

ENVIRONMENTAL BEST PRACTICES FOR HIGHWAY MAINTENANCE ACTIVITIES

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Acknowledgements

The 2004 edition of *“Environmental Best Practices for Highway Maintenance Activities”*, the original precursor of this manual, was produced with guidance from an Inter-Agency Steering comprised of personnel from the British Columbia Ministry of Transportation and Infrastructure (TRAN) and the British Columbia Ministry of Environment & Climate Change Strategy (formerly the British Columbia Ministry of Water, Land and Air Protection). Input at that time was provided by a large cross section of staff from both ministries, as well as representatives of Fisheries and Oceans Canada and TRAN’s Road and Bridge Maintenance Contractors.

The 2010 edition of *“Environmental Best Practices for Highway Maintenance Activities”*, the precursor of this manual, was produced using feedback from both TRAN staff and contractors, and incorporated the latest environmental best practices information available for highway operations activities.

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1. Introduction and Scope

The Ministry of Transportation & Infrastructure (TRAN) has developed this manual, titled *Environmental Best Practices for Highway Maintenance Activities*, to help Maintenance Contractors provide services in an environmentally responsible manner. These standardized practices and protocols are designed to be applicable across the province, and to serve as a practical and cost-effective means to meet regulatory agency requirements, and public expectations for environmental protection.

The scope of this manual is limited to environmental best practices as they relate to the maintenance specifications described in TRAN’s 2018/2019 Highway Maintenance Agreements.

This manual is intended to be a living document—one that will continue to evolve through implementation of the best practices, and through continued dialogue with Maintenance Contractors and regulatory agencies.



2. Environmental Legislation & Due Diligence

In addition to the shared commitment to environmental protection and the public expectation that TRAN and its Maintenance Contractors will do their part in protecting environmental values, all work must be compliant with applicable environmental legislation (federal, provincial, and local). This legislation may regulate where, when and how highway maintenance activities can be carried out. A table summarizing the primary legal requirements applicable to highway maintenance activities is provided on the following page.

Due Diligence

To ensure that highway maintenance work is undertaken in a manner that demonstrates environmental due diligence, there is a responsibility to:

1. Be familiar with federal, provincial and local (municipal) legal requirements;
2. Recognize and address the potential environmental impacts of works on the physical, chemical, and biological components of the environment;
3. Avoid, mitigate or lessen those impacts or risks in the planning of work;
4. Obtain the appropriate permits and authorizations from all regulatory agencies before proceeding with activities; and
5. Conduct works in a manner that complies with the law and avoids, mitigates or lessens potential impacts to aquatic and riparian habitats, water quality and quantity, fish and wildlife populations, and public safety and property.

***Note:** The following table summarizes primary legal requirements that apply to highway maintenance activities, but may not be a full and complete list. It should not be considered an official copy of legislation. If a discrepancy arises between this table and legislation, the legislation takes precedence. The Province does not guarantee the accuracy or completeness of the information referenced here from legislation, and in no event is the Province liable or responsible for damages of any kind arising out of its use.*

Summary of Environmental Legislation

Statute	Section(s) / Regulations	Regulating Agency	Area of Regulation	Potential Approval or Permit Requirements
<i>Fisheries Act</i>	Section 35(1)	Fisheries and Oceans Canada	Prohibits serious harm to fish which is defined as “the death of fish or any permanent alteration to, or destruction of, fish habitat that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery”.	<i>Fisheries Act</i> Authorization may be required, if serious harm cannot be avoided.
	Sections 34(1) and 36(3)	Environment and Climate Change Canada	Prohibits deposit of deleterious substances into waters frequented by fish, or in any place under any conditions where the deleterious substance or any other deleterious substance that results from the deposit of the deleterious substance may enter any such water.	Not applicable (approvals/permits only apply to specific regulated activities, such as industrial discharges from pulp mills).
<i>Migratory Birds Convention Act</i>	Section 12	Environment and Climate Change Canada	Prohibits disturbance or destruction of migratory birds and/or their nests and eggs.	Permit is required for any activities resulting in the disturbance or destruction of migratory birds and/or their nests and eggs.
<i>Navigation Protection Act (NPA)</i>	Section 3	Transport Canada	Prohibits construction, placement, alteration, repair, rebuild, removal, or decommissioning of work in, on, over, under, through or across any navigable waters that are listed in the schedule of navigable waters without approval under the <i>NPA</i> .	Approval under the <i>NPA</i> is required for otherwise prohibited works on listed navigable waters.

Statute	Section(s) / Regulations	Regulating Agency	Area of Regulation	Potential Approval or Permit Requirements
<i>Species at Risk Act (SARA)</i>	Sections 32(1) and 33	Environment and Climate Change Canada	Prohibits killing, harming, harassing, capturing or taking of any species protected under SARA, or the damage or destruction of a protected species residence (including any critical habitat that has been established).	Permit approval is required under the S73 of SARA for any otherwise prohibited activities.
<i>Environmental Management Act (EMA)</i>	Special Wastes Regulation and Contaminated Sites Regulation	BC Ministry of Environment and Climate Change Strategy	Regulates disposal and storage of hazardous materials and hazardous materials spill reporting.	Waste Discharge Authorization may be required for disposal and/or storage of special wastes.
<i>Public Health Act</i>	Sewage Disposal Regulation	BC Ministry of Health	Regulates installation, construction and maintenance of sewage disposal facilities	Permit may be required for the installation of a sewage system, providing that the works meet regulatory requirements.
<i>Water Sustainability Act (WSA)</i>	Sections 9, 10 and 11	BC Ministry of Forests, Lands, Natural Resource Operations, and Rural Development Contacts	Protects water quality, habitat, and water users by regulating changes in and about a stream, water use, and groundwater use for anything other than domestic use.	Water license or use approval may be required under Sections 9 or 10 for water diversion or use. Change Approval or Notification is required for works in and about a stream under Section 11.
<i>Wildlife Act</i>	Sections 9, 34 and 35	BC Ministry of Forests, Lands, Natural Resource Operations, and Rural Development Contacts	Protects virtually all vertebrate animals from direct harm, except as allowed by regulation (e.g. hunting or trapping).	Permit or license is required for any works otherwise prohibited, including (but not necessarily limited to): damage or removal of beaver dams; disturbance or destruction of birds, their nest or eggs; and the transportation or possession of wildlife carcasses.

Statute	Section(s) / Regulations	Regulating Agency	Area of Regulation	Potential Approval or Permit Requirements
<i>Weed Control Act</i>	Weed Control Regulations	BC Ministry of Forests, Lands, Natural Resource Operations, and Rural Development Contacts	Regulates the management of noxious weeds and prohibits the dispersal of weeds and their seed.	A permit and/or a Pest Management Plan is required for the chemical treatment of noxious weed and invasive plants on provincial crown land.
<i>Integrated Pest Management Act</i>	Integrated Pest Management Regulation	BC Ministry of Environment and Climate Change Strategy	Establishes conditions for the sale and use of pesticides.	A license or Pest Management Plan is required for most pesticides.

