Ditch maintenance strategies fall into two categories: routine maintenance and corrective maintenance. Some maintenance strategies can fall into both categories. Different ditch types and different existing conditions require different maintenance strategies, and appropriate maintenance strategies may be limited by cost, space availability, and environmental regulations. Some existing ditches may be so degraded that they require more complicated and expensive source control or retrofit strategies. This field guide focuses on the implementation of routine and corrective maintenance strategies by municipal maintenance staff in roadside ditches that convey stormwater.

The reference bar at the bottom of most of the maintenance strategy pages refers to a set of 8 fact sheets that were also developed as part of this project:

- Fact Sheet A1 - Ditch Mapping Recommendations
- Fact Sheet A2 - Prioritizing Ditches for Inspection and Maintenance
- Fact Sheet A3 - Permit Requirements for Ditch Maintenance
- Fact Sheet A4 - Source Control Strategies for Ditches
- Fact Sheet A5 - Ditch Retrofit Strategies
- Fact Sheet F1 - Considerations for Field Evaluation of Roadside Ditches
- Fact Sheet F2 - Ditch Cleaning Strategies
- Fact Sheet F3 - Maintaining Ditches that Convey Natural Flow

Fact sheets are boxed and shown in brighter text if they are directly applicable to the maintenance strategy described on that page of the field guide.

This field guide was developed by Herrera Environmental Consultants with input from King County and the Regional Operations and Maintenance Program (ROADMAP). Project funding was provided by a National Estuary Program grant from the Washington State Department of Ecology.

This guide is for reference only. All maintenance strategies must comply with local codes and regulations. Maintenance strategies in ditches that convey natural flow require special considerations.
Routine Maintenance

In general, routine maintenance can be completed by municipal maintenance staff without major analysis, engineering, or permits. Ideally, ditches that are in good condition do not require corrective maintenance and can be maintained through routine inspections and maintenance.

The routine maintenance strategies outlined in this field guide include:

- **Ditch Vegetation Management**
  - Mowing (page 3)
  - Brush Cutting (or Brushing) (page 4)
  - Minor Reseeding/Replanting (page 5)
  - Weed Control (page 6)
  - Invasive Species and Noxious Weed Removal (page 7)

- **Inlet/Outlet Cleaning** (page 8)

- **Nuisance Animal/Insect Control** (page 9)

Ditch Vegetation Management

What is ditch vegetation management?

Vegetation management includes the establishment and maintenance of healthy, beneficial vegetation in ditches and the control of excess or unwanted vegetation.

Why is ditch vegetation management important?

Ditches are designed to transport water away from the roadway to prevent roadway flooding. Vegetation can promote this essential ditch function, but can also inhibit the capacity of a ditch to convey water. Vegetation can also capture pollutants from stormwater runoff.

Routine maintenance strategies for vegetation management should ensure that vegetation is healthy, but does not encroach on the adjacent roadway or cause ditch capacity issues.
# Ditch Vegetation Management Strategies

## Mowing

<table>
<thead>
<tr>
<th>Description</th>
<th>Cutting vegetation to a reasonable height to allow for proper water flow and aesthetics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Condition</strong></td>
<td>Tall vegetation is impeding flow of water through the ditch or causing line of sight issues</td>
</tr>
<tr>
<td><strong>Ditch Surface Types</strong></td>
<td>✓ Vegetated</td>
</tr>
<tr>
<td><strong>Water Flow</strong></td>
<td>✓ No flow</td>
</tr>
<tr>
<td><strong>Common Equipment and Materials</strong></td>
<td>Mower</td>
</tr>
<tr>
<td></td>
<td>Specialized mower for steep slopes</td>
</tr>
<tr>
<td></td>
<td>Brooms, scoops, shovels, and/or handheld blowers</td>
</tr>
<tr>
<td><strong>Additional Equipment and Materials for Natural Flow</strong></td>
<td>Reflective markers (&quot;fish sticks&quot;)</td>
</tr>
</tbody>
</table>

### Considerations Prior to Implementation

- Set the mowing height at the highest acceptable level. For standard turf grass, mowing only the top 1/3 of the grass blade height is recommended. Where vegetation growth is excessive, additional mowing may be necessary.
- Avoid operating mowers in wet areas or rough terrain to minimize scalping and rutting.
- Strategize mowing direction to minimize spreading of cut material onto adjacent paved surfaces.
- If vegetation is providing flow control or treatment, too much removal or trimming could reduce these functions.
- If possible, retain vegetation on the south or west sides of the ditch to provide shading of the ditch and reduce water temperature.
- If there is an opportunity to re-seed, low growing grass seed mix is recommended to reduce mowing frequency and cost.

