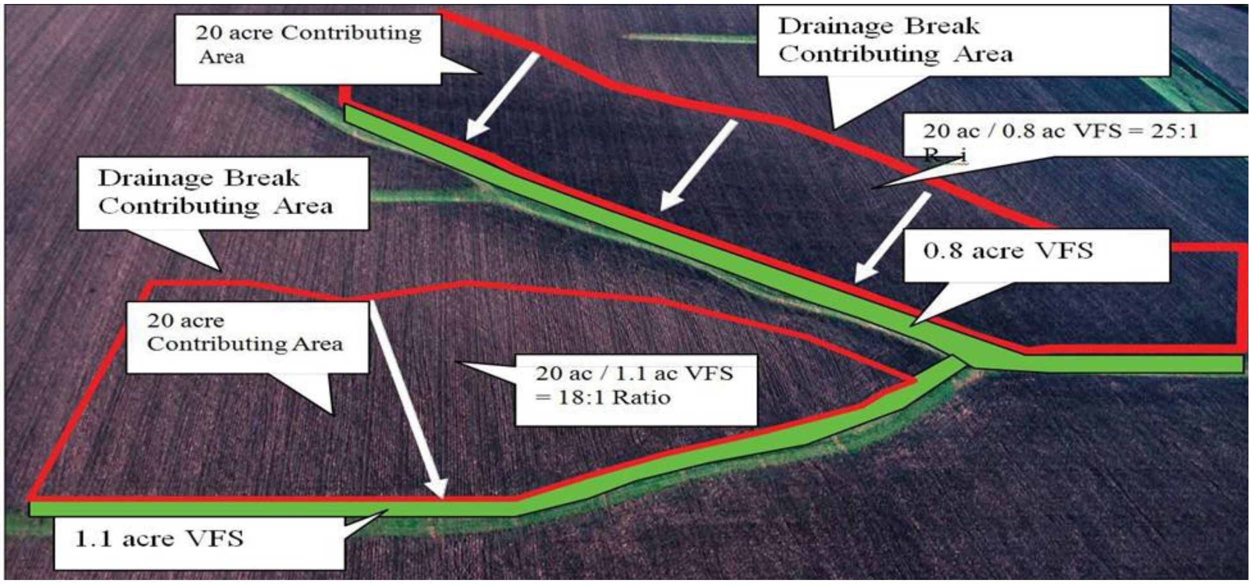


Exhibit 1 below, depicts the estimated time (in years) to accumulate six (6) inches of sediment in the VFS based on the following conditions: (1) sediment delivery rate to the VFS, (2) ratio of the CA to the VFS area, and (3) the trapping efficiency of the VFS. The shaded (yellow) cells display the number of years to accumulate 6 inches of sediment and verify the VFS 10 year projected life span criteria.

Exhibit 1 - Time to Accumulate Six Inches of Sediment in the VFS with a Trapping Efficiency of 75 Percent

Sed. Delivery Tons/Ac/Yr @ upper edge of VFS	Time (years) to accumulate 6 inches of sediment (in years) with a 75% trapping efficiency based on the contributing area to VFS ratio.						
	Ratio of Contributing Area to VFS						
	5:1	10:1	20:1	50:1	75:1	100:1	200:1
1.1	208.0	104.0	52.0	20.8	13.9	10.4	5.2
2.2	104.0	52.0	26.0	10.4	6.9	5.2	2.6
4.5	52.0	26.0	13.0	5.2	3.5	2.6	1.3

Note: *When the soil loss is 5 t/ac/yr. or less and the ratio of the CA to the VFS is 20:1 or less, time to accumulate 0.5 feet of sediment in the VFS will meet the 10-year lifespan criteria.*

Four Step Process to Determine the 10 year Life Span of the VFS

Below is the systematic procedure to determine the 10-year lifespan of the VFS using RUSLE2 input data results in fig. 3A. The following 4-step procedure can also be used to calculate the number of years to accumulate six (6) inches of sediment in the VFS. The weight of sediment, pounds per cubic feet and the number of cubic feet/ton will depend on the map unit soil texture in the CA, used in the RUSLE2 analysis. Below are estimated weights of sediment in pounds per cubic foot specific to soil texture:

- Organic soils—15 lbs./ft^3 and 133 ft^3/ton
- Silty soils—85-90 lbs./ft^3 (87) and 23 ft^3/ton
- Loamy soils—91-95 lbs./ft^3 (92) and 21.7 ft^3/ton
- Sandy soils—96-100 lbs./ft^3 (98) and 20 ft^3/ton
- Clayey soils—101-115 lbs./ft^3 (108) and 18.5 ft^3/ton

Sediment delivered to the VFS (t/ac/yr.) shall be converted to cubic feet/acre/year. The sediment delivered from the CA to the VFS using RUSLE2 is estimated at 3.0 t/ac/yr., to the interface of the upper edge of the filter strip and sediment delivered beyond the lower edge of the VFS is estimated at 0.70 t/ac/yr. The VFS is trapping an average of 2.3 t/ac/yr., and 0.70 t/ac/yr., will exit the VFS lower edge. The VFS trapping efficiency is the difference between sediment delivered to VFS and the sediment leaving or delivered beyond the VFS lower edge divided by the sediment delivered to the VFS. Use the steps below to determine the VFS lifespan for this example.

