

Lake Louise Ski Area Site Guidelines for Development and Use

Strategic Environmental Assessment

Banff National Park
July 2015



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1 Background

1.1 Overview

Lake Louise Ski Area (the Ski Area), situated adjacent to the Village of Lake Louise, is one of four ski areas in Banff and Jasper national parks. Parks Canada is committed to working together with the Ski Area, the Village of Lake Louise, environmental non-government organizations, and the tourism industry to support a vibrant winter outdoor recreation experience while fulfilling its responsibilities for protecting heritage resources and ecological integrity, and facilitating opportunities for public education and memorable visitor experiences (National Park Ski Area Management Guidelines, 2006).

The *National Park Ski Area Management Guidelines 2006* (the Management Guidelines) provide the policy and planning foundation for new ski area long-range plans for the four ski areas. In accordance with direction in the Management Guidelines, Parks Canada has prepared draft *Lake Louise Ski Area Site Guidelines for Development and Use* (Site Guidelines) that represent the site-specific application of the Management Guidelines to Lake Louise Ski Area. The primary focus of the Site Guidelines is to establish permanent limits to growth and outline the types of development and use consistent with the Management Guidelines that can be brought forward in the future.

Following the establishment of Site Guidelines, the Ski Area will be responsible for preparing one or more Long Range Plans that detail development or redevelopment plans, for a time period chosen by the operator (anticipated to be five to 15 years). Long Range Plans brought forward by the Ski Area will be subject to environmental impact analysis (EIA) in accordance with the *Parks Canada Directive on the Implementation of the Canadian Environmental Assessment Act 2012*. Environmental impact analysis of Long Range Plans will address the project-level environmental effects of specific development proposals consistent with the policy direction established in the Site Guidelines.

1.2 Objectives of this Report

The *Lake Louise Ski Area Site Guidelines for Development and Use* are subject to a strategic environmental assessment (SEA) consistent with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals* (the Cabinet Directive). The Cabinet Directive indicates that a strategic environmental assessment of a policy plan or program is expected when the following two conditions are met:

- the proposal is submitted to an individual minister of Cabinet for approval; and
- implementation of the proposal may result in important environmental effects, either positive or negative.

The Management Guidelines indicate that the Chief Executive Officer of Parks Canada will approve Site Guidelines and as such the decision to undertake a strategic environmental assessment is not strictly required by the Cabinet Directive. However the Cabinet Directive also encourages departments and agencies to “conduct strategic environmental assessments for other policy, plan or program proposals when circumstances warrant”. Given the large size of ski area leaseholds within iconic mountain park landscapes, Parks Canada has decided to undertake a strategic environmental assessment of the Site Guidelines to address potential environmental implications and public concerns related to ski area development. The application of strategic environmental assessment to the Site Guidelines is consistent with the *Cabinet Directive* and with the approach to other Parks Canada strategic planning initiatives



including those for Marmot Basin Ski Area, Mount Norquay Ski Area, park communities and outlying commercial accommodations.

The development of Site Guidelines is nested within a larger policy and planning framework. The strategic environmental assessment of the Site Guidelines is neither the first, nor the last, step in the environmental analysis of ski areas in national parks. Rather, it addresses the transition between considering the ecological implications of ski area development at the broad strategic levels reflected in the *Canada National Parks Act*, the *National Park Ski Area Management Guidelines* and the *Banff National Park Management Plan*, and project-level assessment of ski area development at Lake Louise Ski Area as set out in future Long Range Development Plans.

The objectives of this strategic environmental assessment report are:

- to examine the Site Guidelines and present information about how ski area development and activity carried out within those guidelines would affect the ecological, cultural and visitor experience environments of Banff National Park in a strategic planning context
- to affirm that the Site Guidelines are consistent with direction provided in legislation and policy pertinent to the Parks Canada mandate
- to identify and assess potential cumulative environmental effects at regional and local scales in order to inform future long range planning and comprehensive study environmental assessment requirements
- to document the strategic environmental assessment process in accordance with the guidance in the Cabinet Directive.

1.3 Use of this Report

The strategic environmental assessment has been conducted so that decision-makers are informed of the potential environmental consequences associated with the Site Guidelines and may make decisions accordingly.

This document reports on the environmental implications of the draft *Lake Louise Ski Area Site Guidelines for Development and Use* and was used to facilitate government, stakeholder and public review and understanding of the Site Guidelines. While certain key information from the Site Guidelines is summarized in this report, readers may wish to refer to the complete *2006 National Park Ski Area Management Guidelines* and the *Lake Louise Ski Area Site Guidelines for Development and Use* for additional detail.



2 Legal and Policy Framework

2.1 Introduction

The *Lake Louise Ski Area Site Guidelines for Development and Use* provide direction for the consideration of potential, future development and operation initiatives that may be advanced by the ski area as part of a Long Range Plan consistent with existing legislation and policy for the management of national parks. The following sections highlight the legislative and policy requirements most relevant to the development and assessment of the Site Guidelines. It should be noted that government legislation, regulation or formal Cabinet direction may change from time to time and that legal requirements will always take precedent over the policy established by the Site Guidelines or strategic environmental assessment.

2.2 Canada National Parks Act

The *Canada National Parks Act* (2000) is the enabling legislation under which Canada's national parks are established and managed. As a commercial operation within Banff National Park, the development and operation of Lake Louise Ski Area is governed by that legislation. The general purpose of national parks is stated in Section 4 of the *Canada National Parks Act*:

The National Parks of Canada are hereby dedicated to the people of Canada for their benefit, education and enjoyment, subject to this act and the regulations, and the National Parks shall be maintained and made use of so as to leave them unimpaired for the enjoyment of future generations.

Section 8 (1.2) provides clarity on what it means to leave national parks “unimpaired” by managing for ecological integrity:

8 (1.2) Maintenance or restoration of ecological integrity, through the protection of natural resources and natural processes, shall be the first priority of the Minister when considering all aspects of the management of parks.

2.3 Guiding Principles and Operational Policies

The *Parks Canada Guiding Principles and Operational Policies* (1994) provide broad principles that give direction to both present programs and future initiatives of Parks Canada. Specific direction on the management of ski areas is included in Section 5.2.2, Part II, National Parks Policy:

5.2.2 Due to the pressures placed on alpine and subalpine environments, the 1988 National Parks Act Amendments prohibited development of new commercial skiing areas inside the national parks. The five existing commercial alpine skiing areas will be managed within their legislated boundaries according to long range development plans approved by the Minister and subject to public consultation.

Parks Canada is one of the principal cultural resource management organizations in Canada and is responsible for cultural resources in public settings at national parks, national historic sites and other properties. A *Cultural Resource Management Policy* was developed as part of the *Guiding Principles and Operational Policies* and provides the basis for cultural resource management and protection on lands administered by Parks Canada.

The Objective of the *Cultural Resource Management Policy* is:



To manage cultural resources administered by Parks Canada in accordance with the principles of value, public benefit, understanding, respect and integrity.

The *Cultural Resource Management Policy* requires that the concept of historic value of cultural resources be fully integrated into the planning and delivery of conservation, presentation and operational programs specifying that:

2.3.2 In all actions that affect cultural resources, Parks Canada will consider the potential consequences of proposed actions and the cumulative effects of those actions on the historic character of those resources and will plan and implement measures that respect that historic character, and;

2.3.3 When a proposed action on lands or waters administered by Parks Canada requires an environmental assessment, that assessment will include consideration and mitigation of the impacts of the proposed action on cultural resources.