3. Maintenance Activity/Best Practice Reference

The following table is a quick reference guide to assist staff and contractors with determining the Environmental Best Practices (BPs) that are associated with each maintenance activity.

Category	Maintenance Activity	Page #s
Surface Maintenance	1.01 Highway Pavement Patching and Crack Sealing	8 to 12
	1.02 Highway Surface Treatment	
	1.03 Highway and Shoulder Grading and Re-shaping	
	1.04 Dust Control and Base Stabilization	
	1.05 Highway Surface and Shoulder Graveling	
	1.06 Road Base Maintenance	
	1.07 Surface Cleaning	
	1.08 Debris Removal	
	1.09 Cattle Guard Maintenance	
	1.10 Raised Hard Surfaced Infrastructure and Safety Device Maintenance	
	1.11 Railway Crossing Approach Maintenance	
Drainage Maintenance	2.01 Ditch Maintenance	12 to 15
	2.02 Drainage Appliance Maintenance	
	2.03 Shore, Bank and Watercourse Maintenance	
Winter Maintenance	3.01 Highway Snow Removal	15 to 17
	3.02 Snow and Ice Bonding Prevention and Control	
	3.03 Other Snow Removal and Ice Control	
	3.04 Snow Avalanche Response	
Roadside Maintenance	4.01 Vegetation Control	17 to 20
	4.02 Brush, Tree and Danger Tree Removal	
	4.03 Litter Collection and Graffiti Removal Maintenance	
	4.04 Rest Area Facility Maintenance	
	4.05 Fence Maintenance	
	4.06 Roadside Catchment Appurtenances Maintenance	
	4.07 Highway Crossing Infrastructure	
Traffic Maintenance	5.01 Sign System Maintenance	20 to 23
	5.02 Temporary Pavement Markings and Eradication	
	5.03 Traffic Management	

Category	Maintenance Activity	Page #s
Structures Maintenance	6.01 Bridge Deck Maintenance	23 to 26
	6.02 Structures Cleaning Maintenance	
	6.03 Structures Drainage Maintenance	
	6.04 Bridge Joint Maintenance	
	6.05 Bridge Bearing Maintenance	
	6.06 Bailey and Acrow Bridge Maintenance	
	6.07 Structure Minor Coating	
	6.08 Concrete Structure Maintenance	
	6.09 Steel, Aluminum and Multiplate Structure Maintenance	
	6.10 Bridge Piling Maintenance	
	6.11 Retaining Wall Maintenance	
	6.12 Bridge Railing Maintenance	
	6.13 Timber Truss Bridge Maintenance	
	6.14 Timber and Log Bridge Maintenance	
Network Management	7.01 Highway Incident Response	27 to 29
	7.02 Major Event Response	
	7.03 Highway Inspection	
	7.04 Highway Safety Patrol	
	7.05 Communications	

4. Best Practices

The Environmental Best Practices (BPs) in this document have been demonstrated to be an effective and practical means of preventing or limiting harmful impacts to the environment. For each maintenance activity category, general BPs are provided as guidelines to help ensure works are completed in compliance with environmental legislation.

When sensitive environmental values (such as watercourses, sensitive habitats and/or species at risk etc.) are present, site specific BPs will likely be required. Site specific BPs should be developed in consultation with an appropriately qualified professional (AQP). An AQP is an applied scientist or technologist specializing in relevant applied science or technology (e.g. biologist, engineer, environmental monitor). Maintenance contractors may also choose to involve AQP(s) to advise and assist on the selection and application of BPs, use of alternative practices, and adherence to environmental permitting requirements.

More information on terms used in this document and additional resource materials is available in the Glossary and Resources sections (sections 5 & 6), respectively.

4.1 Surface Maintenance

Surface maintenance activities are undertaken to ensure public safety on the highway by maintaining smooth, clean, compacted, level and sealed surface conditions through the following activities, including: Highway Pavement Patching and Crack Sealing, Highway Surface Treatment, Highway and Shoulder Grading and Re-shaping, Dust Control and Base Stabilization, Highway Surface and Shoulder Gravelling, Road Base Maintenance, Surface Cleaning, Debris Removal, Cattle Guard Maintenance, Raised Hard Surfaced Infrastructure and Safety Device Maintenance and Railway Crossing Approach Maintenance.

The BPs provided below are general guidelines to help ensure surface maintenance works are completed in compliance with environmental legislation and to help mitigate potential environmental impacts.

Environmental Impacts

Environmental impacts relating to surface maintenance activities are summarized in the following table. It should be noted that site-specific conditions might present additional issues that should be addressed in planning and undertaking the works.

Potential Environmental Impacts	Works with Potential to Cause Impacts
Introduction of deleterious substances to a watercourse	<ul style="list-style-type: none"> ○ patching or sealing of paved surfaces using chemical compounds /treatments ○ side casting or disposal of debris and other materials from surface cleaning ○ repairs, grading, or shoulder maintenance disturbing existing surfaces (gravel) or introducing new materials ○ release of other deleterious substances (dust control materials)
Contamination of surface waters, groundwater, riparian habitats	<ul style="list-style-type: none"> ○ improper storage / disposal of wildlife carcasses ○ over-spraying of road shoulders with dust control materials ○ side casting or disposal of debris and other materials from surface cleaning
Air quality	<ul style="list-style-type: none"> ○ cleaning of aggregate from paved surfaces
Contributing to spread of invasive plants	<ul style="list-style-type: none"> ○ repairs, grading, or shoulder maintenance disturbing existing surfaces ○ introducing new materials (gravel) without confirming it is free of invasive plants

Planning/Pre-screening

- Identify environmental values that require consideration, based on a desktop-based review of available information, field-based assessments, and/or advice from an AQP. *Environmental values may include, but are not necessarily limited to, the following: watercourses, sensitive habitats, invasive plants and species at risk.*
- Determine general BPs (as described below) that applies to the maintenance activity.
- If there are environmental values that require special consideration such as those identified above, obtain the advice of an AQP, which may include BPs not included in this document.
- Determine other relevant steps such as engaging with regulators, applying for permits, and identifying mitigation plans as necessary.

Timing of Works

- Maintenance activities are preferably undertaken during periods of dry weather as this allows easier control of deleterious materials and runoff.
- If the schedule requires working in the rain (or other inclement weather), the work area should be isolated and appropriate erosion and sediment controls should be installed to prevent the release of sediment-laden water and or other deleterious substances into watercourses and sensitive habitats. Particularly for surface maintenance activities requiring the application of patching and sealing components, tar, asphalt and dust control materials.

