

ENVIRONMENTAL STANDARDS FOR
ROAD MAINTENANCE FUNCTIONS
IN NATIONAL PARKS

SUBMITTED TO
NATURAL RESOURCES BRANCH
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1.0 INTRODUCTION

Background

The Environmental Assessment and Review Process (EARP) applies to all projects and activities proposed for lands or waters under the jurisdiction of the Canadian Park Service, Environment Canada. The scope of EARP encompasses the full range of environmental effects possible with the projects and activities of the Canadian Parks Service, including the biophysical, ecological, cultural, social, archaeological, historical, and aesthetic effects.

Although the Canadian Parks Service has over the years led environmental assessment approaches under EARP, further direction is required in maintaining environmental quality standards at the field level. This need is enunciated with the large volume of small-scale, operations and maintenance activities that are ongoing in national parks. The difficulties in incorporating environmental protection with these activities can be observed particularly in park corridors. Where major transportation routes are located through park corridors, such as the Trans Canada Highway, the level of operations and maintenance activities increases, along with related environmental protection concerns.

The major objective of the Canadian Parks Service with EARP is to ensure that mitigation measures responsive to these concerns are implemented or observed with construction activities occurring in the field. Given the large and varied number of operations and maintenance activities in national parks and construction associated with these activities, sound environmental practices in the field are in many cases not adopted since there have not been any common guidelines or standards to follow.

In compliance with initial assessment requirements under EARP, all operations and maintenance activities conducted in national parks are subject to an environmental screening. Where the Preliminary Screening or

Screening exercises are completed by individual parks for these activities, they usually serve as the only means of environmental protection to guide how the activities should be carried out. Although a comprehensive guide for the preparation of screening reports has been developed at the national level, the process and results of the screening of individual projects and activities vary considerably from park to park, and particularly from one region to another.

A further difficulty encountered in relation to the screening exercise, is that in the variety of screening reports produced, mitigation measures outlined are often vague, providing inadequate direction to those conducting the respective project or activities in the field. The preparation of individual screening reports in this manner also does not allow one project or activity to benefit from the experience of a similar one that may have been completed in another park or region.

The types of weaknesses in initial assessment and screening indicated above are part of the focus for a major reform effort to improve EARP, currently being carried out by various federal departments. Also, interested in improving the way in which EARP is conducted, the Canadian Parks Service has identified a more generic type of screening approach as an alternative to the present screening exercises practised in national parks. With this approach, the development and implementation of environmental standards for routine and similar activities or projects related to the operation and maintenance of national parks could fulfill the initial assessment requirements of EARP. Different sets of standards could be aimed at a wide variety of projects and activities, allowing general approval of these under EARP along with sufficient direction for environmental protection at the park level. The existing screening mechanism or some other improvement to it could still be applied to capital projects initiated in national parks.

The element of standardization underlying established environmental guidelines and codes of practice, and the concept of class or categorical assessment, could be adopted to address the more, common environmental

effects associated with similar types or groups of project activities. Many projects and activities carried out under operations and maintenance programs in national parks lend themselves well to this approach in being similar or related in nature or purpose, small scale, frequent or repetitive, and in having reasonably predictable environmental effects.

A further important factor to consider is that not only do these types of activities and projects often require similar approaches in terms of planning and design, implementation procedures, and construction practices, but that also a major benefit can be realized by Parks from the economy of a more standard approach for environmental protection in relation to the large number of operations and maintenance activities involved.

In recognition of the opportunities offered through a more generic approach to environmental protection for routine operations and maintenance activities, this project was undertaken to develop a set of environmental standards to focus specifically on roads operations and maintenance activities in national parks, and corresponding methods of environmental protection. While other sets of environmental standards may be prepared for different types or classes of operations and maintenance activities occurring in national parks, the scope of this project embraces specifically those activities related to the operation and maintenance of roads. These activities were defined as established by the Maintenance Management System designed for national parks. A listing of standard maintenance functions relating to roads was identified and extracted from the system for this report. These functions are briefly described in the next section of the report.

Since the majority of Parks staff are already familiar with using the Maintenance Management System, the environmental standards that have been developed through this project are closely tailored after the roads maintenance functions that are recognized with the system. While the environmental standards identified are referenced mainly to the maintenance functions from the system, both operations and maintenance activities are

addressed in the standards. Some of the activities described by the maintenance functions may be considered more operational in nature, but for the purpose of the environmental standards described, this distinction is not made. The environmental standards that follow, therefore refer to road operations and maintenance activities synonymously as maintenance activities or functions.

The concept of environmental standards that provided the focus for this project parallels the basic environmental screening requirements under EARP, by identifying the environmental concerns related to a particular activity, and what should be done to deal with them. Environmental concerns associated with road maintenance activities were identified as part of the environmental standards in light of protecting both the natural and cultural environments. Under the natural environment, the types of environmental concerns considered include erosion and surface runoff, wildlife and habitat disturbance, vegetation clearing, and water quality. Typical areas of concern within the cultural environment were visitor facilities and activities disturbance, heritage and archaeological resources, noise, landscape and site aesthetics, and public safety.

The second major provision of the environmental standards concept is the establishment of environmental protection methods or mitigation measures to ameliorate those concerns identified as the first part of the standards. A clear indication of what is or is not acceptable, and what should or should not be done in the field in relation to the environmental concerns identified is provided. The methods outlined correspond to specific road maintenance activities and describe the procedures to be followed or action to be taken to avoid the environmental concerns or problems that can occur with those activities.

Approach

After project initiation with the Natural Resources Branch, Headquarters, a review of the relevant literature was completed as one of the first tasks in this project. A variety of documents relating to environmental guidelines, construction procedures and codes of practice were examined along with the Maintenance Standards Volume from the Parks Maintenance Management System. A meeting with the Project Manager from Canadian Management Control Systems, who was responsible for the development of the Maintenance Management System for Parks was also held to receive additional background on the system.

As part of the scoping exercise during project initiation, the audience for the project results was more clearly defined. The Resource Conservation and General Works staff were targeted as the primary groups that should benefit from the environmental standards produced. In this respect, an emphasis was taken as part of the project strategy to receive the input and review of these groups for the environmental standards. For this emphasis, meetings were arranged with both the Western and Atlantic regional offices, as well as a representative park in each of the regions, as the basis of the review of road operations and maintenance activities, and related environmental protection measures completed in the first phase of the project. Waterton Lakes and Cape Breton Highlands were selected as the representative parks to offer a reasonable cross-section of road operations and maintenance activities. Environmental protection practices being followed with these activities in Waterton Lakes and Cape Breton Highlands were recorded and are included among the environmental standards presented in this report.

During the second phase of the project, a synthesis of all input received from both Western and Atlantic regions, together with relevant material from the scientific and technical literature was completed. The major environmental concerns and specific requirements of the environmental standards presented in this report were then established. The draft standards were then returned

to the regions and headquarters for their review and comments, which are reflected in this report.

Report Format

Following this introductory section of the report, the road maintenance functions for which the environmental standards were developed, are listed along with summary descriptions from the Maintenance Standards Volume. The report is structured so that the next section outlining the environmental standards for individual maintenance functions, can be extracted and inserted directly into the Maintenance Standards Volume of the Parks Maintenance Management System. The environmental standards are referenced by titles and numbers corresponding to the maintenance functions used in the system. In attempting to avoid long descriptions in the presentation of the standards that would more likely be ignored in the field, concise, point-form summaries were prepared and presented separately for each maintenance function. In this format, the environmental standards can be easily incorporated into the Maintenance Standards Volume for use in the field.

