Internal Draft

Clean Water Practices for Livestock Grazing

Washington State

Department of Ecology

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Internal Draft

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Executive Summary

Goals of the Manual

Ecology has partnered with many local conservation districts to provide over 200 producers with clean water practices that prevent pollution and protect over 300 miles of riparian (streamside area) .

This water quality manual builds upon these successes by describing how to prevent livestock related water pollution. The goal of the manual is to provide producers with information on:

- Which practices are eligible for Ecology funding.
- How to resolve water pollution control act enforcements.
- How producers can voluntarily comply with state law

How the manual Works

- Explains Washington state water quality regulations.
- Explains how common water pollution problems may occur on grazing lands.
- Provides a group of clean water practices that, when applied according to this manual, will prevent pollution. When owners or operators apply these clean water practices, the department of Ecology will presume that their operations are in compliance with water quality regulations.
- Offers a set of performance standards so that landowners may design different Best Management Practices (BMPs), which also prevent surface water pollution and protect water quality.
- Provides guidance on water quality protection that can plug into existing implementation efforts such as Conservation District farm planning. Other jurisdictions may also adopt the manual as one type of performance standard for water quality protection.

Consistency with the Farm Planning Process

This guidance does not replace the farm planning process. This guidance merely provides additional information that can support the development and implementation of plans designed in part to prevent water pollution and achieve compliance with state water quality laws.

All of the clean water practices described in the water quality manual are compliant with the applicable NRCS practice standards. In fact, the manual usually defers to the NRCS practice standards and specifications for direction on how to best construct the practices. This manual simply describes how to ensure that common practices are applied in way that prevents water pollution, and complies with Washington State water quality law.

Chapter 1
Introduction

1.1 Introduction

The livestock industry in Washington state is essential. It provides healthy, locally produced food and makes a significant contribution to our state's economy. Livestock producers have a long history of natural resources stewardship, protecting our water, soil and air. While many livestock operators are doing their part, it's a documented fact that several areas of our state have water pollution problems associated with grazing lands. Typical pollution problems associated with grazing include:

- Fecal coliform and other pathogenic contamination associated with defecation in streams and manure contaminated runoff.
- Low dissolved oxygen levels from increased nutrient and sediment loading.
- Increased stream temperatures from the trampling of streambanks, loss of vegetation, widening and shallowing of streams.
- Increased turbidity and suspended solids from erosion and sediment runoff.
- Changes in pH due to added sediment from erosion.

According to the 2008 water quality assessment, there are hundreds of polluted waters where grazing is the primary land use. Also, numerous watershed assessments have documented streams heavily impacted by unrestricted livestock grazing near streams.

When livestock producers want to prevent pollution they will need to develop and use practices that protect clean water. Producers will encounter a variety of information on what to do. Many practices will be called "*best* management practices (BMPs)." However, not all practices are the *best* at preventing water pollution.

This manual provides information for producers who graze livestock near surface waters on how to prevent water pollution and protect water quality. The manual does not apply to owners and operators of facilities meeting the terms and conditions of the Confined Animal Feeding Operation permit[1], feedlots, or licensed dairy operations.

This manual shows:

- How producers can voluntarily comply with state law.
- Which practices are eligible for Ecology funding.

[1] For more information see http://www.ecy.wa.gov/programs/wq/permits/cafo/index.html

- How to resolve water pollution control act enforcements.

The manual accomplishes these objectives by:

1) Explaining common water pollution problems associated with grazing practices;

2.) Offering a set of Best Management Practice (BMPs) performance standards so that landowners may design different BMPs, which also prevent surface water pollution and protect water quality; and

3.) Describing Ecology approved BMPs, known as clean water practices that are presumed to prevent water pollution, and also fulfill the requirements of state water quality law.

Should the reader need help understanding certain terms in this manual, see the glossary at the end of this document.

1.2 Federal and State Law Require the State to Protect Water and Develop Clean Water Practices

Under state and federal law, the state Department of Ecology (Ecology) is responsible for achieving clean water. Those laws require Ecology to monitor the health of streams, and take active measures to clean it up and prevent pollution. They also require Ecology to develop best management practices specifically designed to be the best at preventing and controlling diffuse (nonpoint) sources of water pollution. Because the practices are designed to protect clean water and prevent pollution we call them **"clean water practices**."

1.3 Clean Water Practices and the Conservation Farm Planning Process

The guidance on clean water practices provides additional information that can support the development and implementation of plans when they are designed in part to prevent water pollution and achieve compliance with state water quality laws. Specifically, the manual helps planners and landowners better understand water quality concerns and state water quality requirements. It also provides specific information about how common conservation practices can be applied to meet the goals of water pollution prevention. With this information, planners can effectively help landowners resolve enforcement actions, achieve voluntarily compliance, and be eligible for Ecology funding, without Ecology involvement.

Many times conservation plans are developed to meet multiple criteria, and are partially based on landowner willingness, and conflict minimization. Unfortunately, basing practices in part on what a landowner is willing to do, may not achieve the pollution prevention levels necessary to clean up a watershed or prevent water pollution concerns at a site. The manual can help planners provide landowners with information directly from the pollution control agency about the agency's expectations for pollution prevention. Therefore, integrating this information into the planning process can help landowners develop practices that fit within the total farm plan, and also meet the standards set by Washington State water quality law (discussed in section 1.7).

Planners should have no trouble integrating these practices with the existing planning efforts - - all of the clean water practices described in this water quality manual are compliant with the applicable NRCS practice standards. In fact, the manual usually defers to the NRCS practice standards and specifications for direction on how to best construct the practices. This manual simply describes how to ensure that common practices are applied in a way that prevents water pollution, and complies with Washington State water quality law. (For a more detailed discussion about using clean water practices in the planning process see chapter 3)

1.4 Nonpoint Source Pollution Defined

Environmental regulation puts pollution sources into two broad categories – point source and nonpoint source. Point source pollution is that which comes from the end of a pipe, or other discrete conveyance. A common example of point source pollution is the effluent from a factory or processing plant. Nonpoint source pollution encompasses all other sources of pollution that are not defined as point sources.

Washington State Law defines nonpoint source pollution as pollution which enters any waters of the state from any dispersed land-based or water-based activities, including but not limited to atmospheric deposition, surface water runoff from agricultural lands, urban areas, or forest lands, subsurface or underground sources[2]. State law further defines pollution as:

> contamination, or other alteration of the physical, chemical, or biological properties, of any waters of the state, including change in temperature, taste, color, turbidity, or odor of the waters, or such discharge of any liquid, gaseous, solid, radioactive, or other substance into any waters of the state as will or is likely to create a nuisance or render such waters harmful, detrimental, or injurious to the public health, safety, or welfare, or to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or to livestock, wild animals, birds, fish, or other aquatic life[3]

According to state law, grazing practices and/or runoff from grazing lands that lead to the contamination or alteration of waters of the state, or that interfere with the beneficial uses of state waters are considered nonpoint sources of water pollution.

1.5 Why Should Clean Water Practices Be Used?

[2] WAC 173-201A-020
[3] WAC 173-201A-020

Most land drains to surface waters, such as streams. Whether a property is next to a large river, small intermittent stream, drainage ditch, or is just draining to ground water, the water from precipitation will likely find its way from the property to that surface or ground water.

Most types of anthropogenic, or human-caused, activities run the risk of generating at least some nonpoint source pollution. Human activities such as construction and farming tend to alter soil structure, natural drainage patterns, and native vegetation. These alterations of the land change the nature of the local water cycle (hydrology) by increasing the amount of precipitation that is not infiltrated, and instead runs off the land. This surface flow can carry pollutants such as fertilizer, pesticides, animal waste and excess soil into nearby streams. Also, increasing the runoff and changing soil structures, may lead to increased erosion, or to the movement of soil. When excess soil enters streams, it may change the properties of the water, smother prime aquatic habitats, and further increase a stream's power to erode. This in turn, can cause even more soil or sediment to enter and be transported by the water.

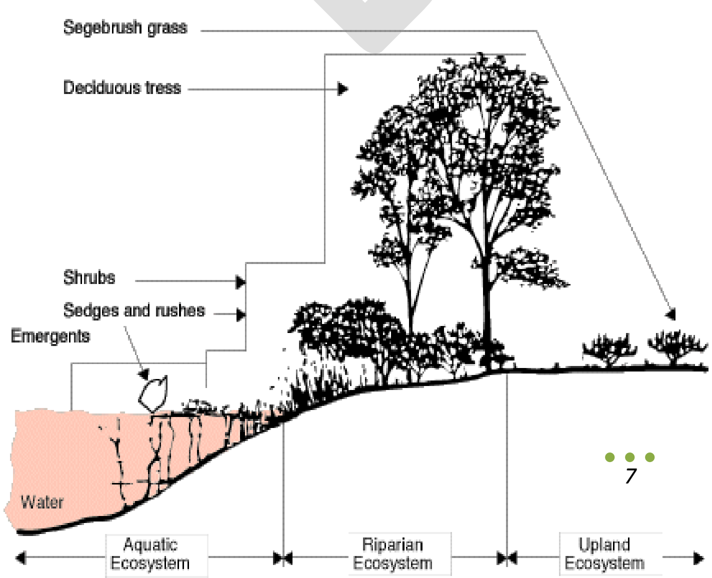
In addition to increased runoff and erosion, many human activities introduce harmful or even toxic substances into the environment. Often these substances are easily transported to surface waters by the increased runoff and erosion caused by changing the land cover.

When these changes occur on, or near the banks of streams, the impacts to water quality may be compounded.

1.5.1 The Riparian Area

Adapted From Stream Habitat Restoration Guidelines. September 2004. Washington Department of Fish and Wildlife, US Fish and Wildlife Service, Washington Department of Ecology.

Preventing impacts to the riparian area in order to abate surface water pollution and protect water quality is an essential goal for any livestock grazing BMP. The term riparian refers to that area adjacent to a river or stream that is physically linked to the moisture regime of the streamside environment. Riparian zones include both the active floodplain and the adjacent plant communities that directly influence the stream system by providing shade, fine or large woody material, nutrients, organic and inorganic debris, terrestrial insects, and habitat for riparian-associated wildlife. They are transitions between aquatic and upland habitats and contain elements of both ecosystems. Riparian corridors also provide habitat for wildlife, especially migrating and breeding birds.



Riparian vegetation, in turn, influences the water. Riparian vegetation stabilizes stream banks and reduces erosion. Stream bank vegetation protects water quality by filtering sediment and capturing excess nutrients in runoff from upland regions.

Stream bank vegetation provides shelter for birds and small animals. Overhanging vegetation cools streams for fish and provides debris and organic matter, food for insects and other life in the water. Approximately 85% of terrestrial vertebrate species in Washington use riparian habitat for essential life activities.

Source: Riparian Area Management, U.S. Government Printing Office 1987-175-814.

1.5.2 How Pollution Prevention Practices Work

In order for any practices to prevent pollution and adequately protect water quality, they must accomplish two tasks:

1. **Provide source control**

    Source control is a structural or managerial practice designed to prevent pollutants at their origin. Source control can prevent pollutants from entering into critical areas where contact with runoff will result in contamination of surface waters. Source control is always the preferred method of pollution management, because removing pollutants from contact with runoff is the most effective way to reduce pollutant loading.

2. **Provide treatment**

    Treatment practices are structural practices that are designed to remove or reduce the amount and type of pollutants when they are being transported by runoff. While source control is the preferred method of pollution management, treatment practices can reduce the impact of runoff that ultimately gets contaminated.

1.6 When is Pollution Prevention Required?

When activities are shown to cause or have the substantial potential to cause nonpoint source pollution, they are required by law to prevent it. The best way to accomplish this is by using BMPs designed and implemented to prevent pollution and protect water quality, such as Ecology's clean water practices.

Producers should observe the conditions of their stream and riparian areas at all times of the year to see if there are indications that nonpoint pollution is occurring. For example, if the following conditions exist near surface waters, then there is a good chance you have a water pollution problem:

<u>Visual indicators that livestock impacts in the riparian area have the potential to pollute</u>

1. Bare ground - mud
2. Manure accumulations
3. Manure deposits in stream
4. Overgrazing

5. Extensive removal of woody vegetation
6. Livestock present in stream
7. Erosion
8. Bank sloughing
9. Damaging hoof action - bank trampling – stream and bank disturbance
10. Livestock trails to the stream
11. Lack of BMPs
12. Confinement areas in close proximity to riparian area
13. Polluted runoff

To prove a substantial potential to pollute under the meaning of state law, Ecology may also use water quality monitoring, scientific research, photo documentation, and field reports to corroborate that site conditions may cause pollution problems. Once nonpoint source pollution problems are verified, owners and operators will be advised to adopt clean water practices. Should an owner or operator refuse to resolve the pollution problem, the use of clean water practices or other corrective actions may be compelled in an administrative order.

1.7 Requirements of State Water Quality Law

The following is a brief summary of state water quality laws that apply to any operation that is generating nonpoint source pollution.

In Washington state, the Water Pollution Control Act (WPCA) makes it illegal to cause or tend to cause or contribute pollution to waters of the state[4]. Specifically, RCW 90.48.080 states that:

> **Discharge of polluting matter in waters prohibited.**
>
> It shall be unlawful for any person to throw, drain, run, or otherwise discharge into any of the waters of this state, or to cause, permit or suffer to be thrown, run, drained, allowed to seep or otherwise discharged into such waters any organic or inorganic matter that shall cause or tend to cause pollution of such waters according to the determination of the department, as provided for in this chapter.

This statute creates a legal duty for landowners not to cause nonpoint source water pollution. When a landowner conducts operations or activities that can be proven to contribute to water pollution problems, they may be found in violation of state law. Violating the WPCA may result in injunctions[5], civil penalties[6], notices of violations[7], or administrative orders[8].

[4] RCW 90.48.080
[5] RCW 90.48.037
[6] RCW 90.48.144

Washington State has also declared it public policy to require the application of *all known available and reasonable methods of treatment* (AKART) to prevent and control pollution entering waters of the state[9]. The AKART policy applies to both point and nonpoint sources of pollution.

Washington's Water Quality Standards further provide that activities which generate nonpoint source pollution will comply with the standards by using Ecology approved best management practices[10].

The Water Quality Standards define best management practices, as "physical, structural, and/or managerial practices approved by the department that, when used singularly or in combination, prevent or reduce pollutant discharges[11]." The legal definition of BMP as applied to water quality protection, requires all BMPs to be approved by Ecology

The clean water practices in this manual are Ecology approved BMPs, and therefore satisfy both the legal definition of BMPs and the compliance requirements for nonpoint sources of pollution, as defined by water quality regulations.