### Steep Slope Considerations

- Use a specialized mower when steep slopes (≥ 15 percent) are present.

### Disposal Considerations

- Turf grass may be mulch mowed and left in place; however, large quantities of turf grass clippings may lead to outlet clogging and nutrient loading in downstream water bodies.

### Fact Sheet References

<table>
<thead>
<tr>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>A4</th>
<th>A5</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image.png" alt="Evaluation" /></td>
<td><img src="image.png" alt="Cleaning" /></td>
<td><img src="image.png" alt="Natural Flow" /></td>
<td><img src="image.png" alt="Mapping" /></td>
<td><img src="image.png" alt="Prioritizing" /></td>
<td><img src="image.png" alt="Permitting" /></td>
<td><img src="image.png" alt="Source Control" /></td>
<td><img src="image.png" alt="Retrofits" /></td>
</tr>
</tbody>
</table>

### Additional References

Refer to *Invasive Species and Noxious Weed Removal* (page 7) for additional recommendations regarding mowing.

Refer to local codes and regulations for additional requirements.

Photo source: King County
**Ditch Vegetation Management Strategies**

**Brush Cutting or “Brushing”**

<table>
<thead>
<tr>
<th>Description</th>
<th>Trimming woody vegetation to remove overgrown and/or excessive vegetation to allow for proper water flow and to restore sight distance</th>
</tr>
</thead>
</table>
| Condition   | • Overgrown/ excessive vegetation impeding flow or storage of water and sediments  
              • Safety or structural integrity of the roadway is jeopardized |
| Ditch Surface Types | ✓ Vegetated |
| Water Flow  | ✓ No flow |
| Common Equipment and Materials | • Brush cutters  
                                 • Power saws  
                                 • Axes and/or machetes  
                                 • Pruning shears, loppers, and/or clippers  
                                 • Brooms, scoops, shovels, and/or rakes  
                                 • Truck cover (for securing load during transport) |
| Considerations Prior to Implementation | • If vegetation is providing flow control or treatment, too much removal or trimming could reduce these functions.  
                                          • If possible, retain vegetation on the south or west sides of the ditch to provide shading of the ditch and reduce water temperature. |
| Disposal Considerations | • Remove cut branches/other vegetative debris after brushing to reduce outlet clogging and spreading invasive species.  
                            • Compost or stockpile vegetative matter in a clean green stockpile at your maintenance facility, if possible. |

**Additional References**

Refer to local codes and regulations for additional requirements.

---

Vegetation management demonstration
Photo source: Kitsap County
### Ditch Vegetation Management Strategies

#### Minor Reseeding/Replanting

**Description**
Adding seed and/or plants to stabilize exposed soils. Applies to conditions affecting a small section of a ditch that can be addressed as part of routine maintenance (see Additional References below).

<table>
<thead>
<tr>
<th>Condition</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sparse vegetation/ eroded patches on ditch bottom&lt;br&gt;Poor grass growth</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ditch Surface Types</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetated&lt;br&gt;Bare Soil</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Water Flow</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No flow</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common Equipment and Materials</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed mix&lt;br&gt;Hydroseeder&lt;br&gt;Post-seeding erosion control BMPs (e.g., straw mulch, biodegradable nets and blankets, coir mats)</td>
<td></td>
</tr>
</tbody>
</table>

**Considerations Prior to Implementation**
- Ensure that erosion control BMPs are installed properly to avoid blockages.
- Low growing grass seed mix is recommended to reduce mowing frequency and cost.
- Confirm that there are no weed seeds or invasive plant seeds in the seed mixes.
- Seed and/or plant during the following optimum windows:
  - Late spring (April 1 through June 30)
  - Early fall (September 1 through October 1)
- Establishment of vegetation may not be feasible in coarse grained or mineral soils.

**Fact Sheet References**

<table>
<thead>
<tr>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>A4</th>
<th>A5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation</td>
<td>Cleaning</td>
<td>Natural Flow</td>
<td>Mapping</td>
<td>Prioritizing</td>
<td>Permitting</td>
<td>Source Control</td>
<td>Retrofits</td>
</tr>
</tbody>
</table>

**Additional References**
When major reseeding/replanting is necessary to correct poor conditions, refer to Major Reseeding/Replanting (page 16) in the Corrective Maintenance section of this field guide.

Refer to local codes and regulations for additional requirements.