Site Management

- Organize the work site (including access routes, laydown areas and equipment and materials storage) to avoid impacts to the environment.
- Avoid disturbing sensitive habitats (including watercourses), or obtain the advice of an AQP if avoidance is not practical.
- Minimize soil exposure and removal of vegetation to prevent establishment of invasive plants.
- Plan proactively for erosion and sediment control. Prior to beginning work, anticipate what techniques will be needed and arrange for materials.
- Regularly monitor and maintain sediment controls and remove when no longer needed (e.g. vegetative cover on seeded areas is adequate to control erosion).
- Dispose of excess materials, excavated soils, and removed debris a minimum of 30 metres away from any watercourse and avoid any sensitive habitats. If excavated materials or any other erodible materials are to be left on site, ensure they are placed in a manner that will prevent the introduction of sediment to any watercourse.
- Spread piles of cast materials thinly and reseed to prevent invasive plants from establishing.
- Revegetate (seed) areas of exposed soils to reduce the risk of invasive plant establishment or sediment entering water bodies. Conduct seeding in the early spring or late fall. Conduct seeding in accordance with Standard Specifications for Highway Construction, Section 757.

Equipment Use

- Prior to site mobilization, make sure equipment is free of invasive plants and plant material.
- Ensure all equipment used on site is well maintained and free of fluid leaks.
- Refuel and lubricate equipment on dry land a minimum of 30 metres away from watercourses. Use drip trays to contain any spillage during equipment maintenance.
- Avoid parking or staging equipment in areas of invasive plant infestations.
- Prior to leaving the site, make sure equipment is free of invasive plants and plant material.

Material Handling and Containment

- Have a spill response plan in place and spill kits on site.
- Limit the application of surface treatments to the road surface and avoid over-spraying near watercourses and at watercourse crossings.
- Use clean fill material free of invasive plant seeds/plant material. If material source piles are infested with invasive plants, scrape off the top one metre to expose clean material underneath.
- Maintain suitable buffers between materials storage and watercourses and sensitive habitats.
- Use temporary covers (e.g. tarps and/or straw/other erosion control materials) to keep erodible materials dry and prevent sediment mobilization.
- Ensure that all hazardous material (chemicals, sealants, patching materials, surface treatments and dust control materials) storage, use and disposal is in accordance with applicable regulations and information contained in their Safety Data Sheets.
- Mix hazardous materials a minimum of 30 metres away from any watercourse or sensitive habitats.
- Transfer and load any hazardous and/or deleterious substances at a designated site away from any watercourses or sensitive habitats. Use caution during loading of trucks and transport to minimize loss of materials.
- If potentially deleterious materials (e.g., cement-based products) are used for repair works, ensure raw material and wash water will not be released to any watercourse. Ensure that all deleterious substances are handled with care.
- Where possible, sweep up loose material or debris. Any material thought to pose a risk of contamination to soil, surface water or groundwater should be disposed of appropriately off-site.

Dust Control and Base Stabilization:

- Dust control materials are best applied to pre-wetted surfaces.
- Avoid applying dust control materials in the rain or to saturated surfaces.
- Limit the application of dust control material to the road surface - avoid over-spraying and prevent runoff.

Surface Cleaning:

- Consider the potential impacts of side casting collected materials. If collected material is to be disposed within the highway right of way, designate disposal sites away from watercourses and sensitive habitats.

Debris Removal:

- Do not store or bury dead animals near watercourses, sensitive habitats or any drinking water sources. Discuss disposal options with TRAN operations staff.

4.2 Drainage Maintenance

Drainage maintenance activities are undertaken to provide unobstructed drainage and to prevent erosion damage to Highways. Drainage maintenance activities include: Ditch Maintenance, Drainage Appliance Maintenance and Shore, Bank and Watercourse Maintenance.

The BPs provided below are general guidelines to help ensure drainage maintenance works are completed in compliance with environmental legislation and to help mitigate potential environmental impacts.

Environmental Impacts

Environmental impacts relating to drainage maintenance activities are summarized in the following table. It should be noted that site-specific conditions might present additional issues that should be addressed in planning and undertaking the works.

Potential Environmental Impacts	Works with Potential to Cause Impacts
Introduction of deleterious substances to a watercourse	<ul style="list-style-type: none">○ removal of obstructions, debris or channel maintenance○ installation, repairs or replacement of drainage appliances
Damage to roadside watercourses, riparian/fish habitats	<ul style="list-style-type: none">○ bank erosion installation or repair with materials that aren't clean (silt-laden) or causing bank disturbance○ improper storage or disposal of materials associated with bank erosion repair / drainage appliances○ side casting or improper disposal of debris, sediment and vegetation
Disturbance of wildlife species (e.g. birds/bats)	<ul style="list-style-type: none">○ drainage appliance maintenance disturbing birds, bird nests or bats
Contributing to spread of invasive plants	<ul style="list-style-type: none">○ ditch maintenance resulting in disturbed areas which aren't properly re-vegetated○ improper disposal of debris, sediment and vegetation removed from ditches, watercourses, or drainage appliances

Planning/Pre-screening

- Identify environmental values that require consideration, based on a desktop-based review of available information, field-based assessments, and/or advice from an AQP. *Environmental values may include, but are not necessarily limited to, the following: watercourses and sensitive habitats, fish, species at risk; wildlife (e.g. beavers and/or amphibians); nesting birds and roosting bats (in culverts).*
- Determine general BPs (as described below) that applies to the maintenance activity.
- If there are environmental values that require special consideration such as those identified above, obtain the advice of an AQP, which may include BPs not included in this document.
- Determine other relevant steps such as engaging with regulators, applying for permits, and identifying mitigation plans as necessary.

Timing of Works

- Maintenance activities are preferably undertaken during periods of dry weather as this allows easier control of deleterious materials and runoff.
- If the schedule requires working in the rain (or other inclement weather), the work area should be isolated and appropriate erosion and sediment controls should be installed to prevent the release of sediment-laden water and or other deleterious substances into watercourses and sensitive habitats.
- If maintenance activities require instream work, schedule activities during environmental timing windows (see definition and website links in the Glossary and Resources sections; sections 5 & 6 respectively). Consult with an AQP, as more specific BPs may be required.
- Culverts should be surveyed for the presence of nesting birds or roosting bats prior to work commencing. Culverts where wildlife have been determined to be “not present” do not require scheduling/implementation of environmental timing windows, buffers or exclusion practices.
- If nesting birds or roosting bats are present in culverts, schedule activities during environmental timing windows. Consider consulting with an AQP as more specific BPs may be required.

