Whatcom County
South Lynden Watershed Improvement District
Agricultural and Watershed Enhancement Plan

South Lynden Watershed Improvement District

assisted by

Whatcom Conservation District

The South Lynden WID (SLWID) will sponsor and participate in a series of actions to enhance their farmlands and to enhance the function of watersheds within the district. The purpose of this plan is to identify the practices, such as drainage maintenance, needed to preserve viable agriculture and to identify practices to both offset unavoidable negative impacts and to generally improve ecological functions. The intention is to also demonstrate that work undertaken by the SLWID is consistent with the Whatcom County Critical Areas Ordinance, Shorelines Management Plan and the Washington State Hydraulic Code. The goal is to generally identify the practices and projects, document best management practices designed to minimize impacts, and to secure long term permits from the Washington State Department of Fish & Wildlife (WDFW) and from Whatcom County Planning and Development Services (PDS). The result will be an expedited process that will benefit all three agencies.

SECTION 1: DISTRICT OVERVIEW

General:
The SLWID was founded in 2014 under WA State law (RCW 87.03). Local farmers and landowners organized by watersheds to represent the needs of the agriculture community. The SLWID along with five other established WIDs envisions:

- Healthy and sustainable water systems
- A vibrant and productive agricultural economy
- A sense of community by developing positive and trusting relationships
- A unified presence and educated representation of all agricultural industries

The priorities of the SLWID include:

1. Water Quality
2. Drainage
3. Water Rights
4. Flood Management

Location:
The South Lynden Watershed Improvement District (see Figure 1) is located in the central lowland area of Whatcom County. Much of the District is in the floodplain of the Nooksack River. The area is predominantly agricultural, comprised primarily of dairy and berry farms. The closest city, Lynden (pop. 12,900), borders the WID to the north and west. A significant proportion of the soils in the South Lynden WID have been classified by the USDA Natural Resources Conservation Service as Prime or Prime if managed.

The SLWID area encompasses 12,991 acres in total. The area includes most of the Kamm Creek and Scott Ditch watersheds as well as the northern part of the Wiser Lake/Cougar Creek watershed. Additionally, there are several smaller drainages in the SLWID including one known locally as LLPL. All of these waterways are tributaries to the Nooksack River.

The SLWID overlaps with several other special purpose districts including Consolidated Drainage Improvement Districts #20 and #21, Drainage Improvement Districts #5 and #6 and Diking District #3.

Predominant Land Uses:
Nearly all the lands represented by the SLWID are commercial farmlands. Dairy crops, raspberry, blueberry, and seed potatoes are dominant. Agricultural lands located in the Nooksack River floodplain are protected by levees maintained by Lynden/Everson Subzone (Whatcom County Flood Control Zone District) and Diking District #3. The Natural Resources Conservation Service (NRCS) classifies most of the SLWID as prime farmland.

Fish Presence:
Scott Ditch and Kamm Creek are utilized by Fall Chinook, Coho, Chum, Steelhead and Cutthroat Trout. Cougar Creek is mapped for use by Coho, Steelhead and Cutthroat although current fish use is limited by a floodgate and a dam. Smaller tributary streams and ditches may also have fish use. Watercourses in the Nooksack River floodplain will likely have juvenile fish seeking refuge during flood events. Figure 2 shows fish distribution as mapped by the WDFW "Salmonscape".

Fish Habitat: Factors contributing to functioning fish habitat includes good water quality (cool, clean), instream structure such as large wood (refuge out of flows, cover from predators), and riparian cover (shade, food source, cover from predators). In the SLWID, functioning riparian areas are lacking along many of the watercourses and large woody debris is virtually non-existent. The result is little high quality Salmonid habitat and elevated water temperatures.

Watercourse Classifications:
The classifications used in this plan are defined in the Drainage Management Guide for Whatcom County and are based upon those utilized by WDFW. WDFW jurisdictional watercourses are mapped as Modified Natural for the purposes of this plan. Figure 3 illustrates the watercourse classifications in the SLWID. WDFW watercourse GIS layers, aerial photos and local residents were used to determine the extent of modified natural and constructed watercourses.

Natural Watercourses (Red): Are defined as having not been significantly altered from their natural flow path, floodplain, and riparian cover. No natural watercourses exist in the SLWID. Some channels retain natural features such as meanders but have been either cleared or dredged in the past.

Modified Natural Watercourses (Yellow): Are defined as being historically altered natural systems. They typically have headwaters and may have been previously diverted, dredged, straightened, dyked, or cleared. Scott Ditch, Kamm Creek, and Cougar Creek are all modified watercourses as well are several other smaller tributary streams. There are approximately 275,806 linear feet of modified natural watercourse in the SLWID.

Constructed Watercourses (Green): Are typically short ditches that start in fields, lack headwaters and eventually flow into modified watercourses. Numerous constructed field ditches exist in farmed areas. There are approximately 315,881linear feet of constructed watercourse in the SLWID.

Stream Crossings and Fish Passage: Numerous stream crossings exist in the SLWID including State highways, County roads, private driveways and farm roads. Typical structures are bridges and culverts. Culverts may be barriers to fish passage and are

commonly undersized contributing to poor drainage and flooding. Floodgates are structures used to prevent Nooksack River floodwaters from surging into smaller watercourses. The floodgates found in the SLWID are also barriers to fish passage. Figure 4 shows known fish passage barriers in the SLWID.

Past Drainage Maintenance Mitigation Work: Considerable habitat restoration has been completed in the past as mitigation for drainage maintenance. Extensive Hedgerow plantings have been installed to prevent Reed canarygrass growth in the channel by casting deep shade. Two culverts that were barriers to fish passage have also been remedied and spawning gravels have been supplemented in some stream reaches.

Past Voluntary Habitat Restoration: Considerable work has also been completed to restore more natural habitat conditions using the Conservation Reserve Enhancement Program (CREP) or other voluntary programs. Stream and wetland buffers now exist in the SLWID where landowners have chosen to participate.

Wetlands:
Figure 5 shows Whatcom County CAO wetlands in the SLWID. These may not be representative of actual wetland locations. Farmlands in the SLWID are classified by the Natural Resources Conservation Service (NRCS) as either Prior Converted Wetland, Farmed Wetland, or Non Wetland status.

Other Significant Natural Features:

Nooksack River – The mainstem Nooksack River intersects the SLWID and is a migration corridor to several listed fish species including Bull trout, Chinook salmon, and Steelhead. Work planned by the SLWID will not have direct impacts to the river or river habitat.

Bylsma Flats - A large area of farmland west of Hannegan Rd is known as “Bylsma Flats” and is associated with Scott Ditch. This area ponds and stores floodwater for several months each winter providing critical habitat to many species of Waterfowl, Hawks, Bald Eagles, Blue Heron and other bird species. The area is also known to provide flood refuge and rearing for juvenile Coho Salmon and other fish species.

Kamm Flats - A large area of farmland west of Northwood Rd. This area ponds and stores floodwater for several months each winter providing critical habitat to many species of Waterfowl, Hawks, Bald Eagles, Blue Heron and other bird species. The area is also known to provide flood refuge and rearing for juvenile Coho Salmon and other fish species.

SECTION 2: AGRICULTURAL ENHANCEMENT PRIORITIES

Common agricultural practices that may have negative impacts to other natural resources are listed below as well as WDFW and PDS notification requirements. When required, offsetting enhancements (mitigation) will be negotiated prior to implementation.

Maintenance Dredging - Dredging is completed, as needed, by utilizing a hydraulically operated boom-type excavator operated from the top of bank. The excavator is typically equipped with a wide, flat-bottomed bucket with a lid that is designed to remove Reed canarygrass and accumulated sediments without allowing sediment laden water to spill back into the watercourse. Alternatively, an excavator with a clamshell bucket is sometimes utilized to "pluck" obstructing clumps of Reed canarygrass from the channel also without allowing sediment laden water to spill back into the channel. All dredged material is deposited landward of the ditch so that it will not return to the water and can later be moved back into the adjoining field or be hauled away.
30 day notice to WDFW Habitat Biologist
Natural Resource Notification of Activity to PDS 10 days prior

Watercourse Vegetation Management - Mechanical mowers (rotary or flail designs) are used to control vegetative material from the water line to the top of the bank.
14 day notice to WDFW Habitat Biologist
Natural Resource Notification of Activity to PDS 10 days prior

Culvert Maintenance and Replacement - Culverts must be maintained to ensure normal flow passes through the culvert consistent with its design specifications. This typically includes dredging of a ditch adjacent to culvert openings and occasional cleaning-out of the culvert interior. Cleaning is usually performed through the use of high-pressure water, mechanical dredging or by hand. Repair or replacement is necessary when damage or normal deterioration occurs to the extent that prevents optimum water flow or an unsafe crossing situation.
14 day notice to WDFW Habitat Biologist (maintenance)
30 day notice to WDFW Habitat Biologist (replacement)
Natural Resource Notification of Activity to PDS 10 days prior

Aquatic Herbicides - Reed canarygrass growing in the channel bottom and on streambanks can be treated with an aquatic formula of glyphosate with less impact than mechanical dredging. Treatment is completed in late summer or early fall when the practice is most effective.
Permit from Washington State Department of Ecology.

Bridge Maintenance and Replacement - Bridges must be properly maintained in order to ensure normal flow under the bridge while also continuing to provide equipment or foot access across a watercourse. Repair or replacement is necessary when incidental damage occurs to a bridge that prevents optimum water flow or results in an unsafe crossing situation. Repair or replacement activities typically occur above the high water line.
14 day notice to WDFW Habitat Biologist (maintenance)
30 day notice to WDFW Habitat Biologist (replacement)
Natural Resource Notification of Activity to PDS 10 days prior

Beaver Dam Management - Beaver dams are the most common impediment to drainage. When dams are of a sufficient size to impact property they are typically removed by hand often simultaneously with beaver trapping. If a dam is located in a natural or unnatural constriction point such as a culvert or area where the channel narrows "beaver deceivers" or "flow levelers" may be utilized. Removal of large dams using a tracked excavator may be necessary in rare circumstances.
3 day notice to WDFW Habitat Biologist (dam less than 1 month old)
14 day notice to WDFW Habitat Biologist (dam more than 1 month old)
Natural Resource Notification of Activity to PDS 10 days prior

Hand Maintenance – Minor obstructions often need removed to keep a watercourse open and flowing. Removing obstructions by hand has fewer negative impacts than other practices such as dredging.
14 day notice to WDFW Habitat Biologist
Natural Resource Notification of Activity to PDS 10 days prior

Many other agricultural practices may be needed during the timeframe of this plan. These include but are not limited to practices such as ditch covering (for water quality improvements), pump stations (for use during the growing season), streambank stabilization and fish screens (on irrigation intakes).
14 day notice to WDFW Habitat Biologist
Natural Resource Notification of Activity to PDS 10 days prior

SECTION 3: WATERSHED ENHANCEMENT PRIORITIES

Actions to enhance watershed functions are well documented in other planning documents including the Whatcom County Shorelines Management Plan and the WRIA 1 Salmon Recovery Plan. In general, plans call for implementing practices that improve fish habitat, enhance riparian areas, and improve water quality. Practices such as these always require voluntary landowner participation and may require additional grant funding. The SLWID may implement these projects both as mitigation for agricultural practices and as proactive steps to improve watersheds in agricultural areas. Examples of these practices include:

Riparian Forest Buffers – Planting native trees and shrubs (35' minimum width) along waterways to improve fish habitat and water quality. Funding may be available from the Conservation Reserve Enhancement Program (CREP), the Environmental Quality Incentive Program (EQIP), or from the Washington State Department of Ecology.
14 day notice to WDFW Habitat Biologist
Natural Resource Notification of Activity to PDS 10 days prior

Hedgerow Buffers – Planting predominantly native shrub buffers (15' width) along waterways to improve fish habitat and water quality. Funding may be available from CREP, and EQIP.
14 day notice to WDFW Habitat Biologist
Natural Resource Notification of Activity to PDS 10 days prior

Fish Passage – Replacing culverts that act as barriers to fish passage with larger culverts or bridges. Additional benefits often include safer crossings, better drainage and reduced flooding. Funding may be available from CREP, EQIP, or the Family Forest Fish Passage Program (FFFPP).
30 day notice to WDFW Habitat Biologist
Natural Resource Notification of Activity to PDS 10 days prior

Instream Habitat Structures – Placing large wood in the stream to increase channel complexity and provide cover and shelter for fish. Funding may be available from EQIP.

Other projects that could be considered include spawning gravel supplementation, flow supplementation, wetland enhancement, and floodgate modification.
30 day notice to WDFW Habitat Biologist
Natural Resource Notification of Activity to PDS 10 days prior

SECTION 4: GENERAL MITIGATION REQUIREMENTS

When work takes place in critical areas (watercourses and wetlands) or their buffers mitigation is required to offset any unavoidable impacts, (Whatcom County Critical Areas Ordinance, Shorelines Management Plan and the Washington State Hydraulic Code). Appropriate mitigation will be proposed as each project is planned. Proposed mitigation will be designed to replace any lost natural resources functions or values.

Mitigation Sequencing – As a project is planned, impacts will be mitigated in the following sequence:

1. Avoid. Conducting the work away from critical areas. Many farm practices such as drainage maintenance cannot reasonably avoid undertaking work in critical areas, their buffers or floodplains.
2. Minimize. Practices needed to maintain farmland productivity such as drainage maintenance are expensive and inconvenient to implement. No work will be planned unless it is absolutely necessary.
3. Restore. Disturbed areas will be stabilized and restored. Damaged woody plants will be replaced. In some cases, native trees and shrubs will be planted to replace lost habitat.
4. Compensate. Off site habitat projects may also compensate for impacts. An example is the removal of a fish passage barrier opening new habitat as compensation for habitat lost from drainage maintenance. Riparian planting can also compensate for stream habitat impacts.

Mitigation Plan – Site specific mitigation plans will be submitted to WDFW and PDS staff along with notification of the planned agricultural enhancement or watershed improvement activity. The plan will include detailed descriptions of activities, best management practices, drawings (if needed), maps, and maintenance and monitoring plans.

Mitigation Monitoring and Maintenance – The SLWID will maintain any mitigation projects for a minimum of five years. Native plant buffers will be maintained using CREP standards. Other practices will be maintained following NRCS Operations and Maintenance procedures. The SLWID will monitor all projects annually for a minimum of 5 years.

SECTION 5: BEST MANAGEMENT PRACTICES (BMPs)

Appendix 1 includes a series of BMP factsheets with detailed information on practices designed to minimize impacts to natural resources.