Ultimately, when a landowner or operator uses the clean water practices in this manual, they satisfy the necessary legal definitions, meet the requirements of state law, and therefore will be *presumed* compliant with the all of the above environmental regulations. Essentially, using the clean water practices can speed you through the regulatory process, making it easier for the producer to demonstrate compliance. Owners or operators may select other BMPs provided that they also prevent water pollution and protect water quality. Meeting the performance standards in Chapter 3, will ensure that other practices will be effective and achieve the intended clean water goals.

1.8 Achieving Compliance with Water Quality Law

All landowners are required by law not to pollute. There are two ways in which producers may achieve compliance with the water quality law. Although all landowners are required to do so:

- The **presumptive approach** provides producers with an easy and straightforward way to achieve compliance by adopting clean water practices that have already been evaluated and approved by Ecology. This approach is also called ***good to go***, because once the practices are installed and being properly maintained, no additional work is necessary to achieve compliance.
- The **demonstrative approach** is used when producers are required to prove to Ecology that their practices resolve water pollution problems, and are effective. This situation usually arises when landowners are resolving a formal compliance action. However, a producer may want to

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7 RCW 90.48.120
8 RCW 90.48.240
9 RCW 90.48.010; RCW 90.52.040, WAC 173-201A-300(1)(d)

10 WAC 173-201A-510
11 WAC 173-201A-020

follow the demonstrative approach to guide the development of practices intended to prevent water pollution and protect water quality.

1.8.1 Presumptive Approach – "*the good to go approach*"

When an owner or operator installs and maintains the clean water practices in this manual, they will be protecting water quality with reasonable, straightforward methods. Also, when the clean water practices are installed and maintained, the Department of Ecology will presume that the land covered by the practices is in compliance with water quality regulations. The presumption means Ecology believes the owners or operators have taken the necessary steps to satisfy the legal duties established in the by water quality law; and are therefore, "good to go." When Ecology is evaluating impacts to surface waters in a watershed, Ecology will prioritize and focus compliance efforts in those areas that do not have clean water practices. However, adoption of Ecology clean water practices does not preclude the Department of Ecology from exercising its statutory authority, when the department has evidence that conditions at the site still create a substantial potential to pollute in violation of state law.

1.8.2 Demonstrative Approach

Producers who wish to demonstrate compliance without using the *good to go* approach may use the demonstrative approach. Usually, this only applies under enforcement circumstances, when producers are obligated to show compliance. The demonstrative approach allows producers to demonstrate to Ecology that their preferred management practices will prevent water pollution and their operation will not violate water quality regulations.

This approach is generally a more time consuming and costly way to achieve compliance, because the producer needs to research, design, and justify in technical terms the proficiency of the practices. The demonstrative approach requires the producer to show that the selected management practices clearly satisfy the performance standards found in chapter 3. The performance standards are the basic functions that any practice must accomplish in order to prevent pollution.

This approach requires the producer to show how practices:

1. Prevent pollution causing conditions in the riparian area and stream channel
2. Prevent transport of pollutants from concentrated impact areas to surface waters
3. Treat upland pasture pollutants to prevent discharge to surface waters
4. Maintain Riparian Vegetation to Ensure Basic Ecological Functions
5. Prevent Bank Degradation
6. Ensure Optimal Operation and Maintenance of BMPs

When demonstrating compliance owners and operators will need to:

1. State how practices were selected.
2. Detail the expected pollutant removal performance.
3. Provide the scientific basis which supports the performance claims.
4. Asses how proposed practices will meet all of the performance standards, and therefore satisfy state water quality regulations.

5. Be individually accountable for performance of the practices, and their ability to achieve compliance with state law. This must be demonstrated by implementing a performance monitoring program approved by Ecology.

If a producer has been identified as having a potential to pollute surface water, they may choose the demonstrative approach to achieve compliance. If so, the producer will have the burden of proof to establish that their selected practices prevent pollution and fulfill the requirements of the water quality regulations.

1.8.3 Understanding the meaning of the presumed compliance

Presumed compliance also offers an incentive, in addition to the available financial incentives for pollution prevention. The incentives are:

1. An easy way to avoid formal pollution control actions, and Ecology involvement.
2. An easy way to resolve compliance actions, should they occur; and,
3. To have no obligation on behalf of the owner or operator, to compile evidence and prove that compliance with relevant water quality law has been achieved.

There are two parts to the concept of "presumed compliance": what is meant by a presumption and what is Ecology presuming the subject to be in compliance with?

Compliance

Compliance is measured in two ways. Producers need to prevent pollution to avoid violations of the water pollution control act, and apply practices that conform to the requirements in the water quality standards.

Presumption

When the clean water practices are installed and maintained, Ecology will *presume* that the land covered by the practices is in compliance with the above water quality regulations. The presumption means that Ecology assumes that the owners or operators have taken the steps necessary to prevent pollution. More specifically, Ecology *assumes* the following to be true:

- that the owner or operator is satisfying the legal duty to prevent activities which may cause or tend to cause pollution under the meaning of the WPCA; and
- that the owner or operator is preventing activities which generate nonpoint pollution from contributing to violations of the WQS.

On the ground, the presumption means that in the course of evaluating impacts to surface waters in a watershed, Ecology will prioritize and focus compliance efforts in those areas that <u>do not have</u> clean water practices.

If an operation has been proven to violate the WPCA, the owner or operator has the burden of proof to show that the existing pollution has been stopped, future pollution will be prevented, and that compliance has been achieved. When approved clean water practices are used, the presumption relieves the party using the practices from having to prove to Ecology that compliance has been achieved. When approved clean water practices are not used, the owner or operator would be required to provide evidence, which proves that the practices do in fact prevent pollution and satisfy legal requirements.

Adoption of Ecology approved clean water practices does not create immunity from water quality laws. If Ecology has evidence to prove that the owner or operator has activities which create a substantial potential to generate nonpoint pollution in violation of the regulations, then Ecology may pursue corrective actions. This situation is unlikely, but could happen if, after implementing Ecology approved clean water practices, the owner or operator changes the operation to a different use or adds facilities that were not anticipated when the practices were implemented.

1.9 Applications of this Manual

Primarily this guidance manual applies to producers who are voluntarily seeking to comply with the state water quality laws, and to those who seek to resolve compliance and enforcement issues with the Department of Ecology. The guidance in this manual is also intended to support the cleanup of polluted water bodies, by providing Total Maximum Daily Load implementation plans, and watershed plans with well researched, technically sound clean water practices.

Additionally, other state agencies and local jurisdictions may choose to adopt the approved practices or performance standards for BMP development in this manual. For instance, counties adopting livestock ordinances and Critical Area Ordinances, may adopt this guidance, to help clarify which specific BMPs will satisfy the requirements of the code. Adopting this guidance will also ensure that the required practices will provide sufficient protection of water quality.

Conservation and farm planners may also use this manual when the natural resource protection objective is to protect water quality or the landowner is seeking to achieve presumed compliance, resolve enforcement action, or be eligible for Ecology funding. Farm planners can encourage adoption of practices that will prevent generation of nonpoint source pollution on farms and ranches, and therefore protect owners and operators from violations of water quality law.

Chapter 2
Potential Water Pollution Problems of Grazing Livestock Near Surface Waters

2.1 Introduction

The purpose of this section is to explain how and why livestock congregation in the stream and riparian area may contribute to specific water pollution problems. The information was gathered from an extensive literature review (see bibliography), as well as the agency's collective experience conducting watershed studies, and water pollution inspections. Predominately, unlimited livestock access to streams without some sort of water quality based BMPs, is the most common situation associated with livestock related water pollution problems in Washington state. As a result, the pollution problems associated with unlimited livestock access to streams is the focus of this chapter.

Loss of vegetation from heavy trampling and browsing in the riparian area can lead to bareground, mud, erosion, and polluted runoff. These conditions can cause problems for clean water.

When livestock congregate in or near streams, water pollution problems may arise. Polluted runoff, direct discharges, and erosion are some problems that can occur. These water pollution problems associated with livestock congregation in or near streams have been well documented throughout the world[12]. A majority of the scientific studies conducted on potential livestock impacts have concluded that extended livestock congregation in or directly adjacent to surface waters negatively impacts stream morphology and aquatic habitat[13].

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12 Steinfeld, H., Gerber, P, Wassenaar, T, Castel, V.,Rosales, M, Haan, C. 2006. Livestock's long shadow: environmental issues and options, Food and Agriculture organization of the United Nations.

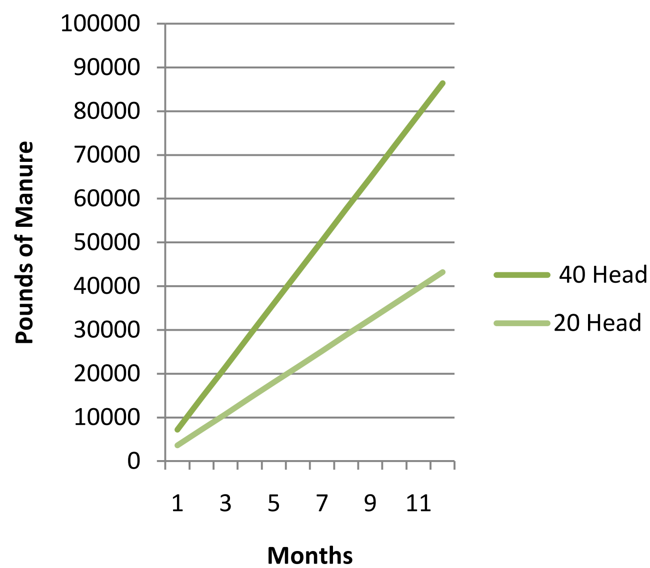
13 Belsky, A., A. Matzke, and S. Uselman. 1999. Survey of livestock influences on stream and riparian ecosystems in the western United States. Journal of Soil and Water Conservation 54(1):419-43

Research shows that livestock congregation in or near streams causes impacts to the riparian area's soil and vegetation. Some of the basic impacts are:

- Defoliation of plants which may reduce their growing capacity;
- Livestock choose specific plants and plant parts in a mixed stand, and affect relative productivity and persistence of some species, and invasion of others;
- Stepping on plants may damage them, compact the soil, cause soil structure homogenization, and slow water infiltration;
- Urine and manure concentrate in small areas and can enter water[14]

These impacts may not occur evenly over the landscape, but develop in patches based on uneven usage. For instance, loss of vegetation and compaction may be concentrated in the riparian if livestock tend to wallow there. The riparian area strongly influences livestock position, and commonly encourages congregation and concentration of livestock near the surface water. This concentrates and compounds the basic impacts of livestock in the riparian area, and can result in numerous water quality impacts.

Figure 1
Potential Deposition of Manure Into Steams From Beef Cattle When Livestock Have Unrestricted Stream Access



When livestock have unlimited access to streams, studies and observations have shown that animal wastes are directly deposited into the stream or within close proximity to the stream. The deposition of animal waste into or next to the stream may simply be related to a physiological response to drinking the water or coming into contact with cool flowing water[15] [16]. In fact, a study monitoring cattle behavior demonstrated that up to 10.5 % of defecations and 9% of all urinations were deposited directly in the stream[17]. A single beef cow may generate approximately 60 lbs of manure a day[18]. Therefore, even a

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[14] Manas R. Banerjee, David L. Burton, W. P. (Paul) Mccaughey, and C.A. Grant. 2000. Influence of pasture management on soil biological quality, *Journal of Range Management* 53:127–133 January

[15] Gary, H, Johnson, S., and Ponce, S. 1983. Cattle grazing impact of surface water quality in a Colorado Front Range stream, *Journal of Soil and Water Conservation*, March-April. 38(2):124-128 at 126

[16] E James; P Kleinman; T Veith; R Stedman; A Sharpley. 2007. Phosphorus contributions from pastured dairy cattle to streams *Journal of Soil and Water Conservation;* Jan/Feb; 62, 1 at 45

[17] Gary, et al. (1983) supra at 126

[18] Klickitat County Solid Waste. 2005. Available at http://www.klickitatcounty.org/solidwaste/contentrone.asp?fcontentidselected=313956151&fcategoryidselected=965105457

small herd of 20 cattle with direct access to a stream may result in over 120 lbs of manure deposited directly into the water each day. Another study on cattle position has shown that cattle are likely to defecate 7.8 times more within a 30 ft zone from the stream bank than other areas of a pasture[19]. Excreta deposited near surface water are more likely to contribute pollutants to runoff, because both pollutant travel time and filtration time are short. Therefore, livestock access to surface water and the riparian area increases the potential pathogen and nutrient associated water quality impacts.

In addition to animal wastes, the greatest threat to water quality is caused by consistent livestock activity in the riparian area[20]. Cattle's preference for the riparian corridor[21] concentrates their effect on soil and plants, and therefore may lead to erosion in or near the stream. When the associated water quality impacts are viewed cumulatively at the watershed scale, the potential harm to the stream is great. Changes in stream velocity, alteration of the stream bank, compaction of the riparian area, excess nutrients and pathogens, decreased dissolved oxygen, and attachment of pollutants to soils cause an interrelated and compounding set of impacts, which can cumulatively result in multiple forms of water pollution.

2.2 Potential Surface Water Impacts from Livestock Congregation in or near streams

The following is a more in-depth discussion of how livestock impacts in or near surface water can affect water quality. Although the effects of livestock impacts are always cumulative, the following section discuses each pollutant individually to better explain the full range of water quality issues.

2.2.1 Nutrient Impacts

Generally it can be said that several pounds of cattle excrement deposited at the soil surface, where nutrients are most likely to be transferred to overland flow, are likely to lead to coinciding nitrogen (N) and phosphorus (P) peaks in the overland flow data. When excess nutrients reach the water they may cause an increase in organic matter. This matter eventually decays and in the process of doing so, consumes oxygen. Therefore, depending on the nature of the system, increased nutrients can lower levels of dissolved oxygen, which is essential for aquatic species. Moreover, pollutants such as nitrates and nitrites are responsible for an array of human health problems.

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[19]James, et al. 2007. supra and at 43 (showing that upwards to 68% of a beef cattle heard can be observed within the riparian corridor at any given time)
[20] Fleischner, T. 1994. Ecological Costs of Livestock Grazing in North America. *Conservation Biology* 8(September, 3): 629-644l
[21] Fleischner. 1994. (showing that upwards to 68% of a beef cattle heard can be observed within the riparian corridor at any given time)

Nitrogen (N)

The excreta of grazing cattle can contribute significantly to nitrate leaching under pastures[22] [23] [24] [25] and in the runoff[26]. Approximately, 80% of nitrogen consumed by cattle is returned to the pasture, mainly in the form of ammonia in urine[27]. If nitrogen were evenly dispersed over a pasture or rangeland, the effects might only be minor. However, localized high concentrations of urine and excreta, driven by cattle position preference, such as drinking or feeding locations in or near streams, can have serious water pollution effects. Leached ammonium from urine, and leached nitrate can also cause problems in the riparian area when heavy grazing causes bare ground or reduces the uptake ability of plants[28].