I. Sediment delivered to the VFS is 3.0 t/ac/yr. Convert t/ac/yr. to $ft.^3$/ac/yr. using the formula below:

   a. 3.0 t/ac/yr. X 21.7 ft^3/ton equates to 65.1 ft^3/ac/yr. The 21.7 is the number of ft^3 /ton of soil consisting of a loamy texture weighting 92 lbs. /ft^3.
   b. Sediment delivery to the VFS is 65.1 ft^3 /ac/yr.
   c. Sediment leaving the VFS is 0.70 t/ac/yr.
   d. Sediment trapped in the footprint of the VFS is 2.3 t/ac/yr.
   e. Trapping efficiency of 77%: 1) 3.0 t/ac/yr. minus 0.70 t/ac/yr. / 3.0 t/ac/yr., or 2) 2.3 t/ac/yr. / 3.0 t/ac/yr., multiplied by 100.
   f. Ratio of the 20 acre CA to the 0.8 acre VFS is 25 or 25 to 1.

II. Sediment Delivery in ft^3/ac/yr. X the Trapping Efficiency X the Ratio = ft^3 trapped in the VFS/ ac/yr.

   a. 65.1 ft^3 /ac/yr. x 0.77 x 25 = 1,253.2 ft^3 / ac/yr. in the VFS.

III. Cubic feet trapped in VFS/acre/yr. / 43,560 ft^2/ac. X 12 inches per foot = Accumulated depth (inches per year).

   a. [1,253.2 ft^3/ac/yr. / 43,560 ft^2 per acre] X 12 inches foot = 0.35 inches per year accumulates in the VFS.

IV. 6 inches (Maximum Accumulation) /Accumulated depth (inches/year) = Years to accumulate 6 inches.

   a. 6 inches per 10 years / 0.35 inches per year = 17.1 years to accumulate 6 inches of sediment in the VFS.

NOTE: *For this example, the VFS design is acceptable and the VFS will function as intended for a minimum of 10 years. When the VFS design will exceed the maximum annual sediment accumulation, resulting in the practice lifespan of less than 10 years , the planner shall consider the following options: 1) reduce the soil loss from the contributing area, and or increase the size of the VFS.*

An excel spreadsheet for determining the lifespan of the VFS is available for use to verify the number of years, the VFS is expected to function before sediment removal or re-grading is required (see exhibit 2). The spreadsheet allows actual values to be entered and reduces the need to manually perform calculations to determine trapping efficiency and the ratio of contributing area to the VFS area.

Exhibit 2 - Four Step Process to Determine the VFS Life Span

Step 1. Enter Sediment Delivery in t/ac/yr calculated from RUSLE2
Step 2. Enter the Measured "Contributing Areas" for the VFS
Step 3. Enter the Area (in Acres) of the VFS
Step 4. Enter the Sediment Leaving the "downslope" side of the VFS calculated from RUSLE2

Step 1	Step 2	Step 3	Step 4	Calculated	Calculated	Calculated	Calculated	Calculated
Sed. Delivery to VFS (t/ac/yr)	Contibuting Area (ac)	VFS (ac)	Sed. Leaving VFS (t/ac/yr)	Trapping Efficiency %	Sed.In VFS (Ft^3/Yr)	Sed. Depth (in.) Accum/yr in VFS	Years to Accum 0.5 Ft.	Meets 10 yr Life Span
3	20	0.8	0.65	78%	1277	0.352	17.1	YES

Note: *The input data for Step 1 and 4 are computations of output data using the RUSLE2 program (see fig. 3A). Compare the computations using the excel spreadsheet and the example computations on the previous page. The attached spreadsheet is available to verify the 10 yr. lifespan requirement.*

Worksheet in H 2
Work Tech Notes FY 2

APPENDIX 3 "USING SNAP-PLUS AND THE WINDOWS PESTICIDE SCREENING TOOLS TO ASSESS THE MOVEMENT OF SUSPENDED SOLIDS IN SURFACE RUNOFF AND TO ASSESS THE LEACHING OF DISSOLVED CONTAMINANTS TO GROUNDWATER"

Using the Snap-Plus Nutrient Management Planning Tool to Assess the Movement of Suspended Solids in Surface Runoff and Assess the Leaching of Dissolved Contaminants to Groundwater

Soil Nutrient Application Planner (Snap Plus) is Wisconsin's nutrient management planning software program that helps farmers make the best use of their on-farm nutrients, and justification of commercial fertilizer purchases. The planning tool can compute the potential soil and phosphorus runoff losses on a field-by-field basis. SNAP+ can predict the following:

1) Average rotational and annual phosphorus index (particulate P and dissolved P) losses
2) Average rotational and annual soil losses.