Maintenance Dredging

BMP Factsheet #6 General Drainage Maintenance BMPs
BMP Factsheet #7 Maintenance Dredging
BMP Factsheet #14 Constructed Watercourse Maintenance
BMP Factsheet #15 Fish Protection
BMP Factsheet #16 Water Quality Protection Measures

Beaver Dam Management

BMP Factsheet #6 General Drainage Maintenance BMPs
BMP Factsheet #8 Beaver Dam Management
BMP Factsheet #15 Fish Protection
BMP Factsheet #16 Water Quality Protection Measures

Watercourse Vegetation Management

BMP Factsheet #9 Watercourse Vegetation Management

Aquatic Herbicides

BMP Factsheet #10 Aquatic Herbicides and Watercourse Maintenance

Culvert Maintenance and Replacement

BMP Factsheet #6 General Drainage Maintenance BMPs
BMP Factsheet #7 Maintenance Dredging
BMP Factsheet #11 Culvert Maintenance and Replacement
BMP Factsheet #14 Constructed Watercourse Maintenance
BMP Factsheet #15 Fish Protection
BMP Factsheet #16 Water Quality Protection Measures

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Bridge Maintenance and Replacement

BMP Factsheet #12 Bridge Maintenance and Replacement

Constructed Watercourse Maintenance

BMP Factsheet #14 Constructed Watercourse Maintenance

Hand Maintenance

BMP Factsheet #17 Hand Maintenance

South Lynden Watershed Improvement District Work Schedule			
Agricultural Improvements			
Maintenance Practice	**Date(s) Planned**	**Watercourse feet impacted**	**Notes**
Maintenance Dredging			
Unnamed trib. west of Ritter Rd	Summer 2017	2,240	
Additional as needed	?	?	
Watercourse Vegetation Management			
Additional as needed	?	?	
Culvert Maintenance and Replacement			
Additional as needed	?	?	
Bridge Maintenance and Replacement			
Additional as needed	?	?	
Aquatic Herbicide Applications			
Additional as needed	?	?	
Beaver Dam Management			
Additional as needed	?	?	
District Specific Practices			
Additional as needed	?	?	

South Lynden Watershed Improvement District Work Schedule			
Habitat Improvements			
Project Name or Description	**Date(s) Implemented**	**Watercourse feet impacted**	**Notes**
Hedgerow Planting	Spring 2018	2240	Mitigation for Ritter Rd drainage maintenance
Riparian Forest Buffer	Spring 2018	410	Nooksack River buffer west of Ritter Rd
Fish Passage	2017 or 2018	30	Replace barrier culvert in Scott Ditch with bridge
Other projects as available			

South Lynden Watershed Improvement District Reporting and monitoring form			
Agricultural Improvements:			
Maintenance Practice	Date(s) Implemented	Watercourse feet impacted	Notes
Maintenance Dredging			
Watercourse Vegetation Management			
Culvert Maintenance and Replacement			
Bridge Maintenance and Replacement			
Aquatic Herbicide Applications			
Beaver Dam Management			
Sediment Trap Maintenance			
District Specific Maintenance Practices			

South Lynden Watershed Improvement District Reporting and monitoring form			
Habitat Improvements			
Project Name or Description	Date(s) Implemented	Watercourse feet impacted	Notes

Figure 1
South Lynden Watershed Improvement District

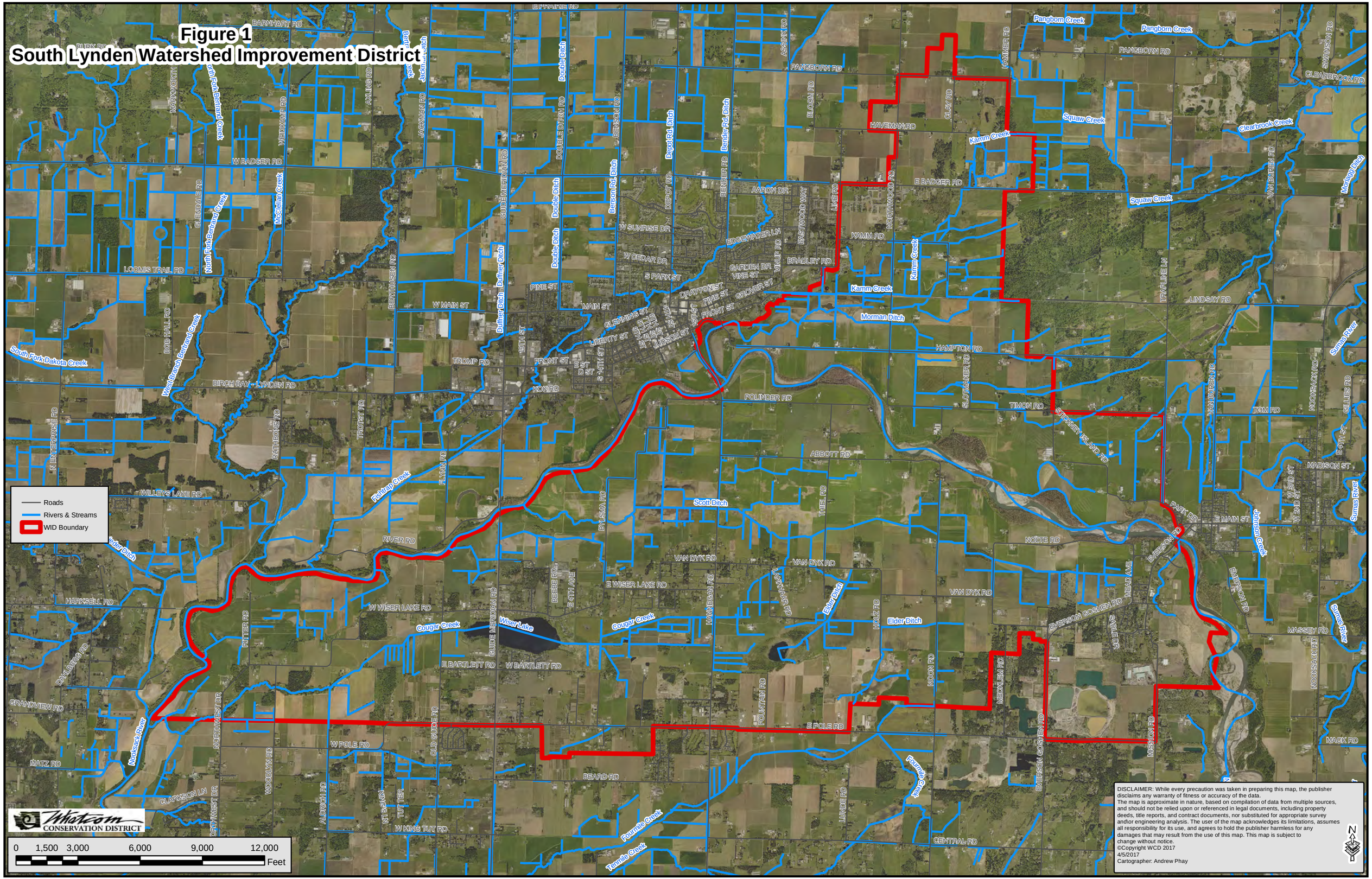


Figure 2
South Lynden Watershed Improvement District
Fish Presence

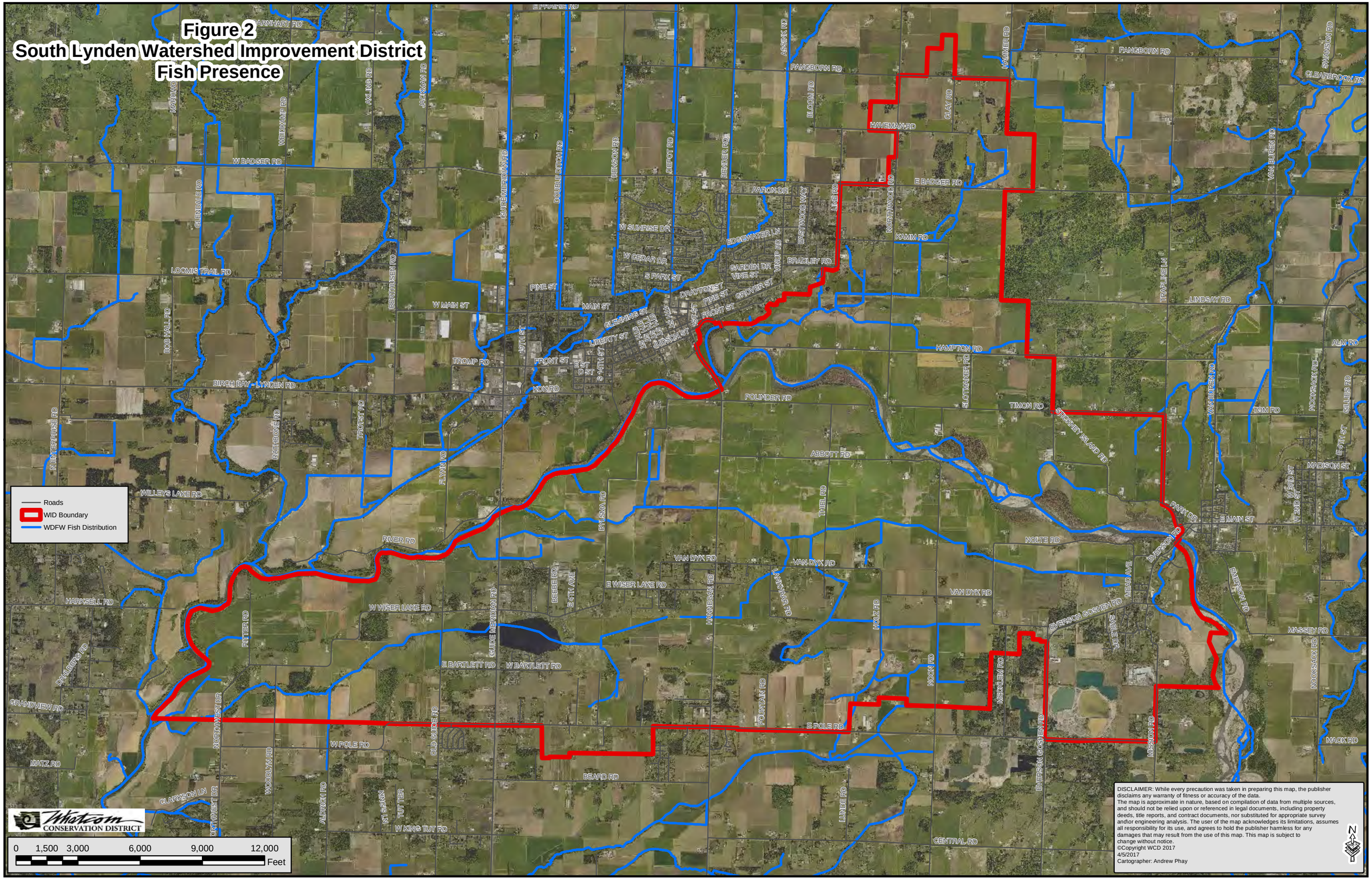
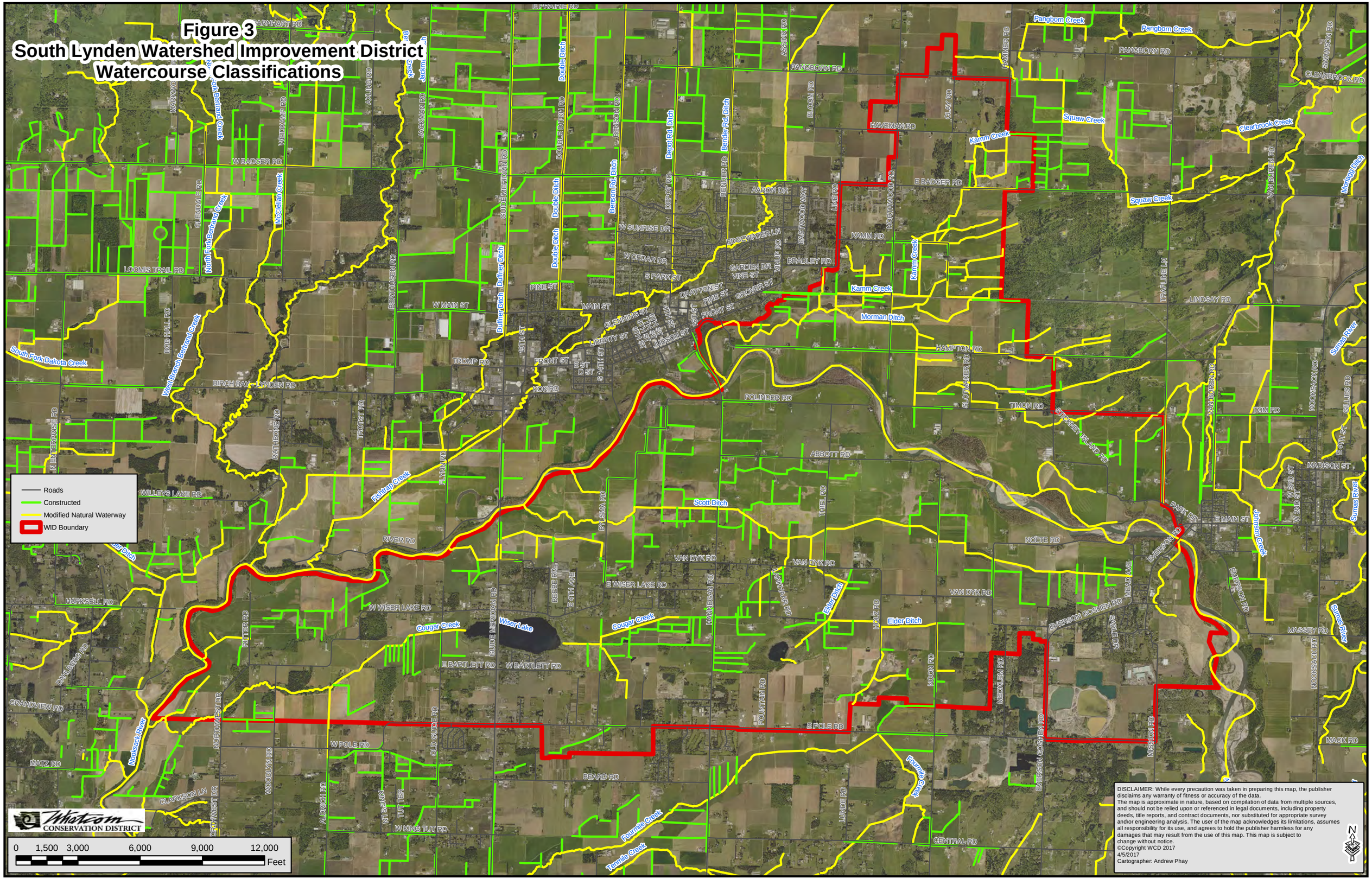


Figure 3
South Lynden Watershed Improvement District
Watercourse Classifications



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4/5/2017

Cartographer: Andrew Phay

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Figure 4
South Lynden Watershed Improvement District
Fish Passage Barriers

