Cottonwood Creek
Preliminary Assessment

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Introduction

Purpose – to describe the current condition of Cottonwood Creek

With guidance and financial assistance from the Natural Resource Conservation Service (NRCS), ranch owners in the Cottonwood Creek watershed, a tributary to the Upper Clark Fork of the Columbia River, will be implementing land and water conservation strategies and stream restoration projects in the summer of 2001. These strategies and projects include grazing management plans, removal of water gaps along the creek, and planting of riparian vegetation. The NRCS will be receiving some funds from the Environmental Quality Incentives Program to assist the landowners in carrying out their projects.

There is limited information on the current health of the Cottonwood Creek. It is the purpose of this study to assess the current health and characterize the landscape of Cottonwood Creek. The information gathered in this study can then be used to assess the benefits of the conservation and restoration activities.

Background on EQIP

The Environmental Quality Incentives Program (EQIP) was established in the 1996 Farm Bill. EQIP is designed to provide technical, monetary and educational assistance to ranchers and farmers who wish to address soil erosion, water quality and related natural resource concerns. Fifty percent of the money in the EQIP fund goes toward livestock-related conservation practices. The conservation and restoration projects in this study are partially funded by EQIP, which provides up to a 75% cost share. In addition, all work perform under EQIP is done on a voluntary basis.

Overview of approach/objectives

The objectives of this study include:

1. To assess the current condition ("health") of Cottonwood Creek's riparian areas.

2. To provide baseline data needed to evaluate the benefits of conservation and restoration projects.

3. To gather information about the current and historical land-uses in the Cottonwood Creek Watershed.

4. To make recommendations on a landowner monitoring system.

As a result of time limits, the health assessment component of this study focused on the lower section of the creek's watershed. This is the portion of the creek in which the conservation and restoration projects will be implemented. The health assessment was done using the University of Montana's Riparian and Wetland Research Program's Lotic Inventory Form. Information about the current and historical land-uses was gathered on a watershed scale.

Organization of Report

First, this paper will discuss the study design and approach used to gather information about Cottonwood Creek. Second, it will present and discuss the findings of field work and information gathering. Third, the paper will provide comments on the creek's use support, the probable value of conservation efforts, and other areas of concern for the watershed. Lastly, the paper will make recommendations for further study and fot the components of a landowner monitoring system.

Study Design and Approach

To characterize the watershed of Cottonwood Creek, six graduate students from the University of Montana's Environmental Studies Watershed Heath Clinic gathered information from existing sources and collected field data during 6 weeks in the fall of 2000.

Existing sources of data

Information about the planned conservation and restoration projects was gathered from Susan Sakay of the NRCS. In addition, Ms. Sakay supplied aerial photographs, U.S.G.S. topographic maps, and soil maps of the watershed. Aerial photographs were used to divide the study area into relatively homogenous sub-areas (polygons) which were then assessed. Aerial and topographic maps aided in classifying the creeks using the Rosgen (1996) method. A Rosgen classification was determined because the system is recognized throughout the land management community. The soil maps provided information on the general soil make up of the riparian assessment area.

Information about climate, geology and historical landuse in the watershed was researched at the William K Kohrs Library in Deer Lodge, MT.

Additional information on current landuse and topographic maps was gathered from the Montana State Library's National Resource Inventory Service (NRIS) web page, http://www.nris.state.mt.us. The information gathered from NRIS was in digital format compatible with the geographic information system program ArcView. Information downloaded from the NRIS web site included digital topographic maps, current landuse, streams, and state political boundaries. This information, along with field data, was used to generate maps of the watershed using ArcView GIS.

Field work data

Riparian condition assessments were conducted along the creek using the University of Montana's Riparian and Wetland Research Program's (RWRP) Lotic Health Assessment Field Sheet. Description of this protocol and examples of the field sheets are available on their web site. A copy of the assessment form used is also in Appendix F. This assessment system was chosen because it has been tested in many Northern Rockies states and Canada since 1992 (Thompson et al. 1998). Also, it has been designed to be relatively quick to complete and to be used as a rough filter to identify sites that need further attention.

In addition to the RWRP's assessment method, information about the riparian area was gathered using the Montana Department of Environmental Quality's (DEQ) Stream Reach Assessment Field Form. Description of this protocol and examples of the field sheets are also available online. A copy of this assessment form is also in Appendix G. This assessment method was compared to the RWRP assessment method. These two methods are similar in their focus on riparian habitat but differ somewhat in what they assess and how they score each area. Table 1 lists the factors assessed by each method.

Table 1 – factors assessed by RWRP and DEQ	
RWRP	
1. Vegetative Cover of Floodplain and Stream Banks	
2. Invasive Plant Species	
3. Disturbance-increaser Undesirable Herbaceous Species	
4. Preferred Tree and Shrub Establishment and Regeneration	
5. Utilization of Preferred Trees and Shrubs	
6. Standing Decadent and Dead Woody Material	
7. Streambank Root Mass Protection	
8. Human-Cause Bare Ground	
9. Streambank Structurally Altered by Human Activity	
10. Pugging and/or hummocking	
11. Stream Channel Incisement (vertical stability)	
DEQ	
1. Average width of riparian zone	
2. Completeness of vegetation in the riparian zone	
3. Characteristics of the Riparian vegetation	
4. Width/Depth Ratio	
5. Channel stability/bar formation	
6. Bank erosion	
7. Stream bottom	
8. Riffle/pool spacing and characteristics	
9. Aquatic plant growth	
10. Turbidity	
11. Water surface oils	
12. Material other than sediment on channel bottom	
13. Stalinization	
14. Water Odor	
15. Dewatering	
16. Amount of fish cover	

Time constraints restricted our riparian assessments to the parts of Cottonwood Creek and Reese Anderson Creek that included NRCS conservation and restoration projects.

Both assessment methods divide the riparian area into polygons (homogenous sub-units) then assess each separately. Our study area was divided into a total of 15 polygons, 11 on Cottonwood Creek and 4 on Reese Anderson Creek. (See Appendix D for polygon map) The DEQ assessment method only applies to second, third and fourth order streams, therefore does not apply to Reese Anderson Creek (a first order stream).

Upstream and downstream boundaries of each polygon were recorded using a Magellan 315 GPS unit. This was done so that the locations can be found in the future. In addition, these points were downloaded into the program Map Site 2.0. The points were then transferred to ArcView GIS, and maps were created showing the location of the polygons. The GIS information from the NRIS web site was used as a base map.

Our sites were photo documented using a Olympus Digital Camera D-460 Zoom, 1.3 Megapixel. Photographs were taken looking upstream and downstream at the boundaries between each polygon.

Stream cross sections were measured at about the middle of each polygon, and locations recorded using the Magellan 315 GPS unit. Measurements taken at these locations include bank full width and depth and base flow width and depth. Depth was measured once every meter along the stream cross section. The measurements were taken to calculate a width to depth ratio along the stream. Rosgen (1996) states that a measurement of the width to depth ratio is one of the basic assessment measures of a stream channel's condition. However, these measurements were only taken on Cottonwood Creek and the one polygon assessed on Baggs Creek. Reese Anderson Creek has a restricted flow because of a dam in its upper reaches and was just a trickle at the time of measurement. However, Reese Anderson Creek was visually assessed for downcutting in the RWRP and DEQ assessment methods.

Stream discharge was measured using a standard Price Pygmy Meter at four locations along Cottonwood Creek. (See map in Appendix C) The six-tenths method was used to calculate discharges. That is, flow was measured 6/10 of the way from the water surface to the stream bed because this is the point in the water column that usually exhibits average water velocities. Measurements were taken at three locations on October 20th. After discussing the first set of measurements, we decided to add a sample point farther upstream on November 3rd and drop one of the previously sampled locations. Discharge measurements were taken to determine whether the creek was gaining or losing water.

Findings and Discussion

Creek Description

Cottonwood Creek, located in Powell County, MT, is a tributary to the upper Clark Fork of the Columbia River (see maps, appendix B and C). Cottonwood Creek joins the Clark Fork River at the northern edge of the town of Deer Lodge, Montana. The headwaters of Cottonwood Creek are in the Beaverhead – Deerlodge National Forest east of Deer Lodge. In the national forest, the creek has three branches, south, middle and north branches. Down on the valley floor Cottonwood Creek has two tributaries, Baggs Creek and Reese Anderson Creek. These two creeks join Cottonwood Creek in the ranch land east of Deer Lodge. In total, the watershed drains about 42.8 square miles of land.

Natural history – climate, soils, hydrology, vegetation

The Cottonwood Creek watershed is in a semiarid environment. The average annual precipitation is 12 to 14 inches, half of which falls during the months of May, June, and July (Nimick et al. 1993).

The watershed includes mountains terrain dropping to a valley underlain by Tertiary and Quaternary sedimentary deposits. The groundwater in the valley is shallow, has a high flow rate and a high infiltration rate. Transmissivity of alluvium in the watershed is 970 feet squared per day and in bedrock 130 feet squared per day. The median well depth in the area is 37 feet, with few wells deeper than 70 feet. (Nimick et al. 1993)

We focused on the soil of the lower watershed floodplain. Most soils in this area are loam types. Much of the soil is alluvium and is more than 60 inches deep, resulting in thick deposits. The range of water capacity for the soils in the riparian area is 5.05 to 6.2 inches. Soil slopes range from 0 to 8% in the floodplain and 8 to 15% along the riparian edge. A few soils in the upper lands have slopes of 15 to 60%. (NRCS 2000) See Appendix H for further soil description.

In 1831 W.A. Ferris provided the first European description of the Deer Lodge Valley, stating that the streams in the valley had “groves and thickets of Aspen, Birch and Willow, and occasional clusters of currant and gooseberry bushes” (Courchene 1989). Today, the general vegetative makeup of the watershed includes mature *Populus trichocarpa* (black cottonwood) stands and *Populus tremuloides* (quacking aspen) groves in the lower watershed riparian areas. Second growth *Pinus contorta* (lodgepole pine) forests exist in the upper watershed, and upland vegetation in the lower watershed is comprised of herbaceous vegetation used for grazing.

Land-use – mining, logging, grazing

Stock raising, homesteading, ranching, and farming began in the Deer Lodge Valley in the 1870’s. By 1890, mining was a major activity in the Deer Lodge Valley with some mines located in the upper Cottonwood Creek watershed. The most recent mining activity in the watershed was the Emery Mine which ended mining in 1950. However, the mine operation did not have any water rights. Today, the main uses in the watershed include logging, ranching, crop and pasture, recreation, and urban areas. The map in Appendix E shows the general landuse in the watershed.