Snap Plus can be used to assess and design VFS under the following conditions:

Criteria for designing VFS using Snap Plus

- The VFS shall have a 10-year lifespan for sediment deposition determined from RUSLE2 output data.
- A minimum 20 ft. width for reducing or minimizing contaminated suspended solids in runoff.
- A minimum of 30 ft. width for reducing or minimizing dissolved contaminants in runoff.

  NOTE: *In the section - criteria for VFS design width, all specifications must comply.*

Using the Windows Pesticide Screening Tool (WIN-PST) to Assess the Movement of Suspended Solids in Surface Runoff and Assess the Leaching of Dissolved Contaminants to Groundwater

WIN-PST is the NRCS supported technical tool that is used to assess relative pesticide leaching, solution runoff, and sediment adsorbed runoff risk to water quality and non-targeted organisms. W I N - P S T analysis of pesticide impacts on water quality are divided into four separate pesticide loss pathways: leaching, solution runoff, adsorbed runoff, and drift.

NOTE: *Technical Note 10 is design to minimize the movement of dissolve pollutants (nitrogen, phosphorus, pesticides and other identified dissolved contaminants) in water by the three pathways identified below:*

1. *Water percolating below the root zone.*
2. *Surface water consisting of dissolved constituents leaving the field edge.*
3. *Sediment leaving the field edge in solution runoff.*

WIN-PST analysis is based on soil properties, pesticide physical properties, pesticide toxicity data, broadcast/banded/spot treatment (area treated), surface-applied/incorporated/foliar (application method), standard/low rate/ultra-low rate (amounts), and humid/dry (irrigated or non-irrigated).

The WIN-PST output data will not provide quantitative computations, only qualitative information for analyzing and assessing the resource conditions.

Conducting a WIN-PST Analysis

Step 1: Choose all the major soil types for the field or planning area (generally those that cover 10 percent or more of the area).

Step 2: Choose all the pesticides that the client is planning to use.

NOTE: *Each pesticide can be chosen by product name, EPA registration number, or active ingredient name. The final ratings are specific to each active ingredient.*

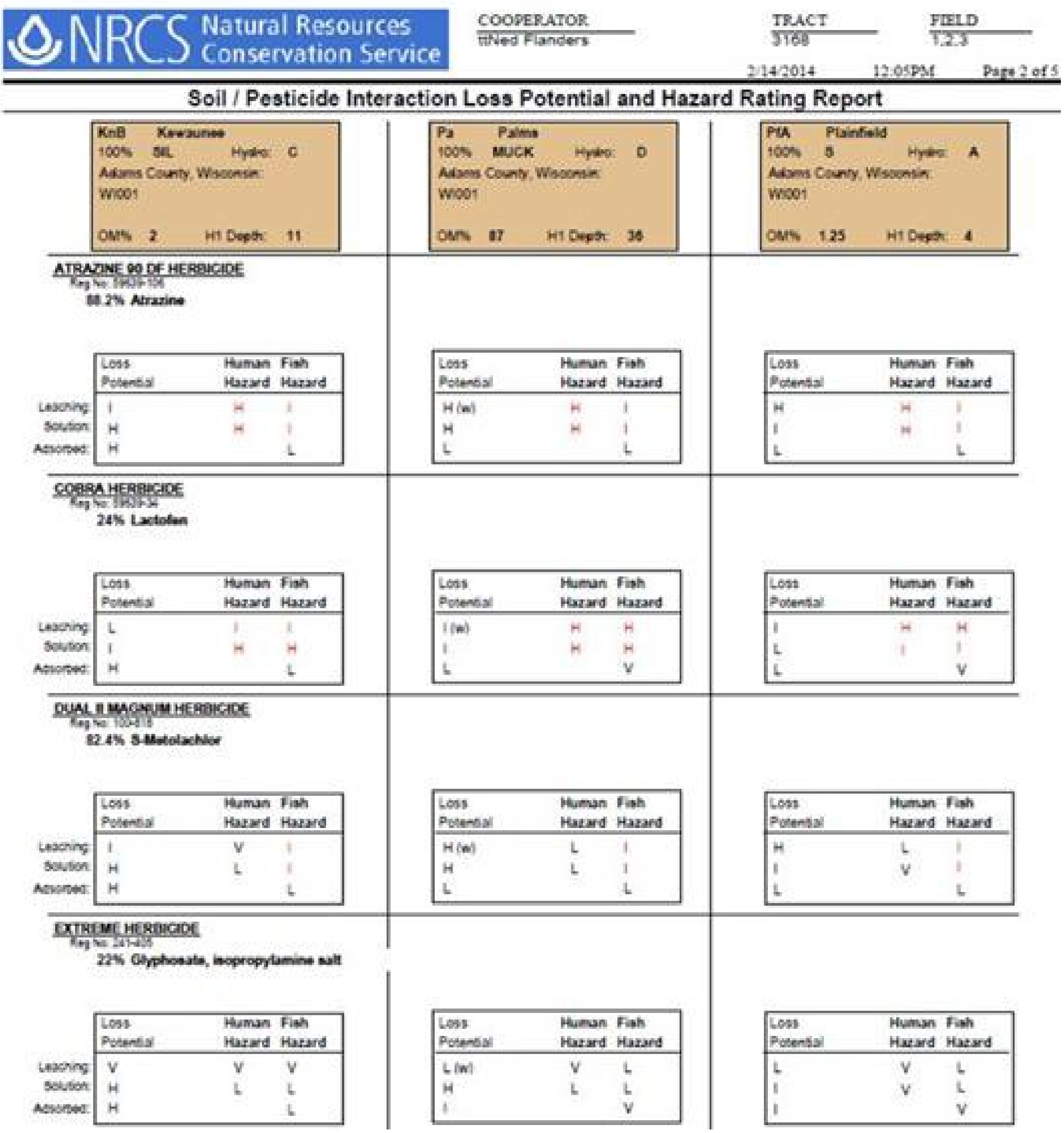
Step 3: Analyze the results for each soil/pesticide interaction.