2.4 Parks Canada Agency Report on Plans and Priorities 2013-14

Parks Canada annual plans and priorities provide direction on achieving the integrated delivery of Parks Canada's mandate of protection, education, and visitor experience through an overarching strategic outcome:

Canadians have a strong sense of connection, through meaningful experiences, to their national parks, national historic sites and national marine conservation areas and these protected places are enjoyed in ways that leave them unimpaired for future generations.

The focus of Parks Canada plans for visitor experience is to connect Canadians to their natural and cultural heritage. This entails pursuing significant increases in visitation and related revenues to support the Parks Canada mandate, and to strengthen its places, through partnerships, as key economic contributors in communities across Canada. Visitation and revenues increases will be pursued by diversifying and renewing visitor experience opportunities and increasing the desirability of these locations as travel destinations. Parks Canada direction supports *Canada's Federal Tourism Strategy* by promoting authentic experiences for visitors and fostering local economic and tourism development opportunities in and around Parks Canada places.

While plans for visitor experience involve diversifying and renewing travel and tourism opportunities, the key long-term and legislated priority of managing parks to maintain or improve the overall ecological integrity in all national parks remains. Natural resource conservation will focus on priority ecological integrity issues where investment is most likely to deliver tangible results for Canadians. Parks Canada efforts to maintain and restore ecological integrity is a key contributor to the Federal Sustainable Development Strategy and the goal of maintaining "productive and resilient ecosystems with the capacity to recover and adapt; and protect areas in ways that leave them unimpaired for present and future generations.

2.5 Banff National Park Management Plan 2010

The *Banff National Park Management Plan 2010* (the Management Plan) sets forth a vision for the future of the park, and strategic goals and key actions towards achieving the vision. Section 5.8 of the Management Plan provides the strategic goal for ski area development and operation:



To implement a strategy for summer and winter use of the three ski areas. The strategy will support the long-term viability of the ski hills, while keeping the impact on ecological integrity to a minimum.

Stated objectives of the management plan in support of the strategic goal are:

- *to provide skiers with the opportunity for a satisfying experience that is consistent with the national park setting and the Heritage Tourism Strategy.*
- *to ensure the management of ski areas respects approved long-range plans.*
- *to ensure summer use of ski areas considers questions of habitat security, wildlife movement and human-wildlife conflicts; and*
- *to provide a reasonable degree of certainty regarding future planning, project review and approvals.*

Of specific relevance to the Ski Area, the Management Plan indicates that the Skoki, Pipestone and Baker Land Management Units bordering the Ski Area are to be managed for low to moderate use in order to provide premier Rocky Mountain wilderness adventure experiences while ensuring secure grizzly bear habitat. A specific, notable objective of the Management Plan is to improve important grizzly bear habitats in Fish Creek/Temple area and Whitehorn wildlife corridor. For summer visitor use the Management Plan contemplates a potential shuttle along the Temple road to facilitate visitor access while minimizing potential impacts to the Whitehorn Wildlife corridor.

At the same time, positioning the Ski Area as an introduction to the backcountry on the edge of the mountain park wilderness is also supported by the Management Plan. In winter, visitors and locals alike are encouraged through the Management Plan to “take advantage of the long cross-country ski season, downhill skiing at the edge of wilderness at the world-class Lake Louise ski area, and backcountry skiing to historic Skoki Ski Lodge National Historic Site”. Consideration of non-ski area visitor experience is a factor in ski area development decisions. For instance, the Management Plan indicates that Ski area development will respect and be sensitive to views from the Bow Valley and trails to the Skoki area.

In addition to issues that are specific to the Ski Area and surrounding environments, the management plan highlights issues that are considered the most serious threats to the ecological integrity of the park. These issues provide a focus for the strategic environmental assessment of the Site Guidelines and include:

- *landscape fragmentation due to human activity and facilities*
- *loss of habitat connectivity between major areas of protected habitat as a result of human development and use*
- *loss of aquatic and riparian habitat associated with dams, stream channelization, and water regulation*
- *blockage of fish movements associated with dams and water regulation*
- *human-caused mortality of fish and wildlife*
- *altered vegetation successional patterns due to fire control and human modification of the landscape*
- *loss of montane habitats due to human development and fire control*
- *blockage of wildlife movement along and across the Bow Valley*
- *altered predator-prey relationships*
- *wildlife-human conflicts*
- *effects of human activities on water quality*



- *introduction of non-native plants and fish.*

Without being prescriptive on the types of use and development that could take place at the Ski Area, the Management Plan is clear that finding a balance between ski area viability, needs of various user groups both on and off the ski area, and maintaining ecosystem integrity is the overall goal. In order to achieve consistency with Management Plan direction the nature and intensity of use and development on the Ski Area will ideally create a transition from the highly developed front side adjacent to major transportation corridors and the Village of Lake Louise, to wilderness adventure experiences that take place on the edge of the mountain park wilderness.

2.6 Ski Area Management Guidelines

The *National Park Ski Area Management Guidelines* and the *Banff National Park Management Plan* together provide the ski area-specific policy and planning foundation for the preparation of the Site Guidelines and the subsequent long range planning process. The Management Guidelines stipulate that Parks Canada's primary goal for the management of ski areas is to achieve long term land use certainty that:

- *ensures ecological integrity will be maintained or restored;*
- *contributes to facilitating memorable national park visitor experiences and educational opportunities; and*
- *provides ski area operators with clear parameters for business planning in support of an economically healthy operation.*

The Management Guidelines distinguish between the existing "Developed Area" within the ski area leasehold and the area of the lease itself. The Management Guidelines stipulate that "*inside the existing Developed Area, new development can be considered where potential ecological impacts can be mitigated. Outside the existing Developed Area, new development can be considered if there is a Substantial Environmental Gain*". Exceptions to the Ski Area Management Guidelines "*may be considered if a Substantial Environmental Gain can be shown by demonstrating a positive change in key ecological conditions*". A leasehold reduction or reconfiguration that results in better protection of sensitive areas in exchange for development in less sensitive areas is an example provided in the Management Guidelines of an exception that can be considered.

The definition of Substantial Environmental Gain in the Management Guidelines includes criteria for determining if an ecological gain is substantial including:

- *magnitude – major as opposed to minor improvement*
- *geographic context – broad scale as opposed to local impact; and*
- *ecological context – improved protection or positive impacts to high value, rare or sensitive species or multiple species.*

The identification of ecological parameters is required by the Management Guidelines as part of developing the *Lake Louise Ski Area Site Guidelines for Development and Use*. With respect to new ski area development the Management Guidelines indicate that:

"Within the Developed Area, improvements to services and facilities can be considered. Additional infill ski runs, glading, run widening and parking can be considered. However, to ensure ecological integrity and address aesthetic issues, modification of physical terrain and forest cover will be carefully managed. Site Guidelines will identify ecological management parameters to ensure ecosystem functioning is maintained and that sensitive areas are



protected. At a minimum, this will include maximum run width, minimum distance between runs, maximum number of new runs and the prohibition of development in sensitive areas. Other parameters will be determined on a ski area by ski area basis."

The Management Guidelines also provide direction on Memorable Visitor Experiences and Education summarized later in Section 4.6.