In the fourth section of the report, some of the more general environmental concerns and protection measures that are applicable to numerous road maintenance functions are described. The final section of the report presents a bibliographic listing of key reference materials used in developing the environmental standards.

2.0 ROAD MAINTENANCE FUNCTIONS

100 SPOT PATCHING

The repair of small areas of road surface or parking lots, etc., using pre-mixed asphaltic materials. Includes the patching of pot-holes, depressions, bumps, pavement edge defects, and parking lots.

101 LONG PATCHING

The repair of large areas of road surface, parking lots, etc., using pre-mixed asphaltic materials. Does not include base or sub-grade repairs.

102 JOINT AND CRACK FILLING

The preparation and sealing of cracks and joints in paved surfaces.

103 SEAL COATING

The application of asphalt and stone aggregate over continuous sections of paved surfaces.

105 GRADING

The machine grading of gravel surfaces, including the removal of rocks or debris brought to the surface during blading.

106 SPOT GRAVELLING

The repair of areas on small gravel roads, parking lots, and trail heads with crushed or pit-run gravel. Includes potholes, depressions, frost boils, and bumps.

107 DUST CONTROL

The application of dust-laying material on gravel surfaces.

108 REGRAVELLING

The addition of gravel over continuous sections of gravel surfaces to restore surface base. Includes grading and compacting.

109 GRAVEL SHOULDER MAINTENANCE

All work associated with the maintenance of gravel shoulders. Includes grading and patching.

110 BASE AND SUBGRADE REPAIR

The repair of base and sub-grade failures, including those due to frost heaves, with granular material. Includes excavation and backfill. Bituminous surface repairs are included under LONG PATCHING.

111 STREET/ROAD CLEANING

The cleaning of townsite streets, roads, intersections, and approaches to bridges to remove accumulated debris and dirt. Includes all related work such as hauling debris from work site.

112 FLUSHING

The flushing of townsite streets to remove dirt and debris from the travelled portion of the road surface.

113 SIDEWALK REPAIR

The repair of all types of sidewalks, handicapped and loading ramps. Includes excavation, removal of deteriorated materials, root cutting, base repairs, and resurfacing.

114 CURB AND GUTTER REPAIR

The repair of all types of curbs and gutters, including the removal and replacement of deteriorated curbs and gutters.

120 DITCH MAINTENANCE

The cutting, cleaning, or shaping of ditches, including repairs to ditch check and rip rap.

121 CULVERT CLEANING

The removal of sediment and debris from culvert inlets and outlets, thawing of blocked culverts, and removal of snow from culvert. Includes the flushing of culverts to remove debris in the barrel of the culvert and for beaver control.

122 CULVERT REPAIR/REPLACEMENT

The repair and replacement of damaged culverts. Includes all related work such as detour construction excavation, anti back-filling.

125 ROADSIDE TREE, BRUSH AND WEED CONTROL

The removal of roadside brush and standing or fallen trees, including the felling, grubbing, and disposal of debris.

126 ROADSIDE LITTER PICK-UP

The removal of trash and debris from the right-of-way.

127 ROADSIDE GRASS CONTROL

The mowing of shoulders and roadside, including the cutting of grass around the guide rail.

128 ROCK SCALING

The removal of loose rock from vertical cut sections to eliminate hazards. Includes all work related to scaling such as the removal and hauling of rock.

129 SLOPE MAINTENANCE

The repair of failures and erosion damage on slopes (fill or cut sections), including the removal of eroded material.

135 BRIDGE CLEANING

The cleaning of bridge and bearing surfaces to remove accumulated sand and any other debris.

136 BRIDGE PAINTING

The cleaning and painting of bridge handrails and steel girders and the application of wood preservative to wooden bridges.

137 MINOR BRIDGE REPAIRS

Minor repairs to bridges including patching of spalled concrete, repairs of handrails and expansion joints, and the repair or replacement of timber decking.

138 STREAM BED MAINTENANCE

The repair of stream bed erosion using sheet piles, gabions, equipment, etc.

150 MANUAL SNOW REMOVAL

The manual removal of snow from hydrants, signs, sidewalks, parking lots, bridge decks, roofs and garbage containers, etc.

151 SNOW PLOWING

The plowing of road surfaces, parking lots, or road shoulder and includes winging back.

152 SNOW HAULING

The hauling of snow from designated areas to an established dump site.

153 APPLICATION OF ABRASIVES

The spreading of abrasives on road surfaces. Includes loading material.

154 APPLICATION OF CHEMICALS

The spreading of chemicals on road surfaces. Includes loading material.

155 INSTALLATION AND REMOVAL OF SNOW MARKERS

The installation and removal of snow markers to delineate the edge of the pavement in excessive snow areas. Includes the manufacture of snow markers.

156 INSTALLATION AND REMOVAL OF SNOW FENCES

The installation and removal of snow fences in areas subject to snow drifting. Includes the repair of snow fences during removal.

157 AVALANCHE REMOVAL

The removal from roadways of snow and debris caused by avalanche.

163 TRAFFIC COUNTERS

The electrical and mechanical maintenance, installation and field servicing. Included are road tool installation, battery replacement and tape removal and replacement.

170 SIGN PREPARATION

All work in the sign shop associated with the manufacture of signs. Includes cutting blanks, printing messages, mounting signs, and drilling holes. This includes traffic control signs and information signs intended for viewing by vehicular traffic on highways.

171 SIGN MAINTENANCE AND PAINTING

The installation of signs at new locations or the replacement of damaged signs. Includes all work related to the straightening of signs: tightening bolts, washing signs, removing damaged signs, digging post holes, and field painting

signs. This includes traffic control signs and information signs intended for viewing by vehicular traffic on highways.

173 TRAFFIC SIGNALS /FLASHING UNITS REPAIRS

Any repair to road or marine traffic signals when such repair cannot be performed within a reasonable time (1/2 hour or less) in conjunction with the preventive maintenance procedure.

174 PAVEMENT MARKINGS

The painting of centre lanes and edge lines. Includes the setting out and picking up of cones used for protecting wet lines and flagging for crew protection.

175 SPECIAL MARKINGS

The painting of intersection and crosswalk markings. Also includes cross hatching, arrows or any other special markings associated with intersections and painting curbs and parking lot stalls.

178 GUIDE POST/DELINEATOR MAINTENANCE

The replacement or straightening of posts and delineators. Includes replacing or cleaning reflectorized strips and the manufacture of posts.

179 GUIDE RAIL REPAIR/REPLACEMENT

The repair or replacement of damaged sections of guide rail. Includes removing damaged sections, replacing removed sections, straightening panels. replacing damaged posts and beams.

3.0 FUNCTION SPECIFIC ENVIRONMENTAL STANDARDS

100 SPOT PATCHING

101 LONG PATCHING

102 JOINT AND CRACK FILLING

- Where possible, asphalt materials removed should be recycled. If an opportunity is not readily available when the asphalt is ready for disposal, consider separating the asphalt from other waste materials when disposed of, so that it can be used for future road projects.
- Asphalt to be removed requires sampling and analysis to determine possible lead contamination and corresponding disposal methods. If contaminated, special measures are required to prevent release of the lead, and the asphalt should be disposed of only at approved disposal sites with appropriate rehabilitation measures. Contaminated asphalt should be transported to a provincial toxic waste disposal site, if such facilities are available.
- Asphalt not contaminated will also only be disposed of at approved disposal sites; existing borrow pits represent one possibility. Approved sites should be identified in the Maintenance Management Manual of each park. Under no circumstances should the asphalt that is to be removed, be disposed of along the roadside or adjacent to the right-of-way.
- The cleaning of equipment and disposal of cleaning agents, again must be done only at approved sites within the park, where there is no concern over contaminating soils, surface runoff or receiving streams.