Step 4: Select the highest hazard rating for the soil/pesticide combination to identify all resource concerns (leaching, dissolved contaminants and sediment in solution runoff. The final WIN-PST Soil/Pesticide Interaction Hazard ratings retrieved via WIN-PST analysis are: Very Low (VL), Low (L), Intermediate (I), High (H), and Extra High (X). Intermediate and higher is an indication that a pesticide is most likely to move with solution runoff or leach to groundwater. The planner should refer to Appendix 1 for additional information when assessing the need for implementation of VFSs.

NOTE: *The rating may be used to justify the need for a VFS. The planner should use WIN-PST to adjust* *management activities such as reduce rates, band applications, or the use of alternative products, to enhance the functionality of the VFS.*

WIN-PST can be accessed and downloaded at the following website: http://www.nrcs.usda.gov/wps/portal/nrcs/main/wi/technical/cp/. The Wisconsin WIN-PST soils database for use with WIN-PST can be accessed and downloaded at the following website: http://websoilsurvey.nrcs.usda.gov/. Refer to Wisconsin Agronomy Technical Note 2 - Companion Document to WI-Practice Standard 595 Integrated Pest Management for additional information. This companion document can be located at the following location: http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_019954.pdf

Figure 5 – Example WIN-PST assessment.



NRCS Natural Resources Conservation Service

COOPERATOR: ttNed Flanders | TRACT: 3168 | FIELD: 1,2,3

2/14/2014 12:05PM Page 2 of 5

Soil / Pesticide Interaction Loss Potential and Hazard Rating Report

KnB Kawaunee	Pa Palms	PfA Plainfield
100% SIL Hydro: C	100% MUCK Hydro: D	100% S Hydro: A
Adams County, Wisconsin:	Adams County, Wisconsin:	Adams County, Wisconsin:
WI001	WI001	WI001
OM% 2 H1 Depth: 11	OM% 87 H1 Depth: 36	OM% 1.25 H1 Depth: 4

ATRAZINE 90 DF HERBICIDE
Reg No: 59639-108
88.2% Atrazine

	KnB Loss Potential	KnB Human Hazard	KnB Fish Hazard	Pa Loss Potential	Pa Human Hazard	Pa Fish Hazard	PfA Loss Potential	PfA Human Hazard	PfA Fish Hazard
Leaching:	I	H	I	H (w)	H	I	H	H	I
Solution:	H	H	I	H	H	I	I	H	I
Adsorbed:	H		L	L		L	L		L

COBRA HERBICIDE
Reg No: 59639-34
24% Lactofen

	KnB Loss Potential	KnB Human Hazard	KnB Fish Hazard	Pa Loss Potential	Pa Human Hazard	Pa Fish Hazard	PfA Loss Potential	PfA Human Hazard	PfA Fish Hazard
Leaching:	L	I	I	I (w)	H	H	I	H	H
Solution:	I	H	H	I	H	H	L	I	I
Adsorbed:	H		L	L		V	L		V

DUAL II MAGNUM HERBICIDE
Reg No: 100-818
82.4% S-Metolachlor

	KnB Loss Potential	KnB Human Hazard	KnB Fish Hazard	Pa Loss Potential	Pa Human Hazard	Pa Fish Hazard	PfA Loss Potential	PfA Human Hazard	PfA Fish Hazard
Leaching:	I	V	I	H (w)	L	I	H	L	I
Solution:	H	L	I	H	L	I	I	V	I
Adsorbed:	H		L	L		L	L		L

EXTREME HERBICIDE
Reg No: 241-405
22% Glyphosate, isopropylamine salt

	KnB Loss Potential	KnB Human Hazard	KnB Fish Hazard	Pa Loss Potential	Pa Human Hazard	Pa Fish Hazard	PfA Loss Potential	PfA Human Hazard	PfA Fish Hazard
Leaching:	V	V	V	L (w)	V	L	L	V	L
Solution:	H	L	L	H	L	L	I	V	L
Adsorbed:	H		L	I		V	I		V

APPENDIX 4 "SITE ASSESSMENT REQUIREMENTS AND SITE ASSESSMENT DOCUMENTATION WORKSHEET"

The site assessment is an onsite inventory and evaluation, required by WI-Practice Standard 393 Filter Strip (V.A.5.) of natural (physical, chemical, and biological characteristics), man-made features, and the client's management activities. This worksheet and Job Sheet 393 are used to document details that assure the Filter Strip will be effective in reducing sediment and suspended pollutants for the length of the practice.