Site Management

- Organize the work site (including access routes, laydown areas and equipment and materials storage) to avoid impacts to the environment.
- Avoid disturbing sensitive habitats (including watercourses), or obtain the advice of an AQP if avoidance is not practical.
- Minimize soil exposure and removal of vegetation to prevent establishment of invasive plants.
- Plan proactively for erosion and sediment control. Prior to beginning work, anticipate what techniques will be needed and arrange for materials.
- Regularly monitor and maintain sediment controls and remove when no longer needed (e.g. vegetative cover on seeded areas is adequate to control erosion).
- Dispose of excess materials, excavated soils, and removed debris a minimum of 30 metres away from any watercourse and avoid any sensitive habitats. If excavated materials or any other erodible materials are to be left on site, ensure they are placed in a manner that will prevent the introduction of sediment to any watercourse.
- Spread piles of cast materials thinly and reseed to prevent invasive plants from establishing.
- Revegetate (seed) areas of exposed soils to reduce the risk of invasive plant establishment or sediment entering water bodies. Conduct seeding in the early spring or late fall. Conduct seeding in accordance with Standard Specifications for Highway Construction, Section 757.

Equipment Use

- Prior to site mobilization, make sure equipment is free of invasive plants and plant material.
- Ensure all equipment used on site is well maintained and free of fluid leaks.
- Refuel and lubricate equipment on dry land a minimum of 30 metres away from watercourses. Use drip trays to contain any spillage during equipment maintenance.
- Avoid parking or staging equipment in areas of invasive plant infestations.
- Prior to leaving the site, make sure equipment is free of invasive plants and plant material.

Material Handling and Containment

- Have a spill response plan in place and spill kits on site.
- Use clean fill material free of invasive plant seeds. If material source piles are infested with invasive plants, scrape off the top one meter to expose clean material underneath.
- Maintain suitable buffers between materials storage and watercourses and sensitive habitats.
- Use temporary covers (e.g. tarps and/or straw/other erosion control materials) to keep erodible materials dry and prevent sediment mobilization.
- Transfer and load any hazardous and/or deleterious substances at a designated site away from any watercourses or sensitive habitats. Use caution during loading of trucks and transport to minimize loss of materials.
- Use caution during loading of trucks and transport of any noxious weed/invasive plant materials to minimize loss of materials (e.g. cover materials during transport).

4.3 Winter Maintenance

Winter maintenance activities are undertaken to proactively monitor, manage and respond to winter accumulations, compact snow/ice and slippery conditions to facilitate the safe and orderly flow of traffic. Winter maintenance activities include; Highway Snow Removal, Snow and Ice Bonding Prevention and Control, Other Snow Removal and Ice Control and Snow Avalanche Response.

The BPs provided below are general guidelines to help ensure winter maintenance works are completed in compliance with environmental legislation and to help mitigate potential environmental impacts.

Environmental Impacts

Environmental impacts relating to winter maintenance activities are summarized in the following table. It should be noted that site-specific conditions might present additional issues that should be addressed in planning and undertaking the works.

Potential Environmental Impacts	Works with Potential to Cause Impacts
Introduction of deleterious substances to a watercourse	<ul style="list-style-type: none"> ○ improper storage of materials (winter aggregate, de-icing and anti-icing compounds)
Air quality	<ul style="list-style-type: none"> ○ spring cleaning of winter aggregates
Damage to roadside watercourses or riparian/fish habitats	<ul style="list-style-type: none"> ○ side casting or improper disposal of accumulated snow, ice, winter aggregates, or de-icing compounds during snow removal ○ improper materials containment at storage locations (winter aggregate, de-icing or anti-icing compounds)

Planning/Pre-screening

- Identify environmental values that require consideration, based on a desktop-based review of available information, field-based assessments, and/or advice from an AQP. *Environmental values may include, but are not necessarily limited to, the following: watercourses, sensitive habitats, invasive plants and species at risk.*
- Determine general BPs (as described below) that applies to the maintenance activity.
- If there are environmental values that require special consideration such as those identified above, obtain the advice of an AQP, which may include BPs not included in this document.
- Determine other relevant steps such as engaging with regulators, applying for permits, and identifying mitigation plans as necessary.

Timing of Works

For winter maintenance, timing of works is dependent upon weather conditions and traffic safety demands.

Site Management

For winter maintenance, site management is dependent upon weather conditions and traffic safety demands.

Equipment Use

- Ensure equipment is properly calibrated to prevent over-spray.
- Prior to site mobilization, make sure equipment is free of invasive plants and plant material.
- Ensure all equipment used on site is well maintained and free of fluid leaks.

- Refuel and lubricate equipment on dry land a minimum of 30 metres away from watercourses. Use drip trays to contain any spillage during equipment maintenance.
- Avoid parking or staging equipment in areas of invasive plant infestations.
- Prior to leaving the site, make sure equipment is free of invasive plants and plant material.

Material Handling and Containment

- Have a spill response plan in place and spill kits on site.
- Maintain suitable buffers between materials storage and watercourses or sensitive habitats.
- Store materials such as de-icing compounds on impermeable surfaces to prevent their release to soils and groundwater.
- Minimize loss at storage piles. Ensure that aggregate storage piles are not contributing sediment to nearby watercourses. Keep storage piles of materials containing de-icing compounds (road salt) well covered (e.g. under a roof shed) and dry to prevent chemical release in runoff.
- Use caution during loading of trucks and transport of any hazardous and/or deleterious substances to minimize loss of materials.

4.4 Roadside Maintenance

Roadside maintenance activities are undertaken to improve visibility and facilitate drainage, maintain clean and tidy Highways, ensure Rest Area facilities are clean, restore the functionality of fences and provide safe passage of pedestrians and animals over/under or beside Highways. Roadside Maintenance activities include: Vegetation Control, Brush, Tree and Danger Tree Removal, Litter Collection and Graffiti Removal Maintenance, Rest Area Facility Maintenance, Fence Maintenance, Roadside Catchment Appurtenances Maintenance and Highway Crossing Infrastructure.

The BPs provided below are general guidelines to help ensure roadside maintenance works are completed in compliance with environmental legislation and to help mitigate potential environmental impacts.

Environmental Impacts

Environmental impacts relating to roadside maintenance activities are summarized in the following table. It should be noted that site-specific conditions might present additional issues that should be addressed in planning and undertaking the works.