- Wildlife species can be attracted to the oil base used in patching. Cover oil with surface dressing as soon as possible. Assign surveillance person to chase wildlife from exposed oil patches if problem arises.
- Valves on oil storage tank and on tanker truck should be checked regularly to prevent accidental spills. Valves must function properly to avoid oil dripping while en route to the work site.

103 SEAL COATING

- The transfer of asphalt emulsion from the tanker trucks to the sprayer truck and its storage should not occur within 100 metres of any watercourse or on any site with sloping grades.
- To avoid poor bonding of the seal coat which can lead to surface runoff and water pollution, the operation will not be undertaken immediately prior to (within 24 hours) or during a rainfall. Similarly, the seal coat would have little effect following a rainfall. Sealcoating should be applied only on dry road surfaces.
- The application of the emulsion must be restricted to the road surface only. The sprayer boom should be operated as closely as possible to the road surface and not over the edge of the shoulder, to avoid the contamination of roadside vegetation, aesthetic impacts and the covering of curbs, buildings or other structures.
- During the chip sealing operation, spray equipment should not be left parked on the roadside overnight and all spray valves should be closed when traveling to the work site.
- Gravel should be obtained only from an existing borrow pit or other approved site. If gravel requires washing, water should not be returned directly to any watercourse. Water may only be discharged over the ground surface in areas of well established vegetation to screen or filter out sediment, or alternately should be contained and transported for disposal at an approved provincial site outside the park.

- When obtaining water from streams for gravel washing, protection of stream banks, ensuring that stream beds are not damaged by pumping, and avoiding excessive amounts of water withdrawals, should all be considered.
- Equipment should be cleaned, and surplus or waste materials disposed of only at sites approved by the General Works Manager or Chief Park Warden.
- Be sure that the oil is covered with the coating gravel to the outside edge so that wildlife will not be enticed and aesthetics maintained.
- Upon completion of the chip sealing operation, signs must be left along the roadside to indicate loose gravel conditions.

105 GRADING
106 SPOT GRAVELLING

- Rocks and debris brought to the surface during grading are to be disposed of in a manner and at a site approved by the Warden Service.
- Grading methods must be conducted to provide appropriate surface runoff, ie. crowning of the road surface by returning loose materials from the edges to the centre of the roadway.
- Graders will not operate off the road surface or outside of the right-of-way. Turn-arounds should be made only at turn-outs along the road, parking lots, etc.
- Gravel will be obtained only from an existing borrow pit or other approved site.
- New gravel that is brought in and remains as excess in large amounts after maintenance operations are complete, is to be returned to its source.

107 DUST CONTROL

- Use only approved dust control agents as set out by the Resource Conservation staff.
- When using calcium chloride (CaCl_2) for dust control, it should not be applied in excess of rates of spread recommended by the manufacturer. The use of calcium chloride in flake form is in some cases preferable over liquid calcium chloride, except when the flake material may be transported away under windy conditions.
- Restrict application of calcium chloride to the road surface; avoid overspray. Application should be concentrated at the centre and crown of the road surface. Spillage and excessive usage must be prevented to minimize water quality and vegetation impacts. A fertilizer spreader is recommended for the application of calcium chloride that is in flake form.
- When using water for dust control, excessive removal of water from small streams, ie. 20% of volume flow, should not be allowed. Withdrawals should not significantly reduce stream flow. The filling of water trucks should be restricted to larger watercourses and lakes. Stream banks and stream beds are also not to be damaged with this activity. Water intake hoses should be equipped with filters to prevent entrainment of fish and other organisms.
- Oil based substances should be avoided for dust control.

108 REGRAVELLING
109 GRAVEL SHOULDER MAINTENANCE

- Granular material should preferably be obtained outside of the park, or from an existing borrow pit within the park.
- Where there are no sources available immediately outside of the park, new borrow pit sites within the roadway corridor should be selected below view points or the line of vision, and a buffer or visual screen should be provided between the right-of-way and the site. A detailed environmental screening specific to each individual case where new borrow pits are required should be completed to provide direction for these measures. A rehabilitation plan for the site should also be prepared with the assistance of the Warden Service prior to initiation of extraction.
- During grading of gravel surface roads, loose gravel must be brought back toward the centre of the roadway, to prevent the creation of berms that can impede surface runoff, block lateral drainage, and result in gravel falling into the ditches and increased ditch sedimentation.
- The rebuilding of shoulder washouts will be done in a timely and acceptable manner to minimize surface runoff and water quality impacts. Care should be taken not to 'blade' gravel onto or beyond the road shoulders when grading.
- Aggregate material that is brought in to build up a road surface and remains as surplus when the work is complete, will be returned to its source or stockpiled at the maintenance compound for future use.

- Graders must not be operated beyond the road shoulders.
- The use of water and/or calcium chloride for compaction following grading must follow the standards set out under maintenance function 107 Dust Control.

110 BASE AND SUBGRADE REPAIR

- Where excavation is required, sediment catchment devices such as silt screens or check dams should be constructed and properly maintained for short-term erosion control until long term stabilization is established. Slopes should be sodded or seeded as soon as possible following excavation or backfill activities to ensure long-term stabilization. The period that soils are exposed should be minimized, ideally less than 48 hours. Excavated granular material is to be placed over the existing road surface. Other unsuitable road materials are to be hauled to an approved dump site.

- Approved dust control measures will be followed as outlined under maintenance function 107, along with appropriate disposal methods of asphalt and base materials as indicated under maintenance functions 100/101/102.

- Heavy equipment used during the operation must remain on established road right-of-ways.

111 STREET/ROAD CLEANING

112 FLUSHING

- Street/road cleaning is to be undertaken prior to maintenance function 112 flushing.
- Debris and dirt collected from the road surface must be disposed of at an approved site.
- While being transported to the disposal site, debris and dirt should be contained with the use of a tarp covering the truck or wetting down the materials to control dust.
- Ensure debris is disposed of properly prior to and during flushing. Inert materials are not to be flushed into drains or into adjacent watercourses.
- Where adjacent watercourses are encountered and the release of sediment is unavoidable, the use of sediment catching devices, ie. settling basins, or timing of the operation during maximum stream flow to ensure dispersal, must be considered.
- Soaps or other chemicals are not to be used in flushing. Where chemical pollutants are encountered (ie. petroleum products), consider localized cleaning rather than flushing. Non-toxic agents are available that break down petroleum products (contact Canadian Petroleum Association as some emulsifiers are toxic to biological components).
- where nearby surface vegetation is destroyed, remove contaminated soil, apply new topsoil and appropriate seed.

113 SIDEWALK REPAIR
114 CURB AND GUTTER REPAIR

- Sidewalk, curb and gutter repairs must maintain proper surface runoff.
- Concrete removed from the existing sidewalk or curb, and other waste materials should be disposed of at an approved site identified for each park in consultation with the Warden Staff.
- When pouring fresh concrete, ensure containment. Leaks or spills of fresh concrete will not be allowed.
- Cleaning of the cement truck and mixer should be done only at an approved site (maintenance compound), exercising precautions to prevent contamination of soils and watercourses, ie. cement that is hosed from the equipment used should be well diluted before being allowed to runoff into adjacent areas and receiving streams.