To illustrate the potential impacts of nitrate leaching, one study has shown that managed intensive grazing strategies using just 200 mature Holstein dairy cows has caused excessive concentrations of nitrate below pastures which would violate the EPA safe drinking water standard[29].

Phosphorus (P)

Laboratory studies have shown that a large proportion of the P in cattle manure is of high potential availability to pollute water[30]. When the presence of fecal matter close to the streambank is combined with the compaction in the riparian area and potential sedimented runoff, the likelihood of phosphorus transport is greatly increased due to P attachment to soil particles and an increased volume of runoff. For instance, compacted soil structure increases the ponding of water and surface runoff and consequently, it increases the soil's vulnerability to water erosion[31]. When pastures or rangeland have high P content at the soil surface due to fecal matter and delayed infiltration, the result is increased

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[22] Ball, P.R., Ryden, J.C., (1984) Nitrogen relationships in intensively managed temperate grasslands. Plant Soil 76, 23-33

[23] Steenvoorden, J.H.A.M., Fonck, H., Oosterom, H.P. (1986) Losses of nitrogen from intensive grassland systems by leaching and surface run-off. In: Van Der Meer, H.G., Ryden, J.C., Ennik, G.C. (Eds.), Nitrogen Fluxes in Intensive Grassland Systems, Martinus Nijhoff, Dordrecht, pp. 85-97

[24] M.J.D. Hack-ten Broeke a, A.H.J. van der Putten b (1997) Nitrate leaching affected by management options with respect to urine-affected areas and groundwater levels for grazed grassland, Agriculture, Ecosystems and Environment 66 197- 210

[25] Macduff. J.H., Steenvoorden, J.H.A.M., Scholefield, D., Cuttle, S.P.(1990) Nitrate leaching losses from grazed grassland. In: Gfiborc[k, N., Krajcovic, V.. Zimkov;i, M. (Eds.), Soil-Grassland-Animal Relationships. Proceedings of the 13th European Grassland Federation, The Grassland Institute, Bansk~Bystrica, Czechoslovakia, pp. 18-24

[26] Poor, C.J. and J.J. McDonnell. 2007. The effect of land use on stream nitrate dynamics. *Journal of Hydrology* 332:54-68.

[27] Kemp, A., Hemkes, O.J., Van Steenbergen, T. 1979. The crude protein production of grassland and utilization by milking cows. *Neth. J. Agric. Sci*. 27. 36-47.

[28] M.B. McGechan, C.F.E. Topp. 2004. Modeling environmental impacts of deposition of excreted nitrogen by grazing dairy cows. *Agriculture, Ecosystems and Environment* 103, 149–164

[29] W L Stout; S L Fales; L D Muller; R R Schnabel; et al. 2000. Assessing the effect of management intensive grazing on water quality, Journal of Soil and Water Conservation; Second Quarter 55, 2 pg. 238

[30] Id, See also Heathwaite, A.L., Johnes, P.J., 1996. Contribution of nitrogen species and phosphorus fractions to stream water quality in agricultural catchments. Hydrological Processes 10, 971–983; Nash, D., Hannah, M., Halliwell, D., Murdoch, C., 2000. Factors affecting phosphorus export from a pasture-based grazing system. Journal of Environmental Quality 29, 1160–1166.2000)

[31] Liisa Pietolaa, Rainer Hornb, Markku Yli-Hallac (2005) Effects of trampling by cattle on the hydraulic and mechanical properties of soil, Soil & Tillage Research 82 (2005) 99–108 at 100

transport of P in the runoff[32]. Moreover, insoluble forms of phosphorus chemically attach to the soil, and are therefore easily transported when increased runoff moves sediment toward the water.

2.2.2 Erosion

Studies of grazed rangeland areas indicate that cattle with unlimited access to streams contribute to streambank alteration and retreat[33 34]. Livestock grazing at intensified levels can remove and limit plant cover growth, destroy cryptogamic (also known as biologic) crusts, weaken soil aggregate stability, and reduce soil organic matter, all while increasing compaction[35]. In turn, these watershed scale impacts lead to increased runoff, sedimentation[36], and stream widening and shallowing[37].

Loss of vegetation in the riparian area caused by overgrazing, livestock trails, and compaction can lead to destabilized stream banks, sedimentation and erosion

Sedimentation is caused when infiltration capacity is reduced by vegetation removal, soil structure deterioration, and compaction[38]. Both continuous grazing that is localized in the riparian corridor due to position preference, and managed intensive grazing without

[32] Liisa Pietolaa,*, Rainer Hornb, Markku Yli-Hallac (2005) supra at 100
[33] Marlow. C.B., T.M. Pogacnik, and S.D. Quinsey. 1987. Streambank stability and grazing in southwestern Montana. J. Soil Water Conserv. 42:291-296.
[34] Ranganath, Hession, and Wynn (2009) Livestock exclusion influences on riparian vegetation, channel morphology, and benthic macroinvertebrate assemblages, Journal of Soil and Water Conservation. Jan/Feb 2009 vol. 64, no. 1.

[35] Natural Resources Conservation Service National Range and Pasture Handbook Chapter 7 Rangeland and Pastureland Hydrology and Erosion
[36] Wohl, N.E. and R.F. Carline (1996) Relations among riparian grazing, sediment loads, macroinvertebrates, and fishes in three central Pennsylvania streams. Canadian Journal of Fisheries and Aquatic Science 53 (suppl 1) 260-266
[37] Platts, W.S. (1986) Riparian stream management.Trans. West Sect. Wildl. Soc. 22:90–93
[38] Natural Resources Conservation Service National Range and Pasture Handbook Chapter 7 Rangeland and Pastureland Hydrology and Erosion at 21

riparian exclusion are associated with higher sediment production[39 40].

Compaction and soil structure deterioration are caused by the high ground pressure of hooves, and soil homogenization caused by shearing[41]. These effects, in turn, result in reduction of pore sizes, puddling of the soil, and weakening of the soil structure. Consequently, this leads to increased runoff and erosion, which can then greatly exacerbate N, P, and pathogen transport[42]. The compaction and soil homogenization from grazing animals has been documented on most soil types for most animals [43].Sedimentation also impacts a stream's morphology. Excessive fine sediments in the water column fill pools, alter channel shapes, and cover rocky stream bottoms that provide important food producing areas, as well as shelter and spawning grounds for fish[44].

Loss of streamside vegetation and erosive effects of livestock hoof action can alter stream banks overtime and cause wider, shallower, and un-shaded streams. These conditions can lead to increased stream temperatures, which can make streams uninhabitable for important aquatic life.

In Eastern Oregon, studies have shown that continuous grazing with unlimited access to the stream can have substantial effects on the structure of stream banks. One important stream bank characteristic is "undercuts," which are essential for fish habitat. After just two grazing seasons, accelerated erosion was shown to reduce undercuts from 23 cm to 13 cm. In comparison, portions of the rangeland with livestock barriers experienced very little mean change[45].

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[39] NRCS. 2004

[40] Bengeyfield, P. 2007. Quantifying the Effects of Livestock Grazing on Suspended Sediment and Stream Morphology at pg 92, M Furniss, C Clifton, and K Ronnenberg, eds., 2007. *Advancing the Fundamental Sciences: Proceedings of the Forest Service National Earth Sciences Conference, San Diego, CA, 18-22 October 2004*, PNWGTR- 689, Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

[41] Liisa Pietolaa,*, Rainer Hornb, Markku Yli-Hallac. 2005. Effects of trampling by cattle on the hydraulic and mechanical properties of soil, Soil & Tillage Research 82 99–108.

[42] Pietolaa, et. al. 2004. at 100

[43] Pietolaa, et. al. 2004. at 100

[44] Wohl and Carline (1996) supra.

[45] Kauffman, W.C. Krueger, And M. Vavra. 1983. Impacts of Cattle on Streambanks in Northeastern Oregon, Journal Of Range Management 36(6**)**

To some extent, sedimentation can be filtered by vegetation. However, the effectiveness of filtration will depend on the adequacy of the riparian vegetative stand. Stem density has been found to be the most influential variable that affects sediment filtration by vegetation. However, grazing can greatly reduce the stem density[46], and therefore can reduce the effectiveness of the vegetative filtration.

Sedimentation is further increased by the physical breakdown of the streambank.[47] Unstable stream banks make a stream more likely to move and for the channel to widen. Loss of upland vegetation and topsoil can concentrate and increase the speed of runoff[48]. This then can have devastating impacts on the stream channel. In some cases, doubling the velocity of stream flow quadruples its erosive power and gives it 64 times more bedload and sediment carrying power[49].

2.2.3 Temperature and Dissolved Oxygen

Activities such as livestock grazing, affect stream temperatures by altering one or more of the following factors:

- Channel morphology
- Riparian vegetation
- Surface/subsurface water interactions
- Stream flow[50].

Livestock's erosive impacts to the riparian area, such as stream bank trampling, loss of riparian vegetation, bank erosion, soil compaction, and increased sedimentation can cause the changes noted above that affect stream temperature[51]. Livestock use of the riparian area has been shown to cause channel incision, lowering the water table, decreasing interaction between the stream channel and riparian vegetation, decreasing riparian soil permeability by foot fall compaction, and dewatering the stream[52]. Research shows that these cumulative impacts resulting from severe livestock grazing can actually alter flow patterns to the extent that a creek can become intermittent[53].

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[46]R.R. Mceldowney, M. Flenniken, G.W. Frasier, M.J. Trlica, And W.C. Leininger. 2002. Sediment movement and filtration in a riparian meadow following cattle use, J. Range Manage. 55: 367-373

[47] See Bengeyfield, P. (2007) supra at 86.

[48] Bengeyfield, P. (2007) supra at 86.

[49] Chaney, et al. (1993) Managing Change: Livestock Grazing On Western Riparian Areas.

[50] Independent Multidisciplinary Science Team. 2004. Oregon's Water Temperature Standard And Its Application: Causes, Consequences And Controveries Associated With Stream Temperature, Technical Report 2004-1

[51] Platts, W.S., Behenke, R.J., Buckhouse, J.C., Casey O.E., Claire, E.W., Cooper, J., Duff, D.A., Evans, W.A., Haugen, G., Marcuson, P.E., Meehan, W.R., Phillips, R.W., Raleigh, R.F., and Skovlin, J.M 1977. Livestock interactions with fish and their environments. PP 36-41 in Proceedings of the workshop on livestock and wildlife-fisheries relationships in the Great Basin. Special Publication 3301. Edited by J. menke. Agricultural Sciences Publications, University of California, Berkeley.

[52] Belsky, A.J., Matzke., and Uselman, S. 1999 Survey of livestock influences on stream and riparian ecosystems in the western United States. Journal of Soil and Water Conservation 54: 419-431

[53] Li, H.W. Pearsons, T.N.., Tait, C.K.., Li, J.L. 1994. Cumulative effects of riparian disturbances along high desert trout streams of the John Day Basin, Oregon. Transactions of the American Fisheries Society 123: 627-640.

Years of Total Maximum Daily Load studies[54] have also corroborated that loss of riparian vegetation and streambank alteration affect stream temperature. As discussed, livestock impacts create the conditions for increased erosion, such as vegetation removal, and streambank retreat and sloughing, and therefore cause the stream channel to widen[55]. Moreover, added sediment fills pools, and displaces water to the shallows. Wider and shallower streams are also more susceptible to the influences of solar heating, because grazing livestock may have removed or hampered the growth of streamside vegetation which would otherwise provide shade. Ultimately, the loss of deeper pockets of cool water, and the effects of increased solar heating greatly impact surface water temperature.

Increased stream temperatures may also exacerbate other pollution problems. Warmer water temperatures may create an environment less conducive to pathogen die off[56]. Therefore, pathogens entering the surface water may more readily accumulate in a warmer, more sediment influenced stream. Temperature increases may also encourage growth of organic materials which then later decay, and consume oxygen in the process. The influence of excess nutrients from livestock excreta will also feed this cycle, which ultimately depletes the water's "dissolved oxygen" content, essential for aquatic life.

For small order streams in Eastern Washington woody vegetation in the riparian area provides essential shade from solar radiation and stabilizes the streambank.

Unlimited livestock access on Deadman creek caused erosion and inhibited growth of woody vegetation

Livestock exclusion at Deadman creek allowed restoration of native woody vegetation that will help stabilize streams and shade the creek during critical summer months

2.2.4 Pathogens

Livestock presence in the stream and/or grazing in or near the riparian area has the potential to convey pathogenic contamination to watercourses. This contamination arises through the delivery of fecal material in overland and subsurface flows to a watercourse, and direct deposition of fecal material in the water[57].

Animal wastes from diseased or disease-carrying livestock are capable of spreading a large number of diseases to other animals or humans, including salmonellosis, leptospirosis, anthrax, and brucellosis[58] [59]

[54] For a complete list of TMDLs see http://www.ecy.wa.gov/programs/wq/tmdl/TMDLsbyWria/TMDLbyWria.html
[55] Platts, W.S. 1981. Effects of sheep grazing on a riparian-stream environment. Research INT-307 USDA forest Service Intermountain Forest and Range Experiment Station, Ogden, UT.
[56] Metcalf, et al. 1991. Wastewater engineering treatment, disposal and reuse . Third Edition. McGraw Hill.
[57] Collins, R, and Rutherford, K. 2004. Modeling bacterial water quality in streams draining pastoral land. *Water Research* 38,700–712

[60]. C. Parvum, a protozoa, and other enteric pathogens that are excreted by a host, can enter surface water, becoming waterborne hazards[61]. These pathogens from animal wastes are known to be transmitted to humans via water-based recreation[62].

Fecal coliform (FC) is the bacterium which is used to gauge the presence of numerous pathogens in the water column. For instance, at FC densities of 1 to 200/100 ml, the percentage of occurrence of Salmonella disease organisms is 27.6%. Occurrence of Salmonella increases when FC levels are even higher. At FC levels of 201 to 2,000/100 ml the rate of occurrence is 85.2%, and when the levels are over 2,000 FC/ 100 ml the rate of occurrence is to 98.1%[63]. The water quality standards set legal limits for fecal coliform levels based on whether the water is designated for extraordinary primary recreational contact, primary recreational contact, or secondary recreational contact.