Rosgen classification

Using the Rosgen (1996) classification system, Cottonwood Creek is classified as a B3 stream. B refers to the stream type and 3 refers to the makeup of the streambed material. B type streams are moderately entrenched, have a moderate slope and are riffle dominated with infrequently spaced pools. Rosgen (1996) describes the substrate category 3 as being predominantly cobbles with lesser amounts of boulders, gravel and sand. All these characteristics are evident in Cottonwood Creek. Other characteristics of a B3 stream include a sinuosity of greater than 1.2, a slope between .02 and .04, and a width to depth ratio at bankfull of greater than 12. Cottonwood Creek from Baggs Creek to Interstate 90 has a sinuosity of 1.2, a slope of .02, and an average width to depth ratio of 18.

Reese Anderson Creek is classified as an A4 stream using Rosgen’s (1996) system. A4 streams are described as steep, deeply entrenched and confined, and the channel is incised in coarse depositional materials. Cattle use and water restriction has caused Reese Anderson Creek to have a silty creek bed.

Stream Discharge

In this study, discharge measurements were taken to evaluate stream flow losses and gains along the channel. Table 1 shows the results of the discharge measurements. Polygon C-2 is at the upstream end of the riparian assessment area and polygon C-11 is located at the downstream end of the riparian assessment area, right before the stream flows under the highway. The sample location in C-10 is located in one of the water gaps that will be removed in the summer of 2001. After the first set of samples, we did not take second measurement at C-10 because the location being heavily impacted by cattle activity. Also we felt that a sample location should be added further upstream from C-2 before the creek's water gets diverted. This sample site is located just downstream of the confluence of the south fork of the creek – the last fork to join the main stem. See map in Appendix C for measurement locations.

Table 1: Computed discharge measurements

Date	Polygon	Q (m^3/s)
10/20/2000	C-2 upstream	0.214
	C-10	0.0712
	C-11 downstream	0.114
11/03/2000	Upper Cottonwood Creek	0.254
	C-2	0.0268
	C-11	0.0989

One of the project sites (a water gap removal) located in polygon C-10 had heavy erosion with corrals directly in the stream. Such an impacted site has the potential for significant groundwater / surface water interactions (Allan, 1995). The results of discharge measurements taken on 10/20 might indicate there is some groundwater / surface water interactions taking place.

The higher discharge recorded at the upper creek site and the lower discharge recorded at C-11 indicates that the creek is losing water as water flows downstream. This would be consistent with the number of diversions along the lower portions of the creek. At least five diversions were noticed between C-1 and C-11. There is an irrigation diversion just downstream from the C-10 site. This could be the cause of the higher discharge recorded at C-11 relative to C-10 on 10/20. The higher discharge at C-11 from C-2 recorded on 11/03 in relation to the discharges recorded on 10/20 might indicate that some diversions were closed off or that some groundwater recharge is occurring.

It is important to keep in mind that these fall baseflow measurements were made during a very low flow year for the Deer Lodge valley. We recommend that discharge be determined at these sites along with some additional sites and diversions during the spring.

Stream Cross Sections

The stream's cross section was measured at about the middle of each polygon in polygons C1 to C9. Polygons C10 and C11 were measured at the beginning and end of the polygon because this is the proposed site of one of the conservation / restoration projects (water gap removal). Graphs of these measurements are in Appendix I.

Figure 1 illustrates the relationship of the bankfull widths and the fall baseflow widths. Upstream of polygon C9, baseflow width closely tracks the bankfull width. C1 is located on Baggs Creek which was not flowing at the time. The difference between baseflow and bankfull width increase downstream. This could be the result of ground water-surface water interaction, dewatering, and/or grazing activities. The bankfull width drops at C11L because the creek has been armored to align the creek with the culvert going under the highway.

Figure 1

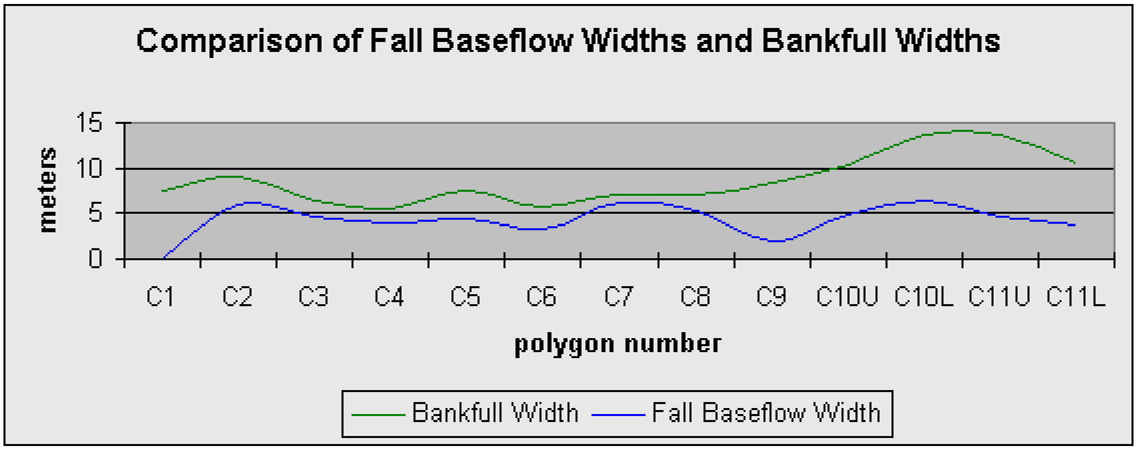
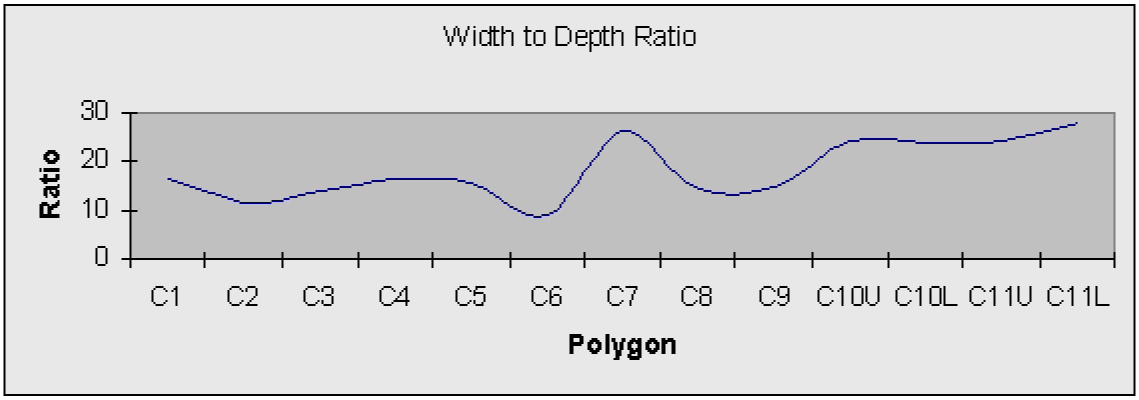


Figure 2 shows the width to depth ratio of Cottonwood Creek from polygon C1 to C11. Rosgen (1996) states that as the width to depth ratio increases the hydraulic stress increases, accelerating bank erosion. This causes the stream to continue to widen. The ratio also illustrates a widening trend downstream from polygon C1; as the ratio increases, the stream becomes wider and more shallow. There is a noticeable drop in the width to depth ratio in polygon C6 because the creek banks in C6 are well stabilized by willows. In polygons C10U to C11L, the greater the width to depth ratio may be due to grazing and the herbaceous-dominated understory.

Figure 2



Proposed Conservation and Restoration Projects

There are three conservation and restoration projects planned for the spring of 2001. See map in Appendix D for locations. Project site one includes removing water gaps from the creek, fencing off a 30 foot riparian buffer, and providing an offstream water source for cattle.

Project site two involves fencing off ponds created by dams in the creek channel. Once the ponds are fenced off, riparian vegetation will be planted and an additional pond will be created upstream of the first two. This additional pond is to act as a sediment trap for the two downstream ponds.

The third project site is a grazing management plan and the construction of three fences perpendicular to Baggs Creek. The fences will result in 3 separate pastures. One pasture will be grazed while the other two are rested. Cattle will not be restricted from the riparian area.

Current condition of riparian area

Riparian and Wetland Research Program's (RWRP) Lotic Health Assessment Field Sheet

Of the 15 polygons assessed using the RWRP Lotic Health Assessment, five were found to be functioning but at risk, and the remaining ten polygons were found to be non-functioning systems. See Appendix A for a summary table of the RWRP assessment forms. The major concerns along the riparian areas include overgrazing, dewatering and invasive plants. All but 3 polygons are dominated by mature *Populus trichocarpa* (black cottonwood) stands. Most of the undergrowth in these stands has been grazed over and little, if any, *P. trichocarpa* (black cottonwood) regeneration is occurring. This is especially the case in Polygons C9, C10 and C11.

Two polygons are classified as *P. trichocarpa / Cornus stolonifera* (black cottonwood / red-osier dogwood) community type, C4 and C7. This mid-seral stage community type is characterized by an overstory of cottonwoods and a potentially dense understory of diverse shrubs and herbaceous vegetation (Hansen et al. 1995). This community type provides excellent wildlife habitat and helps support fish communities by providing thermal cover, debris recruitment and streambank stability (Hansen et al. 1995). *C. stolonifera* (red-osier dogwood) is a highly palatable plant to livestock and is the first affected by grazing (Hansen et al. 1995). The classification system used will classify an area as a *P. trichocarpa / C. stolonifera* (black cottonwood / red-osier dogwood) community even when *C. stolonifera* (red-osier dogwood) occurs in only 1% of the polygon. This is the case with polygon C4 (rated as non-functioning). There is a remnant stand of *C. stolonifera* (red-osier dogwood) which has been protected from grazing by down trees. If it were not for this stand, polygon C4 would be classified as a *P. trichocarpa /* Herbaceous (black cottonwood / Herbaceous) community type.

Six polygons, C1, C5, C9, C10, C11 and R2, were classified as a *P. trichocarpa* / Herbaceous (black cottonwood / Herbaceous) community type. This community type represents a severely disturbed *P. trichocarpa / C. stolonifera* (black cottonwood / red-osier dogwood) community type. A common disturbance comes from heavy grazing – which is evident in the area (Hansen et al. 1995). Two other polygons, R3 and R4, are classified as *P. trichocarpa / Symphoricarpos occidentalis* (black cottonwood / western snowberry) which is also a disturbance indicator community type of *P. trichocarpa / C. stolonifera* (Hansen et al. 1995). Depending on amount of disturbance allowed in the future, this community type can also become a *P. trichocarpa* / Herbaceous community type where the cottonwood stand will open up and result in a drier site (Hansen et al. 1995). When a stand reaches this stage, it can be difficult to revegetate with desired woody plant species because the canopy may to open and/or the water table may have been lowered (Hansen et al. 1995). All polygons classified as *P. trichocarpa* / Herbaceous (black cottonwood / Herbaceous) or *P. trichocarpa / S. occidentalis* (black cottonwood / western snowberry) rated as non-functioning.