Potential Environmental Impacts	Works with Potential to Cause Impacts
Introduction of deleterious substances to a watercourse	<ul style="list-style-type: none"> ○ exposing erodible soils and promoting sediment discharge ○ fence repairs (cement-based products and wood preservatives) ○ introduction of chlorinating compounds used to treat potable water (rest area maintenance) ○ improper storage or disposal of sewage
Damage to roadside watercourses, riparian/fish habitats	<ul style="list-style-type: none"> ○ damaging or disturbing riparian habitats, exposing erodible soils or causing streambank erosion ○ fence repairs resulting in damage or disturbance to riparian habitats
Disturbance of wildlife species (e.g., birds)	<ul style="list-style-type: none"> ○ disturbing birds and their nests
Contributing to spread of invasive plants	<ul style="list-style-type: none"> ○ brushing or mowing resulting in alteration of existing vegetation

Planning/Pre-screening

- Identify environmental values that require consideration, based on a desktop-based review of available information, field-based assessments, and/or advice from an AQP. *Environmental values may include, but are not necessarily limited to, the following: watercourses and sensitive habitats, species at risk, invasive plants and bird nesting habitats.*
- Determine general BPs (as described below) that applies to the maintenance activity.
- If there are environmental values that require special consideration such as those identified above, obtain the advice of an AQP, which may include BPs not included in this document.
- Determine other relevant steps such as engaging with regulators, applying for permits, and identifying mitigation plans as necessary.

Timing of Works

- If the schedule requires working in the rain (or other inclement weather), the work area should be isolated and appropriate erosion and sediment controls should be installed to prevent the release of sediment-laden water and or other deleterious substances.
- In rest areas, remove invasive plants before they set seed.
- When conducting roadside mowing, do not mow invasive plants after seed set.

Brush, Tree and Danger Tree Removal:

- Where possible, schedule vegetation management activities during environmental timing windows.
- If brush, tree and danger tree removal cannot be scheduled during environmental timing windows, confirm nesting birds are not present prior to work commencing. Consider consulting with an AQP, as more specific BPs may be required.

Site Management

- Organize the work site (including access routes, laydown areas and equipment and materials storage) to avoid impacts to the environment.
- Avoid disturbing sensitive habitats (including watercourses), or obtain the advice of an AQP if avoidance is not practical.
- Minimize soil exposure and removal of vegetation to prevent establishment of invasive plants.
- Plan proactively for erosion and sediment control. Prior to beginning work, anticipate what techniques will be needed and arrange for materials.
- Regularly monitor and maintain sediment controls and remove when no longer needed (e.g. vegetative cover on seeded areas is adequate to control erosion).
- Dispose of excess materials, excavated soils, and removed debris a minimum of 30 metres away from any watercourse and avoid any sensitive habitats. If excavated materials or any other erodible materials are to be left on site, ensure they are placed in a manner that will prevent the introduction of sediment to any watercourse.
- Spread piles of cast materials thinly and reseed to prevent invasive plants from establishing.
- Revegetate (seed) areas of exposed soils to reduce the risk of invasive plant establishment or sediment entering waterbodies. Conduct seeding in the early spring or late fall. Conduct seeding in accordance with Standard Specifications for Highway Construction, Section 757.
- Do not mow Invasive Plant sites within 14 days of being treated with herbicide. Chemical treatment sites are marked with white treatment signs.

Equipment Use

- Prior to site mobilization, make sure equipment is free of invasive plants and plant material.
- Ensure all equipment used on site is well maintained and free of fluid leaks.

- Refuel and lubricate equipment on dry land a minimum of 30 metres away from watercourses. Use drip trays to contain any spillage during equipment maintenance.
- Avoid parking or staging equipment in areas of invasive plant infestations. When mowing, start vegetation control activities in “invasive plant free” areas and end in infested areas.
- Prior to leaving the site, make sure equipment is free of invasive plants and plant material.

Material Handling and Containment

- Have a spill response plan in place and spill kits on site.
- Use clean fill material free of invasive plant seeds. If material source piles are infested with invasive plants, scrape off the top one meter to expose clean material underneath.
- Maintain suitable buffers between materials storage and watercourses and sensitive habitats.
- Use temporary covers (e.g. tarps and/or straw/other erosion control materials) to keep erodible materials dry and prevent sediment mobilization.
- Transfer and load any hazardous and/or deleterious substances at a designated site away from any watercourses or sensitive habitats. Use caution during loading of trucks and transport to minimize loss of materials.
- Use caution during loading of trucks and transport of any noxious weed/invasive plant materials to minimize loss of materials (e.g. cover materials during transport).

4.5 Traffic Maintenance

Traffic maintenance activities are undertaken to regulate and facilitate the safe and orderly flow of traffic, keep highway users safe and minimize traffic delays. Traffic Maintenance activities include: Sign System Maintenance, Temporary Pavement Markings and Eradication and Traffic Management.

The BPs provided below are general guidelines to help ensure traffic maintenance works are completed in compliance with environmental legislation and to help mitigate potential environmental impacts.

Environmental Impacts

Environmental impacts relating to traffic maintenance activities are summarized in the following table. It should be noted that site-specific conditions might present additional issues that should be addressed in planning and undertaking the works.

Potential Environmental Impacts	Works with Potential to Cause Impacts
Introduction of deleterious substances to a watercourse	<ul style="list-style-type: none"> ○ sign system maintenance resulting in disturbed existing surfaces (gravel) or introducing new materials ○ improper storage and disposal of chemical compounds (e.g. paint)
Contributing to spread of invasive plants	<ul style="list-style-type: none"> ○ sign system maintenance resulting in disturbed areas which aren't properly re-vegetated

Planning/Pre-screening

- Identify environmental values that require consideration, based on a desktop-based review of available information, field-based assessments, and/or advice from an AQP. *Environmental values may include, but are not necessarily limited to, the following: watercourses and sensitive habitats, species at risk and invasive plants.*
- Determine general BPs (as described below) that applies to the maintenance activity.
- If there are environmental values that require special consideration such as those identified above, obtain the advice of an AQP, which may include BPs not included in this document.
- Determine other relevant steps such as engaging with regulators, applying for permits, and identifying mitigation plans as necessary.

Timing of Works

- If the work schedule requires working in the rain, take steps to install appropriate site isolation and deploy erosion and sediment controls. Ensure that any disturbed areas are contained and that the release of sediment-laden water or any other deleterious substances to nearby watercourses is prevented.

Site Management

- Organize the work site (including access routes, laydown areas and equipment and materials storage) to avoid impacts to the environment.
- Avoid disturbing sensitive habitats (including watercourses), or obtain the advice of an AQP if avoidance is not practical

- Minimize soil exposure and removal of vegetation to prevent establishment of invasive plants.
- Plan proactively for erosion and sediment control. Prior to beginning work, anticipate what techniques will be needed and arrange for materials.
- Regularly monitor and maintain sediment controls and remove when no longer needed (e.g. vegetative cover on seeded areas is adequate to control erosion).
- Dispose of excess materials, excavated soils, and removed debris a minimum of 30 metres away from any watercourse and avoid any sensitive habitats. If excavated materials or any other erodible materials are to be left on site, ensure they are placed in a manner that will prevent the introduction of sediment to any watercourse.
- Spread piles of cast materials thinly and reseed to prevent invasive plants from establishing.
- Revegetate (seed) areas of exposed soils to reduce the risk of invasive plant establishment or sediment entering waterbodies. Conduct seeding in the early spring or late fall. Conduct seeding in accordance with Standard Specifications for Highway Construction, Section 757.