Even when livestock are removed from riparian areas and along ditches, fecal contamination of stream water remains a threat. Fecal coliform organisms can remain viable in animal wastes for up to 1 year, and may survive up to 2 weeks in soil (fecal streptococcus up to 3 weeks)[64]. Both fecal coliform and streptococcus can survive in the water for up to 6 weeks. Stream sediments can also serve as a reservoir for fecal coliform and Salmonellae organisms[65].

2.2.5 Conclusions

There are numerous water quality impacts associated with grazing in or near the riparian area [66]. The most severe impacts are from direct deposition of excrement into surface waters and the degradation of the riparian area due to livestock presence. A single animal can deposit thousands of pounds of waste and associated pollutants into the water annually. Moreover, livestock may denude and compact the riparian area, and break down streambanks. This in turn, decreases infiltration rates, and increases runoff, sedimentation, and bank sloughing and retreat. The trampled riparian area also loses its natural ability to filter out pollutants and stabilize the soil.

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[58] Moore, J. A., Smyth, J., Baker, S. & Miner, J. R. 1988. *Evaluating Coliform Concentrations in Runoff from Various Animal Waste Management Systems.* Oregon State University Agricultural Experiment Station Special Report 817, Corvallis, Oregon

[59] See also Diesch, S.L. 1970. Disease transmission of water-borne organisms of animal origin. In T.E. Willrich and G.E. Smith eds Agricultural practices and water Quality. Iowa State University Press, Ames p. 265-28

[60] See also Steinfeld, H., et. al. (2006) supra at 140 to 143

[61] Kenneth W Tate; Maria Das Gracas C Pereira; Edward R Atwill, Efficacy of Vegetated Buffer Strips for Retaining Cryptosporidium parvum**,** *Journal of Environmental Quality;* Nov/Dec 2004; 33, 6; ProQuest Science Journals pg. 2243

[62] Tate, et. al. 2004

[63] A.R. Tledemann, D.A. Higgins, T.M. Quigley, H.R. Sanderson, And D.B. Marx **(**1987) Responses of Fecal Coliform in Streamwater to Four Grazing Strategies Journal Of Range Management 40(4) at 322

[64] Tledemann, et. al. 1987 at 323

[65] Tledemann, et. al. 1987 at 323

[66] Ranganath, et. al. (2009) supra

Increasing sediment and overland flow encourage transport of pathogens and nutrients, which are often located in close proximity to the water. This increased flow also impacts the structure of the stream, by increasing stream velocity, sediment loading, and ultimately boosting the erosive power of the stream. The cumulative result of these impacts increases the distance that pollutants can be transported from pollution sources. The farther the pollutants travel, the more likely they will accumulate with other pollution problems and cause water quality impairments.

Also, changing the stream structure by denuding and breaking down streambanks causes an increase in water temperature. When that increase is combined with an increase in nutrients, the result is more algal blooms. Algal blooms eventually die off and consume oxygen when they decompose. This directly results in decreased dissolved oxygen levels in the water, which is essential for aquatic organisms.

In sum, the potential cumulative impacts of long term, unmanaged and unlimited livestock access to streams and riparian areas can be great[67]. However, there are simple solutions which can prevent all of these problems. By using clean water practices, the riparian area can be stabilized, and filtration can be provided to control contaminated runoff, and direct discharges can be avoided. The total result is, pollution is prevented, water quality is protected, and peace of mind is gained.

2.3 Protecting streams from polluted runoff

The previous section (2.2) of this chapter identified the various types of pollution resulting from livestock congregation in or near surface water. This section discusses the pollutant migration distances, and the effectiveness of setbacks and stream buffers to prevent pollution and protect water quality.

Riparian Buffers can provide both source control and filtration for livestock related pollutants such as pathogens and sediment.

The use of setbacks is a standard practice in local land use regulation to ensure that the impacts of a use are contained on the property and to maintain adequate separation of different uses. The setback essentially provides a space between two the different land uses, e.g. highway and a residential development, so that the one land use does not impede the use of another. For the purposes of this manual a setback refers to a distance a specific use or facility should be from

[67] For more indepth information regarding potential livestock impacts to water quality impacts see the Bibliography found in the end of this manual.

the stream. A riparian buffer refers to the area adjacent to the stream which is maintained in vegetation for the sole purpose of protecting the stream

The body of science supporting setbacks and riparian buffers is robust; several hundred studies identify set-backs or buffers as a critical tool to control polluted run-off. These studies have evaluated buffers to control or eliminate nonpoint pollution for different land uses and site conditions. They are an internationally recognized practice to prevent pollution, and so have become a part of many critical area ordinances, stream protection overlays, and farm plans, as well as state and federal permits throughout the nation.

The following is a discussion of the filtration effectiveness of riparian buffers for various pollutants and buffer sizes. These findings, in addition to field experience, interviews, and feedback from other experts have informed the development of the clean water practices of this manual.

2.3.1 Nutrient Removal

Setting back agricultural practices and maintaining a healthy riparian buffer have been documented to provide successful nutrient removal from runoff. Riparian buffers attenuate nitrogen through plant uptake, microbial immobilization and denitrification, soil storage, and groundwater mixing[68].

A common conclusion of more than 60 studies on nitrogen pollution and riparian buffers is that pollutant removal increases when buffer width increases[69]. A review of numerous nitrogen removal studies concludes that, in most cases, a 100-foot buffer provides good nitrogen control, but a 50- foot buffer may be sufficient under some conditions with less pollutant loading[70].

The following table shows the results of studies evaluating both ground water and surface water sources of contamination, that were modeled to determine 50%, 75%, and 90% effectiveness[71].

Vegetative Cover Type	Number of Studies	Mean nitrogen removal effectiveness (%)	Approximate buffer width (feet) by predicted effectiveness		
			50%	75%	90%
All types	66	74.2	10	92	367
Grass	22	53.3	52	154	295
Grass/forest	8	80.5	16	66	154

Studies suggest, however, that total phosphorus is more difficult to remove than nitrogen. Research indicates that larger buffers are necessary to achieve effective phosphorus removal[72]. For example, 69

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[68] Mayer, P.M., Steven K. Reynolds, Jr., Timothy J. Canfield. 2005. Riparian buffer width, vegetative cover, and nitrogen removal effectiveness: a review of current science and regulations. U.S. Environmental Protection Agency, EPA/600/R-05/118, National Risk Management Research Laboratory, Ada, OK, 28 pp.

[69] Mayer, P.M. et. al. 2005.

[70] Wenger, S.J. 1999. A review of the scientific literature on riparian buffer width, extent and vegetation. Athens: Institute of Ecology Office for Public Service and Outreach, University of Georgia. 59 pp.

[71] Mayer et al 2005[9]

foot wide riparian buffers were shown to provide a 69% reduction in phosphate, and 164 foot riparian buffers were shown to provide a 73% reduction of phosphate [73] [74.] The effectiveness of smaller buffers has also been evaluated[75]. Some studies have reported as little as 17% total phosphorus removal and 0% nitrogen removal from 15 foot riparian buffers[76].

2.3.2 Sediment Removal

Scientific studies have shown that riparian buffers are extremely effective at trapping sediment from run-off and reducing streambank erosion. Protected and healthy riparian areas reduce sediment in a number of ways – trapping sediment run-off from upland areas, reducing the velocity of sediment-heavy stream flows, stabilizing streambanks, and reducing bed scour.

Scientific studies evaluating sediment pollution have made the same conclusions as other pollutant parameters – that generally wider buffers are more effective at sediment reduction. For instance studies have shown that a 120 foot buffer is sufficiently wide to trap most sediment, except when there are steeper slopes. Other studies have shown that buffers less than 35 feet wide are insufficient to trap sediment. In several cases, buffers between 35 and 80 feet wide have been demonstrated to achieve significant sediment reductions in runoff (84 – 97% of the sediment from run-off[77]), while other studies have concluded that at least 80-foot riparian buffers were needed to achieve 90% removal of the suspended solids from a livestock operation[78].

When slope is a factor, scientific research has reported that buffers 200 feet wide were necessary to remove pollutants on a 15% grade[79]. However, when there is very little slope (only 1%) a 50-foot buffer was shown effective at sediment removal[80] , but may be ineffective at treating soluble contaminants[81].

2.3.3 Pathogen & Biocontaminant Removal

Fecal Coliform bacteria are found in the fecal matter of humans, livestock, and other animals. Fecal coliform bacteria are an indication that human and/or animal waste is in the stream. It is also an indicator of the presence of other pathogens harmful to humans, such as certain protozoa or other

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[72] Young, R. A., T. Huntrods and W. Anderson. 1980. Effectiveness of vegetated buffer strips in controlling pollution from feedlot runoff. Journal of Environmental Quality 9(3):483-487

[73] Peterjohn, W. T. and D. L. Correll. 1984. Nutrient dynamics in an agricultural watershed: Observations on the role of a riparian forest. Ecology 65(5): 1466-1475;

[74] Young, R. et. al. 1980.

[75] Dillaha, T.A. et al. 1989. Vegetative Filter Strips for Agricultural Non-pont Source Pollution Control. Transactions of the ASAE 32(2):513 – 519; Magette, W.L et al. 1989. Nutrient and sediment removal by vegetated filter strips. Transactions of the ASAE 32(2): 663-667

[76] Magette, W.L et al. 1989. Nutrient and sediment removal by vegetated filter strips. Transactions of the ASAE 32(2): 663-667

[77] Peterjohn, W. , et. al. 1984.

[78] Young, R., et. al. 1980.

[79] Cook

[80] Cook

[81] Schmitt, T.J., M.G. Dosskey, and K.D. Hoagland. 1999. Filter strip performance and processes for different vegetation, widths, and contaminants. *Journal of Environmental Quality* 28:1479–1489.

bacteria. Buffers and setbacks reduce pathogens by allowing pathogens to infiltrate and absorb into the soil, where microorganism predation, environment, and time provide for die off of the pathogens.

In order to control animal waste, studies have reported effective filtration from buffers at widths ranging from 30 to 130 feet. Some studies suggest that 30 foot buffers were only partially effective, because those buffers were documented as only providing a 74% and a 34% reduction in fecal contamination in two plots with a 30 foot buffer compared with no buffer. However, increased fecal coliform filtration performance (87% reduction) has been reported where filter strips were sized to 118 feet. One study also suggests that the 118-foot filter strip size, and the fecal coliform reduction rate it provided, were necessary if the receiving waters were to meet water quality standards for fecal coliform and be safe for human recreation. Other scientific reviews of the research have corroborated the finding that buffers exceeding 100 feet were necessary to eliminate fecal coliform contamination in runoff[82].

2.3.4 Temperature and Dissolved Oxygen Maintenance

Riparian vegetation is one of the most important factors determining stream water temperature. Barton and Taylor examined width and length of buffers and their effect on water temperature in small agricultural streams. They found significant differences in stream temperature. Lynch, et al., concluded that at least a 100-foot vegetated buffer was needed to maintain water temperature. Osborne and Kovacic evaluated small streams and found buffer widths between 30 and 100 feet, depending on site conditions, could maintain stream temperature. Other studies suggest that riparian buffer widths of up to 180 feet grown out to site potential tree height were necessary to maintain stream temperature. An evaluation of 15 studies on buffer width and water temperature suggested an average recommended buffer width of 77 feet was needed to control temperature[83.] USDA guidelines for conservation buffers recommend buffers of between 150 to 1000 feet to maintain microclimatic factors which also affect stream temperature[84].

2.3.5 Overall Water Quality Protection

At least five major scientific reviews have been completed to evaluate the scientific literature on buffers and water quality protection. These researchers looked at the science that compared non-buffered streams with varying sizes of buffers, and then recommended buffer widths.

[82] Ellis, J. H. 2008. Scientific Recommendations on the Size of Stream Vegetated Buffers Needed to Protect Water Quality, Part One, The Need for Stream Vegetated Buffers: What Does the Science Say? Report to Montana Department of Environmental Quality, EPA/DEQ Wetland Development Grant. Montana Audubon, Helena, MT. 24 pp

[83] Ellis, J.H. 2008

[84] Bentrup, G. 2008. Conservation buffers: design guidelines for buffers, corridors, and greenways. Gen. Tech. Rep. SRS-109. Asheville, NC: Department of Agriculture, Forest Service, Southern Research Station. 110 p.

In summary, when all water quality parameters are considered together and not in isolation, research suggests that an effective riparian buffer is achieved at a width of approximately 100 feet. Research also suggests that buffers should never be sized under 35 feet, as water quality protection is minimal at less than that width.

Summary of the Specific Conclusions and Recommendations of Five Riparian Buffer Review Articles	
Castelle et al 1994	"Based on existing literature, buffers necessary to protect wetlands and streams should be a minimum of 50-100 feet
	"Buffers less than 10 meters (33 feet) provide little protection of aquatic resources under most circumstances."
Fischer et al 2000	Concluded that "most buffer width recommendations for improving water quality tend to be between 10 – 30 meters (33 – 100 feet)."
Knutson and Naef 1997	Concluded that scientific studies indicated that vegetated buffers to protect water quality should be between 24 and 42 meters (78 – 138 feet).
Mayer et al 2005	Concluded that 'wider buffers (greater than 50 meters / 167 feet) more consistently removed significant portions of nitrogen entering the riparian zone
Wenger 1999	To protect water quality overall, "a 100 foot (30 meter) fixed-width buffer is recommended for local governments that find it impractical to administer a variable-width buffer."
	For long-term sediment control and short-term phosphorus control a "30 meter (100 ft) buffer is sufficiently wide to capture sediments under most circumstances."
	For nitrogen control, in "most cases 30 meter (100 ft) buffers should provide good control, and 15 meters (50 ft) should be sufficient under many conditions."
	For pesticide and heavy metal control 15 meters (50 ft) seen as a bare minimum, and 50 meters (164 feet) shown to filter out much of two specific pesticides.

The clean water practices in this manual recommend using both setbacks and riparian buffers to protect clean water. At a minimum, this manual recommends using well vegetated buffers no less than 35 feet wide and setting back more intensive uses with water pollution potential, even further. Using a combination of setbacks and buffers allows quality pasture and rangeland to provide for some of the pollutant treatment, and allows producers to commit less land to the riparian buffer. Setting back more intensive use patterns away from the stream, also provides source control, as pollutants are less likely to travel to the stream, requiring less filtration. Therefore, taking into consideration the combination of treatment and source control provided for by the clean water practices, the practices can achieve the desired effectiveness consistent with the reviews of current riparian buffer effectiveness for pollutant removal.