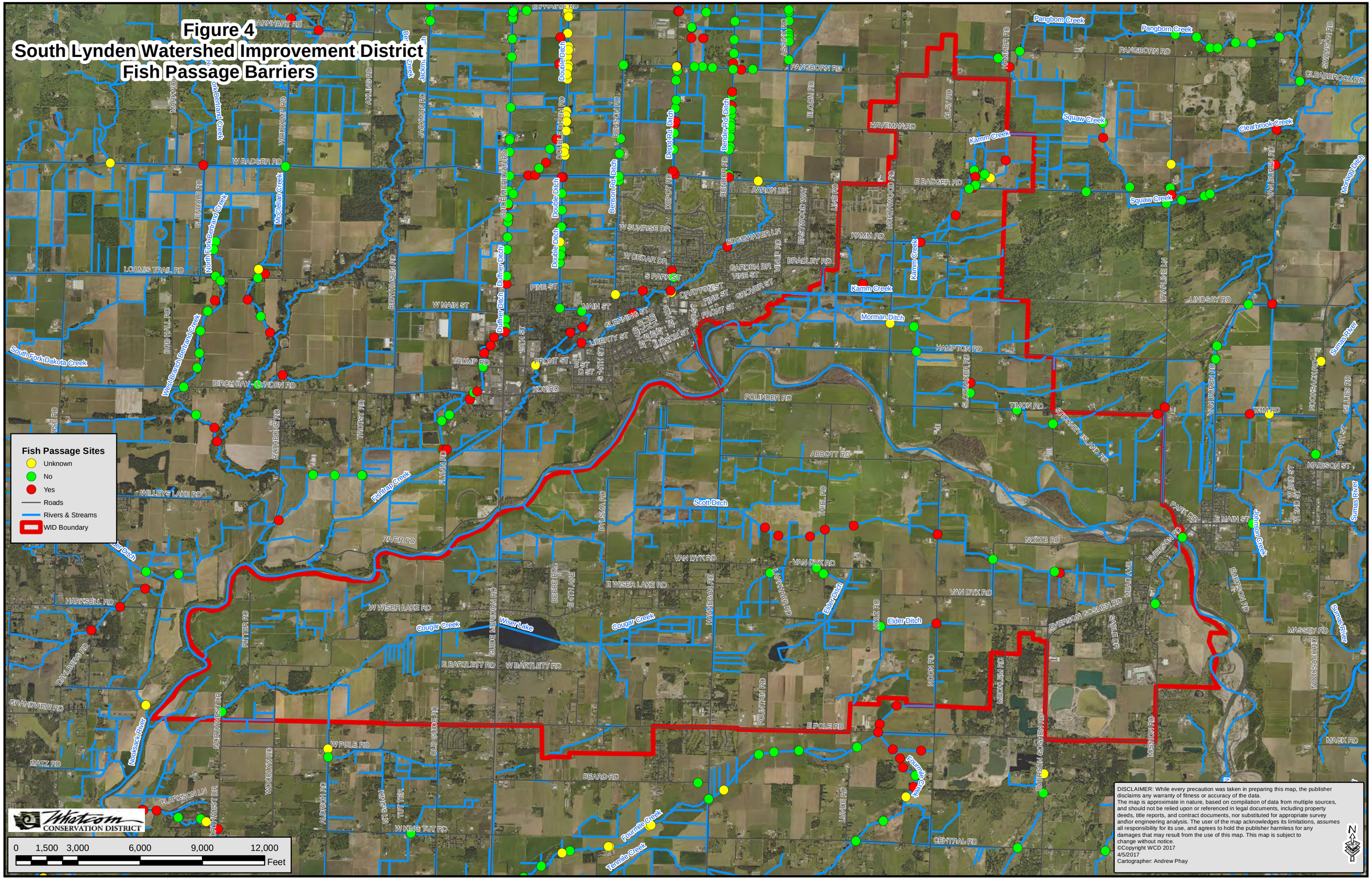
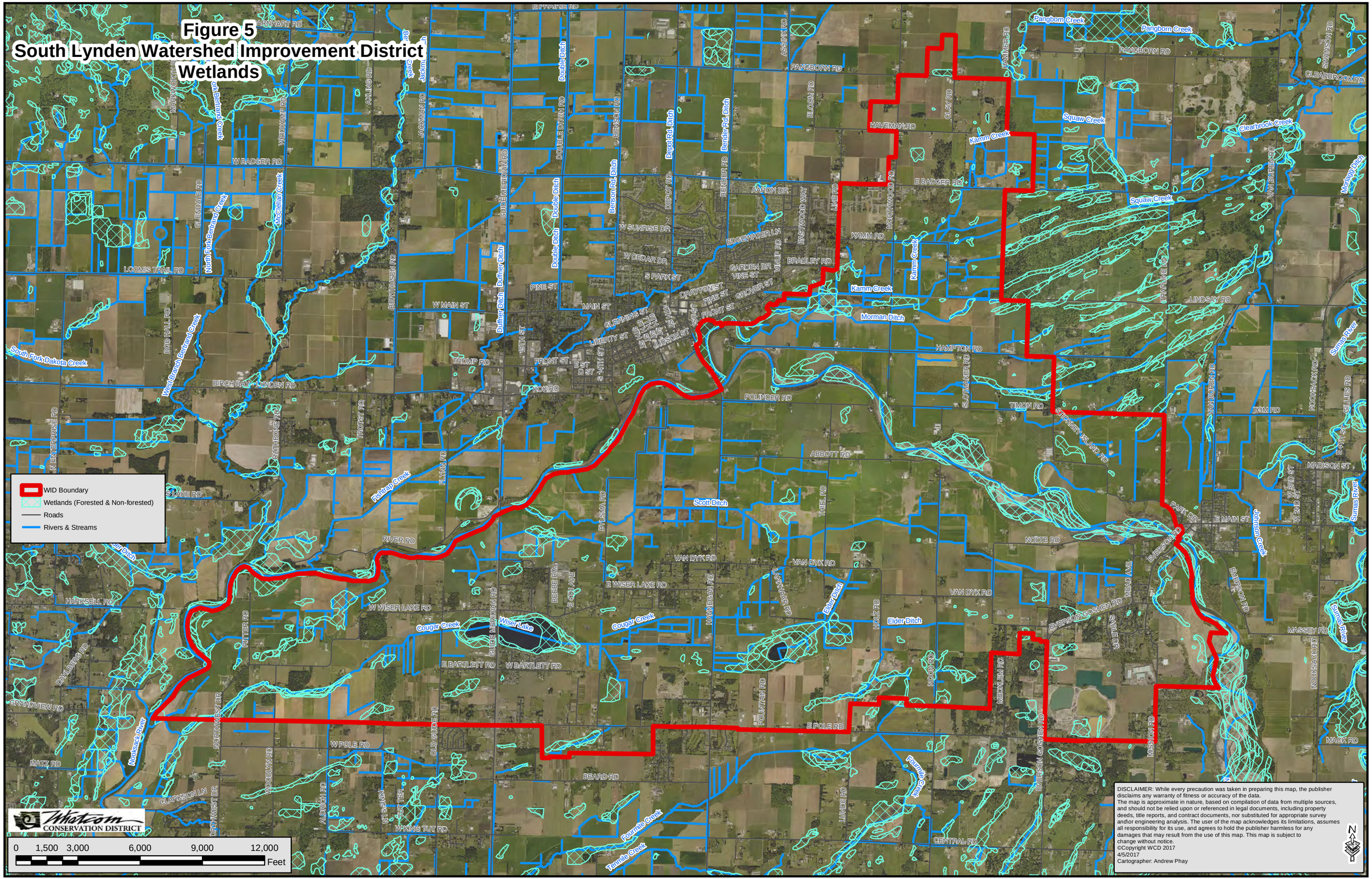


Figure 5
South Lynden Watershed Improvement District Wetlands



Drainage Management

Whatcom County Washington

Whatcom Conservation District

BMP Factsheet #6

General Drainage Maintenance BMPs

Introduction

Drainage Maintenance work such as dredging, mowing or beaver dam removal will have negative impacts to natural resources. Best Management Practices (BMPs) have been developed to minimize the environmental impacts. This Factsheet contains general BMPs that should be used when implementing any type of drainage maintenance project. BMP Factsheets #7 to #17 describe additional BMPs needed for specific types of drainage maintenance work.

BMPs

1. Operate equipment only from the top of the channel bank. Watercourse crossings are not allowed.
2. Equipment shall not enter or cross the channel when water is present.
3. Existing vegetation shall be retained on the sidewalls of the channel to the maximum extent possible.
4. Work will take place from the north or east banks whenever possible.
5. Disturbance of the channel banks and woody stem riparian vegetation shall be held to the absolute minimum necessary to access the channel and to conduct the drainage maintenance activity.
6. Disturbance of woody stem riparian vegetation shall be limited to one side of the channel at any given location along the watercourse.
7. Along the shoreline, disturbed soils at risk of entering the watercourse shall be protected from erosion using vegetation and/or other means.
8. Dredged, excavated, or bucket mowed materials shall be deposited landward of the top of the channel bank.
9. Dredged, excavated, or bucket mowed materials shall not be stockpiled below the top of the channel bank.
10. Project activities shall be conducted in a way that minimizes the introduction of silt-laden water into the watercourse.
11. Pilings or lumber treated with creosote or pentachlorophenol shall not be used for project construction.
12. All treated wood shall be professionally treated and completely cured prior to installation below the high water line in order to minimize leaching into the water or substrate.
13. Wet concrete shall be prevented from entering the watercourse. Footings, foundations and/or super structures constructed with fresh concrete shall be sufficiently cured prior to contact with water to avoid leaching. Forms and impervious materials shall remain in place until the concrete is cured.
14. All debris or deleterious material resulting from drainage maintenance activities shall be removed from the watercourse and prevented from re-entering the channel.
15. No petroleum products or other deleterious materials shall be allowed to enter the surface waters in the channel.
16. If a fish kill occurs or fish in distress are observed, in-water drainage maintenance activities shall immediately cease and the Area Habitat Biologist (AHB) shall be immediately contacted.
17. Removal of trash and plant debris blocking culverts, bridges, and floodgates shall not be subject to a timing limitation.
18. Whenever rock is used to armor the channel bank in the immediate vicinity of a drainage structure (culvert, floodgate, bridge, pump facility), the rock shall be composed of clean, angular material of a sufficient durability and size to prevent its being broken up or washed away by high water.
19. The footprint of a maintained, repaired or replaced drainage structure (culvert, floodgate, bridge, pump facility, trash rack) below the high waterline shall not exceed the footprint of the original drainage structure below the high waterline.
20. Emergency work that must be done outside the normal work window of August 1 to September 30 must be verbally approved by the AHB prior to implementation.

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Drainage Management

Whatcom County Washington

Whatcom Conservation District

BMP Factsheet #7

Maintenance Dredging Best Management Practices

Introduction

Maintaining drainage by dredging is a common and proven method to remove nuisance vegetation and accumulated sediments. Dredging is also the practice with the most negative impacts to natural resources. Fish, fish habitat and water quality are significantly impacted during and after dredging. *Informational Factsheets #20 Watercourse Re-vegetation and #22 Farm Practices* suggest methods that will prevent sediments and nuisance vegetation from impacting the watercourse, thereby reducing the need for dredging.

Additionally, BMP Factsheet #15 Fish Protection and Factsheet #16 Water Quality Protection Measures provide detailed Best Management Practices (BMPs) to minimize impacts to fish and water quality during dredging. The following general BMPs apply to all maintenance dredging work:

Temporary silt fence

Dredging BMPs

General BMPs

1. Timing Limitations: Whenever water is present in the channel, maintenance dredging below the waterline shall only occur from August 1 through September 30 of any year for the protection of migrating juvenile and adult salmon.
2. NOTIFICATION REQUIREMENT: A representative of the Drainage Improvement District or contractor shall notify the Washington Department of Fish and Wildlife Area Habitat Biologist (AHB) of the project start date. Notification shall be received by the AHB prior to the start of dredging activities. Note: This notification assumes that the DID has obtained all appropriate permits prior to work.
3. Dredging shall be conducted with hand tools and/or a tracked excavator equipped with a clam shell or lidded bucket to minimize fallback.
4. Each pass with the excavator bucket in the channel shall be complete.
5. Dredging shall be held to the absolute minimum necessary to achieve the target channel width, depth and gradient.
6. The channel banks shall be sloped such that the resulting channel banks are stable.
7. Maintenance dredging shall not straighten or shorten the existing channel alignment.
8. Existing large woody material embedded in the channel bank or streambed shall be left undisturbed and intact.

Lidded bucket on tracked excavator

Silt Management

9. When water is present in the channel, maintenance dredging activities in and immediately upstream of a watercourse reach that has been identified as juvenile salmonid rearing habitat in the Drainage District's Drainage Maintenance Plan shall implement silt management provisions 10 through 14.
10. Prior to initiating maintenance dredging activities, a temporary silt fence shall be installed immediately downstream of the watercourse reach to be dredged. The temporary silt fence shall be installed across the watercourse and perpendicular to the water flow.
11. The temporary silt fence shall remain in place for the duration of the maintenance dredging activity.
12. If watercourse flows are encountered that exceed the design capacity of the silt fence, the maintenance dredging activity shall stop until the watercourse flows subside.
13. Prior to the removal of the temporary silt fence from the watercourse, silt that has accumulated behind the silt fence shall be removed to the greatest extent possible.
14. The temporary silt fence shall be removed within 2 days of completing the maintenance dredging activity.

BMP Factsheet # 16 Water Quality Protection Measures provides detailed information on sediment management.

Fish Removal

15. When water is present in the channel, the provisions in *BMP Factsheet #15 Fish Protection* shall be implemented prior to initiating maintenance dredging activities in watercourse reaches that have been identified as juvenile salmonid rearing habitat in the Drainage District's Drainage Maintenance Plan.

Fish removal

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Drainage Management
Whatcom County Washington
Whatcom Conservation District

BMP Factsheet #8

BEAVER DAM MANAGEMENT

Introduction

Beavers are North America's largest rodent and perhaps are second only to humans in their ability to alter the environment. Beaver dams can cause drainage problems on managed watercourses and impounded water can cause property damage.

Pursuant to RCW 77.55 a permit must be issued for work that will use, obstruct, change, or divert the bed or flow of state waters. To remove or modify a beaver dam on a natural or modified watercourse, you must have a Hydraulic Project Approval (HPA) issued by the Washington Department of Fish & Wildlife (WDFW). In emergency situations (when an immediate threat to property or life exists), verbal approval from WDFW may be obtained for work necessary to solve the problem. A Drainage Improvement District may hold a five year HPA covering beaver dam management as a component of their Drainage Management Plan.

Beaver pelts were once integral to the economy of North America, until beavers were nearly trapped out of existence in the late 1700s and early 1800s when demand for their pelts peaked in Europe. Beaver populations rebounded in the 1900s but remained at relatively low and stable levels due to sport and commercial trapping influence. In 1998 and 1999 beaver pelt prices fell dramatically, eliminating incentives for commercial trappers. Concurrently, a trapping initiative was passed in Washington banning leg hold traps. Sport trappers proved unwilling to use livetraps so beaver populations have grown steadily, largely unchecked since the late 1990s.

Beavers eat a wide variety of plants including grasses, pond lilies, cattails, corn, other herbaceous plants, and a variety of woody plants. Beaver dams create habitat for many animals and plants and provide essential habitat for juvenile salmon, particulary Coho. In winter, deer and elk frequent beaver ponds to forage on shrubby plants that grow where beavers cut down trees for food or to use in making their dams and lodges. Weasels, raccoons, and herons hunt frogs and other prey along the marshy edges of beaver ponds. Migratory waterbirds use beaver ponds as nesting areas and resting stops during migration. Ducks and geese often nest on top of beaver lodges, since they offer warmth and protection, especially when lodges are formed in the middle of a pond. The trees that die as a result of rising water levels attract insects, which in turn feed woodpeckers, whose holes later provide homes for other wildlife. Additionally, beaver ponds collect and slowly release stormwater and are a natural means of flood control and groundwater recharge.

In some situations it may make more sense to accomodate beavers and their dams rather than attempt to remove them. Low lying marginal farmlands may be more productive as beaver wetlands and could be enhanced through the Conservation Reserve Enhancement Program or other programs.