Equipment Use

- Prior to site mobilization, make sure equipment is free of invasive plants and plant material.
- Ensure all equipment used on site is well maintained and free of fluid leaks.
- Refuel and lubricate equipment on dry land a minimum of 30 metres away from watercourses. Use drip trays to contain any spillage during equipment maintenance.
- Prior to leaving the site, make sure equipment is free of invasive plants and plant material.

Material Handling and Containment

- Have a spill response plan in place and spill kits on site.
- Use clean fill material free of invasive plant seeds. If material source piles are infested with invasive plants, scrape off the top one meter to expose clean material underneath.
- Maintain suitable buffers between materials storage and watercourses and sensitive habitats.
- Use temporary covers (e.g. tarps and/or straw/other erosion control materials) to keep erodible materials dry and prevent sediment mobilization.

- Transfer and load any hazardous and/or deleterious substances at a designated site away from any watercourses or sensitive habitats. Use caution during loading of trucks and transport to minimize loss of materials.
- Ensure that all hazardous material storage, use and disposal is in accordance with applicable regulations and information contained in their Safety Data Sheets.

4.6 Structures Maintenance

Structures maintenance activities are undertaken to provide safe, stable, free draining, clean and structurally sound structures and extend the service life of bridges. Structure Maintenance activities include: Bridge Deck Maintenance, Structures Cleaning Maintenance, Structures Drainage Maintenance, Bridge Joint Maintenance, Bridge Bearing Maintenance, Bailey and Acrow Bridge Maintenance, Structure Minor Coating, Concrete Structure Maintenance, Steel, Aluminum, and Multiplate Structure Maintenance, Bridge Piling Maintenance, Retaining Wall Maintenance, Bridge Railing Maintenance, Timber Truss Bridge Maintenance and Timber and Log Maintenance.

The BPs provided below are general guidelines to help ensure structures maintenance works are completed in compliance with environmental legislation and to help mitigate potential environmental impacts.

Environmental Impacts

Environmental impacts relating to structures maintenance activities are summarized in the following table. It should be noted that site-specific conditions might present additional issues that should be addressed in planning and undertaking the works.

Potential Environmental Impacts	Works with Potential to Cause Impacts
Introduction of deleterious substances to a watercourse	<ul style="list-style-type: none"> ○ structures cleaning, repairs or painting (e.g., sediments, oils, de-icing chemicals, painted chips, treated wood debris, cement-based products, wood preservatives, epoxies, paints or sealants) ○ retaining structure cleaning, debris removal or repairs from retaining structures near watercourses ○ multi-plate structure repairs (sediment, cement-based products, epoxies, sealants)
Damage to roadside watercourses, riparian/fish habitats	<ul style="list-style-type: none"> ○ structures repairs resulting in changes to stream channel, banks or vegetation ○ extraction of water for cleaning resulting in disruption of flow, habitat damage (including erosion) or death of fish ○ side casting or improper disposal of debris resulting from cleaning and debris removal from retaining structures

Potential Environmental Impacts	Works with Potential to Cause Impacts
Disturbance of wildlife species (e.g. birds/bats)	<ul style="list-style-type: none"> ○ structures maintenance disturbing birds, bird nests or bats
Contributing to spread of invasive plants	<ul style="list-style-type: none"> ○ structures maintenance resulting in disturbed areas which aren't properly re-vegetated ○ brushing resulting in alteration of existing vegetation

Planning/Pre-screening

- Identify environmental values that require consideration, based on a desktop-based review of available information, field-based assessments, and/or advice from an AQP. *Environmental values may include, but are not necessarily limited to, the following: watercourses and sensitive habitats, fish, species at risk, invasive plants, nesting birds and roosting bats.*
- Determine general BPs (as described below) that applies to the maintenance activity.
- If there are environmental values that require special consideration such as those identified above, obtain the advice of an AQP, which may include BPs not included in this document.
- Determine other relevant steps such as engaging with regulators, applying for permits, and identifying mitigation plans as necessary.

Timing of Works

- Maintenance activities are preferably undertaken during periods of dry weather as this allows easier control of deleterious materials and runoff.
- If the schedule requires working in the rain (or other inclement weather), the work area should be isolated and appropriate erosion and sediment controls should be installed to prevent the release of sediment-laden water and or other deleterious substances into watercourses and sensitive habitats.
- If maintenance activities require instream work, schedule activities during environmental timing windows (see definition and website links in the Glossary and Resources sections; sections 5 & 6 respectively). Consult with an AQP, as specific BPs may be required.
- Structures should be surveyed for the presence of nesting birds or roosting bats prior to work commencing. Structures where wildlife have been determined to be “not present” do not require scheduling/implementation of environmental timing windows, buffers or exclusion practices.

- If nesting birds or roosting bats are present on structures, schedule activities during environmental timing windows. Consider consulting with an AQP as more specific BPs may be required.

Site Management

- Organize the work site (including access routes, laydown areas and equipment and materials storage) to avoid impacts to the environment.
- Avoid disturbing sensitive habitats (including watercourses), or obtain the advice of an AQP if avoidance is not practical.
- Minimize soil exposure and removal of vegetation to prevent establishment of invasive plants.
- Plan proactively for erosion and sediment control. Prior to beginning work, anticipate what techniques will be needed and arrange for materials.
- Regularly monitor and maintain sediment controls and remove when no longer needed (e.g. vegetative cover on seeded areas is adequate to control erosion).
- Dispose of excess materials, excavated soils, and removed debris a minimum of 30 metres away from any watercourse and avoid any sensitive habitats. If excavated materials or any other erodible materials are to be left on site, ensure they are placed in a manner that will prevent the introduction of sediment to any watercourse.
- Spread piles of cast materials thinly and reseed to prevent invasive plants from establishing.
- Revegetate (seed) areas of exposed soils to reduce the risk of invasive plant establishment or sediment entering water bodies. Conduct seeding in the early spring or late fall. Conduct seeding in accordance with Standard Specifications for Highway Construction, Section 757.

Equipment Use

- Prior to site mobilization, make sure equipment is free of invasive plants and plant material.
- Ensure all equipment used on site is well maintained and free of fluid leaks.
- Refuel and lubricate equipment on dry land a minimum of 30 metres away from watercourses. Use drip trays to contain any spillage during equipment maintenance.
- Prior to leaving the site, make sure equipment is free of invasive plants and plant material.