120 DITCH MAINTENANCE

- Ditches filling in with excessive sediment materials is usually an indication of some form of erosion occurring upstream that should be investigated and corrective measures taken.
- Where rapid infilling occurs, the reshaping of ditches with approximately a 2:1 slope and narrow V-cut bottoms should be considered. Ditch specifications for major highways must be followed on a site specific basis.
- Disturbance of upslope stability should be minimized. Soils that have been exposed on erodible slopes should be stabilized with the use of vegetation or other stabilizing materials (burlap, rip rap, gabions, etc.). Organic material on ditch slopes should be salvaged where possible in the reshaping of ditches. Depending on the dimensions of the ditch, consider seeding and mulching with an erosion control agent applied to stabilize banks. This will minimize erosion and possible stream sedimentation.
- Leave buffer zone of vegetation on approaches to waterways. If necessary, carry out activities in the buffer zone after the remainder of the ditch has been stabilized.
- Settling basins will be constructed to intercept excessive loads of waterborne silt draining from ditches into receiving waters, as a result of ditch cleaning operations.
- Silt materials and other debris cleaned from ditches must not be left in locations where it can wash into receiving

watercourses. All materials cleaned from the ditches will be collected and disposed of at an approved site. Where topsoil fines that offer suitable material for rehabilitation are removed from ditches, efforts should be taken to stockpile this material separately for future use.

121 CULVERT CLEANING

- Activity should be scheduled to prevent interference with fish migration and spawning periods. The Warden Staff and/or the provincial fish and wildlife agency must be consulted to establish the 'work windows'.
- Where there is a continual problem of culverts clogging with debris, the placement of log boom barriers upstream from the culvert to catch floating debris and slash materials should be considered. The installation of wire fencing at the culvert inlet or preferably a few metres upstream from the inlet is another method to prevent materials from entering culverts. Precautions must be taken not to block fish movements with the installation of fences or wire grates.
- Precaution should be taken not to alter stream flow and pattern characteristics during the cleaning operation. Artificial substrate, usually comprised of a layer of stone, that has been purposely placed on the bottom of the culvert for flow control should be retained.
- During the removal of rocks that have accumulated at the entry/approach to culverts, some rocks/boulders can be retained to provide resting places for migrating fish. Rocks should be spaced approximately 1-10 metres apart alternating from one side of the channel to the other to avoid long runs of fast flowing water along either side.
- All excavated debris and soil materials cleared from the culvert should be removed from the stream channel and disposed of at an appropriate site identified by the Warden Service, to prevent them from washing downstream. Depending on site conditions,

disposal of these materials on-site may not be appropriate, leading to possible aesthetic impacts.

- Where beavers are attracted to road culverts, a variety of deterrent methods can be applied:
 - battery operated electric wire fences at the culvert inlet;
 - upstream devices including steel screens, wire mesh culvert extensions and other culvert attachments.

Resource Conservation Staff should be consulted regarding the most appropriate techniques for any given site.

- Before removing beaver dams that are blocking culverts, the Warden Service must be consulted to determine whether the resident beavers can be live trapped and transported to another suitable habitat within the park.
- When breaching a beaver dam, sediment traps or silt fences should be used to control sediment and soil materials from being washed away, particularly where downstream fish spawning habitats are located.
- To control the rate of water discharge when dismantling a beaver dam, a small channel should be opened gradually with hand tools in the centre of the dam. Heavy equipment and explosives for removing dams must be avoided.

122 CULVERT REPAIR/REPLACEMENT

- Where the design or sizing of culverts is to be changed, or where the operation of equipment is to occur within the wetted perimeter of the stream, a detailed, site specific environmental screening may be required.
- Proper sizing, shape and placing of culverts represent major requirements to avoid environmental concerns. Culverts should be of sufficient size to accommodate peak stream flows and the culvert should be placed at an angle as close as possible to the original gradient of the stream bed to avoid hanging culvert outlets.
- Repair and replacement methods will take into consideration environmental concerns including erosion and stream siltation, stabilization of disturbed or exposed slopes or embankments, and blockage of fish passage.
- The following general guidelines for the replacement of culverts are recommended, along with the relevant references included in the Subject Bibliography presented in Section 6 of this report:
 - Identify any migrating fish species and their migration patterns and habitat requirements.
 - Establish their upstream swimming capability.
 - Design slope of culvert and any internal baffles to meet swimming speed specifications of migrating fish.

125 ROADSIDE TREE, BRUSH AND WEED CONTROL

- All vegetation clearing activities should be scheduled to avoid peak visitation periods in the park. To minimize disturbance of the subgrade at the roadside, clearing and grubbing operations will not be planned for the early spring before surface and sub-surface materials have dried out.
- Vegetation that shades the road, should be removed to allow quicker drying of the road surface and increase visibility along the right-of-way. The right-of-way should generally be kept clear of tall brush and trees that restrict vision along the road.
- Clearing of trees and shrubs along straight sections of the roadway should be limited, while the vegetation encroaching upon curves and approaches to curves in the road alignment will be cut back more.
- Where line-of-sight or view point slashing is conducted, only the vegetation which obscures the necessary views will be removed.
- Clearing limits should be clearly marked in the field with flagging tape by the Warden Service to guide work crews. Trees within clearing limits should be cut such that they fall within clearing boundaries marked. Trees that may fall outside of boundaries should be removed for firewood at park campgrounds.
- In level areas, alders and other shrub vegetation should not be cut back further than 4 metres from the paved roadway. In more sloping areas, brush should be cut down to the roadside ditch and up the back slope to about 3 metres or where it levels off.

- Vegetation must not be cleared indiscriminately along the right-of-way. Shrubs, herbs and grasses assist erosion control and contribute to aesthetics along the roadside. To prevent aquatic habitat impacts relating to water temperature fluctuations and stream siltation, brush should not be cleared along watercourses adjacent to roadsides.
- Shrubs and trees growing in drainage ditches should be cleared to allow the ditches to dry out and provide proper drainage. Sediment control measures should also be applied, as with other ditch maintenance activities.
- Shrub and tree cover within the right-of-way must also be managed to enhance its aesthetic value. The edges of forest stands along the right-of-way should be periodically thinned to make the interior of the stands more visible and the right-of-way less visually contrasting with the natural landscape. The appearance of hard, continuous lines at the edge of right-of-ways should be avoided through appropriate maintenance thinning methods.
- Roadside vegetation will be cleared to provide an irregular or scalloped edge line at the limits of the right-of-way.
- All stems (brush and trees) should be cut flush at ground level, or should not exceed a maximum 20 cm stump. Angle cuts slightly to face away from the road to make them less apparent where they are viewed from the road. Otherwise, cuts should be made flat.
- Clearing or grubbing of low vegetation cover along the roadside within 100 metres of a water crossing or adjacent watercourse

should be restricted to avoid increased surface runoff, erosion and stream siltation. The extent of a buffer zone between the area grubbed and the watercourse should be determined in consultation with the Warden Service. The use of heavy equipment for these activities should not be allowed within 100 metres of any watercourses that is known to provide fish habitat.

- On sloping sites where there is a risk of erosion, brushing and grubbing operations must be avoided to prevent mineral soils from being exposed and more subject to erosion. Grubbing will not be allowed or at least be restricted in areas of ice-rich or fine grained soils such as clays, silts and fine sands that are also more prone to erosion and disturbance.
- In grubbing operations, the vegetative mat should be stripped only within the confines or extent of the road shoulder. If subsequent regeneration of vegetation along the roadside is desired, special equipment, blades or attachments can be used to retain some organic mat; or grubbing can be conducted in the winter when clearing above the frost line can be achieved.
- Grubbing should be restricted to dry weather conditions and material that has been grubbed must not be piled or stored where it can be carried away by or block surface runoff and drainage.
- All tree and brush clearing equipment must be fitted with spark arrestors, and clearing should take special precautions or be avoided during periods of high fire hazards. The use of heavy equipment such as graders, bull dozers, and skidders for routine vegetation clearing along the right-of-way will not be allowed.