Beaver Control

The beaver is classified as a furbearer (WAC 232-12-007). A trapping license and open season are required to trap or shoot a beaver. The property owner, the owner's immediate family, an employee, or a tenant of property may shoot or trap a beaver on that property if a threat to crops exists (RCW 77.36.030). In such cases, no special trapping permit is necessary for the use of live traps. However, a special trapping permit is required for the use of all traps other than live traps (RCW 77.15.192, 77.15.194; WAC 232-12-142). There are no exceptions for emergencies and no provisions for verbal approval. All special trapping permit applications must be in writing on a form available from the WA Department of Fish and Wildlife (WDFW).

Beaver Dam Management on Modified Watercourses

Where unacceptable flooding is affecting property (including agricultural fields) or roads, dam modification or removal should be considered. While dam removal is an option, it can be very frustrating and ineffective if the beavers repair the breach very quickly.

Not all beaver problems can or should be handled the same way. Flow control devices and beaver deceivers may be more effective than continued maintenance of beaver dams or the outright removal of beavers and their dams. The important feature of these techniques is to reduce the beavers' dam building instinct in response to the sound of running water.

Beaver Dam Modification and Removal BMPs

- Dams can be removed during the work window of August 1st to September 30th using a Drainage Improvement District's (DID) five year permit.
- Dams needing removal outside the work window or on land outside a DID require prior contact with the Washington State Department of Fish and Wildlife (WDFW) Area Habitat Biologist (AHB) and a Critical Areas notification to Whatcom County. See *Permiting Factsheets #1 - 5* for more information.
- Remove dam materials slowly and by hand or with hand tools to the extent possible. Chain saws and winches can be used to dislodge and remove material.
- If large equipment is needed it must be stationed at the top of the bank, road or bridge. See *BMP Factsheet #6* for general BMPs.
- If large woody material 6 feet or longer and 4 inches or greater in diameter is embedded in the streambank it shall be left undisturbed.
- The water level should drop by no more than 1" per hour and 12" in 24 hours.
- Remove enough dam material to reach the desired water level and to ensure that the dam location does not generate more running water sounds than the rest of the channel. The sound and feel of rushing water triggers the dam building instinct in beaver and may well result in a new dam constructed in the same area.
- Monitor the upstream and downstream for signs of stranded or stressed fish. If a fish kill occurs or fish are observed in distress, cease work immediately and contact the AHB. Then implement Fish Protection BMPs before additional dam work is completed. See *BMP Factsheet #15 Fish Protection*.
- Monitor downstream for turbidity and sedimentation. If suspended sediments are being released from the dam or pond, the installation of sediment control measures will be necessary. See *Factsheet #16 Water Quality Protection Measures*.

Dam breach

Beaver Dam -- Flow Control Devices

- The water level can also be managed by installing a "flexible leveler" (Figure 1). The advantages include maintaining an acceptable pond level, not risking the repair of dams or construction of new dams nearby and not displacing the beaver family.
- Maintain at least a 3' pond depth so that the beaver colony will stay rather than move elsewhere and potentially cause other problems.
- The pipe should extend at least 10' upstream and downstream of the dam and be of adequate size (usually 4" to 12") to convey enough water flow to maintain the desired water level.
- The upstream end should be protected with a wire cage made of 6"x8" welded steel cattle panels to prevent plugging and noise. The cage should remain submerged to prevent the beaver from plugging the wire mesh.
- This type of device is only effective if small flows through the dam are required. They will not provide effective drainage where large flows are required.

Flexible Leveler at Tennant Lake

Beaver Deceivers

- To a beaver, a culvert probably looks like a hole in an otherwise fine dam. Beavers will almost always try to dam these holes.
- Rather than continuing to remove dam materials, a beaver deceiver may be a permanent solution needing very little maintenance (Figure 2).
- Construct in a trapezoidal shape with 10’ to 16’ side lengths.

Beaver Deceiver on Schneider Ditch

- Construct with 6”x8” welded steel cattle panels to maximize fish passage.
- Monitor regularly for maintenance needs.

Note: Flow Control Devices and Beaver Deceivers may have negative impacts to fish passage. Consult the WDFW Area Habitat Biologist for site specific BMPs prior to any installation.

Beaver Dam Management on Constructed Watercourses

Beaver dams less than one year old on a constructed watercourse may be removed or modified as needed using the methods listed above. If the dam has been in place for a number of years, then the pond, adjacent riparian areas and the downstream channel are often considered valuable fish and wildlife habitat. In most cases a Whatcom County Critical Areas notification will be needed prior to any dam modification or removal. See *Factsheet #3 Growth & Shorelines Management Acts*.

Figure 1

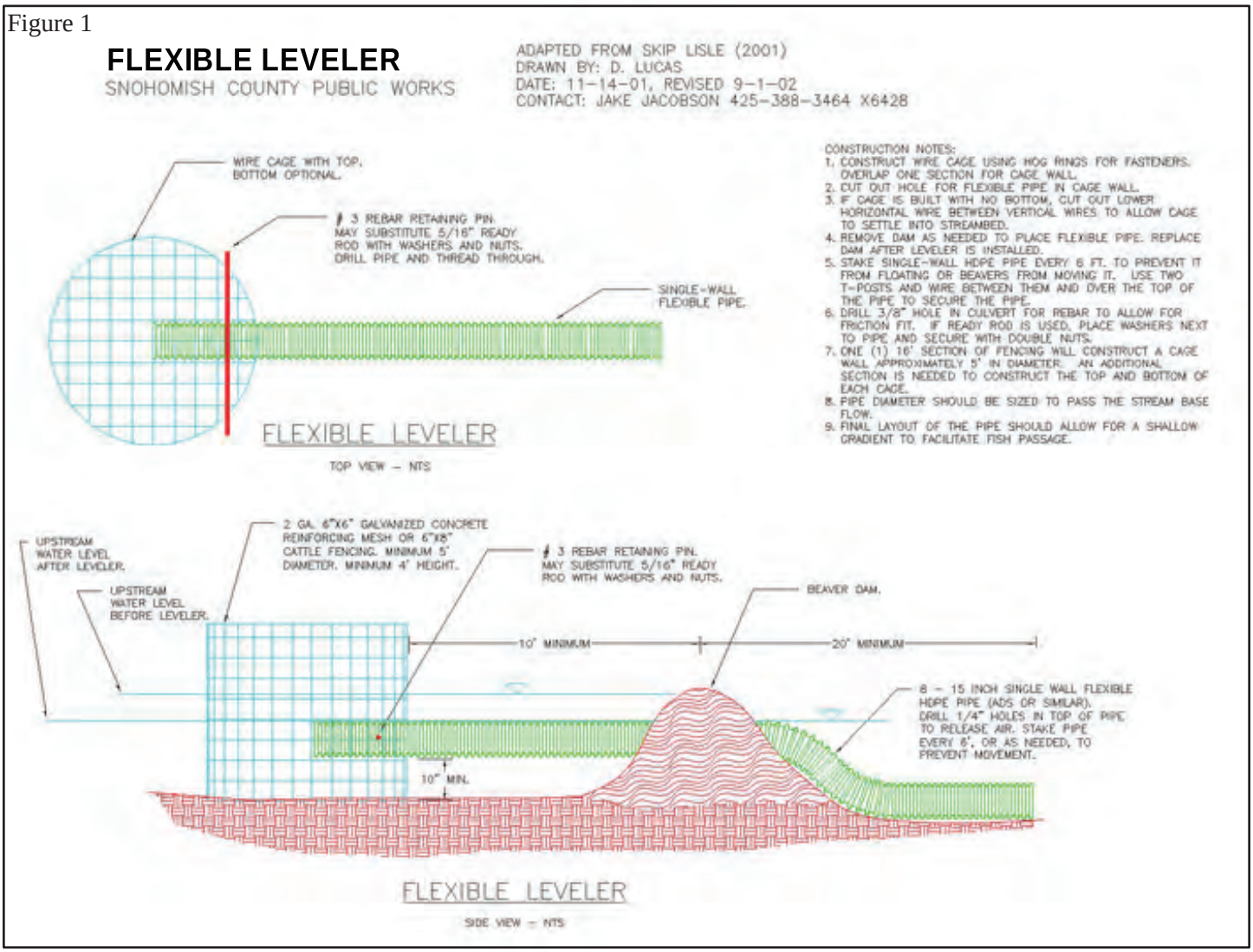

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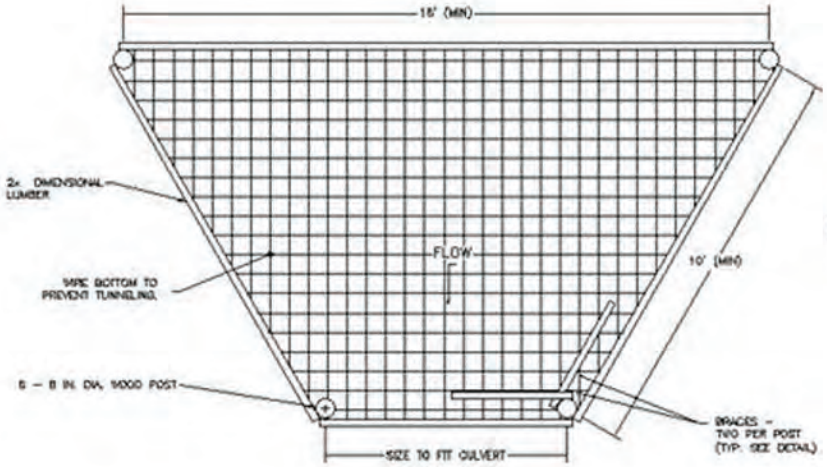
Figure 2

BEAVER DECEIVER

SNOHOMISH COUNTY PUBLIC WORKS

ADAPTED FROM SKIP LISLE (2001)
DRAWN BY: D. LUCAS
DATE: 11-14-01, REVISED 12-3-04
CONTACT: JAKE JACOBSON 425-388-3464 X6428



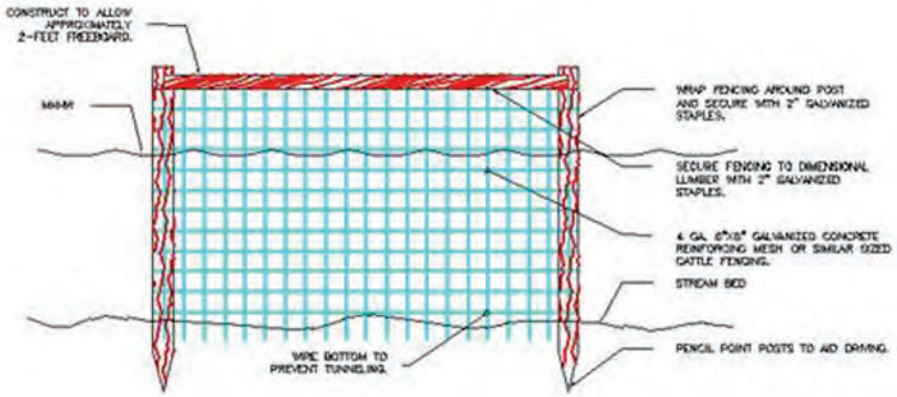
NOTE:
1. THIS DESIGN ONLY ADDRESSES THE INLET OF A CULVERT. THE INSTALLER SHOULD ALSO GUARD THE PIPE OUTLET TO PREVENT BEAVERS FROM ENTERING AND BLOCKING THE FLOW. THERE ARE NUMEROUS METHODS AVAILABLE AND IT IS LEFT TO THE INSTALLER TO PICK A DESIGN.

BEAVER DECEIVER

PLAN VIEW - NTS

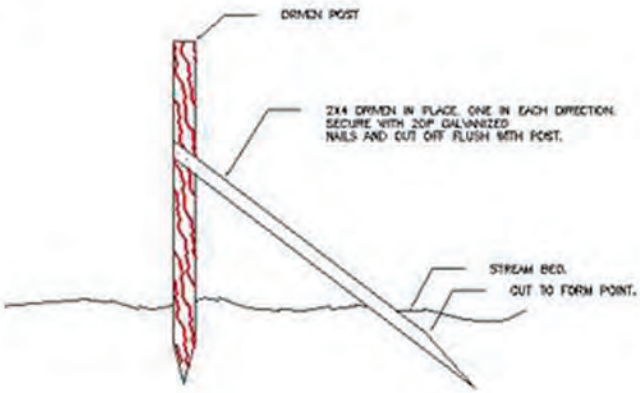
BEAVER DECEIVER

SIDE VIEW - NTS



BEAVER DECEIVER

SIDE VIEW - NTS



BEAVER DECEIVER

POST BRACE DETAIL - NTS

Drainage Management

Whatcom County Washington

Whatcom Conservation District

BMP Factsheet #9

WATERCOURSE VEGETATION MANAGEMENT

Introduction

Maintaining vegetation on watercourse channel banks and in the watercourse may be an inexpensive and effective way to maintain drainage. However the removal of vegetation and dead vegetation left in the watercourse can be detrimental to water quality and to fish habitat. Please remember:

- All types of plants growing near waterways can provide shade. This shade can reduce water temperatures and provide fish habitat.
- Vegetation roots are an invaluable means to stabilize stream banks and prevent erosion.
- Steep channel banks can be destabilized by aggressive mowing or herbicide use. Resulting erosion can both inhibit good drainage and degrade fish habitat and water quality.
- There is a **big** difference between maintaining grass, blackberries or noxious weeds along the channel and doing anything to adversely affect native trees and shrubs that can have significant benefit to water quality, fish habitat and to drainage.
- Mowing vegetation of any kind on the channel bank below the Ordinary High Water Mark will require a Hydraulic Project Approval (HPA) from the Washington State Department of Fish and Wildlife (WDFW).
- Mowing vegetation within the standard Critical Areas buffer requires notification to Whatcom County prior to work.
- *Permitting Factsheet #1 Hydraulic Project Approval and #3 Growth and Shorelines Management Acts* provide detailed information on permitting requirements.

General Mowing BMPs (Grass and Blackberry)

1. Remove mowed material from the watercourse so it does not reduce drainage efficiency.
2. Prevent mowed material from reentering the channel, as the decay of material can lower oxygen levels in the water downstream, thereby harming fish.
3. Continual mowing becomes quite expensive over time. Often this practice is done in advance of more long term solutions to vegetation control such as *Watercourse Re-vegetation, Factsheet #20*.

Mowing Bank Vegetation BMPs (Grass and Blackberry)

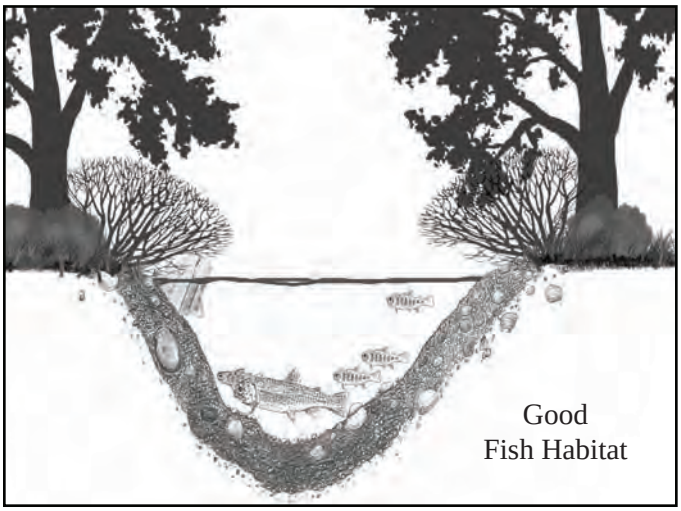
1. Fall and winter are the preferred times of year for mowing vegetation along watercourses. Mowing during fall/winter months allows for riparian vegetation to green up along the ditch during the summer months and provide shade to help keep water temperatures cool. Vegetation along the banks of a watercourse also provides protective cover for juvenile fish and shades out instream vegetation.
2. Dry watercourses or watercourses where the streambanks would be too wet and unstable in the fall can be mowed at any time.