Examples of sparse or absent vegetation that could be classified as poor (left), moderate (center), and good (right) vegetation coverage.
# Ditch Vegetation Management Strategies

## Weed Control

### Description
Control of weeds through biological, physical, mechanical, chemical, or cultural methods

### Condition
Weeds are present in a ditch

### Ditch Surface Types
- ☑ Vegetated
- ☑ Bare Soil
- ☑ Rock

### Water Flow
- ☑ No flow
- ☑ Standing water
- ☑ Low flow

### Common Equipment and Materials
- Required permits (keep documentation on-site during work)
- Weeding tools
- Weed burner
- Brooms, scoops, shovels, and/or rakes

### Considerations Prior to Implementation
- Verify that required permits have been obtained prior to beginning work.
- Review preferred implementation strategies documented in an Integrated Pest Management (IPM) plan.
- Ensure that herbicide applications are performed by licensed, qualified staff.
- Use physical and/or mechanical methods of vegetation removal rather than applying herbicides, where practical.

### Disposal Conditions
Compost or stockpile vegetative matter in a clean green stockpile at your maintenance facility, if possible, and only if invasive species and noxious weeds are not present.

### Fact Sheet References

#### Additional References
Refer to Invasive Species and Noxious Weed Removal (page 7) for disposal considerations when invasive species and noxious weeds are present.

Refer to your local IPM plan, local codes and regulations for additional requirements.
### Ditch Vegetation Management Strategies
#### Invasive Species and Noxious Weed Removal

<table>
<thead>
<tr>
<th>Description</th>
<th>Control of invasive species and noxious weeds through biological, physical, mechanical, chemical, or cultural methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition</td>
<td>• Invasive species present  ○ Noxious weeds present</td>
</tr>
<tr>
<td>Ditch Surface Types</td>
<td>✓ Vegetated  ✓ Bare Soil  ✓ Rock</td>
</tr>
<tr>
<td>Water Flow</td>
<td>✓ No flow  ✓ Standing water  ✓ Low flow</td>
</tr>
</tbody>
</table>

#### Common Equipment and Materials
- Required permits (keep documentation on-site during work)
- Weeding tools
- Weed wrench
- Targeted herbicide applicator (woody painter/ herbicide wand)
- Garbage bags (to prevent seed development and dispersal)
- Protective clothing and eye protection (for toxic, noxious weeds)

#### Considerations Prior to Implementation
- Verify that required permits have been obtained prior to beginning work.
- Invasive species may need to be removed by hand.
- Pull plants when soils are moist and before seeds are produced.
- Identify invasive species that can and should be controlled or reduced by mowing.
- Ensure that herbicide applications are performed by licensed, qualified staff.
- Prior to mowing, implement the following for small populations of invasive plants:
  - Use herbicides early in the summer.
  - Physically remove (cut) flower or seed heads.
  - Physically remove rootstock (mechanically excavate).
- Implement the following for large, mature invasive plants:
  - Control large purple loosestrife plant populations with biocontrol beetles (*Hylobias sp.* or *Galruccella sp.*) prior to mowing.
  - Mow plants prior to seed maturation, allow the plants to regrow to a height of 2 to 4 feet and then treat with foliar herbicide.
- If mowing occurs after seed maturation, hand clean the upper parts of the mowing equipment with a brush or broom prior to moving to a new location.

#### Disposal Conditions
- Ensure proper disposal per the Washington State Noxious Weed Control Board.
- Bag cut flowers and seed heads.

#### Fact Sheet References
<table>
<thead>
<tr>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>A4</th>
<th>A5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation</td>
<td>Cleaning</td>
<td>Natural Flow</td>
<td>Mapping</td>
<td>Prioritizing</td>
<td>Permitting</td>
<td>Source Control</td>
<td>Retrofits</td>
</tr>
</tbody>
</table>

#### Additional References
- Refer to the Washington State Noxious Weed Control Board ([www.nwcb.wa.gov](http://www.nwcb.wa.gov)) for weed identification, removal, and disposal considerations.
- Refer to your local IPM plan, local codes and regulations for additional requirements.