Other habitat and communities types found in the assessment area include *Juniperus scopulorum / C. stolonifera* (rocky mountain juniper / red-osier dogwood) habitat type (polygon C2), *Populus tremuloides / C. stolonifera* (quacking aspen / red-osier dogwood) habitat type (polygon C3 and C8), and *Salix lutea / Carex rostrata* (yellow willow / beaked sedge) habitat type (polygon C6). These four polygons are considered functional but at risk. These polygons are at risk because of such problems as invasive species in polygon C6, moderate grazing in polygon C8, down cutting of the stream in polygon C2, and road building through the creek in polygon C3.

Montana Department of Environmental Quality's (DEQ) Stream Reach Assessment Field Form

Table 2

RWRP Form Overall Score	Descriptive Category	Polygon	DEQ Form Overall Score	Rating
57.89	Non-functioning	C1	0.68	Moderate impairment
78.95	Functional At Risk	C2	0.71	Minor impairment
61.40	Functional At Risk	C3	0.62	Moderate impairment

35.09	Non-functioning	C4	0.68	Moderate impairment
42.11	Non-functioning	C5	0.53	Severe impairment
70.18	Functional At Risk	C6	0.68	Moderate impairment
71.93	Functional At Risk	C7	0.64	Moderate impairment
70.18	Functional At Risk	C8	0.70	Moderate impairment
40.35	Non-functioning	C9	0.65	Moderate impairment
35.09	Non-functioning	C10	0.64	Moderate impairment
17.54	Non-functioning	C11	0.58	Moderate impairment
14.29	Non-functioning	R1		Form does not apply
35.09	Non-functioning	R2		Form does not apply
42.11	Non-functioning	R3		Form does not apply
54.39	Non-functioning	R4		Form does not apply
RWRP scoring: 80 – 100 Proper Function Condition (healthy) 60 – 79 Functional At Risk (healthy but with problems) <60 Nonfunctional (unhealthy)			DEQ scoring: 87-100 Non-impaired (full support) 80-86 Non-impaired but Threatened (full support) 71-79 Minor impairment (partial support) 55-70 Moderate impairment (partial support) 0-54 severe impairment (non-support)	

A comparison of the results from the RWRP assessment method and the DEQ assessment method are shown in Table 2. The RWRP rating and DEQ ratings are fairly comparably except for polygons C9, C10 and C11. For the purposes of this study, we felt that the RWRP assessment presents a more realistic picture of the condition present in the Cottonwood Creek watershed. This in part because the assessment team received training in the RWRP assessment method but not in the DEQ assessment method. Moreover, the DEQ assessment method does not look as closely at vegetation components in the riparian area as the RWRP assessment method. The DEQ assessment method seems to be more appropriate to use with a larger stream.

Discussion and Conclusion

Use Support

Cottonwood Creek is used for agriculture and probably helps recharge private drinking water wells. In 1988, Montana Fish Wildlife and Parks found westslope cutthroat trout, brown trout, brook trout and slimy sclupin in Cottonwood Creek. During this study's field work, fish were sighted in the creek, but the species were not identified. So we can not say if Cottonwood Creek still supports a cold water fishery.

Likely value of the conservation efforts

Site One

The removal of the watergaps along the creek and fencing off a 30 foot riparian buffer will have a positive effect for the creek (Ehrhart and Hansen 1998). Providing a riparian buffer will reduce nutrients entering the creek. Since site one is a *Populus trichocarpa* / Herbaceous (black cottonwood / Herbaceous) community type, there may be problems with revegetation of the riparian zone if the water table has been lower drastically. However, it is possible the water table has not dropped significantly since the general geology of the area has a higher water table (Nimick et al. 1993). If revegetation is successful, woody species along the creek will help to control the widening of the creek, help with bank building, and provide fish habitat (Ehrhart and Hansen 1998).

Site Two

Fencing off the constructed ponds on Reese Anderson Creek and planting riparian vegetation should improve water quality in the ponds. However, with the dams still in place, flow will still be restricted downstream. There is no evidence of flooding occurring below the ponds. Populus trichocarpa (black cottonwood) requires the fresh soil deposits left by flooding for regeneration (Hansen et al. 1995). The stand of black cottonwood present will eventually become decadent and likely will not regenerate (Hansen et al. 1995).

Site Three

Our assessment of Baggs Creek is insufficient to proved much evidence for commenting on the possible benefits of fencing and a grazing management plan. However, limiting the length cattle will be in a pasture will have a positive affect (Ehrhart and Hansen 1998). There is still debate on what the best management strategy is but there is a consensus that the length of time the animals spend in an area can be a significant factor in the health of a site (Ehrhart and Hansen 1998). Also, the use of upland attractors, ie. off stream water and mineral blocks, will help disperse cattle within each pasture, reducing the pressure on the riparian areas (Ehrhart and Hansen 1998).

Other problematic sites

Downstream of the ponds on Reese Anderson Creek, cattle are allowed to graze in the riparian area. This is the major cause of the poor health scores. Polygons R4 and R3 still have shrubs species in them but *Symphoricarpos occidentalis* (western snowberry) is an indicator of a degraded site. A grazing management plan limiting cattle use of the riparian area could help maintain woody vegetation along the creek and improve the health of Reese Anderson Creek below the ponds and keep.

The riparian area above project site one (polygons C9 and C10) might benefit from a grazing plan. However, with these areas already severely disturbed, resulting in a *Populus trichocarpa* / Herbaceous (black cottonwood / Herbaceous) community type, it would take an intensive management plan to return woody species to the riparian area (Hansen et al. 1995). Such a plan would probably included excluding grazing from the area with no guarantee of success of woody species revegetation because the water table may have been lowered and the cottonwoods now shade the underrstory(Hansen et al. 1995).

Recommendation for future study and for landowner monitoring

We recommend 1) extending this riparian corridor assessment upstream of polygon C1 along Baggs Creek and along Cottonwood Creek to the where the creek forks. 2) analyzing stream nutrient levels upstream and downstream of water gaps to assess the benefit of the watergap removal. This analysis can also help determine if a 30 foot buffer will be wide enough to help reduce nutrients entering the creek from the corrals which will remain next to the buffer area.

As far as landowner monitoring, we recommend 1) use of the RWRP short form. The use of this form could be taught in a one day workshop. Most of the questions on the form are straight forward and would require only a little training. The bulk of the education needed to use the form is likely to be teaching plant communities types. 2) continued measurement and photo documentation of the creek's cross section. Creek profile monitoring will determine if the creek is widening or narrowing. Photo documentation provides an excellent visual assessment of the riparian area throughout the years.

Acknowledgments

This study was conducted by a group of six graduate students which includes Victoria Edwards, Gary Hughes, Jeff Dunn, Michael Sanctuary, Matt Vitale, and myself. Dr. Vicki Watson at the University of Montana and Susan Sakay at the Natural Resource Conservation Service in Deer Lodge, Montana, offered guidance to the group. Thanks to all these people and to all the landowners involved in restoration efforts in the Cottonwood Creek watershed.

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Appendix A – RWRP Lotic Health Summary

Vegetative Score is determined from question 1 to 6. Soil/ Hydrologic Score is determined from questions 7 to 11. See sample score sheet in Appendix F. Problem Summary includes field observations and the question number in which the polygon scored in the lower third, ie. if a possible 6 points for the question the polygon scored a 2.

Polygon	**Dominance Type**	**Habitat Type - Community Type**	**Vegetative Score**	**Soil/Hydrologic Score**	**Overall Rating**	**Descriptive Category**	**Problem Summary**
C-1	Populus trichocarpa (black cottonwood)	Populus trichocarpa / Herbaceous (black cottonwood /Herbaceous)	33.33	80.00	57.89	Non-functioning	Dewatered / Channelized 2-3-4-5-7
C-2	Pseudotsuga menziesii (douglas fir)	Juniperus scopulorum / Cornus stolonifera (rocky mountain juniper / red-osier dogwood)	74.07	83.33	78.95	Functional At Risk	Downcutting 3
C-3	Populus trichocarpa (black cottonwood)	Populus tremuloides / Cornus stolonifera (quacking aspen / red-osier dogwood)	40.74	80.00	61.40	Functional At Risk	Road through stream 2-4-5-8
C-4	Populus	Populus	29.63	40.00	35.09	Non-	Removed

	trichocarpa (black cottonwood)	trichocarpa / Cornus stolonifera (black cottonwood / red-osier dogwood)				functioning	riparian forest 1-2-3-4-7-8-9
C-5	Populus trichocarpa (black cottonwood)	Populus trichocarpa / Herbaceous (black cottonwood / Herbaceous)	29.63	53.33	42.11	Non-functioning	Stream runs through pasture 2-3-4-5-7-8-9-10
C-6	Yellow Willow	Salix lutea / Carex rostrata (yellow willow / beaked sedge)	44.44	93.33	70.18	Functional At Risk	Willows are stabilizing banks – knapweed colonized gravel beds 2-3-4
C-7	Populus trichocarpa (black cottonwood)	Populus trichocarpa / Cornus stolonifera (black cottonwood / red-osier dogwood)	66.67	76.67	71.93	Functional At Risk	“Moderately grazed” 2-3-7
C-8	Populus trichocarpa (black cottonwood)	Populus tremuloides / Cornus stolonifera (quacking aspen / red-osier dogwood)	66.67	73.33	70.18	Functional At Risk	“Moderately grazed” 2-3-7
C-9	Populus trichocarpa (black cottonwood)	Populus trichocarpa / Herbaceous (black cottonwood / Herbaceous)	25.93	53.33	40.35	Non-functioning	only Cottonwoods and grass 2-3-4-5-7-9
C-10	Populus trichocarpa (black cottonwood)	Populus trichocarpa / Herbaceous (black cottonwood /	44.44	26.67	35.09	Non-functioning	Water gaps – better shrubs than polygon 9 1-2-3-5-7-8-9

		Herbaceous)					
C-11	Populus trichocarpa (black cottonwood)	Populus trichocarpa / Herbaceous (black cottonwood / Herbaceous)	18.52	16.67	17.54	Non-functioning	Creek banks armored Young cottonwoods 1-2-3-4-5-7-8-9-11
R-1	herbaceous	na	14.29	14.29	14.29	Non-functioning	Earth dams across creek to create ponds 1-2-3-4-7-8-9-10
R-2	Populus trichocarpa (black cottonwood)	Populus trichocarpa / Herbaceous (black cottonwood / Herbaceous)	40.74	30.00	35.09	Non-functioning	Ponds holding back most of water. Cows grazing in riparian area. 2-3-4-5-7-8-9-10
R-3	Populus trichocarpa (black cottonwood)	Populus trichocarpa / Symphoricarpos occidentalis (black cottonwood / western snowberry)	44.44	40.00	42.11	Non-functioning	Knapweed on facing uplands 2-3-4-5-7-9-10
R-4	Populus trichocarpa (black cottonwood)	Populus trichocarpa / Symphoricarpos occidentalis (black cottonwood / western snowberry)	62.96	46.67	54.39	Non-functioning	Downcutting Some aspen and junipers – heavy browsing on low branches 2-3-5-9-10

Polygon C1 starts where the road crosses over Baggs Creek and ends at the confluence of Baggs Creek and Cottonwood Creek. Baggs Creek was dewatered in this section. Cottonwood Creek flowed through a low gradient ditch, with a silty bottom, before the confluence with Baggs Creek. The polygon contained a *Populus trichocarpa*/ Herbaceous (black cottonwood/ Herbaceous) community type and had a *Populus trichocarpa* (black cottonwood) dominance type. This is a disclimax plant community type occurring on heavily disturbed sites and characterized by an overstory of widely spaced cottonwoods and an understory containing grasses (Hansen, et al,1995).