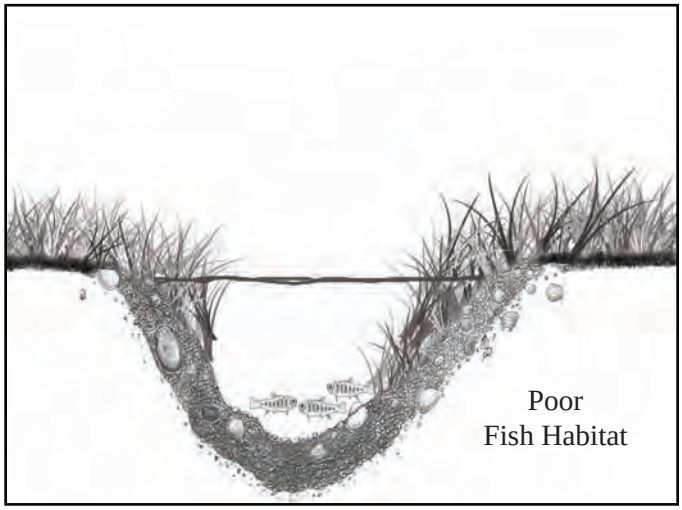
Mowing Watercourse Vegetation BMPs

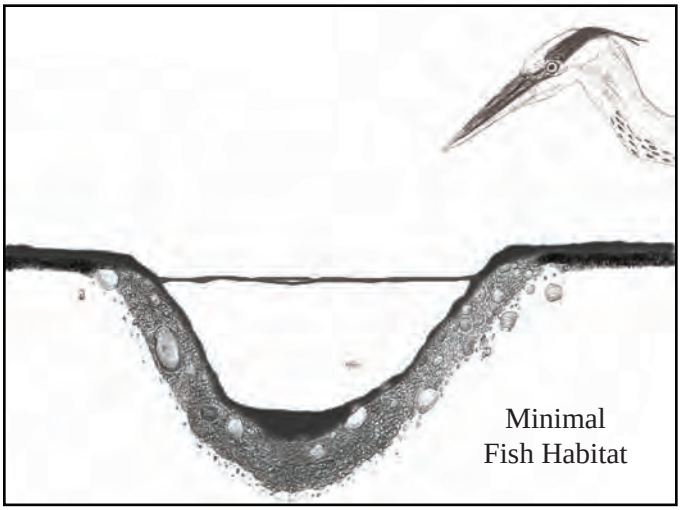
1. Timing Limitations: When water is present mowing shall take place in the low flow period of August 1 to September 30.
2. Mowing equipment can only cut and remove vegetation from the channel and shall not alter the channel profile or the slope of the channel banks.
3. Large woody material embedded in the bank or streambed shall be left undisturbed and intact.

Vegetation Management (Trees & Shrubs)

Native trees and shrubs provide critical functions along all types of watercourses. They provide food for fish and other aquatic animals, filter sediment and other pollutants, and shade the watercourse, keeping temperatures low and reducing vegetation in the water. Roots from native woody plants create a dense mat, preventing erosion and bank failure.







Tree & Shrub Management BMPs

1. Leave native trees and shrubs intact unless it is absolutely necessary to access the channel.
2. Prune vegetation by hand if possible and only on one side of the channel (north or east).
3. Vegetation on the south and west sides should be left to provide shading for the watercourse.
4. Prune vegetation in the fall or winter months so that vegetation shades the water during summer to help keep water temperatures cool.
5. All fallen debris from hand-cutting or pruning should be cleared from the watercourse to prevent flow blockages and to prevent decaying material from reducing oxygen levels in the water and harming fish.
6. The vegetation pruning area should only be wide enough to allow equipment access to conduct maintenance. Vegetation removal should be minimized as much as possible.
7. Maintain the integrity of the ditch by keeping the vegetation roots in place and bottom and bank side slopes intact.
8. If maintenance activities inadvertently damage native vegetation, the native vegetation should be replanted. See *Factsheet #20 Watercourse Re-vegetation* for helpful guidelines.

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Drainage Management

Whatcom County Washington

Whatcom Conservation District

BMP Factsheet #10

AQUATIC HERBICIDES and WATERCOURSE MAINTENANCE

Introduction

Aquatic herbicide applications are an effective means of maintaining drainage in watercourses where Reed canarygrass infestation traps sediment and impedes flow. However, the use of herbicides in and around water also has potential negative impacts to water quality and to fish habitat and is strictly regulated by the Washington State Department of Ecology (WDOE) and the Environmental Protection Agency (EPA).

Do I need permits?

- A National Pollutant Discharge Elimination System (NPDES) permit must be obtained before aquatic herbicides can be applied to water.
- Applicators must be licensed by the Washington State Department of Agriculture.
- Notification and posting are required before herbicide application and there may be additional mitigation proposed to protect rare plants or threatened and endangered species.

The general permit covers the discharge of products used to control noxious weeds in waters of Washington State. Under the Washington State Water Pollution Control Act, a permit is required to discharge pollutants that alter the biological or chemical characteristics of a water body.

How: Permit coverage can be applied for on-line at: http://www.ecy.wa.gov/programs/wq/pesticides/final_pesticide_permits/noxious/noxious_index.html.

Who: Drainage Improvement Districts, individual landowners, or the licensed applicator can act as the applicant and hold the permit.

What weeds: This permit applies only to plants on Washington State's noxious weeds list such as Purple loosestrife or Reed canarygrass. It is a violation of the permit to treat any native aquatic plants.

Note: Additional Federal requirements are needed for work on Lummi Indian Reservation lands.

What are the Advantages?

- Aquatic herbicides can be less expensive than other aquatic plant control methods, especially when used to control wide-spread infestations of state-listed noxious aquatic weeds.
- Occasional use will extend channel maintenance intervals.
- Aquatic herbicides are very effective if used in combination with long term practices such as *Watercourse Re-vegetation* (*see Informational Factsheet #20*) to shade out noxious weeds.

Aquatic herbicide on Reed canarygrass

What are the Disadvantages?

- Herbicides applied to vegetation on watercourse banks may kill the plant roots stabilizing the bank, resulting in erosion, bank failure, and additional dredging expense to clear the channel.
- Herbicides may have restrictions relative to swimming, drinking, fishing, irrigation, and water use. Check the label and general permit for restrictions.
- Herbicide use may have unwanted impacts to people who use the water and to the environment.
- In addition to nuisance plants, non-targeted plants may be negatively affected or killed by some herbicides.
- Depending on the herbicide used, it may take several days to weeks or several treatments during a growing season before the herbicide controls or kills treated plants.

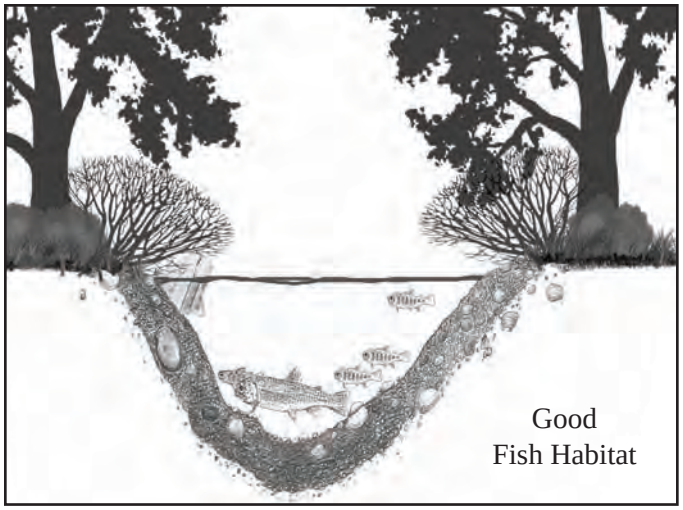
- As treated plants die and decompose in the water, low oxygen conditions will develop that can kill fish, insects and other aquatic life.
- Some expertise in using herbicides is necessary in order to be successful and to avoid unwanted impacts.
- Many people have strong feelings against using chemicals in water. Find out what your neighbors think about chemical use before deciding to treat your water plants with herbicides.
- Some cities or counties may have policies forbidding or discouraging the use of aquatic herbicides. Check before hiring an aquatic herbicide applicator.

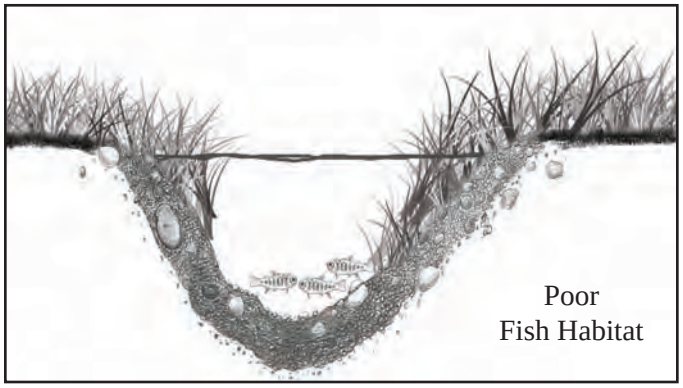
Bank Failure following herbicide application

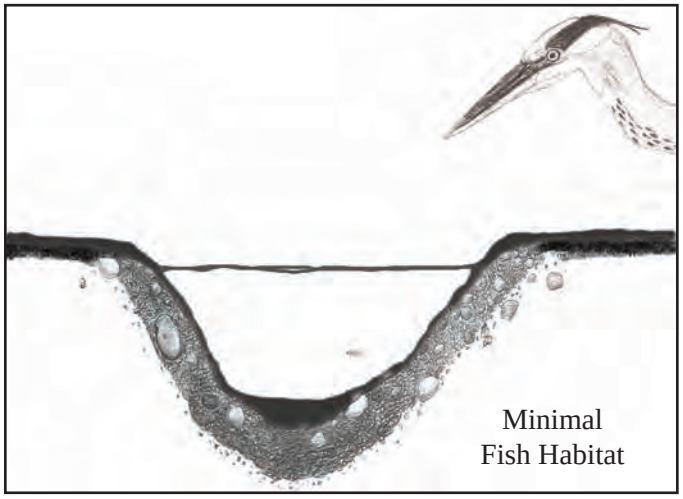
Aquatic Herbicide BMPs

- Use only when permits have been secured.
- Use only licensed applicators.
- Limit applications to vegetation in the channel bottom.
- Do not apply to stream bank vegetation or bank stability will be lost.
- Apply in late summer and early fall for best results.
- Spring and early summer applications rarely result in a lethal dose but may be effective in reducing growth rates and maintaining drainage throughout the summer.

Reed canarygrass controlled using shade







Is this a long term solution?

Aquatic herbicides can be one useful component of a drainage maintenance plan for a Drainage Improvement District or landowner. However their use is limited. For example, if field sediments are eroding into the watercourse, farm practices such as replacing bare ground with vegetative filter strips will save costs and soil over the long term. Reed canarygrass provides some cover and habitat for fish. Repeated annual herbicide treatments will eliminate this habitat unless it is replaced with another vegetative cover. (See *Informational Factsheet #20 Watercourse Re-vegetation*).

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BMP Factsheet #11

CULVERT MAINTENANCE & REPLACEMENT

Introduction

Road crossing culverts are common on all types of watercourses and are critical infrastructure for field and farm access. But if undersized or poorly installed, culverts can be a problem because they impede or block fish passage to important habitat. Culverts that impede fish passage have been identified as one of the most limiting factors to healthy stocks of migrating salmon and other fish species. In comparison, well constructed bridges are superior to culverts in allowing drainage and fish passage. Consider replacing culverts with bridges (see BMP *Factsheet #12 Bridge Maintenance and Replacement*).

Drainage Improvement Districts (DIDs) may include and permit culvert maintenance and replacement as part of their Drainage Maintenance Plan (DMP) if Best Management Practices (BMPs) listed in this *Factsheet* are adopted.

Culvert Replacement and Fish Passage

When replacing or installing a culvert in natural watercourses or modified natural watercourses, the design will largely be based on criteria necessary to ensure fish passage and avoid impacts to fish habitat. There are five common conditions at culverts that create barriers to migrating fish:

- Excess drop at the culvert outlet
- High velocity within the culvert
- Inadequate depth within the culvert
- Turbulence within the culvert
- Debris and sediment accumulation at the culvert inlet or internally

Salmon jumping at culvert.

The Washington Department of Fish & Wildlife (WDFW) has published extensive information on culvert design and installation. This guidance should be used when replacing an existing culvert or installing a new culvert. It is recommended that installations on constructed watercourses also use WDFW criteria because it ensures that new culverts are properly sized and will not impede drainage. See *Factsheet #4 Agency Contact Requirements*. Additional fish passage criteria can be found at http://www.nwr.noaa.gov/Salmon-Hydropower/FERC/upload/fish_passage_design.pdf.

Culvert Maintenance BMPs

Every watercourse structure will require periodic maintenance. Culverts often become plugged or their capacity reduced because of debris or vegetative material. Headwalls may need occasional maintenance to prevent erosion and collapse. In conducting maintenance activities consider:

1. Timing Limitations: When water is present, culvert maintenance shall only occur from August 1 to September 30 when flows are low.
2. Debris or vegetative material can be removed by hand without timing limitations to prevent the need for larger repairs.
3. Maintenance work on culverts in modified natural watercourses are subject to *Agency Contact Requirements*, see Permitting *Factsheet #4*.
4. Headwall repair should take place during the dry season when the work can be completed out of the water.
5. If water is present when removing large quantities of debris, vegetation or accumulated sediments, additional measures must be taken to minimize impacts to aquatic life and water quality. See *BMP Factsheet #16 Water Quality Protection Measures* for more details.

Culvert Replacement or Installation

Three design options have been approved by WDFW:

- The No-Slope Design Option results in reasonably sized culverts without requiring much in the way of calculations. The No-Slope option is almost always the best choice for lowland agricultural watercourses.
- The Hydraulic Design Option is based on velocity, depth and maximum turbulence requirements for a target fish species and age class.
- The Stream Simulation Design Option involves constructing an artificial stream channel inside the culvert, thereby providing passage for any fish that may be migrating through the reach.

Undersized culvert with unstable road crossing

Culvert Location

Even the best designed culvert has the potential to become a fish passage barrier, drainage barrier or maintenance headache. Look at your farm or Drainage Improvement District from a big-picture perspective and find ways to have as few culverts as possible. Location considerations include:

- Make the culvert as short as possible without deviating from the direction of the upstream and downstream channel course by more than 30 degrees.
- Choose an area with minimal and consistent stream gradient, not areas where the gradient is steep or transitioning.