Common invasive species that thrive in ditches include reed canarygrass and Himalayan blackberry. These species can make ditches difficult to access and inspect and can reduce ditch flow capacity.
### Inlet/Outlet Cleaning

<table>
<thead>
<tr>
<th>Description</th>
<th>Clean accumulated sediment and blockages from inlets and outlets</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Condition</strong></td>
<td>Accumulated sediment or blockage impeding flow (≥ 50% blockage) at inlet/outlet pipe</td>
</tr>
<tr>
<td>Ditch Surface Types</td>
<td>✓ Vegetated ✓ Bare Soil ✓ Rock ✓ Paved ✓ Metal</td>
</tr>
<tr>
<td>Water Flow</td>
<td>✓ No flow ✓ Standing water</td>
</tr>
<tr>
<td>Common Equipment and Materials</td>
<td>• Rake, hoe, or shovel • Wheelbarrow or buckets</td>
</tr>
<tr>
<td>Steep Slope Considerations</td>
<td>Consider adjusting threshold to ≥ 30% blockage when steep slopes (≥ 15 percent) are present.</td>
</tr>
<tr>
<td>Disposal Conditions</td>
<td>Use or disposal options for the sediment removed from the inlet and/or outlet will depend on the characterization of the waste (see Fact Sheet A3 - Permit Requirements for Ditch Maintenance).</td>
</tr>
</tbody>
</table>

**Fact Sheet References**

- F1: Evaluation
- F2: Cleaning
- F3: Natural Flow
- A1: Mapping
- A2: Prioritizing
- A3: Permitting
- A4: Source Control
- A5: Retrofits

**Additional References**

Refer to local codes and regulations for additional requirements.

**Culvert outlet is partially buried in sediment (left). Inlet blocked by structure (right).**
## Nuisance Animal/Insect Control

<table>
<thead>
<tr>
<th>Description</th>
<th>Control nuisance animals/insects through mechanical, manual, or chemical methods. Examples of nuisance animals and insects include:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beavers</td>
<td>May block ditch capacity with dams</td>
</tr>
<tr>
<td>Bees</td>
<td>Could pose a hazard to crews maintaining the ditch</td>
</tr>
<tr>
<td>Moles</td>
<td>Contribute to erosion by burrowing holes</td>
</tr>
<tr>
<td>Mosquitoes</td>
<td>May result from stagnant flow in ditch; nuisance and public health hazard</td>
</tr>
<tr>
<td>Nutria</td>
<td>Contribute to erosion by destroying the banks of ditches</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>✓ Nuisance animals/insects present</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetated</td>
<td>✓</td>
</tr>
<tr>
<td>Bare Soil</td>
<td>✓</td>
</tr>
<tr>
<td>Rock</td>
<td>✓</td>
</tr>
<tr>
<td>Paved</td>
<td>✓</td>
</tr>
<tr>
<td>Metal</td>
<td>✓</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ditch Surface Types</th>
<th>✓ Vegetated</th>
<th>✓ Bare Soil</th>
<th>✓ Rock</th>
<th>✓ Paved</th>
<th>✓ Metal</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Water Flow</th>
<th>✓ No flow</th>
<th>✓ Standing water</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Common Equipment and Materials</th>
<th>✓ Animal guards (e.g., rods, flap gates, and finger-type flap gates) for outlet pipes</th>
<th>✓ Traps (if allowed)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Considerations Prior to Implementation</th>
<th>Preferred implementation strategies should be documented in an Integrated Pest Management (IPM) plan.</th>
</tr>
</thead>
</table>

### Fact Sheet References

<table>
<thead>
<tr>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>A4</th>
<th>A5</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Evaluation" /></td>
<td><img src="image2" alt="Cleaning" /></td>
<td><img src="image3" alt="Natural Flow" /></td>
<td><img src="image4" alt="Mapping" /></td>
<td><img src="image5" alt="Prioritizing" /></td>
<td><img src="image6" alt="Permitting" /></td>
<td><img src="image7" alt="Source Control" /></td>
<td><img src="image8" alt="Retrofits" /></td>
</tr>
</tbody>
</table>

### Additional References

Refer to your local IPM plan, local codes and regulations for additional requirements.
Corrective Maintenance

Corrective maintenance may require analysis, engineering, or permitting prior to implementation. The corrective maintenance strategies outlined in this field guide include:

- **Ditch Cleaning**
  - Hand Ditching ([page 11](#))
  - Bucket Ditching ([page 12](#))
  - Shoulder Ditching ([page 13](#))

- **Ditch Stabilization** ([page 14](#))

- **Minor Ditch Reshaping/Regrading** ([page 15](#))

- **Major Replanting/Reseeding** ([page 16](#))

- **Trees of Concern** ([page 17](#))

- **Minor Inlet/Outlet Repair** ([page 18](#))

---

**Ditch Cleaning**

**What is ditch cleaning?**

Ditch cleaning is a corrective maintenance strategy for ditches that is focused on sediment and debris removal.

**Why is ditch cleaning important?**

Ditches should be cleaned to ensure that they are functioning as designed in order to convey runoff away from road surfaces and minimize high flows, erosion, and pollution.