- Resource Conservation staff will identify any noxious weeds and designate proper disposal methods.
- The use of herbicides for roadside vegetation control should be considered only after mechanical measures are found not to be effective. Proposed herbicide application programs must be submitted for approval by the Parks representative of the Federal Interdepartmental Committee on Pesticides.
- Herbicides generally considered acceptable for use in and specifically approved for controlling roadside vegetation in national parks include 2, 4-D, mecoprop, ammonium sulphate, glyphosphate, and dichlorprop mix, as set out in Management Directive 2.4.1, 'The Management of Pesticides by Parks Canada'.
- Trees greater than 10 cm in diameter (dbh) that are cut during roadside maintenance operations should be removed from the site and salvaged. Small trees and brush material can also be salvaged by chipping and stockpiling for use in rehabilitation and landscaping projects. Alternately, wood chips can be spread over the ground beyond the right-of-way where they will not be readily visible.
- Under no circumstances should wood chips or other wood materials and debris from the clearing of roadside vegetation be allowed to enter any water body.
- Wherever possible, all vegetation that is slashed and not chipped, should be removed from the site and properly disposed of. Burning of cleared vegetation should be considered only when fire hazards are negligible. Burning of slash should only

be carried out in approved areas and not within 200 metres of any water body or known wildlife habitat.

- Slashed brush and trees that are not removed from the site should be made less visible from the road. Branches should be cut and stems sawn and laid flat to facilitate decomposition. Large stems (> 10 cm) remaining on site should be sawn to 2 metres in length.
- Where median and roadside vegetation within the right-of-way has been cleared, fertilization may be required to promote new growth for erosion control and landscape aesthetics. Fertilizers must not be used on slopes leading to watercourses, wetlands or areas frequented by wildlife.
- Timing of vegetation clearing should be considered in relation to seasonal use of the area by wildlife. For example, clearing activities should be scheduled to avoid disturbance to bird nesting and fledging along roadsides.
- Where roadside vegetation has been cut back or cleared through other maintenance functions, an attractive habitat can be offered for the establishment of knapweed and other undesirable species. Seeding and/or planting with native species should occur as soon as possible on cleared or otherwise disturbed sites requiring regeneration.

126 ROADSIDE LITTER PICK-UP

- Trash and debris up along the roadside should be disposed of at an approved waste disposal site or dump. Litter must not be allowed to blow out from the truck when being transported to the dump site.
- Litter and refuse containers at rest stops, viewpoints and interpretation sites should be emptied on a regular basis. Roadside pull-offs should also be checked for litter more regularly than the longer sections of road where vehicles stop less frequently.

127 ROADSIDE GRASS CONTROL

- Grass cutting should be kept to a minimum and carried out only where required to maintain a safe line of sight for drivers. Grass should not be mowed beyond 4 metres of the road shoulder.
- Roadside grass cutting will only be undertaken following the completion of maintenance function 126 Roadside Litter Pick-up.
- Prior to grass cutting, the Warden Service must be consulted to determine if nesting birds or other wildlife present any concerns.
- Where there is the potential for ungulates and other wildlife to be attracted to the new, lush growth following grass cutting, and for corresponding road kills, cutting should be limited.
- Notify Resource Conservation prior to mowing so that specific noxious weeds can be located and controlled.
- To improve site aesthetics following cutting, the grass should be mulched during the activity, particularly for high grass. Where mowers are not equipped with mulchers, raking and pick-up of the grass should be considered.
- The use of herbicides and growth retardants for grass control should be in accordance with the environmental standards set out for maintenance function 125 Roadside Tree, Brush and Weed Control, as based on Management Directive 2.4.1, 'The Management of Pesticides by Parks Canada'.

128 ROCK SCALING

- Where blasting is used in rock scaling operations, the use, handling and storage of explosives must be under the supervision of a qualified operator.
- Blasting is to be avoided during peak visitation periods. Roads should be temporarily closed where rock scaling operations present major safety hazards to passing motorists. Where roads cannot be closed, flag men and warning signs should be used to alert and control traffic.
- The Warden Service should be notified prior to any blasting to determine the potential for disturbance to nesting, staging, spawning or other critical periods for fish and wildlife. Where wildlife are present within 500 metres of proposed blasting operations, blasting should not be undertaken until the animals move or are herded from the area by the Warden Service. Blasting must not be undertaken within 500 metres of inhabited cliff nests or where calving or denning activities are occurring.
- Blasting should not be allowed within 100 metres of spawning beds. Where spawning beds are identified within 100 to 400 metres of proposed blasting operations, the blasting should be scheduled before the spawning season.
- During blasting, trees and other vegetation should be protected as much as possible by containing fly rock with blasting mats and/or laying charges to direct explosions away from trees.
- Fly rock should be removed from the site as soon as possible and transported to a location designated by the Warden Service. Material from rock scaling is particularly suitable for rip rap and

embankments because of its sharp edges. Separation of fly rock from other waste materials should be considered, so that it can be recycled for future use.

- Measures should be taken to control dust as much as possible during the removal and falling of rock materials down slope. Slopes with particularly dry site conditions should be sprayed with water to reduce dust.
- Where adjacent watercourses are involved, silt catching devices may be required in drainage ditches. Settling ponds, silt fences or other erosion control installations should be considered where warranted.
- On sites where the sub-surface has not been previously disturbed, the regional archaeological staff should be notified of any blasting requirements for the rock scaling operation.

129 SLOPE MAINTENANCE

- All slopes that are subject to erosion, particularly those that are adjacent to stream crossings and areas of cut and fill, should be monitored regularly for signs of erosion and to ensure that vegetation cover is maintained.
- The recontouring of slope failures will not exceed a 2:1 ratio or contrast significantly with local relief of the natural topography in the area. The top of slopes should be properly rounded.
- All slope maintenance work is to be restricted during and immediately following periods of heavy rain.
- Where eroded material cannot be used in the recontouring of the slope failure, it must be removed from the site and disposed of at an approved location.
- Overburden material imported to the site for slope stabilization and placed below the high water level of an adjacent watercourse should be the most erosion resistant material available, ie. coarse textured soils or granular material.
- Slopes that are subject to erosion or slopes that have eroded should be stabilized by seeding and mulching, sodding, or planting ground cover or shrub vegetation. Consider vegetative mats, mulch and tackifiers on steeper slopes to stabilize.
- Care should be taken in the selection of topsoil and in seeding and planting for slope stabilization to avoid exotic and noxious vegetation species. Wherever possible, native species should be selected in seed and plant material for slope stabilization.

135 BRIDGE CLEANING
136 BRIDGE PAINTING
137 MINOR BRIDGE REPAIRS

- When scheduling bridge cleaning, painting or minor repairs, the Warden Service must be consulted to determine the most appropriate time for these operations for each specific watercourse. Operations should be scheduled to avoid periods of minimum stream discharge, fish spawning or migration, and avifauna nesting periods. Periods of low park visitation should also be considered to reduce noise and visual impacts of bridge work. When possible, bridge cleaning and painting activities should only be undertaken on days with little or no wind.
- If regionally or nationally significant species of birds are known to nest on bridge beams, bridge cleaning should be undertaken only after the nesting season.
- No soaps or chemicals should be used for cleaning bridge decks. Flush with clean water. If chemical contaminants are found on the bridge, flushing is not to be undertaken.
- Abrasives used during bridge cleaning should be removed from the bridge decks and properly disposed of. Do not wash sand materials and other abrasives over the side of the deck and into the water below. The release of sandblasted paint, as well as new paint into the water should be prevented as much as possible. All grouts, binding/adhesion agents and preservatives will also be prevented from entering the water during painting operations.
- Physical barriers should be designed and provided to contain all foreign materials during cleaning, painting and repair

operations. Among physical barriers that should be considered are shrouds, tarps, screens, curtains and scaffold canopies. Drop curtains and other barriers should not be allowed to extend to the surface of the water or to inhibit the movement of fish.