No-Slope Design Option

Successful fish passage can be expected if the culvert is sufficiently large and is installed flat, allowing the natural movement of bedload to form a stable bed inside the culvert. Bedload is the sediments making up the watercourse bottom such as gravel and soils. Design criteria for a No-Slope culvert are:

- Width equal to or greater than the average channel bed width at the elevation the culvert meets the streambed. Make the culvert the same width as the channel to maximize both water flow and fish passage.
- A flat gradient. (No slope)
- The downstream invert is countersunk below the channel bed by a minimum of 20 percent of the culvert diameter or rise.
- The upstream invert is countersunk below the channel bed by a maximum of 40 percent of the culvert diameter or rise.
- The possibility of upstream headcut has been taken into account.
- There is adequate flood capacity.

Combining the requirements of countersinking the outlet and the culvert width for a circular culvert, the diameter must be at least 1.25 times the channel bed width. The information typically needed for a No-Slope Design Option culvert includes:

- The average natural channel-bed width.
- The natural channel slope.
- The elevation of the natural channel bed at the culvert outlet.
- The evaluation of potential headcut impacts upstream of the culvert.

Channel-bed Width

Use the average of at least three typical widths in free flowing and unconstrained areas upstream and downstream of the culvert location. For the purpose of culvert design, the channel-bed width is defined as the width of the bankfull channel. The bankfull channel is defined as the stage when water just begins to overflow into the active floodplain. Many incised streams or modified watercourses are no longer connected to the floodplain. In these situations the channel bed width may also be determined from the Active Channel Width and Ordinary High Water Mark (OHWM). The OHWM can usually be identified by physical scarring along the bank

Culvert Replacement

or shore, or by other distinctive signs such as the lower line of perennial vegetation. This scarring is the mark along the bank where the action of water is so common as to leave a natural line impressed on the bank. That line may be indicated by erosion, shelving, change in soil characteristics, destruction of terrestrial vegetation, presence of litter or debris, or other distinctive physical characteristics.

Culvert Replacement

Channel Slope

The calculation for average channel slope is based on water-surface elevations and a distance along the channel that is at least 40 channel widths long, or 400 feet.

Once these determinations are made, a culvert design can be finalized. In fish bearing watercourses it has become common place to fill the bottom 20% of the culvert with "fish gravel" to both stabilize the bed material and enhance a little fish habitat. It may be advisable to hire professional help to ensure an appropriate design and long lasting installation.

Concrete

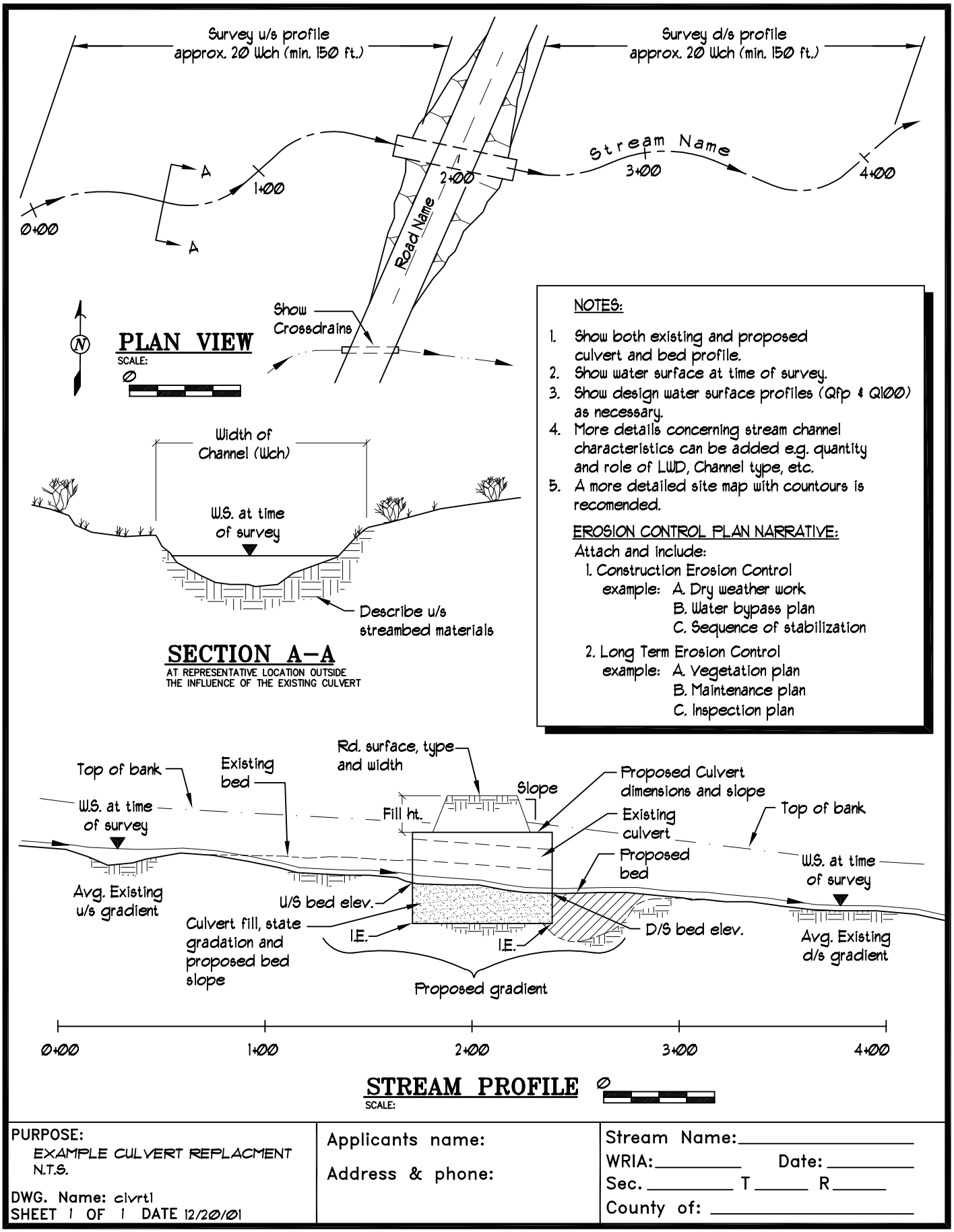
If any concrete, cast-in-place concrete, or grouting works are to be undertaken, a high potential exists for concrete and/or concrete leachate to enter a watercourse. Concrete, concrete leachate, grout and other uncured concrete substances (e.g. concrete bags for headwall construction) are deleterious and highly toxic to fish and other aquatic organisms.

To perform any concrete-related works, all water must be completely isolated prior to the commencement of any instream works. In addition, measures must be taken to prevent the incidence of concrete from entering a watercourse, ravine or storm sewer system for a minimum of 72 hours after the works have been completed. This is to ensure that the concrete has fully cured.

Culvert Replacement BMPs

1. Timing Limitations: When water is present in the channel, culvert work below the waterline shall occur between August 1 and September 30.
2. The damaged culvert and associated fill shall be removed from the watercourse and deposited upland so that it cannot re-enter the watercourse.
3. The culvert shall be placed on a flat gradient with the bottom of the culvert placed below the level of the streambed a minimum of 20 percent of the culvert diameter for a round culvert, and 20 percent of the culvert's rise for an elliptical culvert. The 20 percent placement below the streambed shall be measured at the culvert outlet. (see above for more details).
4. The culvert shall be constructed to pass the 100-year peak flow with considertation of the debris likely to be encountered.
5. The culvert shall be maintained free of debris to ensure unimpeded drainage and fish passage.
6. Fill associated with the culvert installation and approach material shall be structurally stable and shall be composed of material that, if eroded into the watercourse, shall not be detrimental to fish life.
7. Fill associated with the culvert installation and approach material shall be protected from erosion to the 100-year peak flow.
8. If an existing culvert is replaced by a bridge structure, then the existing culvert and associated fill shall be completely removed from the watercourse and the new bridge shall be subject to the bridge provisions discussed in *Factsheet #12 Bridge Maintenance and Replacement*.
9. When water is present in the channel, fish must be removed from the impacted area prior to any work. *Factsheet #15 Fish Protection* provides more detailed information.
10. When water is present in the channel, measures must be implemented to ensure that contaminated water does not leave the work site. *Factsheet #16 Water Quality Protection Measures* provides more detailed information.
11. Leave riparian vegetation along the banks of the watercourse.
12. All disturbed areas must be re-graded and stabilized by seeding or re-vegetating the riparian area upon completion. This helps to prevent surface erosion and/or sedimentation of the watercourse.

Figure 1



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Drainage Management

Whatcom County Washington

Whatcom Conservation District

BMP Factsheet #12

BRIDGE MAINTENANCE AND REPLACEMENT

Introduction

In fish bearing waters, bridges are preferred as water crossing structures in order to ensure free and unimpeded fish passage and to preserve spawning and rearing habitat. Other structures which may be approved, in descending order of preference, include: temporary culverts, bottomless arch culverts, arch culverts, and round culverts. Professional engineering assistance should be used for bridges over natural watercourses and modified natural watercourses. Multiple landowners should consider constructing a single shared bridge rather than individual crossings.

Approval Requirements

Maintaining or replacing bridge structures requires Hydraulic Project Approval (HPA) from the Washington State Department of Fish & Wildlife (WDFW) with review by Whatcom County Critical Areas and Flood Division. Drainage Improvement Districts (DIDs) can permit, maintain and replace bridges on modified watercourses using their Drainage Management Plan (DMP) and using the Best Management Practices (BMPs) listed below.

Work on bridges over Constructed watercourses requires only Whatcom County Planning and Development Services notification if located within a critical area. The written notification must be sent to the Technical Administrator at least 10 business days prior to beginning and should include:

- Bridge design drawings and specifications.
- Type of equipment to be used.
- Manner in which the equipment will be used.
- Best Management Practices to be used.

Bridge construction may also require a permit from the Army Corps of Engineers.

Livestock crossing made of recycled concrete bridge panels

Bridge Replacement BMPs

1. Timing Limitations: When water is present in the channel, the bridge work below the waterline shall occur only from August 1 through September 30 of any year for the protection of migrating juvenile and adult salmon.
2. Damaged bridge elements shall be removed from within the banks of the watercourse and deposited upland so that they cannot re-enter the watercourse.
3. New bridge footings or foundations shall be constructed landward of the channel high waterline at the project site.
4. Excavation for the bridge footings or foundations shall only occur landward of the high waterline of the watercourse.
5. The bridge shall be constructed to pass the 100-year peak flow with consideration for debris likely to be encountered.
6. Fill associated with the bridge or water crossing structure installation shall be protected from erosion to the 100-year peak flow.
7. Armoring of the channel banks to protect the bridge footings or foundations with rock materials shall be limited to the bank area immediately under the footprint of the bridge.
8. Approach material for the bridge shall be structurally stable and be composed of material that, if eroded into the watercourse, shall not be detrimental to fish life.
9. Alteration or disturbance of bank vegetation must be limited to that necessary to construct the project.

Bridge Maintenance BMPs

1. Vegetative and other debris should be removed by hand (if possible) at any time before it builds up and threatens the structure.
2. Measures shall be implemented to ensure that any waste materials from sandblasting and painting do not enter the watercourse.
3. Limit pruning of native trees and shrubs to the minimum needed to provide bridge access.

Livestock crossing made of retired rail flatcar

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Drainage Management

Whatcom County Conservation District

BMP Factsheet #14

CONSTRUCTED WATERCOURSE MAINTENANCE

Introduction

Drainage Improvement Districts (DIDs) can maintain constructed ditches without a Hydraulic Project Approval permit from the Washington Department of Fish and Wildlife. Nor is a permit from the Department of Army Corps of Engineers needed if the watercourse is determined to be "non-navigable". However Best Management Practices (BMPs) must be implemented to avoid polluting downstream natural or modified watercourses. Informational *Factsheet #18 Watercourse Classifications* defines "constructed" and a DID's map should have all watercourses color coded by classification.

Local Regulations

Whether wet or dry, if the constructed watercourse lies within a Whatcom County designated "Critical Area" or a "Critical Area Buffer", a notification must be sent to the Whatcom County Technical Administrator at least 10 business days prior to beginning work. The written notification is valid for up to five years and should include:

- Type, timing, frequency and sequence of maintenance activity to be conducted.
- Type of equipment to be used (hand or mechanical).
- Manner in which the equipment will be used.
- Best management practices to be used.

Critical Areas include: Wetlands, Frequently Flooded Areas, Critical Aquifer Recharge Areas, Geologically Hazardous Areas, or Habitat Conservation Areas.

Constructed watercourses in active agricultural land are generally not critical areas.

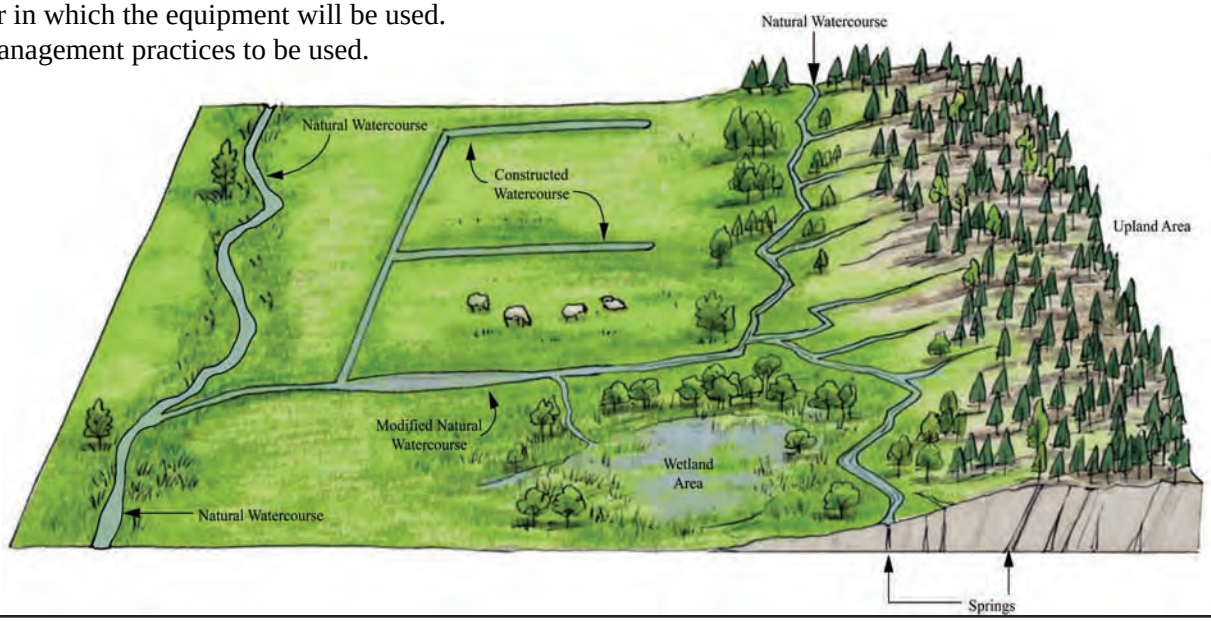
Constructed Watercourse Maintenance BMPs

General:

1. Only remove material sufficient to keep the original ditch depth or to maintain a steady slope between culvert inverts. Excavating deeper will not improve drainage and may result in unstable banks and erosion.
2. Place excavated material in a location so that it cannot re-enter the watercourse.
3. Equipment used to complete drainage maintenance activities shall only operate from the top of the channel bank.
4. All equipment used on the site must be in good repair and be free of excess oil and grease.