2.7 Species at Risk Act

The terrestrial environment in the Lake Louise area serves as habitat for a number of Schedule 1 species listed under the Species at Risk Act (SARA). Whitebark pine are listed as endangered while woodland caribou are listed as threatened and western toad are listed as special concern species under SARA. In addition to these Schedule 1 species, wolverine is listed under Schedule 2 of SARA. The Ski Area environment is part of a core grizzly bear habitat area extending into the Skoki Valley area east of the Ski Area itself and grizzly bear have been the subject of considerable management effort at Lake Louise for many years to ensure habitat security during summer season visitor use and operational activities. Woodland caribou are believed to have been extirpated from Banff National Park in 2009 but ski srea use and development affecting the surrounding landscape may have implications for the eventual recovery of this species.

Both the Pipestone River and Corral creek, and parts of their tributaries, on and adjacent to the leasehold, support populations of Westslope cutthroat trout listed as a Threatened species in Alberta under SARA, and Bull trout, a threatened species liste provincially and by COSEWIC. The Ski Area draws surface water from both these stream systems with potential impacts to fish habitat especially during low flow fall and early winter seasons. Changes to aquatic and riparian habitat, surface drainage, wastewater or surface runoff parameters has potential to directly or indirectly affect habitat for these species.

Under SARA, prohibitions exist to protect individuals, residences and critical habitat of species listed as Extirpated, Endangered or Threatened. Authorization to enga in activities that may affect a listed species, its residence or critical habitat may be igessed for specific purposes under SARA (such as research), and under specified conditions - primarily that the activity would not jeopardize the survival or recovery of the species.

It is important to note that legal SARA requirements will always supersede policy and planning decisions including those of the Site Guidelines. It is equally important to note that the status of species and decisions made for species recovery purposes are likely to change over time. The species presented in the above discussion are not a comprehensive list of federal or provincially listed species that may be present on the ski area at the current time or in the future. Given the fluid nature of species listings, the evolving legal status of species under SARA must be tracked, and Ski Area plans updated as specific proposals are brought forward over the course of a Long Range Plan.

2.8 Cabinet Directive on the Assessment of Policies, Plans and Program Proposals

The conduct of strategic environmental assessment for federal authorities is guided by the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals* (2004). The Guidelines for implementing the Cabinet Directive indicate that federal departments and agencies have “discretion in determining how they conduct strategic environmental assessment” and are “encouraged to apply appropriate



frameworks and techniques and to develop approaches tailored to their particular needs and circumstances”. The general guidance provided on the Cabinet Directive recommends that a strategic environmental assessment should address the following considerations:

- the scope and nature of potential positive and adverse effects including cumulative effects
- the need for mitigation or opportunities for enhancement
- the scope and nature of residual effects
- the need for follow-up measures
- public and stakeholder concerns.

Early integration of the strategic environmental assessment process into existing planning, public consultation, and reporting processes is a key feature of the Cabinet Directive.



3 Public Consultation

Public engagement on the Lake Louise Ski Area Site Guidelines for Development and Use and the Strategic Environmental Assessment was planned and managed in accordance with process established in the *Ski Area Management Guidelines*. Three weeks is the standard comment period for most major public consultations in the Mountain National Parks, and is consistent with the comment periods of other federal consultations such as those required under the *Canadian Environmental Assessment Act 2012*. Parks Canada worked to ensure public awareness of public participation opportunities through the placement of ads and proactive outreach with local media, hosting of three open houses in Banff, Calgary and Lake Louise, and direct outreach with stakeholders. Consultations for the Lake Louise Ski Area draft Site Guidelines were held from June 1, 2015 to June 21, 2015 inclusive. Through this process, Parks Canada sought new information that could inform the SEA and the draft Site Guidelines as well as general feedback on the two documents.

The majority of comments on the Strategic Environmental Assessment addressed potential environmental impacts and proposed environmental gains. Some respondents felt the lease reduction and reconfiguration would provide a net benefit to the environment. These individuals saw the proposal as an example of responsible stewardship and sustainable business practices by an organization working in a national park. Most felt that relocating summer use to higher elevations would reduce human-wildlife conflict and provide grizzly bears with better access to high-quality habitat. Most supported proposed changes in the leasehold that would enhance the maintenance or improvement of the effectiveness of the Whitehorn Wildlife Corridor.

Other respondents felt the draft plan overestimated the net environmental benefit to lease reconfiguration, while at the same time remaining supportive of the return of Purple and Wolverine bowls. These respondents felt that the development of new terrain within the lease and licenses of occupation for Hidden Bowl and West Bowl offset any potential gains of lease reconfiguration. Most concerns about the development of new terrain respected the proposed development of Hidden Bowl. Many respondents expressed concern that development of new terrain currently not in the lease and expansion of existing infrastructure would be detrimental to species such as grizzly bears, wolverine, mountain goats and species at risk such as Whitebark pine and Westslope Cutthroat trout. A number of reviewers felt that proposed extension of summer visitor hours would negate potential environmental gains associated with the relocation of the summer visitor use operation.

In other comments some respondents felt the documents were deficient in baseline data, and that cumulative effects and some wildlife species such as lynx were not addressed. A few respondents raised concern about the sustainability of infrastructure, including roadways and traffic congestion, and water treatment systems and downstream water quality in relation to future ski area growth. In a number of cases it was apparent that comments were based on limited review or interpretation of the SEA or the Site Guidelines.

In response to public comment, some changes were made to the SEA to provide additional clarity on how the SEA addresses cumulative effects, critical habitat for mountain caribou, and protection and management of Whitebark pine. Additional clarity on future baseline information and environmental assessment requirements on local mountain goat populations for long-range planning was added. An additional Valued Component new section on Canada Lynx was added to the SEA, strengthening the mitigations and conclusions on managing the ski area effectively for small mammal habitat.



4 Approach

4.1 Strategic Approach

The primary objective of the SEA is to examine the Site Guidelines and present information about how potential ski area development and activity carried out within the scope of those guidelines would affect the ecological, cultural and visitor experience environments of BNP. Legislation and policy direction as described above is used to focus the SEA on the most important issues to Banff National Park and to provide a benchmark against which the potential environmental impacts of the Site Guidelines can be assessed.

The Cabinet Directive indicates that the focus of strategic environmental assessment “should be on identifying strategic considerations at a relatively general or conceptual level, rather than evaluating quantitative, detailed environmental impacts as in a project level assessment”. Accordingly, the SEA does not attempt to identify or assess all potential environmental impacts arising from ski area development and use. Instead a suite of valued components has been selected for assessment that reflects the key issues arising from legislation and policy direction. The SEA relies on existing information and research to inform the assessment process. Information gaps are identified and future information requirements are noted as appropriate.

Mitigating measures in the SEA take the form of ecological management parameters aimed at achieving expected outcomes pertaining to Parks Canada’s integrated mandate. Mitigations also take the form of planning, operational and knowledge requirements to be addressed in future long range plans and project design proposals. The SEA does not address mitigations related to potential ski area project construction or day-to-day operational or visitor use. These are addressed separately through a combination of best management practices, the implementation of an environmental management system consistent with an approved long range plan, and the environmental assessment of long range plans and other projects pursuant to the requirements of the *Parks Canada Directive on the Implementation of the Canadian Environmental Assessment Act 2012*.

4.2 Geographic and Temporal Scope

The geographic scope of the assessment encompasses both regional and local ecological scales.

At the regional scale the ski area environment is evaluated within the context of the broad mountain ecoregions of which it is a component. No one predetermined scale is defined that applies to all factors being assessed. Instead, the appropriate regional scale is defined relative to each individual valued component scoped into the assessment. At the regional scale the focus of the assessment is on important regional ecosystem functions.