Polygon C2 starts at the confluence of Baggs Creek and Cottonwood Creek where a headgate diverts a portion of the stream into an irrigation ditch that contained three miner's inches of water in early October. The polygon ends where a fence crosses the river. The polygon is relatively undisturbed, since access was restricted by the irrigation ditch and steep bank on river right (facing downstream) and a fence on river left. A steep gradient below the confluence has caused the channel to be downcut. This polygon contains a *Juniperus scopulorum/ Cornus stolonifera* (Rocky Mountain juniper/ red-osier dogwood) habitat type with a *Pseudotsuga menziesii* (Douglas fir) dominance type. This habitat type can occur when the *Populus trichocarpa/ Cornus stolonifera* (black cottonwood/ red-osier dogwood) community type becomes dewatered, due to a lowering water table, and begins to convert to an upland site (Hansen, et al, 1995).

Polygon C3 starts where a fence crosses the river and ends where the riparian vegetation has been removed on river left. There are a couple of places were heavy equipment have been driven through the stream, presumably for construction of the new house on the hill. This site is occupied by a *Populus tremuloides/ Cornus stolonifera* (quaking aspen/ red-osier dogwood) habitat type and a *Populus trichocarpa* (black cottonwood) dominance type. This habitat type contains an overstory of *Populus tremuloides*(quaking aspen) and a dense understory of shrubs, including *Cornus stolonifera* (red osier dogwood), *Alnus incana* (mountain alder), *Rosa woodsii* (woods rose) and *Symphoricarpos occidentalis* (western snowberry) (Hansen, et al, 1995).

Polygon C4 starts where the riparian vegetation was removed on river left and ends where Reese Anderson Creek joined Cottonwood Creek. This polygon was on a highly developed piece of land containing a house, several corrals, and a newly built pond. Cottonwood Creek ran through a fenced grazing pasture that was devoid of woody vegetation. Below the corral the stream contains a large growth of aquatic macrophytes, starting a trend which continues through polygon C11. This polygon contains a *Populus trichocarpa/ Cornus stolonifera* (black cottonwood/ red-osier dogwood) community type and a *Populus trichocarpa* (black cottonwood) dominance type. *Cornus stolonifera* (red-osier dogwood) individuals are primarily isolated to a small area that is protected from grazing by a large pile of logs. The lower section of the polygon, in which the corrals are found, more closely resembles the *Populus trichocarpa*/ Herbaceous (black cottonwood/ Herbaceous) community type.

Polygon C5 starts at the confluence of Reese Anderson Creek and ends where two fences cross the steam. A fence runs along the stream creating an area that appears to be used as a riparian pasture. Some areas of the stream bank are steep and vegetated, while other areas have clearly been trampled by livestock. Extensive pugging and hummocking was visible in between the two fences.

Polygon C6 starts below the two fences and continues until the end of the dense willows. This area has a dense cover of willows. Bare areas recently exposed to flooding were being colonized primarily by knapweed. This site contains a *Salix lutea/ Carex rostrata* (yellow willow/ beaked sedge) habitat type and a *Populus trichocarpa* (black cottonwood) dominance type. This habitat type is found in places where the water table remains near the soil surface throughout the summer (Hansen, et al, 1995).

Polygon C7 begins at the end of the dense willows and ends where a road to access the power lines crosses the stream. This site contains a *Populus trichocarpa/ Symphoricarpos occidentalis* (black cottonwood/ western snowberry) community type and had a *Populus trichocarpa* (black cottonwood) dominance type. This community type occurs when a *Populus trichocarpa/ Cornus stolonifera* (black cottonwood/ red-osier dogwood) community type has been moderately disturbed (Hansen et. al., p.260). Moderate levels of grazing and browsing reduce the abundance of *Cornus stolonifera* (red-osier dogwood) and increase the abundance of *Symphoricarpos occidentalis* (western snowberry) and *Rosa woodsii* (woods rose) (Hansen et al, 1995). A dense stand of *Populous tremuloides* (quaking aspen) has colonized the interface between the riparian zone and the uplands along the right side of the river in this polygon.

Polygon C8 begins where the power line road crosses the creek and ends at the upper fence line of the Burt property. The health score of this polygon was 71%, which is considered to be functional at risk. This site contains a *Populus tremuloides/ Cornus stolonifera* (quaking aspen/ red-osier dogwood) habitat type and a *Populus trichocarpa* (black cottonwood) dominance type.

Polygon C9 begins at the fence line along the upper end of the Burt property and ends were a log spans the creek contiguous with a fence. Most of the riparian vegetation has been removed from this site leaving a stand of mature cottonwoods. This site appears to be used as a riparian pasture. A large pasture separated from the stream by a fence was actively being used for grazing.

Polygon C10 begins where a fence abuts up to a log across the stream and ends where a fence crosses the creek at the bottom of the Burt property. It is in this polygon that the conservation project is to be conducted. The upper end of this polygon contains a braided channel that has a stand of young cottonwoods growing on a gravel bar. A fence, which separates the corrals from the stream, has been built into the stream at three different places creating water gaps used to water the livestock. The streambank has been flattened at each of the water gaps. A corral at the bottom of the polygon, with two fences crossing the river, allows livestock free access to the stream. Riparian vegetation has been remove inside the corrals, while the fenced off portions between the water gaps has provided protection for the stream banks and riparian vegetation

Polygon C11 begins below the last corral on the Burt property and ends were the creek goes through two culverts under the road. This site has been severely impacted. The stream channel, which was widened by flooding, has been mechanically dredged, narrowed and straightened to confine the flow before it heads into the culverts under the road. Young cottonwoods are growing in the gravelly substrate along this altered channel. A long section along the right side of the stream above the culverts has been reinforced with rip-rap. Texas longhorns were actively grazing in this polygon.

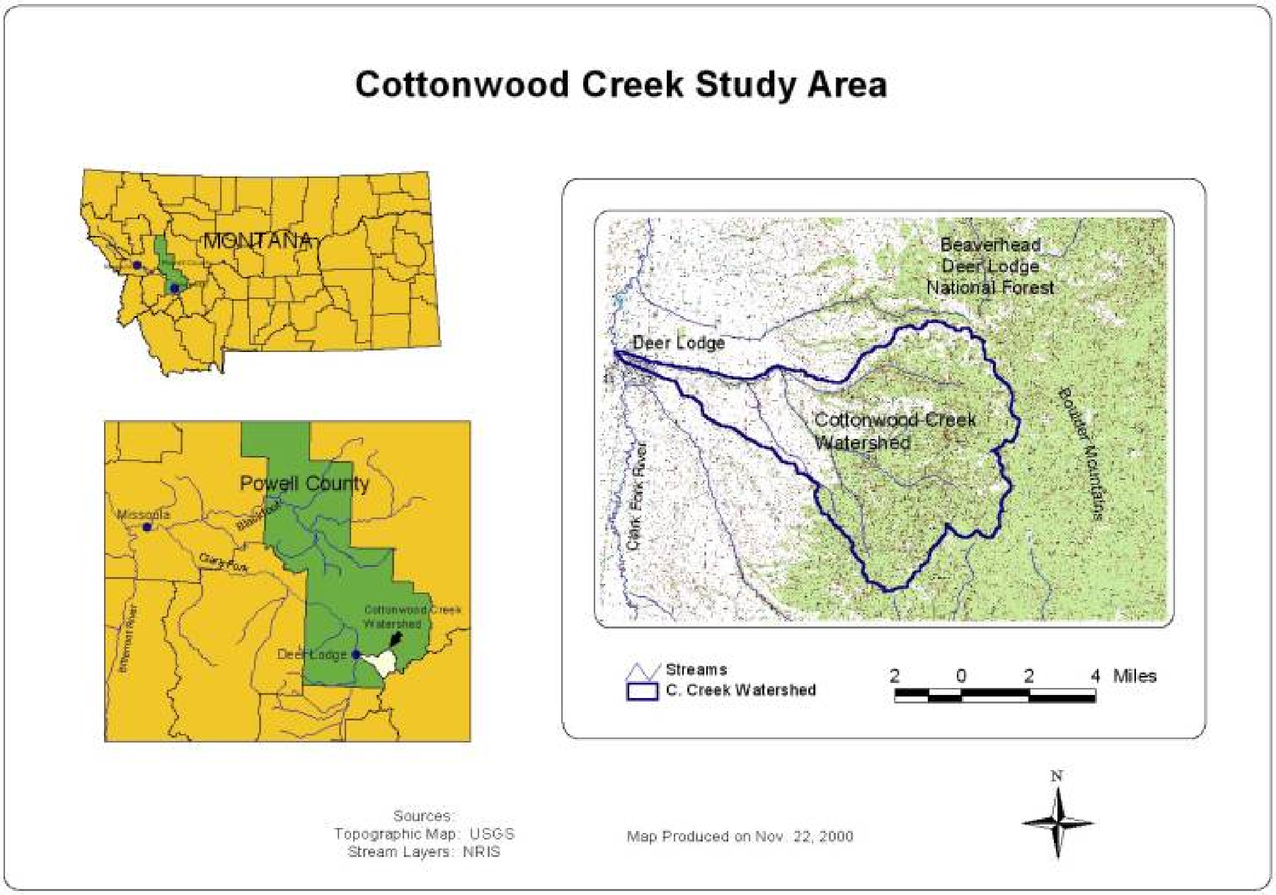
Polygon R1 is the uppermost study site on Reese Anderson Creek. It begins at the fence above the ponds and continues to the first fence below the ponds. It currently contains two ponds. The upper pond has been filled in with sediments and is dry, while the lower pond contains water. Only herbaceous vegetation is growing in this polygon.