If the watercourse is Dry:

5. Work can be done at any time.
6. Maintain the channel early enough in the year that vegetation may stabilize soils prior to the rainy season.



Recently maintained constructed ditch

7. Install temporary Check Dams, Triangular Silt Dams, Silt Fence, Straw Wattles or other measures to prevent exposed sediments from moving once the rainy season has begun.
8. Maintain a 25 foot to 300 foot grass lined swale at the downstream end of the watercourse to filter out any released sediments when water flows.

If the watercourse is Wet:

9. Conduct maintenance activities during periods of lowest flow (August 1 to October 30th).
10. Dredge from upstream to downstream to allow vegetation in the channel to help filter and trap sediment.
11. Install a silt curtain or other means to block or filter the muddy water flowing downstream.
12. If fish in distress are observed, cease work and use Fish Protection techniques from *Factsheet #15* in this series. Also contact your WDFW Area Habitat Biologist for assistance (see *Agency and Organization Contacts, Factsheet #5*).
13. Monitor closely for muddy water leaving the constructed watercourse. Muddy, sediment-laden water must not be allowed to enter natural or modified natural receiving waters downstream. **Before** this occurs, consider the following tips and refer to *Factsheet #16 Water Quality Protection Measures* for more guidance.
14. Pause the maintenance work frequently and allow suspended sediments to settle out.
15. Install temporary coffer dams, additional silt screens, bypass pumps, or other means to reduce the impact.
16. Remember, it is OK and expected that water in the constructed ditch you are maintaining will be muddy. But it's not OK for that muddy water to be allowed to flow downstream and adversely impact other watercourses.

Grass strip left intact temporarily to filter sediments

Cleaning Subsurface Drain Tiles

Subsurface drain tiles may need to be maintained or flushed periodically due to the buildup of sediment or iron ochre.

To minimize impacts on the watercourses downstream when cleaning drain tiles consider the following:

- Install a control structure (or block the ditch downstream) to prevent sediment and iron ochre from moving into the receiving waters of a natural or modified watercourse.
- Install a sediment trap at the downstream end of the ditch to collect contaminated water. Pump the collected water into an area where it will not re-enter the ditch. Clean the sediment trap prior to opening the control structure and allowing flow to proceed downstream.
- More useful BMPs can be found in *Factsheet #16, Water Quality Protection Measures*.

Muddy water from a constructed ditch flowing into a fish-bearing stream

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Drainage Management

Whatcom County Washington

Whatcom Conservation District

BMP Factsheet #15

FISH PROTECTION

Introduction

It doesn't matter to fish whether a watercourse is labeled as natural, modified natural, or constructed. Fish will make use of the watercourse at some life stage if there is water of sufficient quality and quantity and if there are no obstructions to access. Maintenance of any watercourse presents the potential to harm fish or fish habitat. This fact sheet will help you determine when and how to conduct fish removal so as to minimize harming fish and avoid incurring civil and criminal penalties.

Projects where fish removal is necessary will likely require a Hydraulic Project Approval (HPA) from the Washington State Department of Fish and Wildlife (WDFW). See *Factsheet #1 Hydraulic Project Approval* for more information on the permitting process. The HPA will have detailed directions for fish removal activities. Guidelines in this Factsheet are general approaches to fish removal methods, the HPA will serve as the primary protocol for fish removal.

What is fish Removal?

A fish removal involves collecting fish from an isolated watercourse reach where maintenance work is being done and relocating the fish upstream or downstream of this section.

A constructed ditch can provide valuable habitat for fish

When do I conduct Fish Removal?

Modified Watercourses

Fish must be removed from the watercourse prior to any in-water maintenance activity. It is understood that fish removal may not be entirely effective when there is a dense Reed canary grass infestation.

Constructed Watercourses

Fish are assumed to not be present in constructed watercourses. However, if fish are observed in distress during in-water maintenance activities then fish removal BMPs should be implemented.

Fish Removal BMPs

1. Qualified staff must be on site at all times during drainage maintenance work.
2. Isolate the work area by placing a **block net** at the top and bottom end of the section planned for maintenance.
3. Select a fish collection method or methods (see below) best suited to the watercourse.
4. Repeat this method or sequence of methods three times to make sure all the fish have been captured from the isolated section.
5. Monitor the work area, affected downstream area, and spoils closely for signs of fish in distress.
6. If fish are observed in distress, pause the work and capture fish using dip nets and buckets of fresh water.
7. Immediately relocate fish to an area of clean, free flowing water.
8. Continue to monitor and remove fish when needed.
9. Pausing work frequently to maintain relatively good water quality is the best method to ensure minimum impacts to any remaining fish.
10. Remove block nets when maintenance work is complete and water quality impacts have settled.

Fish rescued from work area must be relocated to a upstream or downsteam site

Fish Removal Techniques:

Seine net: a net with weights along the bottom and floats at the top to enable the net to stand in water. Typically, seine nets with a small mesh size (1/8”–1/4”) are adequate for trapping or moving young fish in small-sized channels. These types of nets are relatively small and easy to maneuver in smaller channels. One technique

Stream Seine Net

is to encircle and then remove schools of fish using dip nets. Another is to drag the net downstream, encouraging fish to move below the channel reach planned for maintenance. Both of these techniques can be made more effective by first removing some of the water by means of a coffer dam or water diversion, then seining and removing fish in the remaining pools.

Electrofishing: passes electric current through the water that attracts and stuns fish and is most effective in small streams and rivers. Electro-fishing is commonly done on foot using a backpack shocking device or from a boat with a boat-shocker. Special training and certification is required to electrofish. Electrofishing can be highly stressful to fish. Mortality can be extremely high in warm water conditions.

Electrofishing with a Backpack Shocking Device

A common practice is to use a lower risk method (i.e. seine netting and dip nets) for the first two passes and then use a more exhaustive approach (i.e. electrofishing) for the third and final pass. Once each pass is done, immediately relocate the removed fish into an upstream or downstream portion of the watercourse.

What Else Do I Need to Know?

If you do not have the expertise and equipment or time to perform your own fish removal, you can hire someone to do this for you. Fish removal work is specialized and it is recommended that a professional be hired.

Fish Biologist with dip net

It is the responsibility of both the Drainage Improvement District holding permits and the contractor performing work to ensure that all appropriate means have been utilized to avoid negative impacts to fish.

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Drainage Management

Whatcom County Washington

Whatcom Conservation District

BMP Factsheet #16

WATER QUALITY PROTECTION MEASURES

Introduction

It probably goes without saying that one cannot muck around in a wet ditch without stirring up the mud. Stirring up too much mud (sediment) without taking necessary protective measures or without obtaining a permit can land you in trouble with the agencies charged with protecting water quality. Too much sediment can cause significant harm to fish, fish habitat and other beneficial uses, and water quality standards have been set under Federal, State, and Tribal law to protect these values. This *Factsheet* provides guidance on how to conduct common watercourse maintenance activities without risking a stop work order or a fine when water quality impacts occur. Generally, any activity that impacts water quality will require a Hydraulic Project Approval permit from Washington State Department of Fish and Wildlife (WDFW). See *Permitting Factsheet #1 Hydraulic Project Approval* for more details.

Potential Impacts of Sediment Releases:

- Injury or death of fish. Sediment can clog or abrade fish gills, causing suffocation or tissue damage.
- Inability to feed. Since fish are visual feeders, sediment in water can impair their ability to forage for food.
- Infill habitat. Sediment may settle in pools or riffle habitats. This may impact salmonid egg viability or may affect food and nutrient sources by covering benthos (bottom-dwelling organisms) upon which fish depend for food.
- Clogging of irrigation intake screens and potential damage to downstream irrigated crops.

Muddy water leaving a maintained watercourse

The Laws:

When undertaking any watercourse maintenance activity, controlling sediment and erosion is essential to ensure protection of fish and other aquatic species. The Federal Clean Water Act (CWA) Section 1251 & Washington State Water Pollution Control Act 90.48 (WPCA) prohibits the discharge of any pollutant from a point source into navigable waters or waters of the State. Tribal laws similarly prohibit pollutant discharges on the Lummi Indian Reservation. The Washington State Department of Ecology is charged with enforcing these laws for most of Whatcom County. The Federal Environmental Protection Agency (EPA) and the Lummi Natural Resources Department enforce these laws on the Lummi Indian Reservation. The CWA Section 404 and the River & Harbors Act of 1899 Section 10 require a Federal Permit before discharging dredged fill materials into the waters of the U.S. or before working on structures in or affecting navigable water. The Department of Army Corps of Engineers is charged with enforcing these laws. Knowing what water quality standards and permit requirements apply before engaging in any maintenance activities are the first steps to avoid liability.

Under all circumstances, maintenance activities must follow “All Known And Reasonable Technologies” (AKART) to avoid violating water quality standards for sediment releases, commonly referred to as “turbidity”. Where turbidity already exists in the “background, it need not be controlled or improved. However, maintenance activities must avoid increasing pollution beyond a specified amount. Prior to undertaking any work for Sediment Control, refer to the following factsheets in this series: BMP *Factsheet #15 Fish Protection* and *Permitting Factsheet #4 Agency Contact Requirements*.

Measuring Sediment Releases:

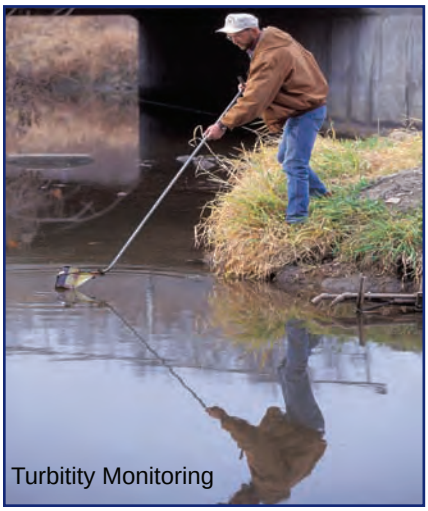
Sediment and erosion control measures should be in place both during and after works that have the potential to cause sedimentation of a watercourse. Suspended sediments are usually measured as "turbidity" and are measured as Nephelometric Turbidity Units or NTUs. Turbidity is the cloudiness or haziness of a fluid caused by individual particles (suspended solids) that are generally invisible to the naked eye, similar to smoke in air.

Turbidity can be measured in a number of ways; the most common are:

- Turbidity meter – This tool measures the intensity of light scattered at 90 degrees as a beam of light passes through a water sample. A meter may be available from the Whatcom County Public Works River & Flood Division or the Whatcom Conservation District.
- Secchi disk – This inexpensive tool uses a black and white disk in the water to measure the relative clarity of water.
- Visual inspection – Significant sediment releases are easily visible to the naked eye.

Aquatic Life Turbidity Criteria – Applies to all natural and modified natural watercourses and constructed watercourse reaches within 300 feet of their confluence with a natural or modified natural watercourse.

- Salmonid Spawning, Rearing and Migration areas - 5 NTU over natural background levels when background is 50 NTU or less. If background levels are above 50 NTUs then the increase should not exceed 10% over background levels.
- Salmonid Rearing and Migration **Only** areas – 10 NTU over background when background is 50 NTU or less and a maximum 20% increase when the background turbidity is more than 50 NTU.



Turbitity Monitoring

Water Quality Guidance for Drainage Maintenance:

Helpful definitions and typical site plan:

Total Maintenance Dredging Work Zone – The watercourse reach scheduled for maintenance during the year's work window including the Immediate Maintenance Dredging Work Zone and the Sediment Control Zone.

Immediate Maintenance Dredging Work Zone - The watercourse reach scheduled for maintenance during the year's work window. The reach should be noted in a Drainage Improvement District's Drainage Management Plan.

Sediment Control Zone – This area begins at the downstream edge of the Immediate Maintenance Dredging Work Zone and continues downstream for 200 feet. Typically one to three silt curtains are placed in this zone to capture and settle suspended sediments (see Best Management Practice (BMP) section below).

Point of Compliance – The point established at the downstream end of the Temporary Mixing Zone and identified on site with a stake or some other type of visible marker. This is the point where turbidity observations or measurements are taken to monitor compliance with Clean Water Act regulations.

Work Day – The length of watercourse planned for maintenance work in one day. The lowest section of a watercourse's Immediate Maintenance Dredging Work Zone will be completed in the first day with additional

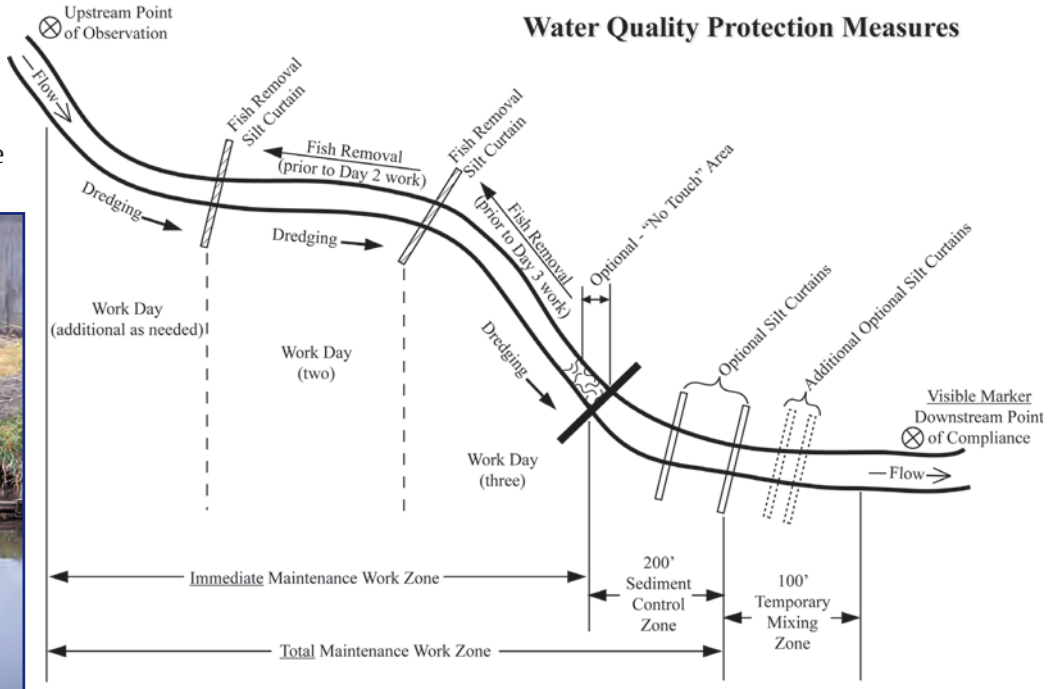


Figure 1

upstream reaches repeated until the planned work is complete.

Temporary Mixing Zone – When a channel maintenance project has received all permits and approvals and BMPs are being implemented to minimize the release of sediments, then a temporary mixing zone can be used to allow sediments to settle out of the water as follows:

- For waters up to 10 cubic feet per second (cfs) at the time of disturbance, the point of compliance shall be 100 feet downstream from the activity causing the turbidity exceedance.
- For waters above 10 cfs up to 100 cfs flow at the time of construction, the point of compliance shall be 200 feet downstream from the activity causing the turbidity exceedance.