The local ecosystem includes the area contained within the ski area leasehold as well as ecosystem features immediately adjacent to the leasehold that may be affected by ski area development and activity. At the local level, the ecosystem is evaluated with a particular focus on ecosystem structure and composition. Special emphasis is given to the identification of important or sensitive ecosystem features.

The existing environmental conditions at the ski area represent the cumulative impact of past projects and activities and provide the temporal baseline from which the strategic



environmental assessment will proceed. The scope of assessment extends to future projects and activities that may be presented in long range plans consistent with the Site Guidelines. The scope of assessment also includes consideration of other key centers of development and activity affecting the Bow Valley that are important from a cumulative effects perspective (see section 4.8).

Although individual project proposals may have limited life spans, overall ski area development is regarded as a permanent change to the environment and the scope of assessment considers potential environmental impacts into the foreseeable future.

4.3 Alternatives

The Cabinet Directive identifies the consideration of alternatives as one of the most important aspects of strategic environmental assessment. Alternative approaches to ski area development in the mountain parks were first considered in the development of the *Ski Area Management Guidelines*. The Management Guidelines provide both direction and limitations on potential development and use alternatives that may be proposed by any of the mountain park ski areas addressing a wide range of issues such as on-hill accommodation, development footprint, growth limits, transportation, terrain modification, water and infrastructure development and summer visitor use. While the purpose of the Management Guidelines is to limit potential alternatives to those that would not impair park heritage resources, they do allow for the consideration of “exceptions” to the established direction and limitations if a “Substantial Environmental Gain” can be shown by demonstrating a positive change in key ecological conditions:

“Exceptions to the Guidelines for facilities, parking, terrain modification limits and adjustments to the perimeter of the Developed Area can be considered if there are Substantial Environmental Gains. Exceptions will not be considered for on-hill accommodation, Growth Limits, water permits and infrastructure requirements.”

Substantial Environmental Gain is defined by the Management Guidelines as:

“An environmental gain is a positive change in key ecological conditions (wildlife movement and habitat, wildlife mortality, sensitive species/areas and aquatic ecosystems) that leads to the restoration or the long-term certainty of maintaining ecological integrity”.

The “exceptions” outlined in the *Lake Louise Ski Area Site Guidelines for Development and Use* are considered as key strategic alternatives to the limitations imposed by the Management Guidelines. The potential exceptions are identified and assessed individually throughout this strategic environmental assessment document and also evaluated as a package with a focus on cumulative environmental effects.

The consideration of alternative means of carrying out a proposed project is not addressed in the scope of the SEA. The need to consider alternative means such as locations, technologies, methods or approaches to development is identified in proposed mitigation measures throughout the SEA. Where recommended in the SEA, alternative means will be more fully considered in the development of long range plans and the associated environmental assessment.

4.4 Ecological Integrity

The *Canada National Parks Act* clarifies the meaning of ecological integrity through the following definition:



“ecological integrity” means, with respect to a park, a condition that is determined to be characteristic of its natural region and likely to persist, including abiotic components and the composition and abundance of native species and biological communities, rates of change and supporting processes.

The key threats to the ecological integrity of BNP (see section 2.5) reflect the definition and include the modification of natural processes, landscape fragmentation and loss of habitat connectivity, modification of vegetation patterns and composition, wildlife displacement, habituation and mortality, degradation of aquatic ecosystems and habitat, altered predator-prey relationships, and the introduction of exotic organisms. To address these threats the SEA focuses on desired outcomes and priorities for ecological integrity that reflect the wildlife, vegetation, terrain and aquatic concerns of importance to BNP. With respect to the potential impacts of the Site Guidelines ecological integrity will be maintained when the following desired outcomes are realized:

- Land use decisions contribute to local region ecological integrity goals including fire and vegetation management, wildlife movement, grizzly bear habitat security and species at risk protection and recovery.
- Terrestrial and aquatic habitat conditions for sensitive species including Whitebark pine, grizzly bear, wolverine, mountain goat, west slope cutthroat trout, bull trout and mountain caribou are conserved or restored.
- Habitat security is ensured by maintaining or reducing the potential for grizzly bear/human conflict, displacement and habituation
- The effectiveness of the Whitehorn Wildlife Corridor is maintained or improved.
- Vegetation is managed to reflect natural composition, diversity and patterns and maintain function of sensitive soil-vegetation complexes, including rare plants, wet soils, and alpine plant communities.
- Demonstrated leadership applied to environmental management, stewardship, monitoring and best practices.

Building on these desired outcomes and priorities, the suite of valued components selected for assessment in Section 7 represent ecological integrity issues consistent with the requirements of the *Canada National Parks Act* and the *Banff National Park Management Plan*.

4.5 Cultural Resources

The Cultural Resource Management Policy defines a cultural resource as:

a human work, or a place that gives evidence of human activity or has spiritual or cultural meaning, and that has been determined to be of historical value.

The Lake Louise Ski Area has not been fully evaluated with respect to historic or archaeological resource values (G. Langevin 2009 pers com) however there are no such resources currently known within the Ski Area leasehold. The site of Halfway Hut on the trail to Skoki lodge northeast of the Ski Area is known to have been the site of one of the largest First Nations alpine hunting camps discovered in the Canadian Rockies (Christensen 1969, Reeves 1972 in Leeson 1982). On the leasehold, certain buildings, structures and sites are nearing an age where cultural resource values may be considered. The original gondola, Whitehorn lodge, and the Peyto corrals along the Temple road are examples of historic use and development where potential historic and cultural values may warrant future consideration.



Although there are no identified cultural resource values that can be assessed through this strategic assessment process, potential cultural resource values will be addressed through Long-Range Plans and project proposals that include consideration of the following cultural resource outcomes:

- Sites and built facilities with potential cultural, historic or archaeological value are maintained and protected until cultural resource values can be determined
- Protection and presentation of identified cultural resource values are incorporated into facility maintenance and modification plans, and visitor experience and education initiatives as appropriate.

Potential impacts to unknown cultural resources, such as buried archaeological resources, are addressed as part of ski area best management practices and will be considered further as part of the environmental assessment of Long-Range plans or individual project proposals.

Given the application of the cultural resource outcomes into Long-Range Plans, best management practices, and individual project assessment and review processes, cultural resource values are not considered further as part of this strategic environmental assessment.

4.6 Visitor Experience

The operation of existing downhill ski areas including Lake Louise is appropriate in accordance with overarching direction in Parks Canada legislation, policy and plans as outlined in Section 2. Accordingly, the issue of ski area development as an appropriate park use is not considered further as part of the SEA.

As reviewed in Section 2.4 Parks Canada plans and priorities promote meaningful experiences and quality visitor services that improve personal connections to the heritage places administered by Parks Canada.

The *Ski Area Management Guidelines* provide specific direction on memorable visitor experience and education indicating that “the nature of ski area operations and visitor experiences will reflect and reinforce its location in a national park and world heritage site”. Ski areas are encouraged to “provide winter educational opportunities that focus on the heritage values of the park and world heritage site as a component of the skiing/snowboarding experience”.

In order to meet the intent of the Ski Area Management Guidelines, the Site Guidelines and the SEA focus on desired outcomes and priorities that may be affected by changes to the environment as a result of ski area development and use. Impacts to both on-hill and off-hill park visitors are considered. Desired outcomes and priorities for visitor experience in support of the Ski Area Management Guidelines include:

- Develop and maintain authentic mountain national park experiences for all visitors in all seasons at the ski area
- Ensure a balance of ski area components in order to minimize congestion and crowding and maximize memorable visitor experience and connection
- Strengthen the connection of ski area winter and summer visitors to Banff National Park and the World Heritage Site through enhanced heritage interpretation, learning and experiential opportunities



- Maintain, and where feasible, restore visual and natural viewsapes and minimize other sensory disturbance such as noise and traffic for on and off-hill visitors.