Polygon R2 begins at the fence below the ponds and continues to the next fence. Livestock have free access to this section, causing pugging and hummocking to be widespread. Knapweed is abundant on the south facing slope rising from the stream in this polygon, as well as in polygons R3 and R4.

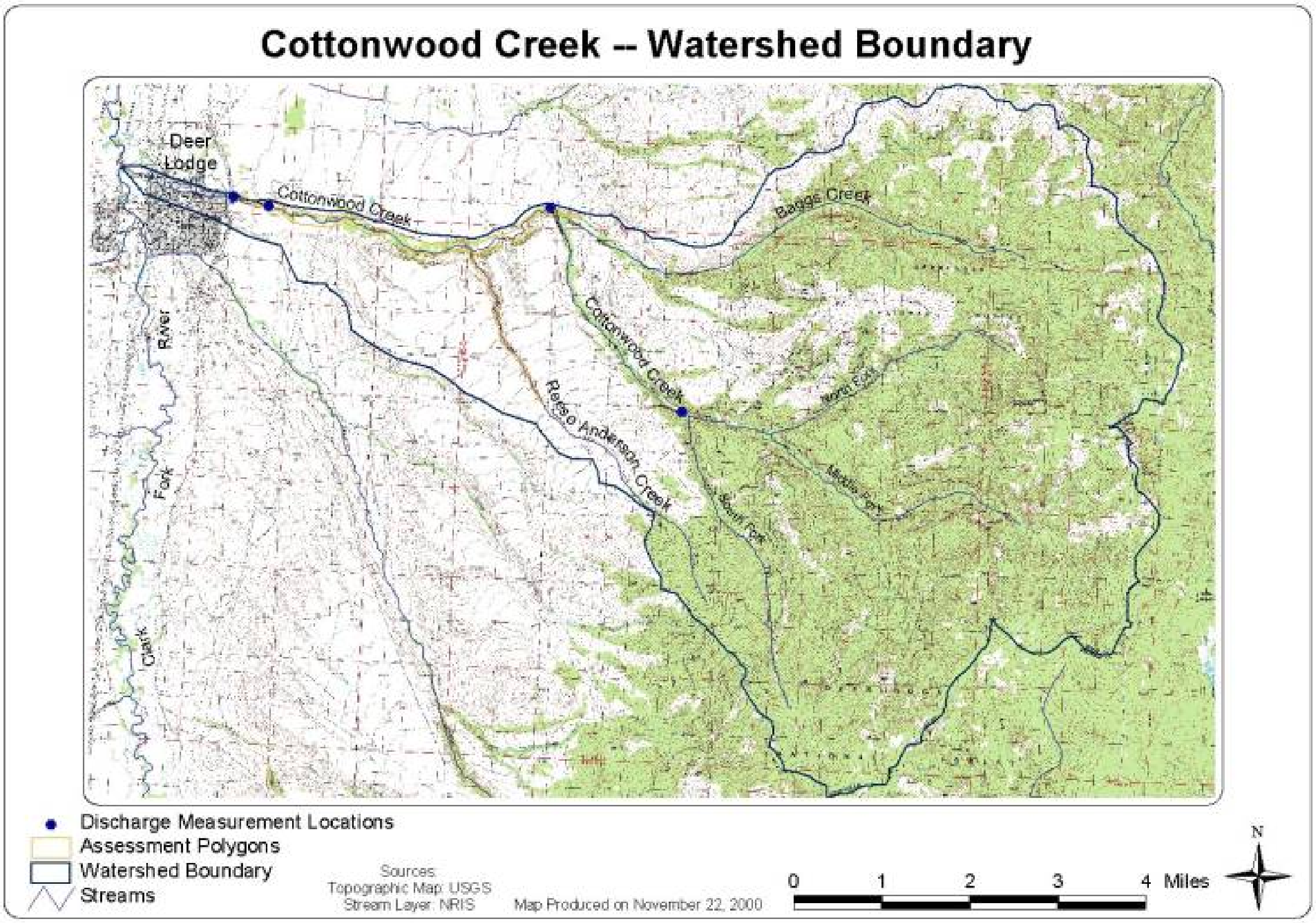
Polygon R3 extends down to the next fence. This site contains a *Populus trichocarpa*/ Herbaceous (black cottonwood/ Herbaceous) community type and a *Populus trichocarpa* (black cottonwood) dominance type.

Polygon R4 extends down to the confluence with Cottonwood Creek. There was a small wetland located within this polygon. This site contains a *Populus trichocarpa*/ Herbaceous (black cottonwood/ Herbaceous) community type and a *Populus trichocarpa* dominance type. Populus tremuloides is also abundant in this polygon.