Excess sediment and debris buildup in ditches can limit vegetation growth, contribute to the pollutant loads carried by runoff in ditches, decrease ditch capacity, and cause flooding.
## Ditch Cleaning Strategies
### Hand Ditching

<table>
<thead>
<tr>
<th>Description</th>
<th>Remove sediment and debris manually using a rake, hoe, or shovel</th>
</tr>
</thead>
</table>
| **Condition**                                    | ▪ Sediment accumulation near inlet and/or outlet  
▪ Excess sediment impeding flow or causing erosion |
| **Ditch Surface Types**                          | ▪ Vegetated  
▪ Bare Soil  
▪ Rock  
▪ Paved  
▪ Metal |
| **Water Flow**                                   | ▪ No flow  
▪ Low flow |
| **Common Equipment and Materials**               | ▪ Rake, hoe, or shovel  
▪ Wheelbarrow or buckets  
▪ Erosion control BMPs (e.g., wattles, check dams, silt fences) |
| **Additional Equipment and Materials for Natural Flow** | ▪ Required permits (keep documentation on-site during work)  
▪ Containment dams (e.g., water bladders, sand bags)  
▪ Vactor truck (for non-fish bearing waters and low-flow scenarios)  
▪ Fish exclusion nets (9.5 mm stretched mesh)  
▪ Pump and bypass setup (if ditch flow is significant)  
▪ Spill kit, including containment for the pump  
▪ Erosion control BMPs for pump outfall, channel stabilization, etc. |
| **Considerations Prior to Implementation**       | ▪ Verify that required permits have been obtained prior to beginning work.  
▪ Cleaning should be performed during low flow or no flow periods if possible.  
▪ Install erosion control BMPs prior to conducting sediment removal.  
▪ Consider retaining vegetation near ditch outlet(s), also known as “skip ditching.”  
▪ Reseed and install erosion control BMPs after sediment has been removed if needed. |
| **Steep Slope Considerations**                  | ▪ Retain additional vegetation near ditch outlet(s) when steep slopes (≥ 15 percent) are present. |
| **Disposal Considerations**                     | ▪ Sweep and collect dirt and debris remaining on the pavement at the completion of work.  
▪ Separate screenings into soil and vegetative matter (e.g., leaves, grass, needles, branches) categories:  
▪ Compost or stockpile vegetative matter in a clean green stockpile at your maintenance facility, if possible, and only if invasive species and noxious weeds are not present.  
▪ Use or disposal options for the removed soil will depend on the characterization of the waste (see Fact Sheet A3 - Permit Requirements for Ditch Maintenance). |

### Fact Sheet References

- F1 Evaluation
- F2 Cleaning
- F3 Natural Flow
- A1 Mapping
- A2 Prioritizing
- A3 Permitting
- A4 Source Control
- A5 Retrofits

### Additional References
- Refer to Minor Reseeding/Replanting (page 5) in the Routine Maintenance section of this field guide.
- Refer to local codes and regulations for additional requirements.
# Ditch Cleaning Strategies

## Bucket Ditching (Mechanical Excavation)

**Description**

Removing sediment and debris in deep ditches where hand ditching is impractical. Also known as “mechanical excavation.”

**Condition**

- Sediment accumulation near inlet and/or outlet
- Excess sediment impeding flow or causing erosion

**Ditch Surface Types**

- Vegetated
- Bare Soil

**Water Flow**

- No flow
- Low flow

**Common Equipment and Materials**

- Backhoe or excavator with ditching bucket or Ditch Master
- Front end loader
- Erosion control BMPs (e.g., wattles, check dams, silt fences)

**Additional Equipment and Materials for Natural Flow**

- Required permits (keep documentation on-site during work)
- Containment dams (e.g., water bladders, sand bags)
- Vactor truck (for non-fish bearing waters and low-flow scenarios)
- Fish exclusion nets (9.5 mm stretched mesh)
- Pump and bypass setup (if ditch flow is significant)
- Spill kit, including containment for the pump
- Vactor truck (for non-fish bearing waters and low-flow scenarios)
- Erosion control BMPs for pump outfall, channel stabilization, etc.

**Considerations Prior to Implementation**

- Verify that required permits have been obtained prior to beginning work.
- Cleaning should be performed during low flow or no flow periods if possible.
- Install erosion control BMPs prior to conducting sediment removal.
- Consider “skip ditching” or retaining vegetation near the ditch outlet(s).
- Reseed and install erosion control BMPs after sediment has been removed if needed.
- Keep excavation equipment on the roadway and off the ditch bank.