4.7 Regional Infrastructure Capacity

The Ski Area Management Guidelines indicate that increases in infrastructure capacity may be considered but that there must be sufficient capacity in place, and environmental standards must be met, before related development projects are implemented. With this expected outcome from the Management Guidelines in mind, the strategic environmental assessment will consider the implications of:

- increasing traffic levels and potential impacts to wildlife mortality, wildlife travel corridors, and public safety
- increasing water demand and potential impacts to downstream availability and water quality
- increasing demand on electrical power consumption and potential impacts or upgrades to current systems and infrastructure
- increasing demands on visitor accommodation and staff housing capacity and potential impacts to townsite systems and infrastructure.

The Site Guidelines establish growth limits that define the limits of potential build-out and require balancing of ski area components. These limits can be used to identify and evaluate the potential change in natural resource and infrastructure demand pertaining to transportation, water, power and accommodation. The focus of the strategic environmental assessment is on avoiding potential impacts first, and second, on identifying mitigations that address planning, operational and knowledge requirements for inclusion in the long range plan and environmental assessment process.

4.8 Approach to Cumulative Effects Assessment

“Cumulative effects are the residual adverse effects of the project being assessed, in combination with the adverse effects from other activities which have affected, are currently affecting, or are likely in the future to affect the same ecosystem components or cultural resources” (Parks Canada 2007). Consideration of cumulative effects is an important aspect of strategic environmental assessment and is the main focus of the strategic environmental assessment of the Site Guidelines.

Cumulative effects issues in the Lake Louise area are well known and are reflected in the important ecological issues previously identified for Banff National Park in Section 2.5. Many actions have been cumulatively taken over the years in the greater Lake Louise area to address key issues including highway traffic mortality, grizzly bear habituation and aggressive bear/human encounters, wildlife movement corridors, and restoration of natural wildfire and vegetation succession processes. Visitor management in busy centres including Lake Louise, Moraine Lake, and the Village of Lake Louise, at bear jams along highways, and for the existing summer use program at the ski area have all been successful at reducing human/bear encounters and in providing habitat security for bears and other wildlife. The CPR rail line is perhaps the last key remaining mortality hazard for grizzly bears and other wildlife has been studied as the subject of an active collaborative research program between Canadian Pacific Railway and Parks Canada. Perhaps most significantly with respect to cumulative effects, development and use in the Lake Louise area has been capped through the park management planning process, the Lake Louise community planning process, and the Outlying Commercial



Accommodation Guidelines. No significant projects or increases in regional development that would predictably compound cumulative effects issues are anticipated over the foreseeable future.

The strategic environmental assessment in its entirety is essentially a cumulative effects assessment, evaluating potential development and use under the Site Guidelines against valued components that are representative of locally relevant cumulative effects issues. Potential impacts to valued components are evaluated, in turn, against outcomes and parameters designed to ensure that cumulative effects issues are effectively addressed in both the Site Guidelines and in future Long Range Plan proposals. A three-pronged approach to cumulative effects assessment has been integrated into the strategic environmental assessment.

First, the potential cumulative effects of past and current activities are incorporated into the selection and description of the current status for each of the valued components of ecological integrity included in the scope of the strategic environmental assessment. Although cumulative effects are the main consideration for all factors throughout the strategic assessment, the SEA focuses greatest effort on cumulative effects with respect to valued components that are relevant in a regional context including:

- wildlife movement and habitat connectivity
- fish habitat and connectivity
- wildlife habitat security
- Species at Risk considerations.

Second, the assessment of regional infrastructure capacity as outlined in Section 4.7 directly addresses cumulative effects and interactions between potential ski area development activity and regional resource capacity and infrastructure. The SEA recognizes that other developments and use in the Bow Valley may combine with the potential effects of development and use at Lake Louise to exert additional stress on regional resource capacity issues.

Third, the evaluation of potential exceptions to the Ski Area Management Guidelines is focused on cumulative effects. As outlined in section 4.3 proposed exceptions are identified and assessed individually as appropriate in relation to each valued component. The exceptions are also evaluated as a package with a focus on cumulative environmental effects and interactions with valued components at the local and regional ecosystem scales.

The cumulative effects of potential ski area development are reflected in the ability of the Site Guidelines to satisfy the expected outcomes for ecological integrity, cultural resource protection, visitor experience and infrastructure capacity as outlined in previous subsections. The expected outcomes as a group reflect Parks Canada's integrated mandate and serve as the benchmark for assessing the potential implications of cumulative effects.

5 Lake Louise Ski Area Site Guidelines Summary

The Lake Louise Ski Area is a large and complex winter and summer outdoor recreation operation situated in one of Canada's most popular and iconic park settings. The Ski Area is located centrally at the conjunction of several significant mountain valleys that serve as habitat and movement corridors for a wide range of aquatic and terrestrial



wildlife species. The location of the ski area provides unique opportunities for visitors to experience spectacular scenery, wildlife and outdoor recreation activities on the edge of mountain park wilderness. The Site Guidelines are developed around a Core Concept for the ski area that links the commercial development and recreational use of the Ski Area to its position on the edge of mountain park wilderness, and that recognizes the local, regional and even international importance that the ski area plays in tourism, visitor experience and ecological integrity.

This section summarizes the key components of the Site Guidelines to be considered in the strategic environmental assessment. The reader should refer to the Site Guidelines themselves for more detailed information.

5.1 Core Concept

The Core Concept in the Site Guidelines establishes the connection between Ski Area development and use and the Parks Canada mandate. The Core Concept provides a conceptual approach for the development of the rest of the Site Guidelines and for evaluating specific ski area initiatives as they are brought forward as part of Long Range Plans. Key elements of the Core Concept include the purposeful connection of ski area services to the wild, natural environment of Banff National Park, to authentic mountain experience and education opportunities, and to infrastructure and resource sustainability.

In its approach to winter use and development, the Core Concept encourages a progression in winter recreational challenge that ranges from comfortable full-service experiences in the base area, to opportunities to progressively step into the wild of Banff National Park through access to areas that are managed for those visitors with greater independence and experience. Summer use as envisioned by the Core Concept is focused on view-from-the-edge experiences involving active learning and site-seeing opportunities and on opportunities for visitors to experience activities and events that celebrate authentic mountain culture. Architectural and design themes that reflect local mountain tradition and connect visitors to the natural environment are important elements of the Core Concept that help to engage visitors with the spaciousness and wildness of the mountain park environment in all seasons and activities. The engagement of visitors and staff in the Core Concept is realized through a culture of environmental stewardship and protection, application of best practices, incorporation of green design technologies and resource efficiency in all aspects of ski area design and operations.

The Core Concept is applied to Ski Area development and use in the Site Guidelines through a substantial leasehold reconfiguration, the development of Area Concepts, and supporting development guidelines and ecological management parameters. Consistency between the direction of the Core Concept and the rest of the Site Guidelines is a key factor in the strategic assessment of the Site Guidelines.

5.2 Leasehold Reconfiguration

The Site Guidelines provide for a series of exceptions to the Ski Area Management Guidelines in exchange for a leasehold reconfiguration that facilitates a substantial environmental gain, reducing the overall land base available for ski area development by approximately 30 percent and returning key areas under threat of potential development to designated park wilderness.