Deck drains must also be covered and sealed to prevent the release of sand and paint materials, chipped concrete and fresh poured concrete into the water.

Barriers should be cleared regularly to remove accumulated debris and waste materials from the bridge, and continually monitored to ensure effectiveness.

- Sandblasting should only remove loose paint to provide a clean surface for the new paint to adhere to. Excessive sandblasting should be avoided. To reduce the amount of old paint needed to be removed, the new paint to be used should be as similar in colour as possible to the existing painted surface.
- Paints should be selected that have minimal amounts of potentially harmful substances, particularly water soluble organic chemicals, lead and other metals. Rust inhibiting paints should be chosen over barrier types of paints to reduce the total volume of paint required over the long term.
- Hand painting is preferred over spray painting. Where sprayers are used, they must be properly adjusted to minimize the amounts of paint lost to overspray.
- Paint thinners and cleaning fluids must be disposed of in proper containers and at approved sites, ie. maintenance compound.

- All waste and surplus materials from bridge repairs are to be removed from the site and disposed of at an approved waste facility. Debris left from bridge repairs is not to be swept into deck drains. Littering by work crews at the site should be strictly prohibited.
- Asphalt, cement and other construction materials used during bridge repairs should be contained within the work site, not be allowed to enter the watercourse, and not be left behind following completion of the work. Special precautions must be taken in the handling of materials such as loose boards, ends and cuttings, nails, lime, cement and fresh concrete, and other debris to prevent their entry into the water below.
- An on-site materials storage area with well defined boundaries should be designated for minor bridge repairs. All materials and equipment should be stored in this area, which should be located well back from the water's edge.
- Under most circumstances, bridge repair equipment should not be allowed to operate from stream beds. Off-road access by construction vehicles and equipment should also be restricted.
- Concrete buckets, wheel barrows, shovels and other construction equipment used for bridge maintenance is not to be cleaned in the watercourse. All equipment should be cleaned at appropriate off-site locations, ie. maintenance compound, or outside of the park in an area where there is no concern for environmental contamination.
- Where the falling of debris or materials during bridge maintenance operations is unavoidable, the use of siltation traps and log booms immediately downstream from the bridge site

should be considered to catch foreign materials in the water and reduce water quality impacts. Every effort must be taken to remove accidentally fallen debris and materials from the watercourse.

- Work from the water is to be restricted to the erection of scaffolding for minor bridge repairs. Where necessary, scaffold supports should not interfere with stream flow or fish passage.
- Silt catching devices (siltation traps) should be provided where required, particularly where extensive work on bridge abutments is involved.
- Any excavation or backfilling for the repair of abutments is to be done in such a manner to prevent erosion into the watercourse and to minimize disturbance to site vegetation. Embankments must be stabilized following such repairs. A detailed, site specific environmental screening may be required for abutment repairs that involve in-stream work.
- Substrate from the stream is not to be used as borrow material for the stabilization of embankments following bridge maintenance works. Only clean, granular fill should be used to stabilize embankments, and not any fine-textured soils or other erodible materials. The application of topsoil for embankment stabilization should be delayed until immediately before sodding or seeding to reduce erosion with surface runoff.
- Any gutter drains located down bridge embankments must be placed to avoid soil erosion and be cleaned out regularly.
- Prior to any bridge maintenance work, the heritage significance of the structure must be determined, to avoid alterations that may result in permanent impacts.

138 STREAM BED MAINTENANCE

- All preventative maintenance and rehabilitation works within stream channels must be scheduled to avoid fish spawning, incubation or migration periods. The most appropriate periods are when water levels are lower and a greater portion of the stream beds become exposed.
- The work is to be completed from within the dry or exposed part of the stream bed. General access to the stream bed should be limited and clearly marked. Except where particularly sensitive site conditions are involved along or adjacent to the shoreline, as much work as possible should be carried out from the shoreline or top of bank.
- Natural stream channel configurations must be maintained wherever possible, but if realignment is necessary for stream bed maintenance, then natural stream features should be incorporated into the work.
- Where siltation and other bottom deposits have occurred on coarse gravels over fish spawning beds, the stream bed can be sprayed with high pressure fire hoses to move silt and dead algae ahead of the water discharge. The cleaning of stream beds in this manner is only effective in shallow water depths.
- The scouring and erosion of stream beds at culvert outlets can be corrected by the reinstallation of culverts aligned as close as possible to the original stream bed gradient to avoid hanging outlets, and through the placement of larger culverts to reduce flow velocities.

- Physical barriers such as logs, rip rap, gabion baskets and concrete or sheet pile walls should also be considered to provide erosion protection against culvert discharge and at other points of high stream velocities adjacent to the roadway concerned.
- The general order of preference for stream bank stabilization is as follows:
 - revegetation,
 - rip rap,
 - gabion baskets,
 - retaining walls.
- Vegetation is not considered effective for the stabilization of shorelines or stream banks with slopes in excess of 33°. One of the alternate methods above should be applied in these areas.
- Where rip rap is used to achieve stability of stream banks and shorelines along roadways, small stones should not be separated from large ones. An uneven grade of surface materials provides strength to the revetment.
- When placing rip rap or other stabilizers along shorelines, as much vegetation as possible should be left intact on the stream banks and at the water's edge. The removal or covering of vegetation can lead to further erosion and reduce shading of the channel, also causing increased water temperature fluctuations.
- Avoid the continuous placement of rip rap or gabion baskets over stream banks or bottoms of stream beds, that can result in the reduction of aquatic habitat diversity. Similarly, concrete or sheet piling should not cover both the banks and bottom of stream channels, which can lead to increased water temperature fluctuations and flow velocities.

- During winter maintenance operations, disturbance of the stream bed in areas of known fish spawning must be minimized in the clearing of ice build-up under or adjacent to bridges. Blasting to break up the ice in these areas should be avoided. The use of chain saws to cut through the ice is preferred.

150 MANUAL SNOW REMOVAL
151 SNOW PLOWING
152 SNOW HAULING

- Accumulated snow that may be contaminated with salt should be disposed of only at approved dump sites or designated areas. Snow containing salt and/or sand will under no circumstances be dumped or allowed to melt and run off into watercourses.
- Following snow plowing operations, snow banks along the roadside should be cleared back with a wing blade well beyond the road shoulder to reduce the time required for melting and to minimize spring saturation and erosion of the roadbed. When winging back with grader blade, use caution not to damage young trees.
- The winging back of snow banks also reduces the obstruction of wildlife movements at the roadside. During plowing operations, the creation of barriers to wildlife movements should be avoided. Openings should be made in the snow banks at regular intervals along the road to provide exit points from the road corridor for wildlife.
- When snow blower is used to remove accumulated snow, operator should direct blow spout so as not to damage vegetation (ie. remove bark, break small branches). Similarly, the plowing of snow into areas of significant vegetation cover should be avoided.