Chapter 3
Applying the Clean Water Practices in the Farm Planning Process

3.1 Introduction

The following chapter is a discussion of how and why the clean water practices or the performance standards can be used in the farm planning process. Specifically, a planner will find the information in this manual useful when surface waters are identified as a resource concern and landowners are seeking to:

- resolve WPCA enforcement actions;
- be eligible for Ecology funding; or
- achieve voluntary presumed compliance with water quality law.

Planners should treat the practice criteria in this manual as minimum criteria to prevent surface water pollution. In many cases planners and landowners may want to do more conservation depending on the goals of the planning and implementation effort. For instance, a landowner may want to expand riparian buffers to address habitat concerns or satisfy critical area ordinances. Because the practice criteria in this manual are merely minimums for pollution prevention, a larger or more protective practice will satisfy both requirements.

In the end, the planning process is adept at incorporating many differing state and local regulations as additional criteria into the process. Like other local regulations, planners can build upon the minimum pollution prevention criteria in the manual to develop a complete plan, and help producers navigate conformance with local and state regulations, and multiple funding guidelines

3.2 The Clean Water Practices and the NRCS Practice Standards

The clean water practices are **not** a new or competing standard with NRCS standards. The practices in this manual are all well recognized conservation practices, commonly used by conservation planners. All of the applicable practices in this manual are compliant with corresponding NRCS' field office technical guide practices standards and specifications. In fact, in most cases the clean water practices direct implementers to certain NRCS standards for guidance on construction and installation. The clean water practices in this manual merely state how common practices can be applied on the landscape to ensure pollution prevention and protect water quality.

3.3 The Conservation Planning Process

Generally speaking, the design and application of NRCS conservation practices to a farm or ranch is based on a conservation planning process which identifies the resource problems, and then develops resource management systems designed for each land unit. According to NRCS, conservation planning is generally characterized as follows:

> Conservation planning is a natural resource problem-solving process. The process integrates ecological (natural resource), economic, and production considerations in meeting both the owner's/operator's objectives and the public's natural resource protection needs. This approach emphasizes identifying desired future conditions, improving natural resource management, minimizing conflict, and addressing problems and opportunities[85].

As noted above, the planning process strives to achieve several goals when recommending practices to solve natural resource problems. Recommendations are based, in part, on the landowner's objectives, landowner production considerations, and conflict minimization. The recommendations are also balanced against what is deemed to be the "public's natural resource protection needs". When landowners seek financial assistance through various cost-share programs, the respective agency's financial guidelines also apply. These guidelines differ between each agency, and the landowner may have to accept some minimum criteria regarding how the BMP is installed, in order to receive the funding. In the end, what practices actually get implemented not just planned for will be based in large part on:

- what elements of the plan the landowner decides are acceptable and is willing to apply, and
- conformance with the financial assistance guidelines, if any apply.

The following common example illustrates this dynamic:

If surface waters are identified as a resource concern, then the planning process may recommend a variety of practices, including filter strips, herbaceous riparian buffers, forested riparian buffers, hedge rows, and in some cases no riparian buffer. Each of the corresponding NRCS Field Office Technical Guide practice standards contains a different recommendation on how the practice should be applied, should it be chosen for development. For instance, the riparian forest buffer standard recommends a minimum buffer width of 35 feet, while the herbaceous buffer standard contains no minimum width, but simply states that "riparian widths will vary depending on the requirements of wildlife species and associated environmental concerns[86]." Ultimately, is up to the individual planner and the producer to pick a

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[85] NRCS National Planning Procedures Handbook, Subpart B, Part 600.50, Draft Comprehensive Nutrient Management Planning Technical Guidance, 600.50.

[86] Natural Resources Conservation Service, conservation practice standard riparian herbaceous cover, code 390 available at http://efotg.nrcs.usda.gov/references/public/WA/WA-RIPARIAN_HERBACEOUS_(390)(Jul_2001).pdf

practice from the menu, and apply it in a way that protects water quality, prevents surface water pollution and satisfies the landowner. Let's say that a planner follows some recent NRCS guidance for the intermountain west, and recommends an "optimal" riparian buffer of 100 feet for water quality protection[87], however, the landowner is only willing to develop a grass filter strip of 20 feet. Yet, if the landowner would like to receive a per acre incentive payment for land taken out of production to be used for the riparian buffer, then they may have to install a buffer of a minimum of 35 feet to meet the financial requirements of the incentive program[88]. The landowner then needs to decide if these minimums imposed by the financial guidelines are acceptable. If not, then the landowner can choose to seek alternate funding sources that have either smaller or no minimum width as a condition, or pay for the buffer out of pocket, or not develop one at all. Thus, despite the best efforts of the planning process, the end result (the on-the-ground practices) may be based either on the relevant minimum criteria imposed by the financial guidelines or the landowner's level of willingness to implement the recommended measures.

3.4 Using the Clean Water Practices as Minimum Criteria in the Planning Process

The above example can be problematic when if an landowner wants to: 1.) resolve WPCA enforcement actions; 2.) be eligible for Ecology funding; or 3.) voluntarily achieve presumed compliance with water quality law. Under those circumstances, the target for BMP implementation needs to be based on pollution prevention and compliance with Washington state water quality law. Practice choices cannot be not be based on landowner willingness, and complicated by differing perceptions of the "public's resource protection needs."

In Washington state, "the public's natural resource protection needs" for **clean water** are based on **Washington State's WPCA and the water quality standards**. According to the regulations, activities generating nonpoint sources of pollution achieve compliance by adopting BMPs that are approved by Ecology and provide assurances that they achieve compliance[89].

The clean water practices in this manual are designed to set *minimum* requirements, similar to those NRCS funding policies which establish minimum buffer widths for landowners enrolled in riparian buffer incentive payment programs. However, Ecology minimums are based exclusively on compliance with the state's water quality law. The minimums in this manual are designed to provide Ecology, the landowner, and the citizens of Washington state with assurances that publicly funded, publicly assisted,

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[87] Optimal Riparian Buffer Widths for the Intermountain west have been described by the USDA as between 70-160 ft. See Johnson, Craig W.; Buffler, Susan. 2008. *Riparian buffer design guidelines for water quality and wildlife habitat functions on agricultural landscapes in the Intermountain West*. Gen. Tech. Rep. RMRS-GTR-203. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 53 p.

[88] 35 feet is the minimum buffer width for enrollment in NRCS' Continuous CRP

[89] See WAC 201A-173 et seq.

and/or publicly recommended practices will in fact achieve the public's resource protection needs for water quality, i.e., *compliance with Washington State's WPCA and water quality standards*.

The minimum criteria in the manual are usually concerned with setting back intensive uses, sizing riparian buffers for adequate filtration and source control, avoiding facility locations where drainage patterns will lead to polluted runoff, and providing sufficient operation and maintenance. However, the ultimate decision of what type of systems to use and where to locate facilities will need to be decided by the landowner (or planner). Therefore, landowners are encouraged to seek assistance from a conservation planner in developing, siting, and installing clean water practices.

When a landowner is facing an enforcement action, a planner can use the manual to help resolve enforcement issues. However, planners will need to apply, and landowners will have to accept, consistent minimum pollution prevention criteria. Also, the water pollution prevention parts of the plan must be fully implemented for enforcement to be resolved.

In sum, planners can incorporate Ecology minimums into the natural resource planning process when surface waters of the state are indentified as a natural resource issue. All of the structural clean water practices in this manual are compliant with NRCS FOTG standards and are therefore eligible for NRCS and Washington State Conservation Commission funding.

3.5 Conclusion

The federally based voluntary planning process is not based solely on the target of Washington's water quality law, but instead tends to address multiple criteria. In some cases, certain criteria such as landowner willingness to implement practices, conflict minimization, and economics may rise above other criteria such as preventing polluted runoff. In such a situation, what the landowner chooses to implement may not prevent water pollution enough to achieve compliance with state law. While this is certainly not the case in all situations, planners and landowners can take steps to ensure that consistent application of practices will meet minimum pollution prevention criteria. The manual can help planners and landowners accomplish this, by providing information directly from the pollution control agency about the agency's expectations for pollution prevention and compliance.

Ultimately, the planning process can build upon the minimum pollution prevention criteria, similar to other local, state and federal regulations, with the outcome of developing a complete plan that helps producers navigate conformance with local and state regulations, and multiple funding guidelines.

Chapter 4 Practice Performance Standards to Prevent Pollution and Protect Water Quality

4.1 Purpose

The performance standards in this chapter constitute the environmental protection levels necessary to be in compliance with state water quality regulations. All performance standards should be achieved to ensure compliance. The clean water practices in the manual meet all of the performance standards and represent the presumptive approach. Practices were developed, based upon the scientific findings, field experience, interviews, and expert testimony.

Any alternative practices proposed under the demonstrative approach will be approved only if Ecology determines that the alternative practice will meet the same performance standards as the substituted practice.

When proposing an alternative practice, proponents will have to demonstrate that the practice will achieve the performance standards listed below by providing the following information:

1. State how practices were selected.
2. Detail the expected pollutant removal performance.
3. Provide the scientific basis which supports the performance claims.
4. Asses how proposed practices will meet all of the performance standards, and therefore satisfy state water quality regulations.
5. Be individually accountable for performance of the practices, and their ability to achieve compliance with state law, by implementing a performance monitoring program approved by Ecology.

4.2 Performance Standards for Practice Design, Operation and Maintenance

This section provides a set of standards which can be used to evaluate practices developed and applied to prevent pollution and protect water quality. The performance standards should be used when owners or operators are designing and implementing practices to prevent pollution, and the proposed practices are not approved by Ecology. The performance standards are based on the goal of preventing nonpoint source water pollution at grazing operations.

As with the *good to go clean water practices*, owners and operators will also need to ensure source control and treatment of livestock impacts to meet the goal of preventing water pollution. All practices, no matter what type or approach, can attain this goal by meeting these standards. All of the following performance standards need to be met. The performance standards are as follows:

Prevent pollution causing conditions in and adjacent to the stream channel

Producers need to prevent the conditions that cause water pollution. This includes preventing erosion, sedimentation, and contaminated runoff adjacent to the stream.

Pollution causing conditions include:

- Manure accumulations
- Manure deposits in stream
- Bare ground - mud
- Overgrazing
- Removal of woody vegetation
- Livestock present in stream
- Erosion
- Bank sloughing
- Damaging hoof action - bank trampling – stream and bank disturbance
- Livestock trails to the stream
- Polluted runoff

Practices need to prevent or filter runoff from overgrazing, compaction and denuding of landscapes caused by concentrated livestock areas. Bare, compacted ground may increase sedimented runoff and erosion, and therefore pollute the water.

Prevent transport of pollutants from concentrated livestock areas to surface waters

No evidence of overland flow, erosion, sediment deposition, or other forms of pollutant transport from congregation areas to surface water.

Livestock areas that facilitate extended congregation, such as stabling, confinement, off stream watering developments, loafing areas, or winter feeding locations, concentrate livestock impacts and can pose a threat to water quality. Concentrating excrement in areas of heavily trampled, bare ground can result in heavily polluted runoff.

Treat upland pasture pollutants to prevent contribution to surface waters

Provide a level of treatment so that pasture/rangeland related pollutants are removed before runoff enters surface waters.

A dense stand of vegetation in the riparian area can filter runoff from the upland pasture or rangeland. Sediment in runoff from bare ground caused by trampling settles out in the vegetation. Vegetation also traps and encourages die-off of pathogens carried in runoff, and supports nutrient cycling of excess phosphorus and nitrogen.

Practices should use un-compacted, un-trampled vegetated filters free of manure. Scientific findings demonstrate that no less than 35 feet of filtering vegetation is necessary to reduce nutrient, sediment and pathogen levels to acceptable levels. In many cases, much more filtering and attenuation is needed (See section 2.3 for some examples). The vegetation must lie between the surface water and all upland pasture areas. Livestock may not browse or excrete waste in the vegetated area.

In areas of high animal concentration, such as feeding and watering locations, additional filtration and treatment will be necessary to prevent polluted runoff from reaching surface waters.

Maintain riparian vegetation to ensure basic ecological functions

The riparian area is maintained to provide for riparian function, including but not limited to a healthy stand of riparian vegetation.

The riparian area (discussed in section 1.5) and its associated vegetation is an essential element in protecting the quality of the water. A healthy stand of riparian vegetation captures sediment, slows runoff, filters pollutants, shades the stream, protects stream banks, and ensures the overall health of any stream system.

Prevent bank degradation

The streambank is preserved in a natural state or protected so it can return to that state. Preserved and protected are defined as preventing the conditions which cause pollution.

Streambank stability is essential to prevent erosion and the addition of excess sediment to the water, which in turn can impact stream morphology and water quality. Livestock congregation in the riparian area can cause bank sloughing, erosion, and sedimented runoff. This may lead to wider shallower streams, which decrease habitat and lead to high temperature, altered pH, and low dissolved oxygen levels in the water. Practices will prevent livestock impacts on the banks of waters of the state, so that a visual inspection shows no evidence of livestock impacts.

Ensure optimal operation and maintenance of pollution prevention practices

All practices will be chosen, installed and maintained so to provide optimal performance.

Practices will be able to withstand common inclement weather conditions, and common high-water events. Practices will also have a lifespan of a minimum of 10 years, and intended to match the pressures of respective herd size. Where applicable, structural practices will also be promptly fixed in the case of material failure.

Chapter 5
The *Clean Water Practices*: Ecology Approved BMPs

5.1 Introduction

The following clean water practices are Ecology's approved BMPs to prevent and reduce the generation of livestock-related nonpoint source water pollution. These practices provide the level of source control and treatment necessary to be presumed compliant, or good to go. All practices in this section will be implemented together to achieve compliance. When these practices are adopted individually, they may fail to prevent pollution and provide the water quality protection needed to satisfy the relevant water quality regulations. Also, to be *good to go,* or presumed compliant, the clean water practices need to meet the standards of this manual, and also be constructed according to the applicable NRCS FOTG construction standards and specifications. Cross references to the applicable NRCS standards are provided for each practice.

Using Ecology's clean water practices is a simple way to protect water quality and be considered good to go. Although the practices are described in detail, this manual provides the producer with flexibility, and therefore requires choices be made regarding how to apply these practices. Producers are strongly encouraged to contact their local conservation district or NRCS office to receive technical and financial assistance in implementing these practices and developing a complete conservation plan. By doing so, producers can address pollution prevention, as well as other conservation and production measures.

The intensity of livestock use and the proximity of the use patterns to surface waters will determine the levels of water quality protection needed and how clean water practices can be applied. Generally, when livestock are managed in a way that minimizes impacts to the pasture or rangeland, and concentrated area impacts are not near surface waters, less water quality protections will be required. For instance, if the producer manages livestock in a way that encourages a healthy pasture or rangeland, then a smaller riparian buffer is required. Or, if certain facilities are located far away from surface waters, some supplemental practices may not be needed.