Material Handling and Containment

- Have a spill response plan in place and spill kits on site.
- Use clean fill material free of invasive plant seeds. If material source piles are infested with invasive plants, scrape off the top one meter to expose clean material underneath.
- Maintain suitable buffers between materials storage and watercourses and sensitive habitats.
- Use temporary covers (e.g. tarps and/or straw/other erosion control materials) to keep erodible materials dry and prevent sediment mobilization.
- Inspect tarps, drain blocks, and wash water runoff areas regularly to ensure they are functioning. Repair as required.
- Transfer and load any hazardous and/or deleterious substances at a designated site away from any watercourses or sensitive habitats. Use caution during loading of trucks and transport to minimize loss of materials.

Structures Cleaning Maintenance:

- Dry sweep and collect loose material off bridge surfaces before washing the bridge.
- If superstructure cleaning is undertaken above or on the bridge deck level, prevent potentially harmful materials from entering into road drains. Block deck drains with suitable barriers (e.g., polyethylene or drain blocks) to prevent direct discharge to a watercourse.
- Contain any wash water or runoff to the bridge deck. Direct wash water towards the bridge approaches and away from the watercourse, then to a vegetated area or contained settling area (e.g., dry ditch channel unconnected to a watercourse) where it can infiltrate.

Timber Bridge Maintenance

- Ensure cutting takes place away from the bridge and watercourse.

Concrete Structures Maintenance

- If concrete and patching materials are used for repairs of structures, prevent the introduction of raw product or wash water to a watercourse.

4.7 Network Management

Network Management activities are undertaken to ensure the safety of Highway Users, monitor and respond to highway conditions, re-establish traffic flow and communicate in a timely manner with the public, stakeholders and the Province. Network Management activities include: Highway Incident Response, Major Event Response, Highway Inspection, Highway Safety Patrol and Communications.

The BPs provided below are general guidelines to help ensure network maintenance works are completed in compliance with environmental legislation and to help mitigate potential environmental impacts.

Environmental Impacts

Environmental impacts relating to network management activities are summarized in the following table. It should be noted that site-specific conditions might present additional issues that should be addressed in planning and undertaking the works.

Potential Environmental Impacts	Works with Potential to Cause Impacts
Introduction of deleterious substances to a watercourse	<ul style="list-style-type: none"> ○ clean-up and removal of abandoned vehicles or materials ○ clean up of cargo/dangerous goods
Contributing to spread of invasive plants	<ul style="list-style-type: none"> ○ network management activities resulting in disturbed areas which aren't properly re-vegetated

Planning/Pre-screening

- Identify environmental values that require consideration, based on a desktop-based review of available information, field-based assessments, and/or advice from an AQP. *Environmental values may include, but are not necessarily limited to, the following: watercourses and sensitive habitats, fish, invasive plants and species at risk.*
- Determine general BPs (as described below) that applies to the maintenance activity.
- If there are environmental values that require special consideration such as those identified above, obtain the advice of an AQP, which may include BPs not included in this document.
- Determine other relevant steps such as engaging with regulators, applying for permits, and identifying mitigation plans as necessary.

Timing of Works

It is understood that the timing of works are dependent upon unplanned incidents, without any opportunity to modify timing.

Site Management

- If a highway incident results in the disturbance of soils in an area where sediment could enter a watercourse, install appropriate temporary sediment control devices.
- Revegetate (seed) areas of exposed soils to reduce the risk of invasive plant establishment or sediment entering water bodies. Conduct seeding in the early spring or late fall. Conduct seeding in accordance with Standard Specifications for Highway Construction, Section 757.

Equipment Use

- Prior to site mobilization, make sure equipment is free of invasive plants and plant material.
- Ensure all equipment used on site is well maintained and free of fluid leaks.
- Refuel and lubricate equipment on dry land a minimum of 30 metres away from watercourses. Use drip trays to contain any spillage during equipment maintenance.
- Prior to leaving the site, make sure equipment is free of invasive plants and plant material.

Material Handling and Containment

- Have a spill response plan in place and spill kits on site.
- Prevent all potentially harmful materials from entering into road drains and watercourses.
- Dispose of all waste materials in an approved manner, at an appropriate storage or disposal site.
- Any soils that have been contaminated by a highway accident may need to be excavated from the site and disposed of in accordance with provincial and federal waste management regulations.
- Take care while removing a vehicle to ensure that potentially harmful materials, including vehicle fluids (e.g. Gasoline, motor oil) are contained.

- Use clean fill material free of invasive plant seeds. If material source piles are infested with invasive plants, scrape off the top one metre to expose clean material underneath.
- Maintain suitable buffers between materials storage and watercourses and sensitive habitats.
- Use temporary covers (e.g. tarps and/or straw/other erosion control materials) to keep erodible materials dry and prevent sediment mobilization.
- Transfer and load any hazardous and/or deleterious substances at a designated site away from any watercourses or sensitive habitats. Use caution during loading of trucks and transport to minimize loss of materials.

5. Glossary

Appropriately Qualified Professional (AQP): Means an applied scientist or technologist specializing in relevant applied science or technology including, but not necessarily limited to, archeology, agrolgy, forestry, biology, engineering, erosion and sediment control, geomorphology, geology, hydrology, hydrogeology or landscape architecture. An appropriately qualified professional must be recognized in British Columbia with the appropriate professional organization, and in good standing, and acting under that organization's Code of Ethics and subject to disciplinary action by that organization.

Best Practices (BPs): A practice or combination of practices that are determined to be the most technologically and economically feasible means of preventing or managing potential impacts.

Channel: In relation to a stream, means the bed of the stream and the banks of the stream, both above and below the natural boundary and whether or not the channel has been modified, and includes side channels of the stream.

Contaminated site: An area of land in which the soil, surface water or groundwater contains harmful substances in quantities or concentrations that exceed specified criteria, standards, or conditions.

Critical habitat: Habitat that is necessary for the survival or recovery of a listed species and which may be identified as critical in the species' recovery strategy. Critical habitat may be legally identified by the federal government (*Species at Risk Act*, 2[1]).

Deleterious substance: Any substance harmful to fish or fish habitat and/or Environmentally Sensitive Areas, and includes sediment and toxic substances.

Erosion: The wearing away of soil and rock by water and wind action.

Environment: Refers to the physical, biological, social, spiritual and cultural components that are interrelated and affect the growth and development of living organisms.

Environmental Agencies: Shall mean the current, seceding or successional appropriate regulating branches of the Federal and Provincial government agencies responsible for the management and protection of the Environment and human resources and any issuance of environmental permits, approvals or licenses.