**Steep Slope Considerations**

- Retain additional vegetation near ditch outlet(s) when steep slopes (≥ 15 percent) are present.

**Disposal Considerations**

- Sweep and collect dirt and debris remaining on the pavement at the completion of work.
- Separate screenings into soil and vegetative matter (e.g., leaves, grass, needles, branches) categories:
  - Compost or stockpile vegetative matter in a clean green stockpile at your maintenance facility, if possible, and only if invasive species and noxious weeds are not present.
- Use or disposal options for the removed soil will depend on the characterization of the waste (see Fact Sheet A3 - Permit Requirements for Ditch Maintenance).

**Fact Sheet References**

<table>
<thead>
<tr>
<th>F1</th>
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<th>F3</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>A4</th>
<th>A5</th>
</tr>
</thead>
</table>

**Additional References**

Refer to Minor Reseeding/Replanting (page 5) in the Routine Maintenance section of this field guide.

Refer to local codes and regulations for additional requirements.

*Photo source: King County
Ditch Master performing ditch cleaning*
## Shoulder Ditching (Blade Ditching or Shoulder Pulling)

<table>
<thead>
<tr>
<th>Description</th>
<th>Reshaping and cleaning ditches by removing excess sod from the shoulder. Also known as blade ditching or shoulder pulling.</th>
</tr>
</thead>
</table>
| Condition   | • Sediment accumulation near inlet and/or outlet  
              • Excess sediment impeding flow or causing erosion                                                                |
| Ditch Surface Types | ☑ Vegetated  
                     ☑ Bare Soil                                                                 |
| Water Flow  | ☑ No flow  
              ☑ Low flow                                                                 |
| Common Equipment and Materials | ☑ Grader  
                                 ☑ Belt loader  
                                 ☑ Erosion control BMPs (e.g., wattles, check dams, silt fences) |
| Additional Equipment and Materials for Natural Flow | ☑ Required permits (keep documentation on-site during work)  
                                                       • Containment dams (e.g., water bladders, sand bags)  
                                                       • Vactor truck (for non-fish bearing waters and low-flow scenarios)  
                                                       • Fish exclusion nets (9.5 mm stretched mesh)  
                                                       • Pump and bypass setup (if ditch flow is significant)  
                                                       • Spill kit, including containment for the pump  
                                                       • Erosion control BMPs for pump outfall, channel stabilization, etc. |
| Considerations Prior to Implementation | ☑ Verify that required permits have been obtained prior to beginning work  
                                               • Cleaning should be performed during low flow or no flow periods if possible  
                                               • Install erosion control BMPs prior to conducting sediment removal  
                                               • Consider “skip ditching” or retaining vegetation near the ditch outlet(s)  
                                               • Reseed and install erosion control BMPs after sediment has been removed if needed  
                                               • Keep excavation equipment on the roadway and off the ditch bank |
| Steep Slope Considerations | ☑ Retain additional vegetation near ditch outlet(s) when steep slopes (≥ 15 percent) are present |
| Disposal Considerations | ☑ Sweep and collect dirt and debris remaining on the pavement at the completion of work  
                                    • Separate screenings into soil and vegetative matter (e.g., leaves, grass, needles, branches) categories:  
                                      • Compost or stockpile vegetative matter in a clean green stockpile at your maintenance facility, if possible, and only if invasive species and noxious weeds are not present.  
                                      • Use or disposal options for the removed soil will depend on the characterization of the waste (see Fact Sheet A3 - Permit Requirements for Ditch Maintenance). |

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**Fact Sheet References**

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<tr>
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<tbody>
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**Additional References**

Refer to Minor Reseeding/Replanting (page 5) in the Routine Maintenance section of this field guide.

Refer to local codes and regulations for additional requirements.