5.2 Local regulations

Whenever local regulations, such as critical area ordinances or livestock ordinances require setbacks or buffers, it is best to apply the more stringent of the practices. Applying wider buffers and larger setbacks will ensure compliance with both sets of requirements, and avoid any problems with regulatory consistency. Moreover, when ordinances require producers to develop farm plans, those plans can incorporate the clean water practices to achieve compliance with both local and state regulations.

5.3 The Pasture and Rangeland *Clean Water Practices*

The following clean water practices are designed to protect water quality on grazing lands that do not experience concentrated livestock impacts such as winter feeding or confinement. Clean water practices for concentrated impact areas are found in section 4.3.

Pasture and Rangeland BMPs			
BMPs	**Source Control**	**Treatment**	**Criteria**
Riparian Buffer	Stabilizes stream and prevents erosion	Filters upland pollutants	Minimum 35 feet width, sized according to some site specific criteria
Exclusion Fence	Prevents livestock impacts in or near the stream	Facilitates natural recovery of riparian area	Prevent livestock access to riparian buffer
Off-Stream Water Facility	sets back concentrated animal impacts from surface waters	Creates additional infiltration, filtration, and uptake capacity to treat runoff from concentrated impact areas	Set back minimum of 75 feet from surface waters
Water Gaps	Prevents access to streams when off- stream facilities are operational, and provides controlled access to surface waters when watering facilities are temporarily inoperable.		Prevents livestock access to surface waters when off-stream water facilities are properly functioning. For 50 animals or less, water gaps shall be no wider than 10 feet. Water gaps shall be no wider than 20 feet.
Stream Crossings	Limits access to streams and riparian areas when stream crossing is necessary		Ford style crossings should be sized according to the number of animals to minimize in-stream lingering or loafing of animals. Maximum crossing widths are: • For 50 animals or less, no wider than 10 feet at the edge of the water and 20 feet at the edge of the riparian buffer and upland pasture. • For larger operations no wider than 20 feet at the edge of the water and 30 feet at the edge of the riparian buffer and upland pasture or rangeland.

THE RIPARIAN BUFFER

NRCS Practice Standard Cross References: Code 390, 391 & 393

Purpose

Riparian buffers provide source control by stabilizing streambanks, preventing erosion, providing shade to streams, and preventing pollution causing conditions from occurring next to streams. Also, when properly sized, the riparian buffer area serves to filter upland pollutants in runoff, and therefore provides the necessary treatment to prevent discharges to surface water.

Pollution Prevention

Buffering livestock operations from surface waters prevents pollution causing conditions adjacent to streams and filters upland runoff. When properly sized, the riparian buffer can prevent violations of water quality law. Riparian buffers may also be required by other agencies or local jurisdictions depending on the requirements of fish and wildlife species, associated environmental concerns, topographic and geographic contexts, associated state or federal grant requirements, or local statutes, ordinances, rules or laws.

Riparian Buffer Vegetation

Vegetation in the riparian buffer shall be maintained to provide dense vegetation, including wherever possible woody vegetation such as trees and shrubs to provide shade and bank stabilization, and good treatment of runoff. Owners or operators should also consider the use of site potential native vegetation.

Riparian Buffer Sizing

As a rule of thumb, a larger buffer is always more protective of water quality. Generally, buffer sizing for water quality protection should be based on the following criteria.

Runoff potential + Pollution potential = Treatment needed

Therefore, minimum buffer widths will increase when runoff and pollution potential are greater at the site. Livestock impacts to the pasture increase the runoff and pollutant potential. The following criteria should be used to determine your minimum riparian buffer width at the site. Recognizing the riparian buffer is the key practice in protecting water quality, it is recommended that planners err on the side of protection. The department of Ecology will provide assistance to determine the proper buffer width.

West of the crest of the Cascades

In order to provide adequate source control and treatment, riparian buffers will be no less than 35 feet wide, measured horizontally from the ordinary high-water mark of surface water at any location.

When pasture conditions are optimal, the need for larger buffers will be reduced, because the livestock impacts causing runoff and contamination are minimized. Pastures characterized as “optimal” are those with:

- high infiltration capacity and low surface runoff, similar to an ungrazed meadow
- no evidence of erosion
- no evidence of overgrazing– no less than 90% cover – thick stands of vegetation – rapid pasture recovery - yields at site potential for the species adapted to site’s soil and climate
- no visible signs of runoff, ponding, or puddling

- no presence of pollution causing conditions such as manure concentrations, bare ground, and mud adjacent to the riparian area

When existing pasture conditions do not meet these criteria, an owner or operator may choose to improve pasture conditions to reduce their need for a wider buffer. If so, owners or operators can implement a plan to achieve the desired pasture conditions within one year.

When pasture conditions are not optimal, an owner or operator will need to increase the size of the minimum riparian buffer width. Increased buffer widths are based upon increased runoff and pollution potential. Each site condition described below will add the specified amount to the minimum buffer. For instance, for a pasture with poorly drained soils and severe livestock impacts, the total width of the buffer would be:

35 feet (minimum width) + 5 feet (poorly drained soils) + 20 feet (severe livestock impacts) = 60 feet

1. **Poorly drained soils** - **add 5 feet to the riparian buffer width**
   Poorly drained soils have reduced infiltration capacity and therefore increase runoff potential. If ponding, puddling, or visible runoff occurs on the pasture, increase the minimum riparian buffer width by 5 feet.

2. **Intermediate livestock impacts to the pasture – add 10 feet to the riparian buffer width**
   When the descriptions below best characterize your pasture, increase the minimum riparian buffer width by 10 feet.

   - Signs of soil compaction causing reduced infiltration
   - Some evidence of erosion – soil surface loss
   - occasional overgrazing - between 90% - 65% cover – intermediate vegetation - reduced vegetative resilience – areas grazed below proper height needed for plant vigor
   - few livestock trails, and one or two concentrated area impacts

3. **Severe livestock impacts to the pasture – add 20 feet**

   When the descriptions below best characterize your pasture, increase the minimum riparian buffer width by 20 feet.

   - Infiltration capacity and surface runoff are effected by compaction
   - Evidence of rill, gully or sheet erosion
   - Severely overgrazed pastures – less than 65% cover – sparse vegetation– vegetal retardance – edible plants grazed to lowest level feasible
   - Large manure accumulations
   - Wide spread heavy use impacts

4. **Liquid manure application – add 10 feet**
When liquefied manure is applied as a pasture amendment, surface waters are at greater risk of nutrient and pathogen contamination, due to increased polluted runoff potential. If manure is applied to the pasture, increase the minimum riparian buffer width by 10 feet.

East of the crest of the cascades

In order to provide adequate source control and treatment, riparian buffers will be no less than 35 feet wide, measured horizontally from the ordinary high-water mark of surface water at any location. When pasture or rangeland conditions are optimal, the need for larger buffers will be reduced, because the livestock impacts causing runoff and contamination are minimized. Pasture or rangeland characterized as "optimal" are:

- high infiltration capacity and low surface runoff, similar to an ungrazed meadow
- no evidence of erosion
- no evidence of overgrazing within 250 feet of the riparian area– greater than 80% cover - thick stands of vegetation – rapid recovery after grazing –yields at site potential for the species adapted to site's soil and climate
- no visible signs of runoff, ponding, or puddling
- no presence of pollution causing conditions such as manure concentrations, bare ground, and mud adjacent to the riparian area

When existing pasture or rangeland conditions do not meet these criteria, an owner or operator may choose to improve pasture or rangeland conditions to reduce their need for a wider buffer. If so, owners or operators can implement a plan to achieve the desired rangeland conditions within one year.

When pasture or rangeland conditions are not optimal, an owner or operator will need to increase the size of the minimum riparian buffer width. Each site condition described below will add the specified amount to the minimum buffer. For instance, for a pasture with poorly drained soils and severe livestock impacts, the total width of the buffer would be:

35 feet (minimum width) + 5 feet (poorly drained soils) + 20 feet (severe livestock impacts) = 60 feet

Increased buffer widths are based upon increased runoff and pollution potential. Use the following criteria to determine the increase in minimum buffer width needed:

1. **Poorly drained soils** - **add 5 feet to the riparian buffer width**
Poorly drained soils have reduced infiltration capacity and therefore increase runoff potential. If ponding, puddling, or visible runoff occurs on the pasture or range, increase the minimum riparian buffer width by 5 feet.

2. **Intermediate livestock impacts to the pasture or rangeland – add 10 feet to the riparian buffer width**

When the descriptions below best characterize your pasture or rangeland, increase the minimum riparian buffer width by 10 feet.

- Signs of soil compaction causing reduced infiltration
- Some evidence of erosion – soil surface loss
- occasional overgrazing - between 80 - 60% cover – intermediate vegetation - reduced vegetative resilience – areas grazed below proper height needed for plant vigor
- few livestock trails, and one or two concentrated area impacts

3. Severe livestock impacts to the pasture or rangeland – add 20 feet

When the descriptions below best characterize your pasture or rangeland, increase the minimum riparian buffer width by 20 feet.

- Infiltration capacity and surface runoff are effected by compaction
- Evidence of rill, gully or sheet erosion
- Severe overgrazing – less than 60% cover – sparse vegetation– vegetal retardance – edible plants grazed to lowest level feasible
- Large manure accumulations
- Widespread heavy use impacts

4. Liquid manure application – add 10 feet

When liquefied manure is applied as a pasture or rangeland amendment, surface waters are at greater risk of nutrient and pathogen contamination, due to increased polluted runoff potential. If manure is applied to the pasture, increase the minimum riparian buffer width by 10 feet.

EXCLUSION FENCE

NRCS Practice Standard Cross References: CODE 382 & 472

Purpose:

A livestock exclusion fence creates a barrier that restricts animal access to the riparian buffer. Livestock exclusion also creates a buffer area between sources of livestock pollution and surface water. This provides source control by preventing conditions which cause pollution from occurring next to the stream.

Pollution Prevention:

In order to provide adequate source control, fences will be positioned between the edge of the riparian buffer and upland pasture.

Animal access to the riparian buffer will be prevented to ensure:

- The treatment capacity of the buffer is optimized
- Streambanks are properly stabilized
- Livestock pollutants are set back from the stream

Frequently Flooded Areas

Exclude animal access to frequently flooded areas, prior to seasonal inundations, and during periods of saturation.

Construction:

Fences shall be designed to control livestock and meet the intended life of the practice as described in the NRCS FOTG Fence-General Specification.

Type and size of livestock should be evaluated when choosing the appropriate type and design of fence.

EXAMPLES

Before livestock exclusion fencing

After livestock exclusion fencing

Before livestock exclusion fencing

After livestock Exclusion

Easily repaired fences such as high tensile should be used in areas where flooding may occur or where debris may collect.

Operation and Maintenance:

Regular inspection of fences and gates should be part of an on-going management program to ensure protection of water quality. Inspection of fences after storm events is needed to ensure the fence continues to restrict animal access in the intended manner.

EXAMPLES

Before livestock exclusion fencing

After livestock exclusion fencing

OFF STREAM STOCK WATER FACILITY

NRCS Practice Standard Cross References: CODE 614

Purpose:

A device for providing animal access to clean, continuous reliable water in a manner that will not pollute surface waters.

Pollution Prevention:

Off-stream water facilities may provide source control of livestock impacts by preventing pollutants from entering into critical areas where contact with runoff will result in contamination of surface waters.

Location

Off stream water facilities should be constructed no less than 75 feet from the ordinary high water mark of the stream. This setback will provide:

- Source control – sets back concentrated animal impacts from surface waters.
- Treatment – provides additional infiltration, filtration, and uptake capacity for concentrated impact areas.

Heavy Use Area Protection

Areas adjacent to watering facilities that will be trampled by livestock create a potential to pollute, and should be graveled, paved, or otherwise treated to provide firm footing and reduce erosion.

Off-stream watering facilities within 150 feet of the stream must use heavy use area protection to prevent erosion and sediment runoff. Design and construction of the protective surface around the trough shall be in accordance with NRCS FOTG standard 561 Heavy Use Area Protection.

Off-stream watering facilities placed at a distance greater than 150 feet from the stream are not required to use heavy use area protection to be *good to go*.

Construction:

Design and construct off-stream water facilities to:

- Comply with the construction standards of NRCS FOTG 614, including the General Specifications.
- Provide continuous and reliable water throughout the entire use period of the pasture or rangeland.
- Accommodate seasonal or typical drought or low flow periods. Where facilities are unable to provide water to a stock tank during seasonal low flows, but the pasture is intended to remain

in use, owners or operators shall plan for, and provide, alternative water sources that do not include livestock access to surface waters of the state.

- Have adequate capacity to meet the water requirements of the livestock and/or wildlife. This will include the storage volume necessary to carry over between periods of replenishment. Animal water requirements can be obtained from the NRCS Engineering Field Handbook, Table 11-1.

- Use automatic water level control and/or overflow systems as appropriate.

- Prevent overflow systems from transporting contaminants, causing erosion, or otherwise causing a discharge of pollutants to surface waters.

Operation and Maintenance:

Owners and operators will need to maintain stock water tanks by providing maintenance, such as:

- check for debris which may restrict the inflow or outflow system;
- check for leaks and repair immediately if any leaks are found;
- check the automatic water level device to insure proper operation;
- check to ensure that adjacent areas are well protected against erosion;
- check to ensure the outlet pipe is freely operating and not causing erosion problems; and
- prepare for winter weather, such as adding material in the storage area to allow for ice expansion without damage.

EXAMPLES

OFF-STREAM WATERING FACILITIES

WATER GAPS

NRCS Practice Standard Cross Reference: Code 575

Purpose

Provides controlled and improved emergency livestock access to surface waters where full exclusion has been implemented, but emergency access to surface water may be needed to provide a back up water supply to off-stream stock water facilities.

Emergency access is defined as any period when off-stream stock water facilities fail to operate due to unplanned for and unforeseen circumstances. Seasonal failure of off-stream stock water facilities due to common weather patterns or typical low flow periods, does not constitute an emergency, but instead should be planned for and addressed during off-stream water facility design.

Pollution Prevention

Water gaps provide source control of livestock impacts to the riparian area by preventing access to streams when off-stream facilities are operational, or by providing controlled access to surface waters when no other watering options are available.

Access Control

In order to provide source control of livestock impacts, water gaps will be designed to:

- prevent livestock access to surface waters when off-stream water facilities are properly functioning
- prevent the up and downstream movement of livestock in the riparian area and stream
- prevent livestock from entering fully into or across the water source, unless water gap also serves as a stream crossing, in which case cattle access to cross the water is prohibited at all times when stock are not being moved.