Contributing Area (CA):

1. Dominant soil texture and average land slope in the contributing area.
2. Average slope within 300 ft. of the VFS.
3. Percentage of the CA consisting of frequently flooded soils.
4. Acres of the CA flowing through the VFS.
5. Acres of the CA entering the VFS as concentrated flow (identified on plan map) and overland sheet flow.
6. Average Soil Loss in the CA and within 300 ft. of the VFS. Identified ephemeral and gully erosion areas on the plan map. These sites shall be addressed.
7. Verification that CA is being farmed at or below tolerable soil loss and there are no concentrated flow channels contributing to the runoff loads.

Vegetated Filter Strip (VFS):

1. Site preparation, seeding mix and establishment criteria follows NRCS standards.
2. Pesticides and nutrients used for crop production in the CA are taken into consideration.
3. Average slope within 100 feet upstream of the low edge of the VFS.
4. Average slope from 100-300 feet upstream of the low edge of the VFS.

Environmentally Sensitive Area (ESA):

1. Identification of the ESA.
2. Existing area of protection (buffer) contiguous to the ESA.
3. Distance of the ESA from the low edge of the planned VFS.

For a printout of the worksheet, refer to Exhibit A. The worksheet can be used to document the data collected.

*Hydrologic Soil Group – The hydrologic soil group is a classification or rating assigned to each soil map unit based on estimates of runoff potential or the minimum rate of infiltration obtained for a bare soil, after prolonged wetting. Each soil is assigned to one of four groups (A, B, C, D) according to the rate of water infiltration. Below are the group descriptions:

Group - A soils have low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of sands and gravels that are deep, well drained to excessively drained, and have a high rate of water transmission (greater than 0.30 in/hr.).

Group - B soils have moderate infiltration rates when thoroughly wetted and consist chiefly of soils that are moderately deep to deep, moderately well drained to well drained, and have moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission (0.15 to 0.30 in/hr.).

Group - C soils have low infiltration rates when thoroughly wetted and consist chiefly of soils having a layer that impedes downward movement of water and consist chiefly of soils with moderately fine-to-fine textures. These soils have a slow rate of water transmission (0.05 to 0.15 in/hr.).

Group - D soils have high runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, permanent high water table, clay pan or clay layer at or near the surface, and may have shallow soils over nearly impervious material. These soils have a very low rate of water transmission (0 to 1.5 in/hr.).

This information can be found at: http://websoilsurvey.nrcs.usda.gov/.

*Soil Map Unit Flooding Frequency - Flooding frequency is the probability of temporary covering of the soil surface by flowing water from any source, such as streams overflowing their banks, runoff from adjacent or surrounding slopes, or any combination of sources. The occurrence of flooding is described in one of six categories below:

1. None - No reasonable possibility of flooding; one of 500 probability of flooding in any year or less than 1 time in 500 years.
2. Very Rare - Flooding is very unlikely but is possible under extremely, unusual weather conditions; less than a 1 percent chance of flooding in any year or less than 1 time in 100 years, but more than 1 time in 500 years.
3. Rare - Flooding is unlikely, but is possible under unusual weather conditions; 1 to 5 percent chance of flooding in any year or

nearly 1 to 5 times in 100 years.

4. Occasional - Flooding is expected infrequently under usual weather conditions; 5 to 50 percent chance of flooding in any year or 5 to 50 times in 100 years.
5. Frequent - Flooding is likely to occur often under usual weather conditions, more than a 50 percent chance of flooding in any year, 50 times in 100 years, but less than a 50 percent chance of flooding in all months in any year.
6. Very Frequent - Flooding is likely to occur very often under usual weather conditions, more than a 50 percent chance of flooding in all months of any year.

Management and Maintenance of Vegetative Filter Strips

This section will address key management and maintenance activities identified in the filter strip standard.

Filter Strip Inspections

- The VFS should be inspected after intense storm events.
- Sediment deposits at the interface of the filter strip will require more intense maintenance as compared to the low edge or exit area of the VFS.
- Any development of rills and gullies upstream and within the filter strip must be minimized and immediately repaired.
- Remove unevenly deposits of sediment accumulation that will disrupt sheet flow and re-seed disturbed areas

Grazing and Mechanical Harvesting of VFS Biomass

Consistent removal of biomass will result in improved water quality by exporting nutrients deposited in the VFS. The harvesting of plant materials should show a substantial reduction in phosphorus and other nutrients in the soil profile. Critical to the functioning of the VFS is the availability of living plant biomass to retard the flow of runoff from the contributing area, when the probability of runoff events are high. Caution is required when managing the filter strip nutrient loading by harvesting the plant material either mechanically or grazing critical runoff periods. Below is criteria and guidance to minimize offsite movement of dissolved and particulate pollutants when harvesting biomass in the VFS:

- Greater than 50% of the seed mixture consists of grass species.
- Vegetation cannot be harvested or removed consistently until planned vegetation is well established (12 - 16 plants per square foot).
- Introduced species shall not be cut shorter than 4 inches and native species shall not be cut shorter than 7 inches.
- Filter strips shall not have the biomass removed mechanically before May 20th or after September 15th for introduced species and no later than September 1st for native species.