[Shoulder Pulling, Photo source: King County]
## Ditch Stabilization

<table>
<thead>
<tr>
<th>Description</th>
<th>Control erosion and scour by installing additional vegetative cover or riprap on steep side slopes or installing check dams to slow water flow and to cover bare soils</th>
</tr>
</thead>
</table>
| Condition   | - Erosion damage  
- Ditch bottom eroded or scoured during to flow channelization or high flows |
| Ditch Surface Types | ✓ Vegetated  
✓ Bare Soil  
✓ Rock |
| Water Flow  | ✓ No flow  
✓ Low flow |
| Common Equipment and Materials | ✓ Riprap  
✓ Check dams  
✓ Erosion control BMPs during maintenance (e.g., wattles, check dams, silt fences)  
✓ Seed mix  
✓ Post-seeding erosion control BMPs (e.g., straw mulch, biodegradable nets and blankets, coir mats)  
✓ Geotextile fabric |
| Additional Equipment and Materials for Natural Flow | ✓ Required permits (keep documentation on-site during work)  
✓ Containment dams (e.g., water bladders, sand bags)  
✓ Vactor truck (for non-fish bearing waters and low-flow scenarios)  
✓ Fish exclusion nets (9.5 mm stretched mesh)  
✓ Pump and bypass setup (if ditch flow is significant)  
✓ Spill kit, including containment for the pump  
✓ Erosion control BMPs for pump outfall, channel stabilization, etc. |
| Considerations Prior to Implementation | ✓ Verify that required permits have been obtained prior to beginning work.  
✓ Anchoring straw mulch is difficult in narrow areas.  
✓ Vegetation may not be feasible in rocky areas or in ditches that experience high flows.  
✓ Perform ditch stabilization during low flow or no flow periods if possible.  
✓ Do not use hay mulch, which is more likely than straw mulch to contain weed seeds. (Note: Some jurisdictions do not allow straw or hay mulch. Straw mulch is inexpensive, but can easily be washed or blown away.) |
| Steep Slope Considerations | ✓ Anchoring straw mulch is difficult when steep slopes (≥ 15 percent) are present.  
✓ Vegetation may not be feasible when steep slopes (≥ 15 percent) are present. |
| Fact Sheet References | Refer to Minor Reseeding/Replanting (page 5) in the Routine Maintenance section of this field guide.  
Refer to local codes and regulations for additional requirements. |

### Additional References
## Minor Ditch Reshaping / Regrading

<table>
<thead>
<tr>
<th>Description</th>
<th>Excavation of accumulated sediments to restore original ditch slope and/or grade line</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Condition</strong></td>
<td></td>
</tr>
</tbody>
</table>
- Ditch storage capacity is limited by accumulated sediments  
- Standing water remains in the ditch during storms and does not drain freely |
| **Ditch Surface Types** |  
- Vegetated  
- Bare Soil  
- Rock |
| **Water Flow** |  
- No flow  
- Low flow |
| **Common Equipment and Materials** |  
- Excavator  
- Erosion control BMPs during maintenance (e.g., wattles, check dams, silt fences)  
- Seed mix  
- Post-seeding erosion control BMPs (e.g., straw mulch, biodegradable nets and blankets, coir mats) |
| **Additional Equipment and Materials for Natural Flow** |  
- Required permits (keep documentation on-site during work)  
- Containment dams (e.g., water bladders, sand bags)  
- Vactor truck (for non-fish bearing waters and low-flow scenarios)  
- Fish exclusion nets (9.5 mm stretched mesh)  
- Pump and bypass setup (if ditch flow is significant)  
- Spill kit, including containment for the pump  
- Erosion control BMPs for pump outfall, channel stabilization, etc. |
| **Considerations Prior to Implementation** |  
- Verify that required permits have been obtained prior to beginning work.  
- Deep ditches may require more significant ditch reshaping or flow control.  
- Perform ditch reshaping/regrading during low flow or no flow periods if possible.  
- Failure to reestablish vegetation or protect side slopes could lead to erosion.  
- Keep excavation equipment on the roadway and off the ditch bank.  
- Reseed ditch line after reshaping, unless water is flowing. |
| **Steep Slope Considerations** |  
- Ditches with steep side slopes (≥ 15 percent) may require more significant ditch reshaping or flow control. |
| **Disposal Considerations** |  
- Sweep and collect dirt and debris remaining on the pavement at the completion of work.  
- Separate screenings into soil and vegetative matter (e.g., leaves, grass, needles, branches) categories:  
  - Compost or stockpile vegetative matter in a clean green stockpile at your maintenance facility, if possible, and only if invasive species and noxious weeds are not present.  
  - Use or disposal options for the removed soil will depend on the characterization of the waste (see Fact Sheet A3 - Permit Requirements for Ditch Maintenance). |

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</table>

### Additional References

Refer to **Minor Reseeding/Replanting** (page 5) in the Routine Maintenance section of this field guide.