Appendix B – Study Area Map



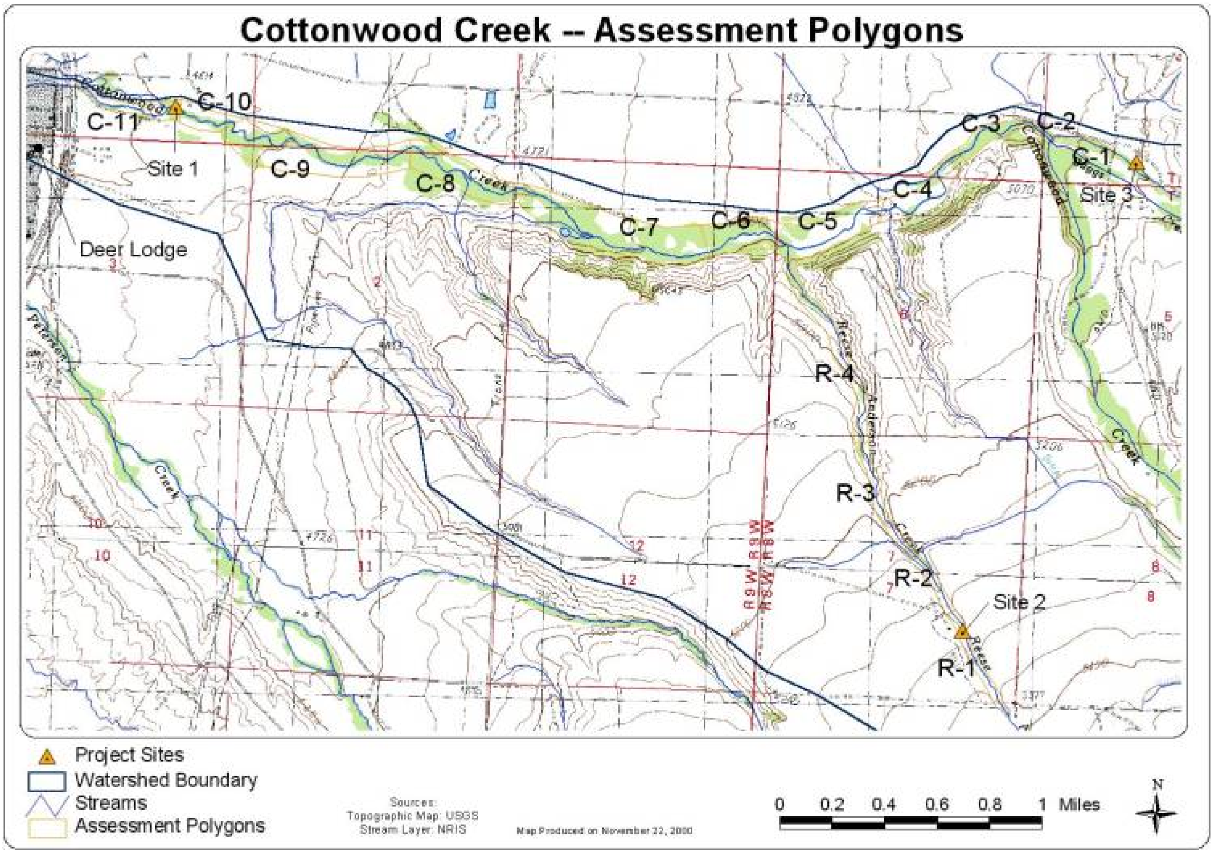
Appendix C – Watershed Map



Sources:
Topographic Map: USGS
Stream Layer: NRIS

Map Produced on November 22, 2000

Appendix D – Assessment Polygons Map

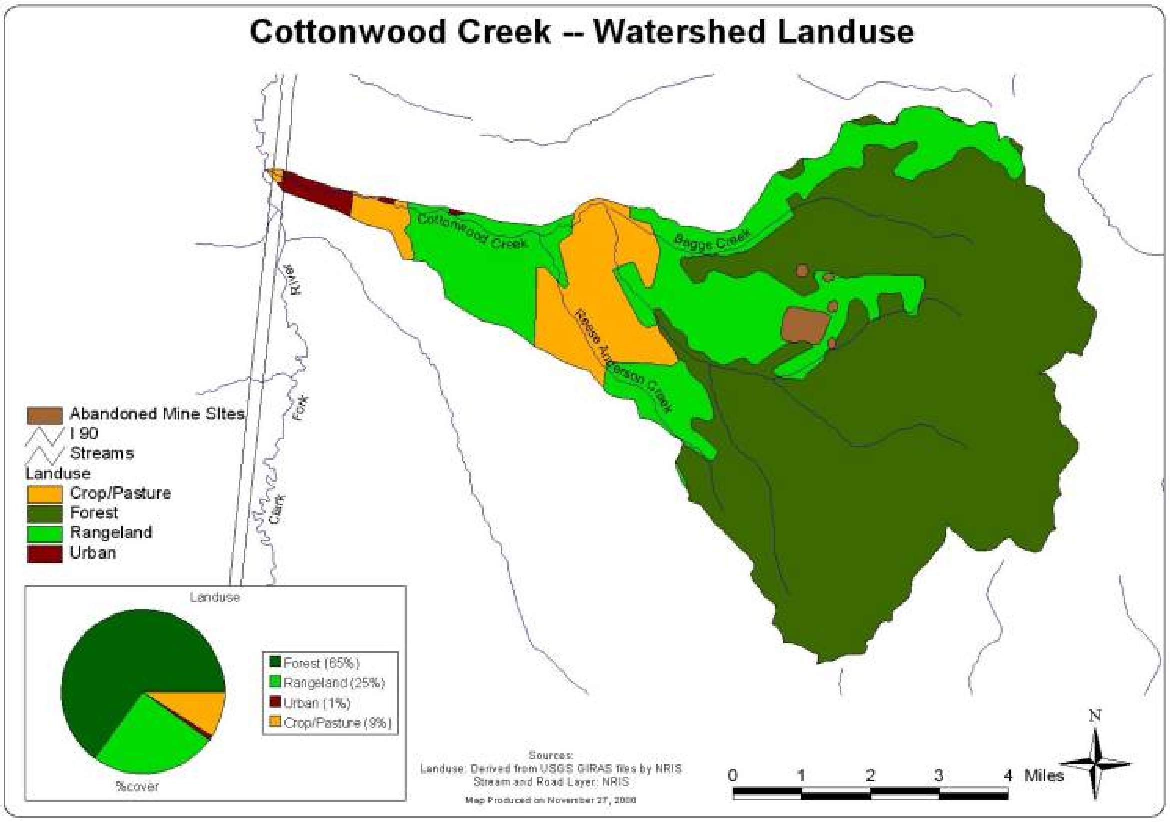


Cottonwood Creek -- Assessment Polygons

Sources:
Topographic Map: USGS
Stream Layer: NRIS

Map Produced on November 22, 2000

Appendix E – Landuse Map

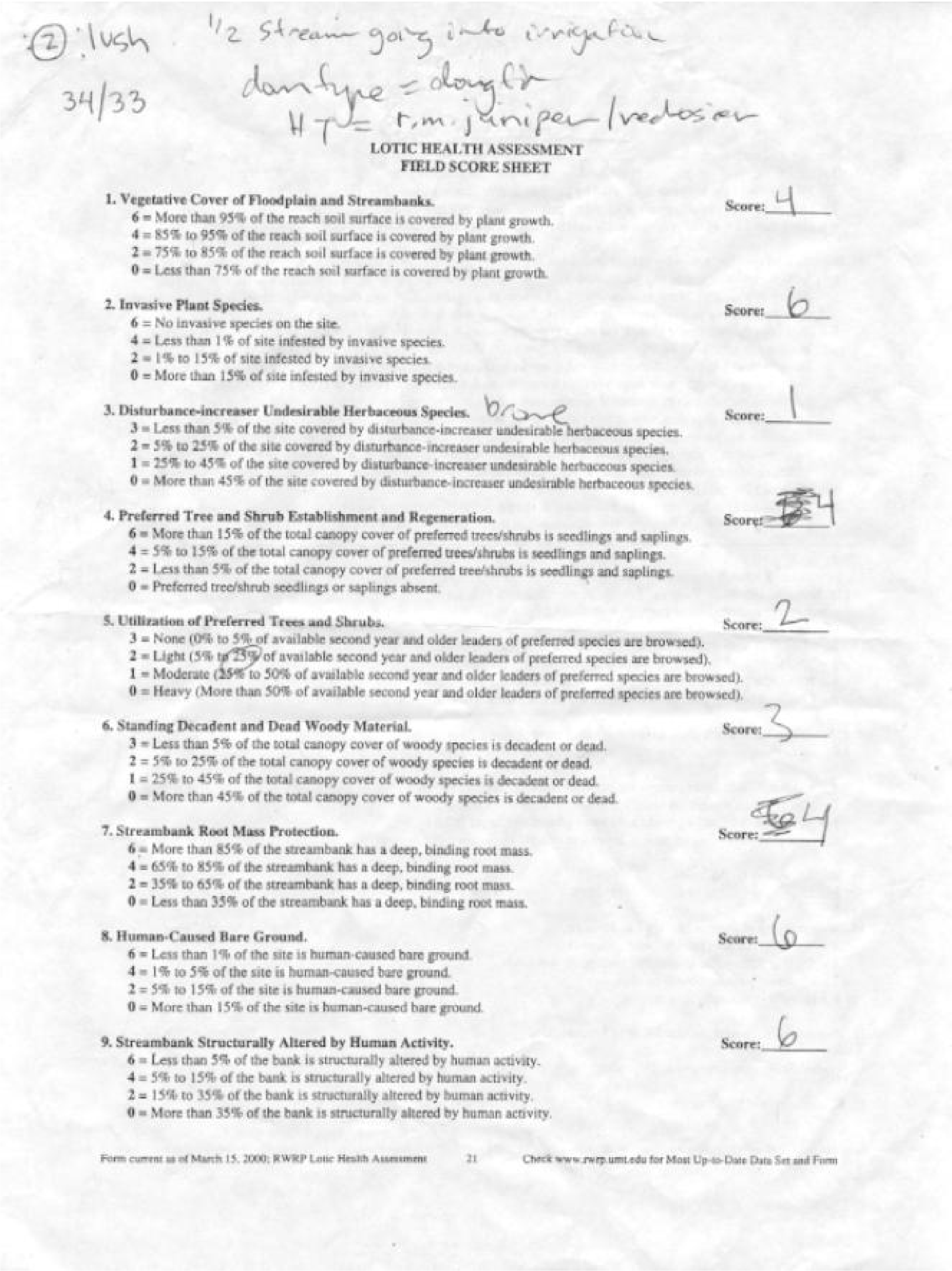


Cottonwood Creek -- Watershed Landuse

Sources:
Landuse: Derived from USGS GIRAS files by NRIS
Stream and Road Layer: NRIS

Map Produced on November 27, 2000

Appendix F – RWRP Lotic Health Assessment Field Score Sheet



② lush 1/2 stream going into irrigation

34/33 dom type = doug fir

HT = r.m. juniper/redosier

LOTIC HEALTH ASSESSMENT
FIELD SCORE SHEET

1. Vegetative Cover of Floodplain and Streambanks. Score: 4

- 6 = More than 95% of the reach soil surface is covered by plant growth.
- 4 = 85% to 95% of the reach soil surface is covered by plant growth.
- 2 = 75% to 85% of the reach soil surface is covered by plant growth.
- 0 = Less than 75% of the reach soil surface is covered by plant growth.

2. Invasive Plant Species. Score: 6

- 6 = No invasive species on the site.
- 4 = Less than 1% of site infested by invasive species.
- 2 = 1% to 15% of site infested by invasive species.
- 0 = More than 15% of site infested by invasive species.

3. Disturbance-increaser Undesirable Herbaceous Species. brome Score: 1

- 3 = Less than 5% of the site covered by disturbance-increaser undesirable herbaceous species.
- 2 = 5% to 25% of the site covered by disturbance-increaser undesirable herbaceous species.
- 1 = 25% to 45% of the site covered by disturbance-increaser undesirable herbaceous species.
- 0 = More than 45% of the site covered by disturbance-increaser undesirable herbaceous species.

4. Preferred Tree and Shrub Establishment and Regeneration. Score: 4

- 6 = More than 15% of the total canopy cover of preferred trees/shrubs is seedlings and saplings.
- 4 = 5% to 15% of the total canopy cover of preferred trees/shrubs is seedlings and saplings.
- 2 = Less than 5% of the total canopy cover of preferred tree/shrubs is seedlings and saplings.
- 0 = Preferred tree/shrub seedlings or saplings absent.

5. Utilization of Preferred Trees and Shrubs. Score: 2

- 3 = None (0% to 5% of available second year and older leaders of preferred species are browsed).
- 2 = Light (5% to 25% of available second year and older leaders of preferred species are browsed).
- 1 = Moderate (25% to 50% of available second year and older leaders of preferred species are browsed).
- 0 = Heavy (More than 50% of available second year and older leaders of preferred species are browsed).

6. Standing Decadent and Dead Woody Material. Score: 3

- 3 = Less than 5% of the total canopy cover of woody species is decadent or dead.
- 2 = 5% to 25% of the total canopy cover of woody species is decadent or dead.
- 1 = 25% to 45% of the total canopy cover of woody species is decadent or dead.
- 0 = More than 45% of the total canopy cover of woody species is decadent or dead.

7. Streambank Root Mass Protection. Score: 4

- 6 = More than 85% of the streambank has a deep, binding root mass.
- 4 = 65% to 85% of the streambank has a deep, binding root mass.
- 2 = 35% to 65% of the streambank has a deep, binding root mass.
- 0 = Less than 35% of the streambank has a deep, binding root mass.

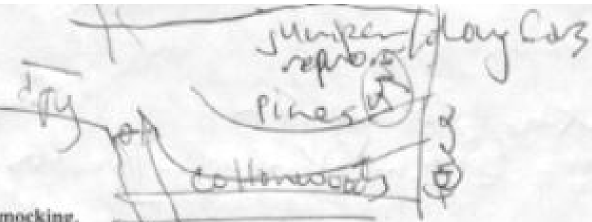
8. Human-Caused Bare Ground. Score: 6

- 6 = Less than 1% of the site is human-caused bare ground.
- 4 = 1% to 5% of the site is human-caused bare ground.
- 2 = 5% to 15% of the site is human-caused bare ground.
- 0 = More than 15% of the site is human-caused bare ground.

9. Streambank Structurally Altered by Human Activity. Score: 6

- 6 = Less than 5% of the bank is structurally altered by human activity.
- 4 = 5% to 15% of the bank is structurally altered by human activity.
- 2 = 15% to 35% of the bank is structurally altered by human activity.
- 0 = More than 35% of the bank is structurally altered by human activity.

Form current as of March 15, 2000; RWRP Lotic Health Assessment 21 Check www.rwrp.umt.edu for Most Up-to-Date Data Set and Form



10. Pugging and/or hummocking. Score: 3

3 = Less than 5% of the polygon is affected by pugging and/or hummocking.
2 = 5% to 15% of the polygon is affected by pugging and/or hummocking.
1 = 15% to 25% of the polygon is affected by pugging and/or hummocking.
0 = More than 25% of the polygon is affected by pugging and/or hummocking.

11. Stream Channel Incisement (vertical stability). Score: 6

9= Channel vertically stable and not incised; 1-2 year high flows access a floodplain appropriate to the stream type. Active downcutting is not evident. Any old incisement is characterized by a broad floodplain inside which perennial riparian plant communities are well established. (**Stages A-1, A-2,** or **A-3** of Figure 3.)

6 = Either of two incisement phases: (a) an early phase where the channel is just beginning to downcut. May be small headcuts, but bankfull flows still access the floodplain. (Look for cutting in channel bottoms) or (b) an old incisement in which the channel may still show limited active downcutting. A new floodplain is well formed at the lower level, although much narrower than it may become. Lateral bank cutting is likely still widening the incised system on outside curves. Perennial riparian plants are becoming well established. (**Stage B** of Figure 3.)