Prescribed Grazing Mitigation Requirements

When grazing vegetative filter strips, an approved grazing plan shall comply with the criteria of WI-Practice Standard 528 Prescribed Grazing and include a grazing system that allows quick, intensive foraging under good soil conditions. Implement the following prescribed grazing techniques and requirements:

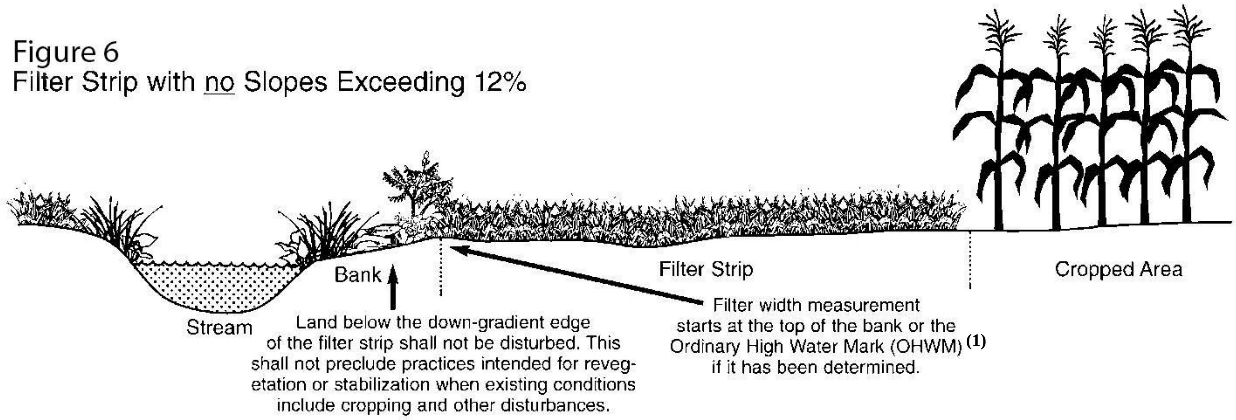
- Continuous grazing system is not allowed.
- Livestock is not allowed when soil is wet.
- Livestock must be excluded from the environmentally sensitive areas.
- Defer 1/3 of the filter strip acres from grazing during the nesting/fawning season each year.
- Grazing shall not occur after September 15th to allow regrowth.