Environmental Monitor: Shall mean an AQP hired by the Contractor to ensure the Contractor's compliance with the environmental protection aspects of legislation, permits and approvals.

Environmental Timing Window: Shall mean the period that the natural or human environment is likely less susceptible to adverse impacts. Works may be restricted outside of these timing windows.

Fish: The term "fish" includes "shellfish, crustaceans, marine animals, and the eggs, spawn, sperm, spat and juvenile stages of fish, shellfish, crustaceans and marine animals" (*Fisheries Act*).

Fish habitat: The *Fisheries Act* defines fish habitat as "spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes". Fish habitat comprises physical, chemical and biological attributes of the freshwater, estuarine, marine and terrestrial (riparian) environment that directly or indirectly support fish populations.

Habitat: The place where an organism lives and the conditions of that environment including the soil, vegetation, water and food.

Invasive Plants: Are defined as a non-native plant species that has the potential to pose undesirable or detrimental impacts on people, animals, infrastructure or ecosystem. All Noxious Weeds are invasive plants, but not all invasive plants are Noxious Weeds.

Mitigate: Taking actions taken during the planning, design, construction, and operation of a project to control, reduce or eliminate a potential adverse impact of a project.

Noxious Weeds: Refers to plants listed in the *BC Weed Control Act*

Riparian area: Is defined as the land adjacent to the normal high water mark in a stream, river, lake or pond and extending to the portion of land that is directly influenced by the presence of adjacent ponded channeled water, or groundwater zone fed by surface water bodies (e.g. zone in which rooted vegetation is influenced)

Sediment: Particulate matter that is entrained within, or settled out from, water.

Sensitive Habitat: Natural areas that provide the home or living space for rare and endangered flora or fauna, and/or support important wildlife values, and can be easily impacted by human activities.

Species at risk: Means an extirpated, endangered or threatened species or a species of special concern.

Stream: A natural watercourse, including without limitation, a lake, pond, river, creek, spring, ravine, gulch, wetland or glacier, whether or not usually containing water, including ice, but does not include an aquifer.

Watercourse: Any channel carrying water, either continuously or intermittently.

6. Resources

Web links – Environmental Timing Windows

Ministry of Environment & Climate Change Strategy. Regional Terms & Conditions & Timing Windows <https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/working-around-water/regional-terms-conditions-timing-windows>

Environment and Climate Change Canada. General nesting periods of migratory birds https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods.html#_03

Web links – Best Practices Information

Ministry of Transportation and Infrastructure. Adopt-a-Highway Program. <https://www2.gov.bc.ca/gov/content/transportation/transportation-environment/adopt-a-highway>

Ministry of Transportation & Infrastructure. Advisory for Handling Wildlife Carcasses https://www.th.gov.bc.ca/publications/eng_publications/environment/references/Advisory-Handling_Wildlife_Carcasses.pdf

Ministry of Transportation & Infrastructure. Best Practices for Managing Invasive Plants on Roadsides. https://www.th.gov.bc.ca/publications/eng_publications/environment/ManagingInvasivePlants.pdf

Ministry of Transportation & Infrastructure. Culverts and Fish Passage Fact Sheet. https://www.th.gov.bc.ca/publications/eng_publications/environment/references/3824_CulvertFishPassage_InfoSheet.pdf

Ministry of Transportation & Infrastructure. Invasive Species Roadside. <https://www2.gov.bc.ca/gov/content/transportation/transportation-environment/invasive-species-roadside>

Ministry of Transportation & Infrastructure. 1997. Manual of Control of Erosion and Shallow Slope Movement. https://www.th.gov.bc.ca/publications/eng_publications/environment/references/Man_Control_Erosion.pdf

Ministry of Transportation & Infrastructure. Wildlife Accident Reporting System (WARS). https://www.th.gov.bc.ca/mot_org/hwyeng/wars.html

Ministry of Transportation & Infrastructure. Wildlife Exclusion Systems.
https://www.th.gov.bc.ca/publications/eng_publications/environment/references/Wildlife_Fencing_Program_2014.pdf

Ministry of Transportation & Infrastructure. Wildlife Identification Field Guide.
https://www.th.gov.bc.ca/publications/eng_publications/environment/AmphibianReptileGuide.pdf

Ministry of Transportation and Infrastructure. Wildlife Roadkill Identification Pocket Guide. 2009 Edition.
http://www.th.gov.bc.ca/publications/eng_publications/environment/wrig/wrig_pocketsize.pdf

Forests, Lands, Natural Resource Operations and Rural Development. 2005. Best Management Practices to Mitigate Road Dust from Winter Traction Materials.
<https://www.for.gov.bc.ca/hfd/library/documents/bib95657.pdf>

Forests, Lands, Natural Resource Operations and Rural Development Fish-stream Crossing Guidebook. <https://www.for.gov.bc.ca/hfp/fish/fish-stream%20crossing%20print.pdf>

Forests, Lands, Natural Resource Operations and Rural Development. Invasive Alien Plant Program (IAPP) Application.
<https://www.for.gov.bc.ca/hra/plants/application.htm>

Forests, Lands, Natural Resource Operations and Rural Development. Standards and Best Practices For Instream Works.
<http://www.env.gov.bc.ca/wld/documents/bmp/iswstdsbpsmarch2004.pdf>

Ministry of Environment, Beaver Dam Removal
<http://www.elp.gov.bc.ca/wld/instreamworks/beaverdamremoval.htm#beaverdammanagement>

Ministry of Environment, Riparian Area Regulation
<https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/fish/riparian-areas-regulation>

Ministry of Environment. Roadsalt and Winter Maintenance for British Columbia Municipalities 1998. <http://www.env.gov.bc.ca/wat/wq/bmps/roadsalt.html>

Environment and Climate Change Canada. Road Salts. <https://www.ec.gc.ca/selsalts/>

Fisheries and Oceans Canada Guidelines to Protect Fish and Fish Habitat From Treated Wood Used in Aquatic Environments in the Pacific Region.

<http://www.dfo-mpo.gc.ca/Library/245973.pdf>

Fisheries and Oceans Canada. Guidelines for the protection of fish and fish habitat during bridge maintenance operations in British Columbia.

<http://publications.gc.ca/site/eng/420615/publication.html>

Government of Canada. Code of Practice: road salts environmental management.

<https://www.canada.ca/en/environment-climate-change/services/pollutants/road-salts/code-practice-environmental-management.html>

Transport Canada. 2016 Emergency Response Guidebook.

<https://www.tc.gc.ca/eng/canutec/guide-menu-227.htm>

Transportation Association of Canada. Syntheses of Best Practices Road Salt Management - Salt Management Plans. <http://www.tac-atc.ca/sites/tac-atc.ca/files/site/doc/resources/roadsalt-1.pdf>