3 = Two phases of incisement also fit this rating. (a) an intermediate phase with downcutting and headcuts probable. Channel is not yet so deeply incised that medium (5-10 year) high flows cannot escape the banks or (b) a deep incisement that is starting to heal. In this phase new floodplain development, though very limited, is key. (Look for widening of the incised system and for early establishment of pioneer perennial plants on the new depositional surfaces.) (**Stage C** of Figure 3.)

0 = The channel is deeply incised to resemble a ditch or a gully. Downcutting is likely ongoing. Only extreme floods overtop the banks. No floodplain development has begun. (**Stages D-1** or **D-2** of Figure 3.)

45/48

93.75

---

12. Streambank Rock Volume and Size

12a. Streambank Rock Volume. Rate the streambank rock volume as the highest appropriate one of the following four categories: Score: 3

Scoring

3 = More than 40% of streambank volume is rocks at least 2.5 inches.
2 = 20% to 40% of streambank volume is rocks at least 2.5 inches.
1 = 10% to 20% of streambank volume is rocks at least 2.5 inches.
0 = Less than 10% of streambank volume is rocks at least 2.5 inches.

12b. Streambank Rock Size. Rate the streambank rock size for the polygon as the highest appropriate one of the following four categories: Score: 3

Scoring

3 = At least 50% of rocks present are boulders and large cobbles (>5 inch).
2 = 50% of rocks present are small cobbles and larger (>2.5 inches).
1 = At least 50% of rocks present are coarse gravels and larger (>0.6 inches).
0 = Less than 50% of rocks present are coarse gravels and larger (>0.6 inches).

13. Vegetative Use by Animals. Score:

[✓ **0 to 25%**] **26 to 50%** **51 to 75%** **76 to 100%**

14. Susceptibility of Parent Material to Erosion. Score: 3

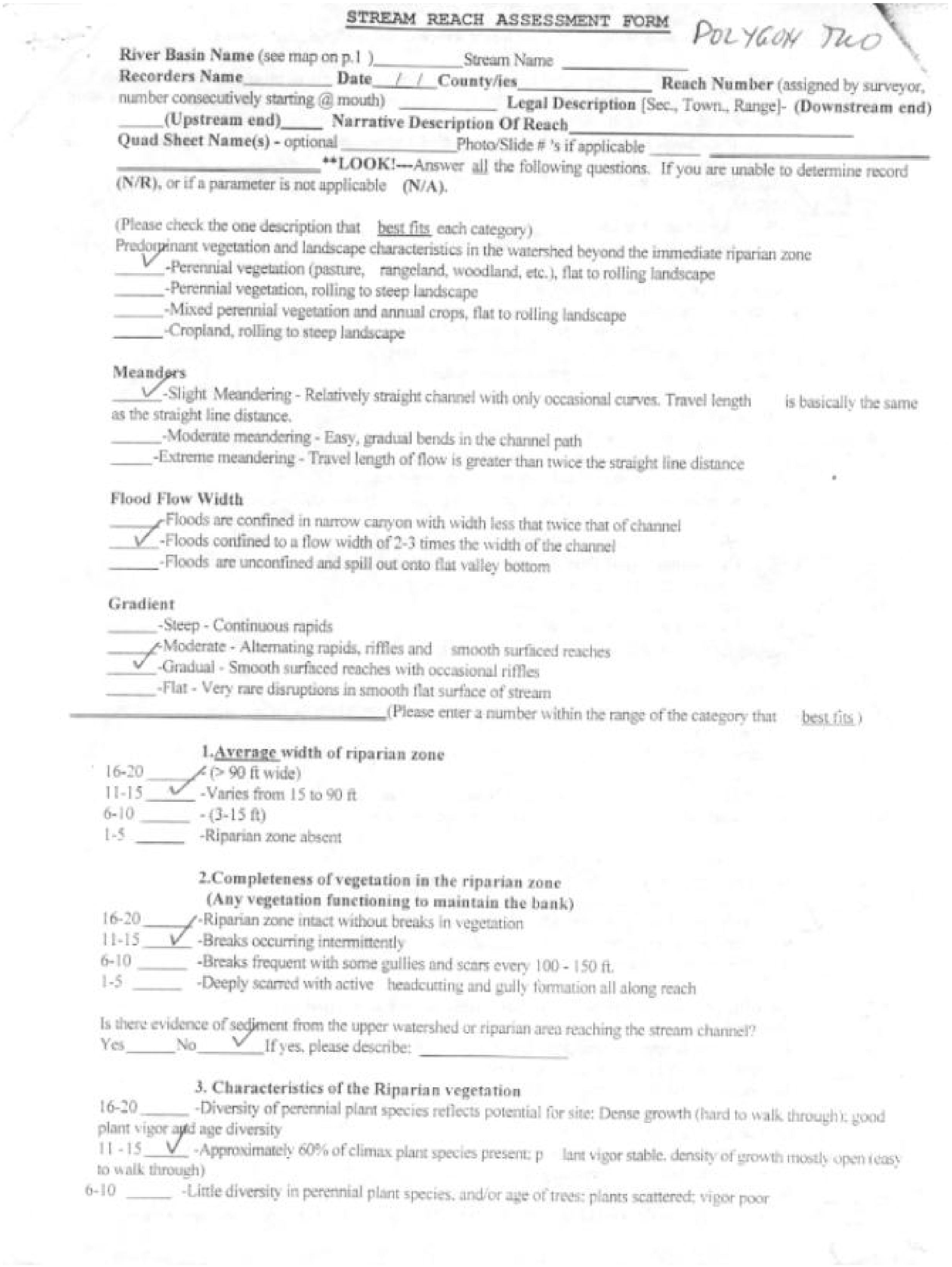
3 = Not susceptible to erosion (well armored).
2 = Slightly susceptible to erosion (moderately armored).
1 = Moderately susceptible to erosion.
0 = Extremely susceptible to erosion.

15. Percent of Streambank Accessible to Livestock. Percent: forced off irrigation

16. Trend. Select one: Improving, Degrading, Static, or Status Unknown

17. Comments and Observations.

Appendix G – DEQ Stream Reach Assessment Form



STREAM REACH ASSESSMENT FORM

POLYGON TWO

River Basin Name (see map on p.1)__________Stream Name ______________
Recorders Name__________ **Date**__/__/__ **County/ies**______________ **Reach Number** (assigned by surveyor, number consecutively starting @ mouth) __________ **Legal Description** [Sec., Town., Range]- **(Downstream end)** _____**(Upstream end)**_____ **Narrative Description Of Reach**______________________________
Quad Sheet Name(s) - optional ____________Photo/Slide # 's if applicable ____________________
____________________****LOOK!**---Answer all the following questions. If you are unable to determine record **(N/R)**, or if a parameter is not applicable **(N/A)**.

(Please check the one description that best fits each category)

Predominant vegetation and landscape characteristics in the watershed beyond the immediate riparian zone
__✓__-Perennial vegetation (pasture, rangeland, woodland, etc.), flat to rolling landscape
______-Perennial vegetation, rolling to steep landscape
______-Mixed perennial vegetation and annual crops, flat to rolling landscape
______-Cropland, rolling to steep landscape

Meanders
__✓__-Slight Meandering - Relatively straight channel with only occasional curves. Travel length is basically the same as the straight line distance.
______-Moderate meandering - Easy, gradual bends in the channel path
_____-Extreme meandering - Travel length of flow is greater than twice the straight line distance

Flood Flow Width
______-Floods are confined in narrow canyon with width less that twice that of channel
__✓__-Floods confined to a flow width of 2-3 times the width of the channel
______-Floods are unconfined and spill out onto flat valley bottom

Gradient
______-Steep - Continuous rapids
______-Moderate - Alternating rapids, riffles and smooth surfaced reaches
__✓__-Gradual - Smooth surfaced reaches with occasional riffles
______-Flat - Very rare disruptions in smooth flat surface of stream

____________________________(Please enter a number within the range of the category that best fits)

1.Average width of riparian zone
16-20 ______ (> 90 ft wide)
11-15 __✓__ -Varies from 15 to 90 ft
6-10 ______ - (3-15 ft)
1-5 ______ -Riparian zone absent

2.Completeness of vegetation in the riparian zone
(Any vegetation functioning to maintain the bank)
16-20 ______-Riparian zone intact without breaks in vegetation
11-15 __✓__ -Breaks occurring intermittently
6-10 ______ -Breaks frequent with some gullies and scars every 100 - 150 ft.
1-5 ______ -Deeply scarred with active headcutting and gully formation all along reach

Is there evidence of sediment from the upper watershed or riparian area reaching the stream channel?
Yes______No__✓__If yes, please describe: ______________

3. Characteristics of the Riparian vegetation
16-20 ______ -Diversity of perennial plant species reflects potential for site: Dense growth (hard to walk through); good plant vigor and age diversity
11 - 15 __✓__ -Approximately 60% of climax plant species present; plant vigor stable. density of growth mostly open (easy to walk through)
6-10 ______ -Little diversity in perennial plant species, and/or age of trees; plants scattered; vigor poor

1-5 ______ -Site is dominated by annual forbs and weeds; few perennial or climax plants present

4. Width/Depth Ratio (Estimated channel width divided by depth as measured at the ordinary high water level). This is the point where high flow normally reaches on the bank and is most easily determined on straight channel sections where the "scoured" channel meets the "permanent" vegetation. Look for characteristics such as terracing, soil changes (rock to soil), presence/absence of vegetation or debris.

10-12 ______ -Width/depth ratio <8
7-9 ✓ -Width/d epth ratio 8 to 15
4-6 ______ -Width/depth ratio 15 to 25
1-3 ______ -Width/depth ratio > 25 or stream is channelized or channel is an incised gully.

5.Channel stability/bar formation

10-12 ______ -Little or no channel instability resulting from sediment accumulation
7-9 ✓ -Some gravel bars of coarse stones and well-washed debris present, little silt
4-6 ______ -Point bars enlarging by gravels, sand and/or silt, new bars forming
1-3 ______ -Channel divided into braids or stream is channelized

6.Bank erosion

16-20 ______ -Little or none evident, banks appear stable and are held firmly by vegetation
11-15 ✓ -Erosion occurring on some outside bends and channel constrictions; non-eroding banks stable
6-10 ______ -Erosion common on most outside bends and channel constrictions
1-5 ______ -Erosion predominant on entire channel (straight sections, inside and outside bends, etc.)

(Answer **ONE**, either 7a. **OR** 7b.)