Turbidity Best Management Practices (BMPs) Diagram – A generic site diagram that generally illustrates watercourse maintenance dredging activities, application of BMPs and integrated fish removal procedures. See Figure #1.

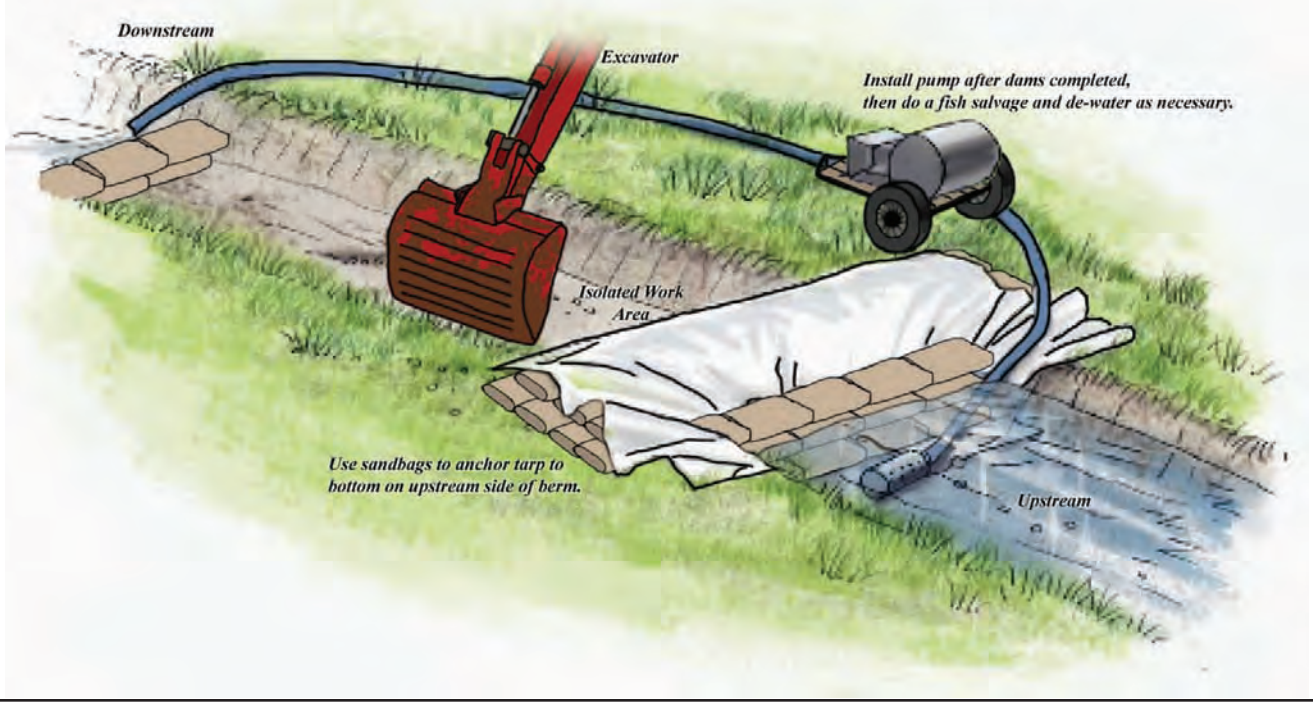
Sediment Control BMPs:

No single BMP or combination of BMPs will work under all conditions. Therefore, in approaching the problem of managing sediment, it is essential that you be vigilant in observing any impacts of your maintenance activities and adaptively apply different or additional BMPs in order to keep the discharge of pollution to less than what is allowed. Again, there is no single magic solution to control sediment release. Follow the process of:

1. Create an adaptive management strategy before work begins;
2. Start with simplest cost-effective strategies;
3. Closely monitor water quality to see if your maintenance activities are making conditions worse; and,
4. Implement additional BMPs until the impacts are within water quality standards.

The following BMPs will help control sediment release during channel maintenance activities.

- Dry Season. If at all possible, plan your maintenance work for the driest time of year, usually August – September. If there is less water flowing overall, it is less likely that dirty water will flow out of your worksite. Plan your crops to make sure the watercourse is accessible during the dry season.
- Adverse Weather. Suspend drainage work in adverse weather. Heavy summer rains can both increase flows beyond what you may be prepared for and may stir up sediments. Wait for low water levels to return prior to proceeding with maintenance work.
- Spoils placement. Place excavated materials well away from the watercourse to ensure they will not erode back into the watercourse.
- Monitor closely. Inspect the water downstream of your work site at the end of the appropriate mixing zone (usually 100 feet). Various tools are available to measure turbidity, however visual monitoring can be an effective measurement. A general rule is that if the water above your project looks clear then it needs to look as clear below your work area.
- Lidded Bucket. Use an excavator equipped with a clamshell or lidded bucket to prevent muddy water from falling back into the watercourse and increasing the level of contamination. This type



of equipment will probably be required in your Hydraulic Project Approval permit (HPA).

- Work Direction. Conduct maintenance activities from upstream to downstream to allow the downstream vegetation to screen and trap suspended sediments. Note: Impacts to fish may be less if work takes place downstream to upstream. Consult with the WDFW Area Habitat Biologist to determine the best site specific strategy.
- Pause your work. If you see muddy water in imminent danger of leaving your mixing zone, the easiest BMP is to stop, let the sediments filter out, then start again. After a little trial and error you should be able to set a sustainable work pace.
- Channel Blocking. Block the channel downstream to slow water flow and allow sediments to fall out. Multiple installations may be needed to capture all the sediment.
  * Fabric silt curtain. Constructed of woven filter fabric with weights at the bottom and floats at the top.
  * Coffer Dam or Check Dam. Rock, plywood, sandbags or other temporary structure to stop water flows and let sediments filter out.
- Water Diversion*. Pump some or all water around the work site and then return it to the channel. Isolating the work area and diverting flowing water around the worksite is the most effective method to ensure clean water law compliance. Pump intakes need to have fish screens meeting WDFW criteria to avoid entraining fish.
- Water Removal. Pump some or all the muddy water leaving the work area into an adjacent area for on site infiltration.
- Coordination with Fish Removal Activities. A silt curtain may be useful at the upstream end of the Work Day reach to isolate the reach after fish removal and to temporarily slow the flow of water through the reach.

*Deviation from this BMP may be allowed if WDFW or equivalent freshwater habitat biologist indicates pumping water around or from a channel maintenance project will create a more negative aquatic biological impact than the release of in-place sediments to downstream areas.

Additional Information on Instream BMPs:

Fabric Silt Curtain

Drainage Improvement Districts typically own their own silt curtains. They are made of woven fabric with tapered sides, weighted bottom and a float at the top. These inexpensive curtains are easy to install and can be moved as work progresses.

- Curtains 12’ to 16’ wide and 6’ to 8’ high can be utilized in most watercourses.
- Functions are to filter some muddy water as it passes through and to slow the water flow, allowing suspended sediments to drop out.
- Install 1 – 3 curtains at 100 foot intervals beginning 100 feet below your work area.
- Anchor the curtain sides with 8’ to 10’ heavy duty metal T posts as tightly to the edge of the watercourse as possible. The fabric curtain will naturally form to fill the channel profile.
- Monitor curtains closely to ensure they are functioning. Your point of compliance for turbidity is usually 100’ below the most downstream curtain.

Fabric Silt Curtain slowing flow and allowing sediments to settle

Simple Coffer Dam slows the water flow allowing sediments to settle

Coffer Dam or Check Dam

Coffer dams are used to isolate a channel reach in order to complete maintenance work. For greater effectiveness, coffer dams may be combined with other methods such as clean water bypasses or pumps. Coffer dams can be made of a variety of materials (rock, sandbags, wood, etc). Considerations in their use include:

- Dam materials must be anchored into the banks of the ditch to prevent seepage and erosion around the edges of the dam.
- A common practice is to line the channel with a tarp

and then anchor it with a sandbag wall to ensure a tight installation.

- If there is water in the channel but little or no flow, temporary coffer dams may be the most cost effective means to isolate the channel and confine muddy water. Once sediments settle out, remove coffer dams slowly to prevent the release of sediments downstream.
- If there is significant water flow, a coffer dam upstream can temporarily block this flow or create a source for clean water diversion.
- A downstream coffer dam will help prevent muddy water from leaving the work area, prevent clean water downstream from flowing back into the work area and becoming contaminated, and can be used in combination with a muddy water removal pump.
- Monitor frequently. Extra material (for example, more sandbags) should be kept on site to raise the dam if water behind the dam threatens to spill over into the work area or if muddy water threatens to overflow out of the work area. Immediately repair any scour, gaps, or holes around the dam to prevent failure.
- Completely remove the dam once the maintenance work is complete.

Water Diversion

A water diversion redirects the water flow temporarily around the section of the watercourse where work is being conducted. Clean water is moved around the worksite to prevent contamination and then returned to the watercourse below the work area. Pumps are most commonly used however; in some cases an alternative channel or bypass flume may be used to transport some water or all water around the work site and then return it to the channel. Considerations in the use of water diversions include:

- The pumped diversion is suitable for intermittent and low flow streams that can be pumped. Pump capacity must be sufficient to handle the flow.

Minimal flow in work area after water is pumped around site

Diverted water returned to watercourse downstream

- Downstream sediment transport can almost be eliminated.
- Temporary coffer dams are constructed upstream and downstream of the work area.
- A pump intake screen meeting WDFW standards should be installed to protect fish and other aquatic life.
- An energy dissipation device should be installed to prevent scouring where water is pumped back into the stream.
- As water in the worksite recedes, monitor closely for distressed or stranded fish. See *Factsheet #15 Fish Protection*.
- Although pumping water can be expensive, sediment removal is less expensive and easier in a dry channel where an operator can see and maintain grades.

Water Removal

Pump water out of the worksite or pump some or all muddy water from the lower end of worksite before it contaminates receiving waters downstream. Considerations in the use of water removal include:

- If there is little or no flow and either no fish present or fish have been removed, the maintenance project site can be isolated using coffer dams. Remaining water can be pumped into an adjacent area for onsite infiltration.
- Another practice is to pump out muddy water trapped above a coffer dam or turbidity curtain before it flows downstream.
- An adjacent grass field is commonly used to receive and filter contaminated water.
- Nearby grass lined ditches may also work well to filter sediments out before water eventually returns to the channel.
- Do not pump water into adjacent natural wetlands.
- Do not pump all the water out of a channel leaving downstream aquatic life to die.
- Monitor closely to ensure that muddy water does not re-enter the channel. Be prepared to move the

outflow pipe often to prevent over saturation of fields.

Erosion control fabric installed after maintenance work

Bank Erosion Controls

Exposed soils on banks and slopes are susceptible to erosion and can result in significant sediment loads. If steep banks are sloped back or if dredge spoils must be placed uphill from the work area, then measures should be taken to minimize any potential erosion. Where exposed earth is adjacent to a watercourse, controlling erosion can be as simple as seeding as soon as possible to establish vegetative cover and prevent sediment entry into the watercourse during the rainy season.

- Erosion Control Seed Mix - Any exposed soils should be immediately seeded with an appropriate seed mix such as:

Chewings or annual blue grass Festuca rubra var. commutate or Poa ann	40%
Perennial rye Lolium perenne	50%
Retop or colonial bentgrass Agrostis alba or Agrostis tenuis	5%
White dutch clover Trifolium repens	5%

- Mulch & Mats. Spreading straw over exposed soils reduces the erosive energy of rainfall and is a quick and inexpensive means to control erosion. Erosion control fabrics made of fine mesh and either straw or coconut fibers work well on steeper or erosion prone slopes.
- Silt Fencing. If excavated sediments are susceptible to erosion, install a silt fence below the sediments to prevent erosion. Silt fence should be trenched into the existing soil 4” to 6” and staked every 6’ to 10’.
- Straw Wattles. Partially trenched into the soil and staked, straw wattles are another effective means to control erosion.
- Stormwater Manual. WDOE’s “*Stormwater Management Manual for Western Washington*” contains detailed information about these and other useful BMPs for erosion control.

Monitoring:

- Visual or measured monitoring for turbidity should be conducted every hour.
- Monitor at the upstream edge of the *Immediate Maintenance Dredging Work Zone*, and at the downstream *Point of Compliance*.
- Record observations on a Water Quality Turbidity Monitoring Report Form.
- Each time there is an observed differential in turbidity, additional BMPs listed above should be implemented.
- Should three successive hourly visual monitorings continue to identify problems after all practicable BMPs have been implemented; the operator will contact the Department of Ecology or the Lummi Naural Resources Department for work conducted on the Lummi Indian Reservation and advise them of the situation. The purpose of the phone call is to report the occurrence, discuss BMPs being employed and consult with the department on appropriate actions to address the situation.

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Drainage Management

Whatcom County Washington

Whatcom Conservation District

Informational Factsheet #17

HAND MAINTENANCE

Introduction

Maintaining watercourse drainage using only hand tools is a technique that humans have utilized since agricultural practices began. It is simple, when you see grass or other types of obstructions blocking a channel and flooding a farm field, reach in and pull it out. Nova Pacific Environmental working out of Vancouver B.C. has developed a system to utilize this age old practice as a more environmentally benign way to maintain drainage. Crews can work down a channel pulling back grass and removing obstructions to maintain drainage with minimal impact to aquatic habitat.

Permits

Any work below the ordinary high water mark of natural or modified natural watercourses requires a Hydraulic Project Approval from the Washington State Department of Fish and Wildlife (see Permitting Factsheet #1). Work within critical areas also requires a Natural Resource Notification of Activity with Whatcom County (see Permitting Factsheet #3). A Drainage Improvement District can permit Hand Maintenance work through the development and approval of their Drainage Management Plan.

photo courtesy of Nova Pacific Environmental

photo courtesy of Nova Pacific Environmental

photo courtesy of Nova Pacific Environmental

Advantages

- Longer work window, June 15th to October 30th.
- Reduces impacts to fish and other aquatic resources.
- Eliminates the need for fish exclusion.
- Eliminates the need for water quality BMPs.
- Allows native riparian plantings to stabilize and function.
- Cost competitive alternative to maintenance dredging.

Disadvantages

- Treatments will likely need repeated over time. The need for hand maintenance will be reduced when combined with improved farm practices to reduce sediment inputs and when combined with Watercourse Re-vegetation to stabilize the streambanks and shade out undesirable aquatic vegetation.
- Not effective if sediment buildup is the primary drainage problem.

When To Use

Hand Maintenance may be a useful practice in many situations including:

- Where land use constraints prevent longer term solutions such as Watercourse Re-vegetation.
- As an interim means to maintain drainage as native tree and shrub buffers are established.
- As a low impact means to maintain isolated obstructions in areas with riparian vegetation.

Hand Maintenance BMPs

1. Work must be completed between June 15th and October 30th.
2. Work will take place using hand tools from the top of the bank whenever possible.
3. If workers must work from channel bottom, areas with gravel substrate will not be disturbed.
4. If workers must work from channel bottom, sediments will not be disturbed and allowed to move downstream.
5. If sediments are disturbed, water quality protection BMPs must be implemented (see BMP Factsheet #16).
6. Native woody vegetation will be left intact as much as possible.
7. Work must be conducted during favorable weather and low water conditions. If heavy rain occurs unexpectedly, delay maintenance until water levels recede.

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