153 APPLICATION OF ABRASIVES
154 APPLICATION OF CHEMICALS

- Excessive use of road salt as a chemical de-icing agent should be avoided to prevent the contamination of surface and groundwater regimes, soils, and vegetation. The use of salt and other de-icing agents should be limited to main travel routes and hazardous locations, ie. intersections.

- The use of road salt and mixtures with abrasives such as sand should be closely controlled according to temperature conditions in which they will act most effectively. Pure rock salt, or sodium chloride, is efficient as a de-icing agent at temperatures above -20° , while calcium chloride, an alternative to salt, is effective to a temperature of -34°C . Calcium chloride and other chemical alternatives to the use of salt, such as urea, are more costly, but may be considered as less environmentally harmful de-icing agents.

- The application of both salt and abrasives should be restricted to the travelled surface of the road. To further reduce the amount of salt required for the de-icing of roads, the following measures should be considered:
 - pre-wetting of salt,
 - proper calibration of spreaders,
 - combined use of abrasives (sand/gravel),
 - early snow removal from the road surface.

- Salt and other road chemicals should be properly stored in designated areas only, preferably in dry sheds to prevent infiltration of leaching to the water table, and surface runoff.

At loading areas to salt sheds, an impervious apron of asphalt or concrete over the ground should be provided.

- Storage areas and road surfaces where salt and sand has accumulated, must be cleaned up immediately following the spring melting period.

155 INSTALLATION AND REMOVAL OF SNOW MARKERS
156 INSTALLATION AND REMOVAL OF SNOW FENCES

- Snow markers should be approved by the Warden Service and meet provincial standards as the minimum. Trees should not be cut from within the park for use as snow markers. Trees used as snow markers should be disposed of in the spring according to guidelines set out in standard 125 Roadside Tree, Brush and Weed Control.
- Terrain disturbance should be minimized during the installation and removal of snow fences. Schedule work to avoid wet periods and restrict installation on erodible slopes. The use of heavy equipment should also be avoided. Disturbed sites must be rehabilitated after the removal of snow fences.
- Long continuous lines of snow fencing should be avoided for aesthetic reasons, and also to not obstruct animal movements.
- Select aesthetic fencing material that blends with the natural landscape. When fences are removed, store material out of sight from visitors. Minimize amount of snow fence used and duration of use.

157 AVALANCHE REMOVAL

- Debris resulting from avalanches should not be cleared from the road surface into drainage channels or ditches. Fallen rock and soil materials, as well as snow in some cases, must be removed from the site and dumped at an approved location.

163 TRAFFIC COUNTERS

- Where excavation is required for the installation of traffic counters, disturbed and erodible sites should be stabilized and rehabilitated following removal and installation of the units.

170 SIGN PREPARATION
171 SIGN MAINTENANCE AND PAINTING

- Caution should be exercised in the handling and storage of pressure treated wood and/or preservatives used in the preparation and maintenance of road signs. All solvents and paint materials will be properly cleaned up and disposed of following the work.
- The Warden Service should be recontacted before the installation of signs at new locations where major excavation is required, regarding the potential for disturbance to any significant vegetation or archaeological resources.
- Sign maintenance work should be conducted as much as possible from the road shoulders. Disturbance of the adjacent roadside is to be restricted, particularly by heavy equipment.
- Where erosion concerns arise during excavation for the installation or reinstallation of large sign foundations, the site should be stabilized along with erosion control measures implemented during and following the work.

173 TRAFFIC SIGNALS/FLASHING UNITS REPAIRS

- Where standards for traffic signals require repairs or reinstallation, work should follow methods identified in 171 Sign Maintenance and Painting.

174 PAVEMENT MARKINGS
175 SPECIAL MARKINGS

- Only approved paint materials should be used and application should be restricted to the asphalt surface.
- The mixing of paint and preparation of all other materials including reflective glass beads, should only be carried out off-site or in areas where any spills can be contained and cleaned up, preferably in the maintenance compound or outside of the park at a disposal site, designated by the province.
- Equipment used should not be cleaned along the roadside or in nearby streams. Left over paint and reflective glass beads should only be disposed of at approved waste facilities.

178 GUIDE POST/DELINEATOR MAINTENANCE
179 GUIDE RAIL REPAIR/REPLACEMENT

- Only approved pressure treated lumber should be used for the replacement of guide posts. Creosote and other oil-base treated wood should be avoided.
- Following the replacement of guide posts, disturbed sites should be stabilized/rehabilitated to prevent erosion and aesthetic impacts.
- Proper care should be taken in the handling, storage and disposal of paint materials. Hand painting of guide rails is preferred over spray painting, as overspray of paint onto roadside vegetation is often unavoidable. The cleaning of painting equipment should not be undertaken on-site.
- Damaged guide rails, which are removed, are to be placed in an approved dump site.
- Where design changes to guide rails or barriers are proposed, wildlife and other environmental implications must be considered on a site specific basis.

4.0 SUMMARY OF GENERAL ENVIRONMENTAL STANDARDS

Along with the function specific environmental standards that were outlined in the previous section of this report, some of the more general environmental concerns and protection measures that can be applied to a variety of road maintenance functions are also identified as environmental standards for road maintenance in national parks. These more generic environmental standards for road maintenance embrace guidelines for common activities and/or concerns relating to the scheduling of activities, public safety and traffic, cultural and heritage resources, training of maintenance staff, operation of equipment and vehicles, and the disposal of waste materials generated with maintenance work.

The timing or period when maintenance functions occur can in many cases present major opportunities to avoid environmental problems associated with these functions. For example, where there is a special visitor activity occurring in a park within a specified period, such as salmon fishing in Gros Morne, all road maintenance functions should be restricted as much as possible during that period. In general, all road maintenance activities should be scheduled as early or late in the operating seasons as possible to avoid peak visitation periods in the park and potential conflicts with park visitors.

Scheduling standards should also be adopted for maintenance activities required in areas of known wildlife habitat. Individual maintenance functions with the potential for wildlife disturbance should be timed to avoid periods of habitat use, ie. spring and fall waterfowl migration through wetland areas, and fish spawning and incubation periods also in the spring and fall.

Road safety hazards and traffic delays are other potential problems that can arise with road maintenance operations. For all maintenance works that are carried out on regularly travelled roads, trained flag persons should be used for the safety of motorists. Proper signage must also be provided during and

after the operations to warn motorists of the work in progress and the road conditions ahead.

To avoid traffic delays, close attention to scheduling of the road maintenance program in the park should be considered. In this regard, the least travelled roads should be scheduled for when park visitation levels are higher during the operating season and the most travelled roads to be left for the shoulder seasons.

Heritage and cultural resources represent special concerns to be taken into consideration with the conduct of road maintenance programs. Where maintenance functions involve excavations in previously undisturbed areas, the regional archaeologist should be contacted to determine the potential for any paleontological, historical or archaeological artifacts or features. Although most road corridors will have been disturbed to varying extents during construction of the road, some sites with archaeological/historic potential may require survey or investigation before proceeding with maintenance operations involving excavation.

At sites of known archaeological or historical significance, maintenance activities are to be limited and any excavation work should be monitored by the regional archaeologist. In all other areas of unknown significance, the General Works Manager or Chief Park Warden must be informed immediately if any items or evidence of archaeological or historical interest are encountered in road maintenance operations, and the work is to be curtailed until further instructions are received. Any such items found on site during maintenance work are to remain on the site, undisturbed.