Key environmental gains associated with the leasehold reconfiguration include:



- Removing the old gondola base area, lower front side, Purple and Wolverine Bowls, Ford Hill and the Olympic West area from the ski area leasehold. These undeveloped areas encompass approximately half of the existing leasehold.

Key exceptions to the Ski Area Management Guidelines include:

- Expanding the developed area to be consistent with the reconfigured leasehold including new terrain on Richardson's Ridge apron, redevelopment of the old Prunepickers area, and new terrain immediately adjacent to Sunny T, Meadowlark and Juniper areas.
- Permit lift access from Richardson's Ridge to Hidden Bowl and Corral Slides through a restricted license of occupation, a lift and warming hut in Hidden Bowl and a winter egress trail above Corral Creek.
- Permit controlled sidecountry skiing access for properly equipped skiers to the West Bowl area through a restricted license of occupation including development of a safe skier egress trail, and avalanche control operations.

Together the suite of gains and exceptions are intended to achieve several purposes that align with visitor experience and long term ecological integrity:

- Facilitates ski area improvements within existing leasehold, but outside of existing developed area, including imbalances in beginner and intermediate terrain
- Facilitates increases in visitor use and demand that are reasonably associated with regional population growth and climate change trends
- Facilitates long term environmental security of key areas long important to Parks Canada
- Addresses key aspects of the Core Concept including step-into-the-wild experiences and changing industry dynamics such as side-country experiences.

Parks Canada considers that the removal of the gondola base, lower front side and Purple and Wolverine bowls represent a significant environmental gain consistent with the Ski Area Management Guidelines by providing long term certainty that these areas will not be developed in the future. Purple and Wolverine bowls have long held ecological significance to Parks Canada, while the lower areas of the leasehold being returned to Parks Canada provide long term security to the function of the Whitehorn wildlife corridor.

The increase in developed area, lift access in Hidden Bowl and the potential operation of sidecountry skiing in West Bowl, both under license of occupation, represent exceptions to the Ski Area Management Guidelines that can be permitted following the reconfiguration of the leasehold.



Several other exceptions are also considered in the Site Guidelines including:

- Development of a new lodge on Eagle Shoulder at the Top of Grizzly Gondola under condition of moving the summer use operation to the upper slopes of Whitehorn mountain above key Grizzly bear habitat
- Development of water storage reservoirs adjacent to Pipestone and Corral creeks on condition that fish habitat conditions are improved during key times of water extraction and low in-stream flows
- Significant terrain modification in key areas to reduce congestion and thereby improve visitor safety.

While these exceptions are all associated with inherent environmental gains as outlined, they may only be considered in association with leasehold reconfiguration.

5.3 Development and Use Capacity

The Site Guidelines identify permanent, negotiated, growth limits for the developed area, ski terrain and commercial space at Lake Louise in accordance with the Management Guidelines. Although expansion and other development may take place the capacity of the ski area will be permanently capped through the growth limits. Capacity will be established as follows:

- the current ski area lease of ~2190 hectares will be reduced to ~1158 hectares
- the developed area will be consistent with the reconfigured lease at ~1158 hectares
- limited development of new ski terrain outside the lease under license of occupation may be considered in West Bowl and Hidden Bowl ~356 hectares
- total ski terrain capacity will be established at ~1514 hectares including the lease and licenses of occupation
- design capacity of 11,500 skiers a day will be applied to the balancing of other resort elements including lifts, parking, power, water, and wastewater capacity representing a 48% increase in potential design capacity
- commercial space will be capped at 17,000 m² in accordance with the design capacity.

These figures define the limits of maximum potential build-out for the ski area.

5.4 Area Concepts

The proposed reconfiguration of the ski area leasehold and surrounding licenses of occupation encompass a landscape with significant variation in elevation and terrain. As a result, different environmental conditions, and different types of potential visitor experience opportunities are found across the Ski Area. The Area Concepts in the Site Guidelines describe a vision and provide the basis for boundary delineation, development capacity, and the types of development, visitor use, and management that may be considered for a given area, based on its environmental characteristics and visitor experience opportunities.

Base Area

The Base Area serves as both the operational hub for the ski area and as the welcome centre and staging area for all visitors in all seasons. Development at the base area facilitates access for skiers and snowboarders, provides recreational and learning opportunities for novice, beginner and family skiers and snowboarders, and serves as the staging area for winter sports events. Non-skiers have opportunity to experience



alternative winter recreation activities or to simply enjoy a comfortable mountain lodge setting. In the summer the Base Area is the staging area for the summer use site-seeing and learning programs offered by the ski area. Summer learning opportunities are available in and around the Base Area itself while more adventurous visitors are encouraged to access the upper mountain experiences through the ski area gondola. While the Base Area must be capable of facilitating high intensity use, mountain architecture and a sense of space are important elements of facility design and visitor experience, connecting visitors to the location in the mountain parks.

Key elements of the Base Area concept important to the Strategic Environmental Assessment include:

- Expansion and modification of existing parking lots to accommodate approved development and use capacity limits
- Integrated parking and ski area transportation strategies that facilitate approved visitor capacity while reducing congestion and improving visitor experience
- Alternative winter access nodes to the ski area including remote parking lot ticket and lift access, and skier conveyance such as people mover lifts or shuttle systems from distant parking areas to the main day lodge
- Day lodge renewal and expansion to accommodate approved capacity limits
- New winter outdoor recreation activities and supporting infrastructure for non-skiing visitors such as pleasure skating rinks, tube parks or ice climbing walls
- Outdoor recreation activities such as snowshoeing within the lease or avalanche safety courses may be staged from the Base Area
- Improvements to summer season visitor learning opportunities, personal and non-personal interpretative media and program development that focus on Rocky Mountain wildlife
- Special events that integrate with and enhance the visitor experience offer in the greater Lake Louise community such as the larch festival or other events with clear connection to authentic mountain recreation, environment or culture
- Managing operations at the old gondola base area below the Whitehorn access road as needed under a license of occupation; old and unneeded infrastructure such as the old gondola towers, buildings and base structures will be removed if no longer required
- Water withdrawal, supply and snowmaking infrastructure will remain in the old gondola base area; alternate water sources or management systems that will provide secure water supply may be considered
- Use of the old gondola base area for off-season storage; the old gondola base building may be renovated or replaced for storage purposes
- Use of the old gondola base area for special event and public transportation support such as bus parking.

Whitehorn Front Side

The Whitehorn Front (west) Side features the overall highest intensity use and development on the ski area both winter and summer. The intensity of use on the front side makes the balance and distribution of lifts and ski terrain, consistent with industry standards, desirable from the visitor experience perspective, and important from a safety standpoint. Frequent wildlife use presents an opportunity for visitors to view and experience wildlife, while at the same time presenting the challenge of effectively limiting wildlife disturbance and habituation associated with development and visitor use. Ski runs, glades, lifts and other infrastructure on the lower mountain are designed and



managed to facilitate effective wildlife movement and provide suitable habitat. The ski area summer use program on the upper edge of the subalpine zone is managed to enhance wildlife habitat effectiveness and limit potential impacts to resident grizzly bears through seasonal and daily timing restrictions, and visitor management protocols. Learning opportunities such as interpretive self-guided walking routes, or wildlife viewing from designated areas, or guided hikes provide opportunities for visitors to experience environments and viewscapes that are not easily accessible from other areas of the Bow Valley.