Refer to local codes and regulations for additional requirements.
### Major Reseeding/Replanting

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adding seed and/or plants to stabilize exposed soils. Necessary to correct poor conditions. Does not apply to conditions affecting a small section of a ditch that can be addressed as part of routine maintenance (see <strong>Additional References</strong> below).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
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</thead>
<tbody>
<tr>
<td>- Sparse vegetation/ eroded patches on ditch bottom</td>
</tr>
<tr>
<td>- Poor grass growth</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Ditch Surface Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Vegetated</td>
</tr>
<tr>
<td>- Bare Soil</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Water Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>- No flow</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common Equipment and Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Required permits (keep documentation on-site during work)</td>
</tr>
<tr>
<td>- Seed mix</td>
</tr>
<tr>
<td>- Hydroteeder</td>
</tr>
<tr>
<td>- Post-seeding erosion control BMPs (e.g., straw mulch, biodegradable nets and blankets, coir mats)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Considerations Prior to Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Verify that required permits have been obtained prior to beginning work.</td>
</tr>
<tr>
<td>- Consider using different seed mixes for different growing environments (e.g., shady slopes, wetter areas) in the same ditch.</td>
</tr>
<tr>
<td>- Low growing grass seed mix is recommended to reduce mowing frequency and cost.</td>
</tr>
<tr>
<td>- Make sure there are no weed seeds or invasive plant seeds in the seed mixes.</td>
</tr>
<tr>
<td>- Seed and/or plant during the following optimum windows:</td>
</tr>
<tr>
<td>- Late spring (April 1 through June 30)</td>
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<tr>
<td>- Early fall (September 1 through October 1)</td>
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<tr>
<td>- If necessary, consult an engineer or a landscape architect to develop a planting plan.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Fact Sheet References</th>
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</thead>
<tbody>
<tr>
<td>F1</td>
</tr>
<tr>
<td>Evaluation</td>
</tr>
</tbody>
</table>

**Additional References**
When conditions affect a small section of the ditch and can be addressed as part of routine maintenance, refer to **Minor Reseeding/Replanting (page 5)** in the Routine Maintenance section of this field guide.

Refer to local codes and regulations for additional requirements.
## Trees of Concern

<table>
<thead>
<tr>
<th>Description</th>
<th>Removing dead or dying trees, dead parts of live trees, or unstable live trees that have the potential to cause property damage, personal injury, or fatalities</th>
</tr>
</thead>
</table>
| **Condition** | - Dead or dying trees present  
   - Dead parts of live trees present  
   - Unstable live trees present |
| **Ditch Surface Types** | - Vegetated  
   - Bare Soil  
   - Rock  
   - Paved  
   - Metal |
| **Water Flow** | - No flow  
   - Low flow |
| **Common Equipment and Materials** | - Required permits (keep documentation on-site during work)  
   - Chainsaw  
   - Ladder  
   - Rope  
   - Ax  
   - Wedges  
   - Wood chipper  
   - Pruning shears, loppers, and/or clippers |
| **Considerations Prior to Implementation** | - Consult with an arborist to verify that the tree should be classified as a tree of concern and to determine an appropriate removal method.  
   - Verify that required permits have been obtained prior to beginning work. |
| **Disposal Considerations** | Consult with an arborist regarding proper disposal. If the tree is diseased, then it may require special disposal considerations. |

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<td><img src="Image" alt="Permitting" /></td>
<td><img src="Image" alt="Source Control" /></td>
<td><img src="Image" alt="Retrofits" /></td>
</tr>
</tbody>
</table>

### Additional References

Refer to local codes and regulations for additional requirements.
## Minor Inlet/Outlet Repair

<table>
<thead>
<tr>
<th>Description</th>
<th>Installing or repairing riprap, aprons, and/or rock plunge pools at inlets and outlets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition</td>
<td>Evidence of scour or undercutting at inlets or outlets</td>
</tr>
<tr>
<td>Ditch Surface Types</td>
<td></td>
</tr>
<tr>
<td>Water Flow</td>
<td>No flow</td>
</tr>
<tr>
<td></td>
<td>Standing water</td>
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<tr>
<td>Common Equipment and Materials</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Riprap</td>
</tr>
<tr>
<td></td>
<td>Shovel</td>
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<tr>
<td></td>
<td>Erosion control BMPs during maintenance (e.g., wattles, check dams, silt fences)</td>
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<tr>
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<tr>
<td>Disposal Considerations</td>
<td>Use or disposal options for the removal of sediment will depend on the characterization of the waste (see Fact Sheet A3 - Permit Requirements for Ditch Maintenance).</td>
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**Fact Sheet References**

**F1** Evaluation  | **F2** Cleaning  | **F3** Natural Flow  | **A1** Mapping  | **A2** Prioritizing  | **A3** Permitting  | **A4** Source Control  | **A5** Retrofits  

**Additional References**
Refer to local codes and regulations for additional requirements.