7a. Stream bottom - (For Fast moving/Riffle dominated streams)

16-20 ______ -Stony bottom of several sizes packed together, interstices obvious
11-15 ✓ -Stony bottom easily moved, with little silt
6-10 ______ -Bottom of silt, gravel and sand, stable in places
1-5 ______ -Uniform bottom of sand and silt loosely held together, stony substrate absent

7b. Stream bottom - (For Slow moving/Pool dominated streams)

16-20 ______ -Mixture of substrate materials with gravel and firm sand prevalent; vascular root mats and submerge vegetation common
11-15 ______ -Mixture of soft sand, mud or clay; mud may be dominant; some vascular root mats and submerge vegetation present
6-10 ______ -All mud or clay, or channelized with sand bottom; little or no submerged vegetation
1-5 ______ -Hardpan clay or bedrock; no vascular root mat or submerged vegetation

(Answer **ONE**, either 8a. **OR** 8b.)

8a. Riffle/pool spacing - (For Fast moving/Riffle dominated streams)

16-20 ______ -Distinct, occurring at intervals of 5-7x stream width
11-15 ✓ -Irregularly spaced, 8-15x stream width
6-10 ______ -Long pools separating short riffles, meanders absent, 16-25x stream width
1-5 ______ -Meanders and riffles/pools absent or stream channelized, >25x stream width

8b. Riffle/pool characteristics - (For Slow moving/Pool dominated streams)

16-20 ______ -Even mix of deep, shallow, large and small pools
11-15 ______ -Majority of pools large and deep, very few shallow pools
6-10 ______ -Shallow pools more prevalent than deep pools
1-5 ______ -Majority of pools small and shallow or pools absent

9.Aquatic plant growth

10-12 ✓ -Not apparent, but rocks or other submerged objects feel slippery
7-9 ______ -In small patches or along channel edges
4-6 ______ -In large patches or discontinuous mats
1-3 ______ -Mats cover bottom (hyper-enriched conditions) or plants not apparent and rocks not slippery (stream

10.Turbidity

10-12 ✓ -Clear

7-9 ______ -Slightly off Color

4-6 ______ -Opaquem (can see through)

1-3 ______ -Cloudy (can't see through)

Color:______________ is rain or runoff influencing turbidity levels today? Yes_____ No_____

STREAM NAME : Cottonwood__________, REACH NUMBER: _____, DATE / /

11.Water surface oils

10-12 ✓ -None

7-9 ______ -Slight

4-6 ______ -Moderate

1-3 ______ -Severe

Slick _____ Sheen _____ Flecks _____ Other _____

12.Materials other than sediment on channel bottom (examples: iron or aluminum oxides, calcium carbonate)

10-12 ✓ -None

7-9 ______ -Slight

4-6 ______ -Modera te

1-3 ______ -Severe

State color ______________________________

13.Salinization

10-12 ______ -None Evident

7-9 ✓ -Evidence of salinity is present in the watershed, but no salt cru sts observed in or near the stream

4-6 ______ -Minor evidence of salts in or near the stream. Plant diversity may be reduced or dominated by salt tolerant species.

1-3 ______ -Salt crusts common in or near the stream or on stream banks. Vegetation may be severely reduced due to salt.

14.Water Odor

10-12 ✓ -None

7-9 ______ -Slight

4-6 ______ -Moderate

1-3 ______ -Strong

Describe Odor - Sewage _____ Petroleum _____ Chemical _____ Natural _____ Other _____

15.Dewatering - From irrigation or natural factors such as subsurface flows. (Assess during critical low flow periods, or you may need to inquire locally about this.)

10-12 ______ -No Apparent water loss (irrigation return flow may be supplementin g base flow)

7-9 ______ -Water loss noticeable, however flows are adequate to support aquatic organisms

4-6 ✓ -Flow supports aquatic organisms, but habitat, especially riffles, is drastically reduced

1-3 ______ -Channel may be dry or flow low enough to preclude or severely impair aquatic organisms

Are irrigation diversion or return structures present? Yes_____ No_____

16.Amount of fish cover (Relative % of reach with some type of fish cover)

10-12 ______ -Extens ive (> 50%)

7-9 ✓ -Moderate (25-50%)

4-6 ______ -Sparse (< 25%)

1-3 ______ -Absent or "choking" vegetation only

Fish cover type -mark all that apply with (**P**)= present, (**C**)=comm on, (**A**)= abundant .

Undercut banks P Overhanging vegetation P Deep Pools _____ Logs/Woody Debris P Boulders P

Rootwads P Aquatic Vegetation _____ Other _____

Total _____ - by Total Possible (rated parameters only) _____ X 100 = _____ %

(Please check one category below)

IMPAIRMENT/USE SUPPORT VALUES

______87-100% = NON-IMPAIRED; (FULL SUPPORT)
______80 - 86% = NON-IMPAIRED; BUT THREATENED; (FULL SUPPORT)
______71 - 79% = MINOR IMPAIRMENT; (PARTIAL SUPPORT)
______55 - 70% = MODERATE IMPAIRMENT; (PARTIAL SUPPORT)
______0 - 54% = SEVERE IMPAIRMENT; (NON-SUPPORT)

TOTAL MAXIMUM COMPARED TO REFERENCE STREAM:

Note: Data should be compared to reference condition.

Total Value: ___________
Reference Stream Value: ___________
(Enter Value of reference stream in order to compare >75%=Fully supporting results from stream being assessed.)
50-75%=Partially supporting <50%=Non-supporting.
Total Value/Reference Stream Value: ___________

Appendix H – Soil Description

NRCS Soils Description

Soils data was obtained from the Deer Lodge Natural Resources Conservation Service. Four general soil maps of the Cottonwood Creek Drainage were obtained and pieced together to create one large soils map for reference. The soil type information was listed and related to each polygon studied from the top of Cottonwood Creek watershed to the bottom at the town of Deer Lodge (Polygon 11). The maps were not included in this report, as it is unimportant to depict the exact location of each soil type. This is a general assessment, therefore the soil types are listed in their general location. The following list explains where each soil type is located in relation to the Cottonwood Creek watershed. (It is helpful to refer to the watershed map in Figure 1.)

Baggs Creek (east to west)

46D east/upper: section 25 and 26 of township and range maps (no name)

200E

846E

195B

242C west/lower: Applegate

110 (borders east side of polygon 1)

Upper Cottonwood Creek (southeast to northwest)

299F (North Fork and South Fork confluence)

8

46B (Baggs and Cottonwood confluence)

51B (west side of Baggs and Cottonwood confluence)

Reese Anderson (southeast to northwest)

299E

51D (51D, 151E, 51C, 53C, and 60B are part of Billy Johnson area)

151E

51C

53C

60B

351F (confluence of Reese Anderson and Cottonwood – polygon 5)

351E (west side of Reese Anderson / Cottonwood confluence)

Table 6 shows each soil type as they are located in each polygon from upstream to downstream. Some polygons only contain one soil type, which is expected of hydric soils in riparian zones. If a particular polygon contains more than one soil type, the number is listed to the right of the polygon number.

Table 6: Soil type numbers are listed for each polygon. More specific

information, including soil names, is located in Appendix 1.

(Natural Resources Conservation Service, 2000, Soil Maps)

Polygon	**Soil Numbers**	**Soil Numbers**	**Soil Numbers**	**Soil Numbers**
C1	110	-----	-----	-----
C2	110	-----	-----	-----
C3	110	51C	-----	-----
C4	110	-----	-----	-----
C5	110	-----	-----	-----
C6	110	-----	-----	-----
C7	110	-----	-----	-----
C8	110	634	31D	-----
C9	110	45B	34B	444
C10	110	444	-----	-----
C11	835	-----	-----	-----

The soils can be summarized by making general classifications of all soils. Not all soils, but most of the soils, fit into this general classification (NRCS, 2000, Soil Maps).

Generalizations

Soils are more than 60 inches deep, resulting in thick deposits. Most are classified as some sort of loam with a dark colored surface layer (moist and nutrient rich). The range for frost free days in these particular soils is 70 to 105 annually. Much of the soil is alluvium that has been deposited by the physical actions of water movement. Rangeland is the dominant land use.

Slope Analysis

Soils within the floodplain have slopes of 0-8%. Those soils that are part of the riparian zone, but are also part of the uplands, have slopes of 8-15%. Two soils that come down into the riparian zone from the uplands have slopes from 15 to 60%.

Water Capacity Analysis

The average water capacity, in inches, of all soils assessed in the polygons is 5.05 to 6.2. The range of water capacity, in inches, is 1.1 to 10. These numbers represent high water capacities in the soils. This is expected since they are mostly hydric soils within a floodplain riparian zone.

Soil 110

This soil constitutes about a half of the lower Cottonwood Creek floodplain. Soil type 110 fits into the general classification but is slightly different from all other soils described. It is a wetsand complex with little or no slope (0-2%). It has a lighter colored surface layer. Major considerations when dealing with this soil type are the water table, flooding, and salinity. It is predominately rangeland, although described as possible woodland.

Soils Related to the RWRP Assessment Process

Soil 110 can be related to soil descriptions given by polygon community type designations from Hansen et. al. A summary is given as evidence of the RWRP lotic form validity. Refer to Table 2, Analyzation of the RWRP Lotic Health Assessment Form Data.

The black cottonwood community types all contain the same soil types. They are generally one meter thick of loam to coarse sand. The coarse soil grains usually resist compaction even by heavy grazing. The water table usually drops below one meter of the surface during the summer and is higher during the rest of the year. Soils tend to stay moist during the summer due to capillary action. Redox reactions are commonplace in the soil due to a fluctuating water table. This soil is usually gray in color. Water interaction in the hyporheic zone of the soils causes rapid water movement, producing aerated soils (Hansen et. al. 1995).

Soil may be silty in some communities consisting of Red Osier Dogwood, with a higher water table due to the finer grained soil particles. The Red Osier species can accommodate the higher water table but does not adjust to long periods of inundation.

The western snowberry root system is vital to soil stability. Therefore, it is important to maintain a healthy community of this vegetation. Because western snowberry is used as forage, and often becomes scarce in heavy grazing areas, it is important to attempt to keep a buffer to the creek to maintain this community. If a particular community has a high water table, snowberry may be able to re-establish itself if populations have decreased.

In the quaking aspen soils, compaction may occur if there is heavy grazing. Red osier dogwood soils have a similar problem. However, due to quaking aspen regeneration through the root system, compacted soils should not deplete this community.

The willow community soils are easily damaged by compaction and thus are not prevalent in lower Cottonwood Creek. The Yellow Willow / Beaked Sedge community type in polygon six is an example of how complete prohibition of grazing has allowed this community to flourish. It was almost impossible to walk through, and there were fences on both ends of it keeping cattle out. In polygon five, the upper polygon above the willow community, cattle grazing was extensive and an area of mainly grass vegetation outside of the floodplain resulted.

Appendix I – Polygon Cross Sections