Key elements of the Whitehorn Front Side concept important to the Strategic Environmental Assessment include:

- Development of new terrain including :
 - Expansion of the Sunny T beginner area to the southeast
 - Expansion of the Juniper area to the northwest
 - Parallel existing Meadowlark run with infill run to the north and a new run to the south.
- Buildings
 - Develop a new lodge on Eagle Shoulder that will be used to replace summer use at Whitehorn lodge and other mid-mountain locations
 - New warming hut at the top of Top of the World lift.
- Terrain modification – alpine
 - Improvements to Sunset and Home Run ski-ways; installation of removable structures to widen ski-ways and improve safety without significant cut and fill
 - Summit Ridge – selective rock removal to improve safety from the notch through Paradise and East ridge
- Major Terrain modification – subalpine
 - Various alternatives may be considered through Long Range Plans where enhancing skier safety or environmental protection
- Run reconfiguration
 - Re-cutting or reconfiguration of existing runs or glades
 - Clearing new runs in the Meadowlark and Juniper areas
- Summer Use
 - Use of gondola for summer visitor access to new Eagle lodge
 - New trails to Whitehorn ridge at or above treeline from the new Eagle lodge
 - Discontinuation of summer use below Eagle lodge.

West Bowl

West Bowl provides an opportunity for adventurous skiers and boarders to access natural, ungroomed snow conditions when snow and avalanche conditions are favorable while remaining close to the developed ski area. Management and development in West Bowl is minimal reflecting the desired adventure experience of stepping into the wild, ensures that sensitive alpine vegetation and Whitebark pine communities persist, and limits intrusion into the Whitehorn Wildlife Corridor. Ski patrol and basic avalanche control work do take place but users are made aware of heightened hazard levels and need for self-reliance. Fencing and signage are used to inform and warn skiers that they are entering a largely uncontrolled environment, to require the personal use of avalanche safety equipment, and provide information on required skill level and egress. Otherwise physical development in the upper bowl is limited to small structures such as rails or steps, or minor terrain modification such as creating rock steps to facilitate safe foot access to the bowl from the ridgetop.



Egress from West Bowl is attained by descending through steep chutes to an egress trail that returns to the developed ski runs above the base area. The groomed egress trail is located and designed, including vegetation management, rope fencing, and information signage, to facilitate convenient egress and emergency access while discouraging skiers from descending further into the Whitehorn wildlife corridor below. Visitor experience and education are enhanced through guiding or instructional programs on avalanche safety and backcountry snow adventure.

Key elements of the West Bowl concept important to the Strategic Environmental Assessment include:

- Facilitated access to the West Bowl area and further along the northwest ridge of Whitehorn Mountain
- Gated access into the upper bowl from Whitehorn ridgetop; requirements for backcountry and avalanche gear
- Avalanche control operations
- Development of a groomed skier egress and snow machine access trail leading back to the ski area.

Whitehorn Back Bowls

The Mount Whitehorn Back Bowls capture wind-blown snow from the front side and quality ski and boarding conditions can be found days after a snow fall when fresh snow on other parts of the ski area have been exhausted. Compared to industry standards, a low density of lift development and preponderance of advanced and expert terrain result in less intensive skier use that maintains the conditions that the advanced and expert skier markets seek. The back bowls are managed for winter use only. In keeping with the desired sense of adventure there are no lodge-based services. Less skilled skiers and boarders can access the back bowl experience through existing ski ways and runs that take them safely to the valley bottom. Maintenance of natural terrain, natural snow conditions, and snow farming are the preferred and dominant methods of managing ski conditions, supplemented only as necessary with limited grooming, snowmaking and terrain modification. Where needed to maintain safety and skiable terrain, glading and vegetation management mimic natural conditions; cleared ski runs through forested areas are not evident.

Key elements of the Whitehorn Back Bowls concept important to the Strategic Environmental Assessment include:

- Development of a backside lift returning skiers directly from upper Pika Creek valley to Whitehorn summit area
- Development of a lift accessing Richardson's Ridge from the Whitehorn Back Bowls valley bottom – this lift primarily provides access to Hidden Bowl
- Minor terrain modification and installation of removable structures to widen the Wounded Knee ski-way and improve safety without significant cut and fill measures
- Major terrain modification to reduce the severity of steep drops and exposed rocks in the Hell's Kitchen area
- A combination of run clearing or glading, and stream channel crossing structures to reduce skier congestion through the Hump and Hump By-Pass area.



Temple side

The Temple side experience is centered at Temple lodge where the Larch, Ptarmigan and Richardson's ridge ski pods address a key ski area need by providing varied terrain for beginner and intermediate boarders and skiers, and contributing to the overall balance of skiable terrain. While the focus of development is on less experienced visitors, the development of glades, bumps and steeps provide challenge for improving skiers and alternatives for more advanced skiers and boarders when weather and snow conditions on the front side or in the alpine bowls are unfavorable. Facilities and infrastructure for skiers and snowboarders are designed to reflect historic, traditional backcountry use and development. Wood and log construction and rustic design, whether fences, rails, signage, bridges, or support buildings such as lift shacks and operational buildings, contribute to the desired experience.

Key elements of the Temple Side concept important to the Strategic Environmental Assessment include:

- Development of a new ski pod on the south end apron of Richardson's Ridge targeted primarily at beginner and intermediate skier groups
- Re-development of the former Prunepickers ski pod to provide beginner terrain and return access to the Richardson's Ridge pod from Temple lodge
- Expansion of Temple lodge to accommodate increased terrain capacity created by Richardson's Ridge, Prunepicker's and Hidden Bowl pods.

Hidden Bowl

Hidden Bowl provides a back-bowl type of experience for intermediate to advanced skiers and boarders who are seeking natural snow and terrain conditions. Development and use of Hidden Bowl is designed and managed in such a way that key visitor experience, wildlife and wilderness values are maintained for winter and summer users including those visitors accessing the Skoki area and Hidden Lake valley. Low visibility and low environmental impact ski lifts provide access to the top of Richardson's Ridge from the Whitehorn side and facilitate low density lift skiing on the Hidden Bowl side. A winter-only trail provides the main egress for skiers as well as operational access.

Key elements of the Hidden Bowl concept important to the Strategic Environmental Assessment include:

- Access to Hidden Bowl from Richardson's Ridge summit ridge lift in Whitehorn Back Bowls area
- Development of an in-bowl lift returning Hidden Bowl skiers to Richardson's Ridge from Hidden Bowl flats or Corral creek valley
- Development of a skier egress and snow machine winter roadway above Corral creek connecting to the ski area above Temple Lodge
- Selective tree clearing within historic Corral creek avalanche paths and glading above the egress trail to improve and maintain ski lines
- Development of a warming hut to provide shelter and basic services to Hidden Bowl skiers.

5.5 *Ski Area Operations, Infrastructure and Environmental Stewardship*

The Site Guidelines allow for the potential improvement and modification of the existing snowmaking and snow farming system at Lake Louise subject to established water



withdrawal limits. Specific potential improvements and modifications considered within the scope of the Site Guidelines include:

- Expansion of the area serviced by snowmaking
- Review of water withdrawal limits and parameters
- The use of snowmaking nucleating additives
- Use and modification of permanent snow fencing.

Potential exceptions considered under the site guidelines include:

- Construction of a new snowmaking water reservoir at the former gondola base near the Trans-Canada highway
- Construction of a water reservoir in the Temple area.

The provincial power grid is the power source for the ski area. As local power stations near capacity there is a level of uncertainty about the capacity of the system to handle potential growth in the community and at the ski area.

Drinking water requirements are met by water withdrawal from the Pipestone and Coral Creek. Waste water is piped from the ski area to the Lake Louise community treatment plant. The combination of increased snowmaking and increased visitor use is likely to increase demand and pressure on water and wastewater systems.