As a prerequisite of the function specific environmental standards, park maintenance staff and particularly contractors, must have a general appreciation of the environmental considerations relating to road maintenance. Beyond contract specifications outlining environmental standards, briefing sessions should be organized by the Warden Service for all

contract work crews and machine operators before work is begun to ensure that the contractors are cognizant of environmental concerns. All park maintenance staff and contractors are to be instructed that should any environmental concerns or problems arise during the maintenance work the Warden Service or Regional EARP Coordinator should be contacted immediately. Apart from any specific problems that may be encountered, communication should be maintained with the Warden Service throughout all road maintenance activities.

Contractors have a major responsibility for the implementation of these standards, as do park staff in providing clear instructions and explanations of this responsibility. As further standard of contract maintenance work, contractors should identify contingency measures for dealing with any environmental problems encountered at the work site, ie. the control of accidental spills of fuel, lubricants, paints or other toxic substances.

The manner in which equipment and vehicles are operated during road maintenance projects presents significant potential for environmental damage of various kinds, particularly in environmentally sensitive areas. When using heavy equipment such as trucks, tractors, backhoes, graders, front end loaders, and bulldozers, wet or poorly drained areas must be avoided wherever possible. Similarly, if an area contains known nesting sites or other wildlife habitat, the use of heavy and noisy equipment should also be limited. The use of hand tools must be considered in these areas.

Vehicles used for maintenance operations should not be left idling when not in use, particularly near vegetation. Vehicles left along side of the road upon completion of work can present safety hazards and lower the aesthetic appeal of the road corridor. Such vehicles to a maximum of six, must be parked in off road areas designated by the Warden Service or General Works Manager.

The operation and servicing of maintenance equipment and power tools such as chainsaws, sprayers, roto tillers, post hole diggers, brush saws and rock

drills must ensure that noise levels, noxious fumes, exhaust, and smoke pollution are minimized. All equipment and power tools are to be maintained and serviced in the maintenance compound or other appropriate service facility. Other than minor repairs or adjustments, equipment is not to be serviced along the roadside.

Under no circumstances should the cleaning, maintenance or fueling of equipment be undertaken near watercourses. The temporary storage or fueling of maintenance equipment is not to be located within 200 meters of any water body. Equipment fueling, maintenance and storage must not allow fuels, oils, chemicals or other toxic fluids to enter surface or groundwater in any area of the park. The cleaning of equipment used in maintenance work, or the emptying of excess fuel, lubricants or solvents into any watercourse in the park is strictly prohibited.

Maintenance equipment and vehicles are to be operated only within the existing disturbed area of the defined work site. Working areas should be well defined in the field by park staff, and contractors must ensure that all operations and activities are strictly confined to these areas. The limits of the work site must be clearly marked prior to commencement of the maintenance activity. Marking of the site boundaries should be with a combination of two colours of flagging tape.

All fuel storage tanks and pump facilities at maintenance compounds should be provided with spill containment dykes or other suitable structures with impervious materials to prevent the release of fuel spills into the ground or surrounding areas. Any storage tanks and pump facilities that are more than 25 years old should be replaced, otherwise periodic inspections must be carried out to ensure that they are not leaking.

The waste materials generated during road maintenance operations is the final area of environmental concern addressed by these general standards. All work sites are to be maintained in a clean and tidy condition, free from the

accumulation of waste materials, debris and other litter resulting from the work. Before any maintenance work can be considered complete, all debris, waste and surplus materials must be cleared from the working area which is to be restored as much as possible to its original condition before the work was undertaken.

Waste collected during and after maintenance projects should be disposed of at designated sites within the park or at approved provincial dump sites. Burning of garbage at work sites is not permitted, and any burning of slash materials should limit the amount of smoke by allowing the slash to dry out before burning.

For maintenance projects around water bodies, appropriate measures such as scaffolding and drop curtains, must be applied to prevent waste and foreign materials including lumber, nails, paint and brushes, fuel, oil, lime, cement and asphalt from entering the water.

5.0 CONCLUSIONS/RECOMMENDATIONS

The difficulties with incorporating environmental protection at the field level, in the numerous small scale, road maintenance activities occurring in national parks, provided the rationale for the environmental standards developed through this project. Although the screening requirement under the federal Environmental Assessment and Review process serves as a mechanism to identify environmental concerns and appropriate mitigation measures for all operations and maintenance projects undertaken by the Canadian Parks Service, the screening procedure is not always undertaken for the large number of maintenance activities that are carried out in the parks from region to region each year.

Where screenings are completed, the procedures and results are often inconsistent and may not provide specific direction to ensure environmental protection in the field. At the same time, the preparation of individual screening reports may also not allow one project or activity to benefit from the previous experience of other similar ones.

The environmental standards presented in this report were developed in recognition of the economy of a more generic approach to the screening and environmental protection of the wide range of road maintenance activities carried out in the parks. In the development and review of the standards presented in this report, it became apparent that while the standards would be adequate to ensure that environmental concerns were addressed during many of the road maintenance functions undertaken, some maintenance projects will still require an individual environmental review and can not be dealt with sufficiently by the standards described.

This observation then becomes a question of the level of detail that is presented in the description of the standards for the range of activities involved, and that are targeted for an audience at the field level. If the standards are to be considered as all encompassing, then certain standards

for selected activities would have to become more detailed. On the other hand, site conditions and environmental features vary from one undertaking to another, underlying the need for site specific assessments in some cases. The preferable option in this respect appears to be the identification of individual maintenance activities for more detailed site specific, environmental screenings. The following road maintenance functions are identified as activities that may require this type of review, depending on the extent of work involved with each case:

- 108 Regravelling
- 109 Gravel Shoulder Maintenance
- 110 Base and Subgrade Repair
- 122 Culvert Repair/Replacement
- 129 Slope Maintenance
- 137 Minor Bridge Repairs
- 138 Streambed Maintenance

The establishment of specific criteria are recommended to determine the requirement that any of these functions be subject to a more detailed form of environmental screening or investigation.

As an initial objective of this project, the environmental standards were to be presented in this report in as much of a graphics format as possible. In consultation with park staff, it was decided that this type of presentation would not lend itself well for inclusion into the Maintenance Management Manual, but rather would be more appropriate for the introduction of the standards at the park level. Upon insertion of the standards presented in this report into the Maintenance Management Manual, a major introduction and training effort will be required before the standards will begin to be implemented to any extent in the field.

For this requirement it is further recommended that the Canadian Parks Service consider developing and undertaking an accompanying training package to introduce and explain the purpose and application of the environmental standards developed. The package could be developed as a

seminar with more of a graphics emphasis, to be delivered to park warden and maintenance staff, as part of an implementation program for the standards in all of the park regions.

Similar to the Maintenance Management System adopted in national parks, numerous other systems have been developed for a variety of applications outside of parks. The Canadian Parks Service is at the forefront of these other maintenance systems, in being the first to incorporate accompanying environmental standards. A final recommendation of this report is that the development of the environmental standards presented in this report, be extended to include the remaining major maintenance functions that comprise the Maintenance Management System followed by the Canadian Parks Service. The other major maintenance activities for which the development of environmental standards should be considered include the following:

- grounds maintenance
- trail maintenance
- golf courses operation and maintenance
- cleaning of buildings and public use facilities
- solid waste collection and disposal
- power generation/distribution and lighting
- domestic water supply and waste water systems
- fire protection
- telecommunications
- building structures/services
- marine works and vessels
- canal operations
- general maintenance

Considering that the focus of the environmental standards in this report is limited to road maintenance activities, the need for further direction to field staff and to ensure environmental protection in relation to the variety of other activities routinely carried out under the Maintenance Management System, is identified and should be acted upon. The development of environmental

standards for these functions would also provide more consistency in their application across the system in each region, while also reducing the need for the individual review of each of these functions as they occur on an ongoing basis.

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