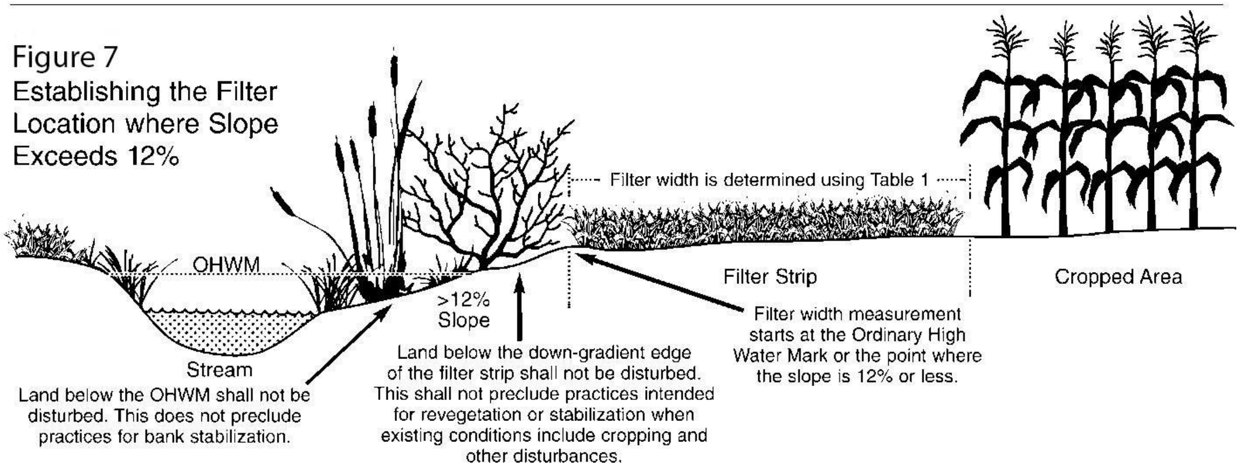
Wildlife Mitigation Requirements

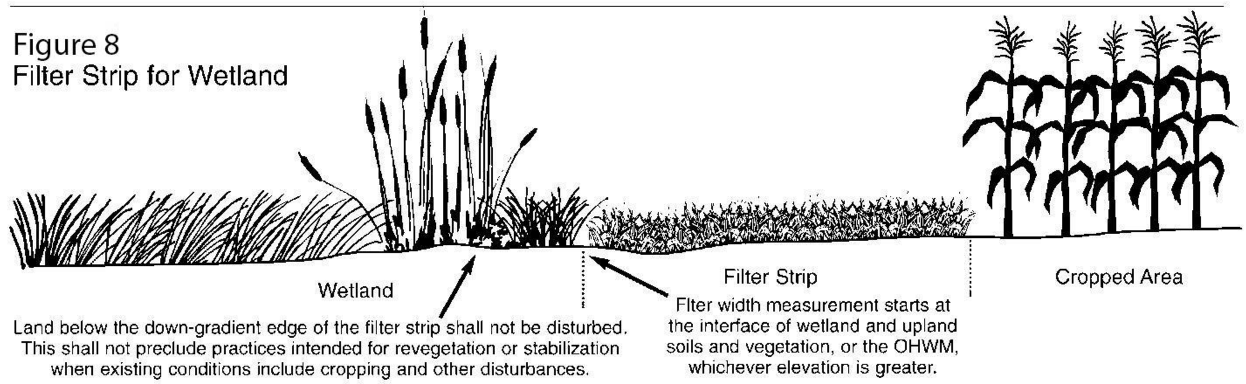
Implement the following guidance and wildlife mitigation techniques when harvesting biomass in the VFS during the primary nesting season (05-15 through 08-01):

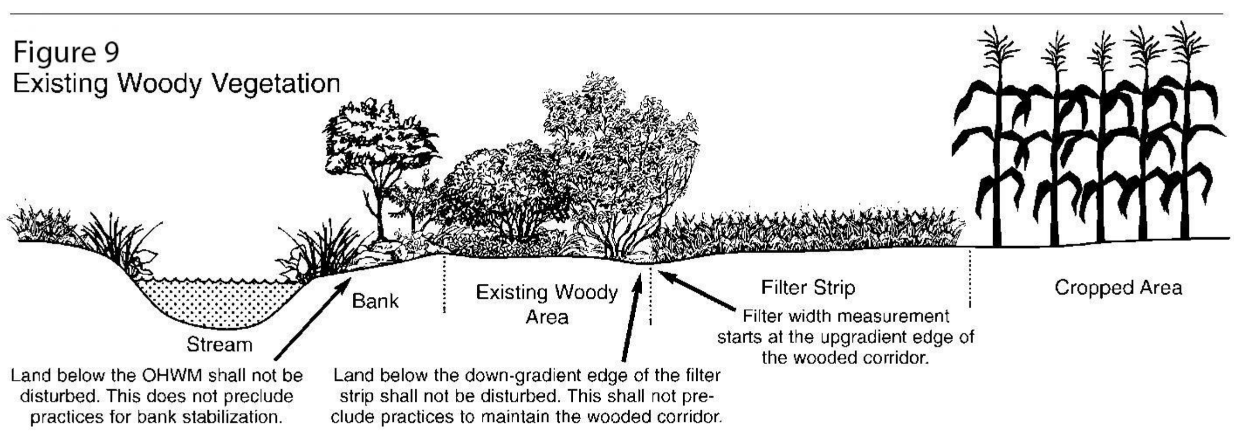
I. Deferred harvesting - Apply and maintain a. or b of the following management activities to minimize the loss of wildlife species:
    a. Do not cut vegetation on at least 1/3 of the acres each year. Idle strips or blocks should be at least 30 feet wide.
    b. For at least 1/3 of the acreage, harvesting of vegetation should be either before and/or after the primary nesting season (May 15th – August 2nd).