Location:

Water gaps remove riparian vegetation, and so, do not provide treatment of upland runoff. Therefore, water gaps must not be located directly adjacent to corrals, barn lots, heavy use areas, calving

EXAMPLES

pastures, animal feeding, confinement, or other high concentration areas.

Locate water gaps at areas where the streambank is stable or grade control can make a stable condition.

Size:

Water gaps will be sized according to the number of animals to minimize streamside impacts and prevent animals from lingering at the streamside. Water gaps should be larger at the edge of the riparian buffer, and funnel down in size toward the edge of the stream.

Maximum water gap widths are as follows:

- For 50 animals or less, water gaps will be no wider than 10 feet at the edge of the water and 20 feet at the edge of the riparian buffer and upland pasture.
- For larger operations, water gaps will be no wider than 20 feet at the edge of the water and 30 feet at the edge of the riparian buffer and upland pasture or rangeland.

Amount:

The number of water gaps must not exceed the number of off-stream watering locations.

Construction

- All planned work shall comply with all federal, state, and local laws and permit conditions and requirements. The landowner shall obtain all necessary permits prior to construction or any land clearing activities. For example, construction in a stream or on stream banks may require a Hydraulic Project Approval from Washington Department of Fish and Wildlife.
- Water gaps must be armored or otherwise stable. Armor material shall be stable, to prevent break-up when the stream exceeds bankfull flow.
- Have a grade <= 2:1

Operation and Maintenance

Owners and operators shall:

- Maintain the designed grade and dimensions,
- Periodically add surfacing materials if used,
- Mend fences and replace gates when needed,
- Remove and manage manure accumulations.

STREAM CROSSING

NRCS Practice Standard Cross Reference: Code 578

Purpose
A crossing provides a controlled and stabilized area, or structure, which allows livestock to cross a small stream in a manner that eliminates or greatly minimizes water quality impacts and stream disturbance.

Pollution Prevention
Stream crossings can provide source control of livestock impacts to the riparian area by limiting access to streams and riparian areas when stream crossing is necessary. However, stream crossings may also serve as a source of water pollution when used or built improperly. Therefore, crossings should be minimized, or avoided when other alternatives are available.

Stream crossings may serve as water gaps, but only to provide time limited and controlled access when emergency watering is necessary. When crossings serve as water gaps, they will also be built according to the water gap criteria of this manual.

When choosing a stream crossing style, such as a bridge or ford, consider fish passage, potential erosion, stream type, and flooding occurrences. Also, consult with the local conservation district, NRCS, or certified engineer to choose the appropriate style crossing.

Bridge/Culvert Style Crossings:

1. **Access Control**

In order to provide source control of livestock impacts, stream crossings will:

- Be avoided, whenever possible, through evaluation of alternative trail or travel-way locations.
- Be designed to prevent the up and downstream movement of livestock in the riparian buffer and stream.
- Limit the width of the animal walkway through the riparian buffer to the width of the crossing.
- Prevent congregation of livestock in the animal walkway that passes through the riparian buffer.

EXAMPLES

2. **Location**

Crossings remove riparian vegetation, and so, do not provide treatment of upland runoff. Therefore, crossings must not be located directly adjacent to corrals, barn lots, heavy use areas, calving pastures, animal feeding, confinement, or other high concentration areas.

The number of crossings should be minimized.

Ford Style Crossings:

1. **Access Control**

In order to provide source control of livestock impacts, stream crossings will:

- Be avoided, whenever possible, through evaluation of alternative trail or travel-way locations.
- Be designed to prevent the up and downstream movement of livestock in the riparian buffer and stream.
- Be gated where the edge of riparian buffer and upland pasture or rangeland meet.
- Only be open during the time needed to move animals from one side to the other.
- Be closed when operators are not actively moving animals.
- If also used as an emergency water gap, prevent livestock access to surface waters when off-stream water facilities are properly functioning.

2. **Location**

Crossings remove riparian vegetation, and so, do not provide treatment of upland runoff. Therefore, crossings must not be located directly adjacent to corrals, barn lots, heavy use areas, calving pastures, animal feeding, confinement, or other high concentration areas.

The number of crossings should be minimized.

3. **Size**

Ford style crossings should be sized according to the number of animals to minimize in-stream lingering or loafing of animals.

Maximum crossing widths are as follows:

- For 50 animals or less, crossings will be no wider than 10 feet at the edge of the water and 20 feet at the edge of the riparian buffer and upland pasture.
- For larger operations, crossings will be no wider than 20 feet at the edge of the water and 30 feet at the edge of the riparian buffer and upland pasture or rangeland.

Construction

Crossings should be designed and constructed to meet or exceed NRCS FOTG standard 578.

Crossing construction should comply with all federal, state, and local laws and permit conditions and requirements. When permits are necessary, the landowner shall obtain permits prior to construction or any land clearing activities. For example, construction in a stream or on stream banks may require a Hydraulic Project Approval from Washington Department of Fish and Wildlife.

Locate crossings at areas where the stream bank is stable or grade control can make a stable condition.

Stream crossings shall provide a way for normal passage of water, fish and other aquatic animals within the channel during all seasons of the year. In fish-bearing streams, fish passage should be provided; the design of culverts, bridges and fords shall be in accordance with the requirements of the Washington Department of Fish and Wildlife.

Operation and maintenance

- The stream crossing, appurtenances, and associated fence should be inspected after each major storm event, with repairs made as needed.
- Crossings will need to be cleared of manure after use.

5.4 Concentrated Impact Area Clean Water Practices

The following clean water practices are for concentrated impact areas – those places used continually or seasonally to feed, stable, board, pen, or otherwise concentrate animals. For the purpose of this manual, this section does not apply to operations defined as a Concentrated Animal Feeding Operation according to Department of Ecology's state waste discharge permit[90], feed lots, licensed dairies, or off-stream watering facilities that meet the requirements of the manual. Most grazing operations utilize concentrated livestock areas, in addition to grazing livestock on the open pasture or rangeland. There are two main types of concentrated areas:

1. **Permanent continual confinement areas** – places used throughout the year for the purpose of calving, finishing, feeding, protection, or shelter – such as barns, stables, pens, or corrals.
2. **Winter feeding areas** –places used seasonally to concentrate/congregate livestock for the purpose of supplemental feeding.

The concentration of livestock in any one area causes repeated trampling of soil and vegetation, and concentrates wastes. These impacts, in turn, may combine to cause erosion, increased runoff, decreased nutrient uptake, decreased pathogen die off, and subsequently a highly polluted runoff that may threaten water quality. In many situations, concentrated areas are most heavily used during winter months, when supplemental feeding and penning are necessary. During winter, plants are more susceptible to trampling, and riparian buffers and filter strips are less effective at filtering pollutants.

Owners and operators should decide which type of concentrated area best describes their operation, and apply the clean water practices accordingly. Owners and operators are also encouraged to seek technical and financial assistance from their local conservation district office or NRCS, to support the implementation of the following practices.

[90] See http://www.ecy.wa.gov/programs/wq/permits/cafo/index.html for more information

5.4.1 Permanent Confinement Area Practices

If your facility has a permanent confinement area, apply the following clean water practices, in addition to the grazing clean water practices. Permanent confinement areas are defined as places used throughout the year for the purpose of calving, finishing, feeding, protection, or shelter – such as barns, stables, pens, or corrals.

Permanent Confinement Areas BMPs			
BMPs	**Source Control**	**Treatment**	**Criteria**
Site Location	Sets back concentrated livestock areas from surface waters. Proper site location can also prevent draining or conveying contaminated runoff to surface waters	Creates additional infiltration, filtration, and uptake capacity to treat runoff from concentrated impact areas	Confinement areas should be set back a minimum of 250 feet from surface waters when feasible. When setback is not achievable, confinement areas will adjust riparian buffer widths and apply manure source control practices. No confinement areas can be within 100 feet of surface waters. Also avoid drainages conducive to the transport of contaminated runoff and erosion.
Riparian Buffer	Stabilizes stream and prevents erosion	Filters upland pollutants	Presence and location of a permanent confinement area increases the minimum buffer width: Located more than 250 feet from surface water—55-foot minimum buffer width. Located 150 to 250 feet from surface water—75-foot minimum buffer width. Located 100 to 150 feet from surface water—100-foot minimum buffer width .
Exclusion Fence	Prevents livestock impacts in the riparian buffer and surface water	Facilitates natural recovery of riparian area	Prevent livestock access to riparian buffer
Heavy Use Area Protection	protects high impact areas from erosion		Operations within 250 feet of surface waters will stabilize concentrated animal impact areas with heavy use area protection.
Manure Source Control	Prevent precipitation contact with manure by collecting wastes		Concentrated livestock areas with manure accumulations exposed to precipitation within 250 feet of surface waters will collect manure to prevent accumulation and contaminated runoff
	Store manure in manner that prevents runoff and leaching of waste.		When operations collect accumulated manure, adequate storage will be provided and sized according to the volume of manure generated and constructed according to NRCS standards.
	Apply or use manure in a manner that prevents runoff and leaching of waste		Apply manure at agronomic rates and to locations that prevent a discharge to surface and ground waters

SITE LOCATION

Purpose

Properly locating confinement and manure storage areas provides source control and treatment by keeping high impact areas outside of the riparian area in places that are not as conducive to runoff and erosion.

Pollution Prevention

Setbacks

A setback is the distance which a structure or intensive use is set back from a stream, or shore or other place which needs protection. Some uses, such as lower impact grazing, are allowed within the setback.

Setbacks are necessary to prevent pollutants from entering into critical areas where contact with runoff will result in contamination of surface water. Because confinement areas concentrate livestock impacts they may cause a high potential for contaminated runoff to pollute surface waters. Therefore, confinement and waste storage areas should be set back a minimum of 250 feet from surface waters whenever feasible. If a 250 foot setback is not achievable, then confinement and waste storage areas will need to increase down gradient riparian buffers accordingly. Use of manure source control BMPs is required if confinement and waste storage areas are located within 250 feet of surface waters.

Under no conditions should a confinement or waste areas be located within 100 feet of surface waters.

Location

Locate confinement and waste areas to avoid conditions that will create concentrated discharges of runoff or erosion. Avoid the following conditions:

- Steep slopes up gradient of surface waters
- Highly erodible soils without heavy use area protection
- Natural or constructed drainages that lead to surface water
- Topography that naturally concentrates runoff

RIPARIAN BUFFERS FOR PERMANENT CONFINEMENT AREAS

NRCS Practice Standard Cross References: Code 390, 391 & 393

Purpose

Riparian buffers provide source control by stabilizing streambanks, preventing erosion, and providing shade to streams. Also, when properly sized, the riparian buffer area serves to filter upland pollutants in runoff, and therefore provides the necessary treatment to prevent discharges to surface water.

Pollution Prevention

Riparian Buffer Sizing

As discussed in the pasture and rangeland clean water practices, the treatment required from riparian buffers (the width) will increase when the pollutant and runoff potential increase. Because concentrated livestock areas always have a high runoff and pollution potential, riparian buffers should be determined according to the distance of the concentrated livestock area (including the waste storage area) from the stream, and the level of source control used to manage potential pollutants.

Buffer widths for permanent concentrated livestock areas and waste storage BMPs

Distance of concentrated impact areas from surface waters	Minimum buffer width	Source control BMPs used
Between 250 and - 400 feet	55 ft	• Manure Storage with Roof
Between 250 and 150 feet	75 ft	• Heavy use area protection • Manure Management • Manure storage with roof • Roof gutters
Less than 150 feet	100 ft	• Heavy use area protection • Manure Management • Manure storage with roof • Roof gutters

Use this chart to determine your minimum riparian buffer width down gradient of concentrated impact areas. Recognizing that the riparian buffer is the key practice in protecting water quality and satisfying the relevant water quality regulations, it is recommended that planners err on the side of protection. If your pasture conditions require a larger riparian buffer than those required in this section, to be good to go, you will apply the greater of the two widths. If assistance is needed in making a determination, contact the Department of Ecology for assistance.

Riparian buffers may also be required by other agencies or local jurisdictions depending on the requirements of fish and wildlife species, associated environmental concerns, topographic and geographic contexts, associated state or federal grant requirements, or local statutes, ordinances, rules or laws.

Riparian Buffer Vegetation

Vegetation in the riparian buffer will need to be maintained to provide dense vegetation, including wherever possible woody vegetation such as trees and shrubs to provide shade and bank stabilization, and good treatment of runoff. Owners or operators should also consider the use of site potential native vegetation.

Heavy Use Area Protection

NRCS Practice Standard Cross References: Code 561

Purpose
Stabilize or relocate areas frequently and intensively used by livestock where erosion and subsequent polluted runoff threaten to contaminate surface waters.

Pollution Prevention
This practice provides source control or treatment of livestock impacts from concentrated impact areas such as feeding locations, pens, barns, confinement areas, or other high traffic areas, by preventing erosion and creating surfaces that support the collection and proper management of manure in concentrated areas.

Location

Heavy use area protection is required when barns, corrals, pens, and other permanent concentrated impact areas are within 250 feet of surface waters. Concentrated impact areas should never be located less than 100 feet from surface waters.

Groundwater

Soil type (high permeability rate), or ground water level may create a potential for manure deposits to contaminate the ground water or nearby wells. Under these circumstances, owners and operators should consider the use of impervious barriers as heavy use area protection, coupled with more frequent manure collection to prevent discharges to the ground water.

Construction and Planning
Construct heavy use area protection according to the construction specifications in NRCS FOTG standard 561.   Also, producers will need to plan and implement a manure management strategy, including the manner of collection, location and type of storage, and the use or disposal of the manure.

Operation and maintenance

Provisions will need to be made to collect, store, utilize and/or treat manure accumulations and contaminated runoff in accordance with the recommended BMPs in this manual and the NRCS conservation practice standards.

Owners or operators will also need to inspect and maintain the requisite thickness of surface materials, in order to maintain the intended function of heavy use area protections.

Owners or operators will also insure that manure does not accumulate, run off, discharge or otherwise pose a threat to water quality.

MANURE SOURCE CONTROL BMPs

NRCS Practice Standard Cross References 313, 367, 629,633, 590, 558

Purpose

To collect, store and utilize livestock manure in a manner that prevents contamination of runoff, and leaching to ground water.

Pollution Prevention

Manure will be managed to prevent contact with precipitation or other surface water runoff.

Roof Gutters

Roof Gutters are necessary to prevent the entrance of roof runoff into the concentrated livestock area, which may result in the transport of manure offsite. Gutters will be installed where roof runoff may enter concentrated livestock or waste storage areas. Gutter out flow will be redirected to prevent runoff from entering the concentrated livestock areas, and causing erosion.

Waste Collection

Owners and operators will collect manure accumulations frequently from permanent confinement areas. Collection is necessary to prevent precipitation mixing with significant manure accumulations, and causing leaching or contaminated runoff. Owners and operators should consider collection prior to precipitation or storm events.

Waste Storage

Producers will need to store collected manure that is not land applied, in a way that prevents contact with precipitation, and leaching.

Waste storage facilities will also need to be installed on an impermeable surface to prevent contamination of ground water. Storage facilities may be built according to NRCS FOTG construction standards or to an equivalent engineering standard. Waste storage facilities will also need to be planned, designed, and constructed to meet all federal, state, and local laws and regulations.

EXAMPLES

Covered waste storage facilities

Covered compost facility

Waste storage facilities must be covered to prevent contaminated runoff and leaching.

Waste Utilization

Producers will need to apply manure in a manner that prevents contaminated runoff and leaching to groundwater. To ensure pollution prevention, apply manure at the agronomic rates for the intended receiving crop. Agronomic application guidance is available through NRCS FOTG standard 590.

Also, to prevent pollution do not apply manure under the following circumstances:

- To frozen, or snow-covered ground
- To saturated soils
- Just before or during precipitation events
- To areas which may easily convey pollutants to surface waters such as ditches, culverts, drain tiles, etc.

Owners and operators are encouraged to contact NRCS or their local conservation district to develop a nutrient management plan.

5.4.2 Winter Feeding Area Practices

If your facility has a winter feeding area, apply the following clean water practices. Winter feeding areas are defined as places used seasonally to concentrate/congregate livestock for the purpose of supplemental feeding

Winter Feeding Area BMPs			
BMPs	**Source Control**	**Treatment**	**Criteria**
Site Location	Sets back concentrated animal impacts from surface waters. Proper site location can also prevent draining or conveying contaminated runoff to surface waters	Creates additional infiltration, filtration, and uptake capacity to treat runoff from concentrated impact areas	Impacted areas from winter feeding will be set back a minimum of 250 feet from surface waters. Also avoid natural or constructed drainages that lead to surface water.
Riparian Buffer	Stabilizes stream and prevents erosion	Filters upland pollutants	A 55-foot minimum buffer width
Exclusion Fence	Prevents livestock impacts in or near the stream	Facilitates natural recovery of riparian area	Prevent livestock access to riparian buffer.

SITE LOCATION

Purpose

Properly locating winter feeding areas provides source control and treatment of livestock impacts by locating concentrated impact areas outside of the riparian area in places that are not as conducive to runoff and erosion.

Pollution Prevention

Setbacks

Setbacks are necessary to prevent pollutants from entering into critical areas where contact with runoff will result in contamination of surface water. Because winter feeding creates concentrated impact areas with a high potential for contaminated runoff to pollute surface waters, all winter feeding areas will need to be set back a minimum of 250 feet from the ordinary high water mark of surface waters.

Site Location

Locate winter feeding areas to avoid conditions that will create concentrated discharges of runoff or erosion. Avoid the following conditions:

- Steep slopes up gradient of surface waters
- Highly erodible soils without heavy use area protection
- Natural or constructed drainages that lead to surface water
- Topography that naturally concentrates runoff

RIPARIAN BUFFER FOR WINTER FEEDING AREAS

NRCS Practice Standard Cross References: Code 390, 391 & 393

Purpose

Riparian buffers provide source control by stabilizing stream banks, preventing erosion, and providing shade to streams. Also, when properly sized, the riparian buffer area serves to filter upland pollutants in runoff, and therefore provides the necessary treatment to prevent discharges to surface water.

Pollution Prevention

Riparian Buffer Sizing

In order to provide adequate source control and treatment, riparian buffers will need to be no less than 55 feet wide, measured horizontally from the ordinary high-water mark of surface water at any location when winter feeding areas are between 250 and 500 feet of surface waters. If your pasture conditions require a larger riparian buffer than this section requires, you will need to apply the greater of the two widths. If assistance is needed in making a determination, contact the Department of Ecology for assistance. Larger buffers may also be required by other agencies or local jurisdictions depending on the requirements of fish and wildlife species, associated environmental concerns, topographic and geographic contexts, associated state or federal grant requirements, or local statutes, ordinances, rules or laws.

A larger buffer is always more protective of water quality. Recognizing that the riparian buffer is the key practice in protecting water quality and satisfying the relevant water quality regulations, it is recommended that planners err on the side of protection. If assistance is needed in making a determination, he/she may contact the Department of Ecology for assistance.

Riparian Buffer Vegetation

Vegetation in the riparian buffer shall be maintained to provide dense vegetation, including wherever possible woody vegetation such as trees and shrubs to provide shade and bank stabilization. Owners or operators should also consider the use of site potential native vegetation.

EXCLUSION FENCE

NRCS Practice Standard Cross References: CODE 382 & 472

Purpose:

Livestock exclusion creates a barrier that restricts animal access to the riparian buffer. Livestock exclusion also creates a buffer area between sources of livestock pollution and surface water. This provides source control by preventing conditions which cause pollution from occurring next to the stream.

Pollution Prevention:

In order to provide adequate source control, fences will need to be positioned between the edge of the riparian buffer and upland pasture.

Animal access to the riparian buffer will be prevented to ensure:

- The treatment capacity of the buffer is optimized
- Streambanks are properly stabilized
- Livestock pollutants are set back from the stream

Frequently Flooded Areas

Exclude animal access to frequently flooded areas prior to seasonal inundations, and during periods of saturation.

Construction:

Fences will need to be designed to control livestock and meet the intended life of the practice. Follow the NRCS FOTG Fence-General Specification standard to accomplish this.

Type and size of livestock will be evaluated when choosing the appropriate type and design of fence.

Easily repaired fences such as high tensile should be used in areas where flooding may occur or where debris may collect.

Operation and Maintenance:

Regular inspection of fences and gates should be part of an on-going management program to ensure protection of water quality. Inspection of fences after storm events is needed to ensure the fence continues to restrict animal access in the intended manner.

Chapter 6
Information on Ecology Financial Guidelines

The structural clean water practices in this manual are all eligible for Ecology water quality funding. Ecology 's Clean Water Act section 319 funds and state Centennial funds are passed down to local grant recipients such as county's and conservation districts. You can contact an Ecology regional office or local conservation district to see if financial assistance is available to implement these practices in your area. Also, all of the structural practices in this manual are also eligible for funding through NRCS and the Washington State Conservation Commission.

Detailed information regarding practice eligibility for water quality grants is available at:

http://www.ecy.wa.gov/biblio/0810080.html , and
http://www.ecy.wa.gov/biblio/0810080addendum.html

The following livestock practices are eligible for water quality funding:

- **Riparian Buffer Planting**
    - Planting must use native riparian vegetation
    - Buffers must be a minimum of 35 feet, and consistent with the recommendations in this manual.
- **Off Stream livestock water facilities**
    - Off-stream livestock water provisions are eligible for financial assistance based on the continuous linear distance of riparian exclusion per land owner. Financial assistance is limited to 75% of the total eligible costs. See table 1 below for limits. Maximum of $30,000 per landowner.
    - Off-stream water developments must be located a distance away from surface waters that will prevent water quality impacts.
    - Loans may be issued to cover up to 100 percent of eligible project cost.
    - Pumps, pipes, water troughs, and wells, as needed, are eligible.
    - All components of solar powered pumps are project eligible.
    - Heavy use area protection at watering facilities is eligible as needed. The cost of heavy use area protection is included in the final cost of the off-stream watering facility and is included in the funding limitations.

Miles of Livestock Riparian Exclusion	Financial Assistance Limit
Less than ½ mile	75 percent of total eligible cost or $6,000 (whichever is less)
Greater than or equal to ½ mile and less than 1 mile	75 percent of total eligible cost or $9,000 (whichever is less)
Greater than or equal to 1 mile and less than 1.5 miles	75 percent of total eligible cost or $12,000 (whichever is less)
Greater than or equal to 1.5 miles and less than 2 miles	75 percent of total eligible cost or $18,000 (whichever is less)
Greater than or equal to 2 miles and less than 2.5 miles	75 percent of total eligible cost or $24,000 (whichever is less)
Greater than or equal to 2.5 miles	75 percent of total eligible cost or $30,000 (whichever is less)

- **Livestock Fencing**
    - Construction must meet NRCS practice standards and specifications
    - Fences must be setback a minimum of 35 feet, measured horizontally from the ordinary high water mark, and consistent with the recommendations in this manual.
- **Livestock Feeding BMPs**
    - These practices are intended to support the relocation of livestock feeding areas that threaten water quality, or enhance existing feeding areas distanced from surface waters. Relocation will need to be consistent with the manual to be eligible.
    - Operations meeting the definition of the Concentrated Animal Feeding Operation Permit are not eligible for funding.
    - All BMPs must be built and located according to NRCS specifications.
    - The producer must exclude livestock in all pasture or rangeland areas where livestock are present, from waters of the state, with a minimum 35 foot setback from the ordinary high water mark.
    - The owner or operator must have a plan in place to manage manure.

    - **Heavy Use Area Protection**
        - Heavy use area protection will need to prevent erosion and polluted runoff at feeding and watering facilities.
        - Concrete and other cement based materials, rock aggregate, and other appropriate materials are eligible for funding. Heavy use area protection areas must designed and constructed according to NRCS standards.

        - Heavy use area protection is not eligible to build permanent feed lots where livestock will be confined continuously throughout the year.
        - Heavy use area protection is only eligible to protect critical areas directly surrounding feeding and watering locations.
        - Heavy use area protection is eligible for 50% of the total eligible cost, up to a maximum of $3,000 per landowner.

    - **Waste storage facilities**
        - Waste storage facilities, waste storage covers, and roof runoff structures are eligible for funding.
        - Waste storage facilities must include covers and roof runoff structures.
        - The total package of waste storage BMPs are eligible for 50% of the total eligible cost, up to a maximum of $6,000 per land owner.
        - This BMP must be part of a manure management plan in order to be eligible for funding.
- **Windbreaks**
    - Windbreaks are planted tree rows used to shelter livestock from summer sun and winter wind, and therefore encourage the congregation of livestock and utilization of pasture or rangeland away from the riparian area.
    - Windbreaks are eligible to support the relocation of winter feeding operations upland, away for riparian areas, and to prevent water quality impacts.
    - Windbreaks are eligible for 50% of the total eligible cost, up to a maximum of $1,000 per landowner.

Chapter 7
Helpful Internet Resources

The following are some helpful internet resources to help producers locate additional information that will assist in the development and installation of clean water practices.

Locate an Ecology Regional Office here:
http://www.ecy.wa.gov/org.html

Find Your Counties NRCS Field Office Technical Guide here:
http://efotg.nrcs.usda.gov/efotg_locator.aspx?map=WA

Find Your Local Conservation District here:
http://www.scc.wa.gov/index.php/contact/Conservation-Districts/

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WA State

RCW 90.48 et. seq.

RCW 7.48.305

WAC 173-201A et. seq.

WA State CAFO program http://www.ecy.wa.gov/programs/wq/permits/cafo/index.html for more information

Federal

33 USC § 1251 et. seq.

42 USC § 6903 (27)

Concentrated Animal Feeding Operation National Discharge Elimination System and State Waste Discharge General Permit

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Glossary

Best Management Practices (BMPs) – a term often generically used to refer to a structural or managerial practice used to eliminate or lessen a specific environmental or human health harm, or provide some other intended benefit. However, not all BMPs will be the best at preventing or eliminating all problems. That is why BMPs need to be designed according to specific criteria intended to address the specific goal.

Sometimes "Best Management Practice" has a specific legal meaning defined by statute. In the context of Washington state pollution prevention, BMPs specifically means "physical, structural, and/or managerial practices approved by the department that, when used singularly or in combination, prevent or reduce pollutant discharges.**" WAC 173-201A-020**

Clean Water Practices – Clean water practices are suites or groups of Ecology approved best management practices that are designed with purpose of preventing water pollution, protecting clean water, and achieving compliance with state water quality regulations. The practices use both source control and treatment methods to prevent direct discharges and polluted runoff from entering surface waters of the state.

Demonstrative approach - when producers are obligated to show compliance. The demonstrative approach allows producers to demonstrate to Ecology that their preferred management practices will prevent water pollution and their operation will not violate water quality regulations.

Discharge – contribution of polluting matter to waters of the state.

Erosion - when the soil surface is worn away by actions which remove sediment, soil, rock and other particles in the natural environment.

Nonpoint Source Pollution - pollution which enters any waters of the state from any dispersed land-based or water-based activities, including but not limited to atmospheric deposition, surface water runoff from agricultural lands, urban areas, or forest lands, subsurface or underground sources.

Pollution – Defined by statute as "contamination, or other alteration of the physical, chemical, or biological properties, of any waters of the state, including change in temperature, taste, color, turbidity, or odor of the waters, or such discharge of any liquid, gaseous, solid, radioactive, or other substance into any waters of the state as will or is likely to create a nuisance or render such waters harmful, detrimental, or injurious to the public health, safety, or welfare, or to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or to livestock, wild animals, birds, fish, or other aquatic life." RCW 90.48.020.

Presumptive approach - when the clean water practices are installed and maintained, the Department of Ecology will presume that the land covered by the practices is in compliance with water quality regulations. The presumption means Ecology believes the owners or operators have taken the necessary steps to satisfy the legal duties established in the relevant regulations; and are therefore, "good to go."

Riparian Buffer - land next to a stream or river that is vegetated, usually with native vegetation, that serves as a protective filter for streams. A buffer helps to stabilize stream banks from washing away and to reduce the impact of upland sources of pollution by trapping, filtering, and converting sediments, nutrients, and other chemicals. In addition, a buffer helps supply food, cover, and thermal protection to fish and other wildlife.

Runoff -runoff is a term used to describe the water from rain, snowmelt or irrigation that flows over the land surface and is not absorbed into the ground, instead flowing into streams or other surface waters or land depressions.

Setback - distance from the surface water that a structure may be erected or an intensive use located.

Source Control - source control is a structural or managerial practice designed to prevent pollutants at their origin. Source control can prevent pollutants from entering into critical areas where contact with runoff will result in contamination of surface waters.

Treatment practices - treatment practices are structural practices that are designed to remove or reduce the amount and type of pollutants when they are being transported by runoff.

Waters of the state – term referring to surface waters within jurisdiction of the state's water pollution control act and water quality standards. Defined by statute as "lakes, rivers, ponds, streams, inland waters, saltwaters, wetlands and all other surface waters and water courses within the jurisdiction of the state of Washington." RCW 90.48.020.