Figure 6, 7, 8 and 9 – Filter Strip Variations



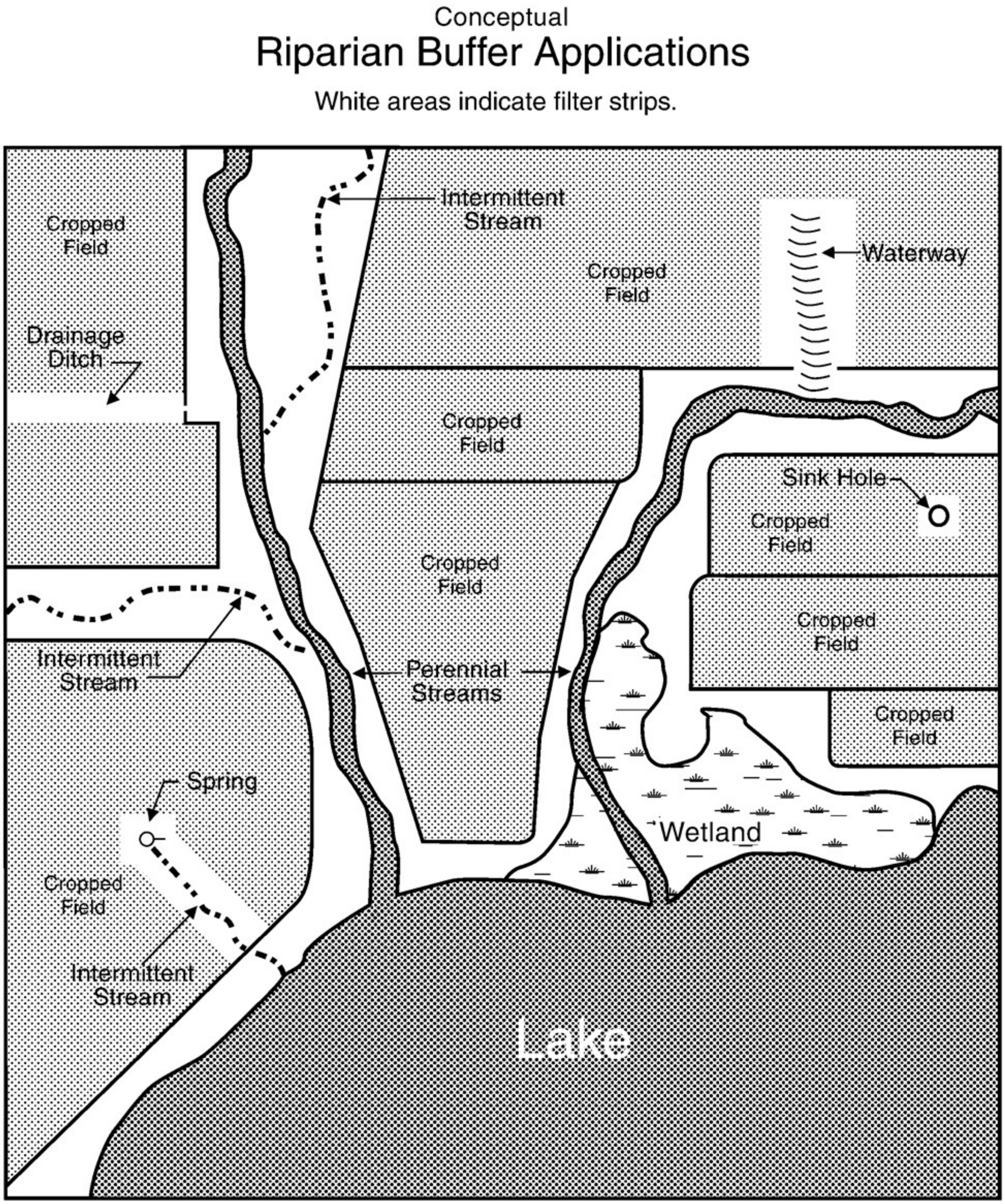






(1) The ordinary high-water mark (OHWM) is the point on the bank or shore up to which the presence and action of water is so continuous as to leave a distinct mark, either by erosion, destruction of terrestrial vegetation, or other easily recognized characteristic.

Figure 10 – Riparian Buffer Applications



WI – PRACTICE STANDARD 393 FILTER STRIP - SITE ASSESSMENT DOCUMENTATION WORKSHEET FOR PLANNING AND DESIGN OF VEGETATIVE FILTER STRIPS

Document the following Criteria and Specifications for the Contributing Area (CA), Vegetated Filter Strip (VFS) and Environmentally Sensitive Area (ESA).

CA DOCUMENTATION:

CA drainage acres:	
CA free of untreated concentrated flow channels (locate on plan map):	
Dominant soil texture and average land slope in the CA:	
Dominant slope within 100 feet upstream of the VFS:	
Average soil loss in the CA and within 300 feet of the VFS:	
Average slope within 300 feet of the VFS:	
Percentage of the CA consisting of frequently flooded soils:	
Dominant Hydrological Soil Group in the VFS footprint:	
Verify that the site is not frequently inundated with water; and large loads of sediment are not frequently deposited in the VFS, resulting in the failure of the VFS:	

Seeding Design:

1. Perennial vegetation selected is suitable for the soil moisture regime: Y N

2. Soil test results and/or soil amendment recommendations support planned vegetation selected for use, where applicable: Y N

   Legumes that are used in the VFS, soil test verify the proper pH for maximum growth and survivability of the legume specie: Y N

3. Any concerns with Proximity of VFS to natural plant communities: Y N
   Natural communities, such as remnant prairies, located within ¼ mile of the planned VFS, if so, use of local genotypes is the first preference, when applicable and be certain to not use invasive cover choices.

4. Pesticides concerns within the CA: Y N

1. If VFS is continuous or within 700 feet of ESA Y N

2. RUSLE2 shows the VFS life span is ten years or more. Y N

Direct Contributing	Factor Points
4. Hydrologic Soil Group	
☐ A	0
☐ B	10
☐ C	20
☐ D	30
5. Average slope within 100 feet upstream of the low edge of the filter	
☐ 0-1%	0
☐ >1-	5
☐ >3-	15
☐ >6-	30
6. Average slope from 100 - 300 feet upstream of the low edge of the filter	
☐ 0-1%	0
☐ >1-	5
☐ >3-	10
☐ >6-	15
☐ >12	20

Total Point Range	Minimum Filter Strip Width for Sediment Trapping[1]	Minimum Filter Strip Width for Dissolved Contaminants[1,2]
0-10	20 Feet	70 Feet
15-20	30 Feet	70 Feet
25-30	40 Feet	70 Feet
35	50 Feet	80 Feet
40	60 Feet	80 Feet
45	70 Feet	90 Feet
50	80 Feet	100 Feet
>50	100 Feet	120 Feet

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