Likewise a growing ski area will likely require more staff. Pressure on staff accommodation and on Lake Louise Village infrastructure must be considered as part of future planning and is pertinent to the Strategic Environmental Assessment.



6 Description of Environment

6.1 Regional Landscape

The majority of the Lake Louise Ski Area is located on Whitehorn Mountain just east of the Trans-Canada Highway and the Village of Lake Louise. Both sides of Whitehorn Mountain are developed and managed for skiing and snowboarding including southerly slopes dropping into the Corral Creek Valley. Ski area development also extends onto the lower slopes of Mt Lipalian to the southeast of Corral Creek. Access to the ski area from the Trans-Canada Highway begins with a short section of the Bow Valley Parkway (Highway 1A) before veering to the north becoming the Whitehorn Road. The base area parking, lodges and lifts are located slightly above the 1600m level on a relatively level bench above the Pipestone River.

The developments and infrastructure of the greater Lake Louise area including the Village and the Ski Area are found at the confluence of several significant mountain watersheds with the Bow River valley. The Lake Louise area itself marks the nominal divide between the middle and upper reaches of the Bow River. The Pipestone River, and Corral and Baker Creeks converge on the Bow River Valley from the east while drainages from Kicking Horse Pass, Lake Louise and Moraine Lake valleys enter from the west. Of particular relevance to the ski area are the Pipestone river and Corral Creek which respectively run adjacent to, or through the ski area, serve as the water supply to the ski area and are important fish habitat for the SARA listed Westslope cutthroat trout and Bull trout.

These same valleys serve as key wildlife corridor routes linking key area of habitat within Banff National Park and across the provincial border into British Columbia. The Whitehorn wildlife corridor on the east side of the Trans-Canada Highway traverses the access road and the lower slopes of the ski area serving as a main connecting route for wildlife moving up and down the Bow Valley. The Pipestone valley provides a broad low elevation movement route for animals moving north and east into remote areas of the park while the Corral Creek and Baker Creek valleys provide higher elevation connections to the Red Deer Lakes area and through to the eastern slopes of the Rockies. While many wildlife species may make use of these natural movement corridors the movement of Grizzly bear, wolf, and formerly caribou, are particularly important to regional distribution of wildlife and predator/prey relationships.

Whitehorn and Lipalian mountains lie on the western edge of the Slate Range above the Bow Valley. The Slate Range, bounded by the Bow, Pipestone and Little Pipestone valleys to the west and north, and by Baker Creek to the south and east, features an ecological complex of high elevation upper subalpine and alpine habitats, lakes and streams, central to the requirements of a number of wildlife species. Together with the rest of the greater Lake Louise area, the Slate Range functions as one of four core Grizzly bear reproductive areas in the park. Minimizing the potential for human-bear conflict and providing secure habitat for Grizzly bears are key objectives of the park management plan. A small mountain goat population inhabits the Slate Range including seasonal use of areas on the periphery of the developed ski area such as Purple and Wolverine bowls and the Hidden Lake area. Mountain caribou formerly used portions of the Slate Range and adjacent valleys as winter habitat secure from wolf predation. The Lake Louise area, including the front side of the ski hill, is one of three known nodes of important lynx habitat within Banff, Yoho, and Kootenay National Parks. These habitat nodes are important because lynx may be able to persist here even during prey population



fluctuations and because these nodes may provide a source of dispersing animals to other areas. Wolverines may include portions of the ski area within their very large home ranges. Mountain caribou, as recently as 2009 used portions of the Slate Range and adjacent valleys as winter habitat secure from wolf predation.

The ecological values of the greater Lake Louise area contrast sharply with the intensity of human use. Nowhere else do so many people and so many bears use and occupy the same space. In addition to the front side of the ski area, human presence in the Bow Valley includes the Village of Lake Louise, a major campground, two of the most visited sites in the Canadian Rockies - Lake Louise and Moraine Lake - and national rail, highway and power line corridors. The Skoki area at the core of the Slate Range is one of the most popular backcountry hiking and camping destinations in the mountain parks and is accessed from the Temple road and trails that run through the ski area lease. Historic Skoki lodge is also located in the Skoki backcountry area. Despite this level of use and development the Lake Louise region is renowned for spectacular mountain scenery, hiking and mountaineering opportunities, wildlife viewing, and a wide variety of tourism accommodation and services including those of the Lake Louise Ski Area.

6.2 Local Landscape

The local landscape of Lake Louise Ski Area includes the existing ski area lease as well as the mountain ridges and valleys immediately adjacent. The existing ski area lease spans a wide variety of terrain, elevation and aspect on Whitehorn, Lipalian, Redoubt Mountains and outlier ridges and summits including Richardson's Ridge, Wolverine Ridge and Purple Peak. Most of the front side of the ski area on Whitehorn Mountain falls within the lower Pipestone River water shed, while the rest of the existing lease falls within the Corral Creek watershed including significant side valleys featuring tributary streams from Purple bowl, Wolverine Bowl and Pika Creek Valley.

The Pipestone River and Corral Creek are significant watercourses featuring both native and non-native fish populations. Two at-risk fish species inhabit these streams; the SARA listed Westslope cutthroat trout and the provincially listed Bull trout. Tributary streams and water bodies in and adjacent to the ski area play a large part in the hydrologic regime especially in the Corral Creek watershed. Surface flows from Pika, Wolverine and Purple creeks, from small lakes in Hidden Bowl, and from Hidden Lake itself, cumulatively supply a significant portion of the flow necessary to sustain fish populations in Corral creek. Many smaller surface and subsurface water flows also likely contribute significantly to the total volume and timing of surface flows in Corral Creek. Low angle basins in Purple and Wolverine bowls and at other scattered locations within the ski area, capture snowmelt and surface runoff and slowly release water to surface waters. These slowly released subsurface flows may be particularly important to sustaining surface flows in Corral Creek during times of low precipitation.

Vegetation on the ski area is very diverse reflecting changes in elevation, slope and aspect, surface and subsurface water sources and the soils complexes that have developed as a result of these conditions. Relatively dry Lodgepole pine forests of the lower elevation slopes on the front side give way with elevation to upper subalpine forests of white spruce and fir. Higher elevations and cooler, moister aspects support mature larch forests primarily on the backside of Whitehorn but also at higher elevations on Richardson's ridge and in the Larch area. Whitebark pine, a SARA protected species occurs primarily within an elevation band in the upper subalpine across the front side of Whitehorn Mountain. At higher elevations forest vegetation transitions to subalpine and



alpine grasslands and meadows. The local landscape includes a number of alpine bowls; West, Purple, Wolverine and Hidden Bowls and the back-bowls of Whitehorn Mountain, that each feature unique ecological and vegetation conditions. At lower elevations the prevalence of water bodies and watercourses result in significant amounts of riparian forest and meadow vegetation. The upper reaches of Corral Creek to the east of the ski area leasehold feature significant areas of sedge meadows, saturated soils and even a small fenland. The significant diversity of the local landscape provides habitat for a significant number of rare and sensitive plant species at different locations both on and around the existing ski area.

The size and variation of ecological landscape across the ski area means that habitat conditions exist supporting virtually the entire range of wildlife species in the mountain parks. Lynx and coyote, as well as a full range of ungulates are year round residents of ski area forest environments. Some wolverine include the ski area within their home ranges and are occasional visitors. Both black and grizzly bears utilize the forests and open meadows of the ski area. Cleared ski runs actually enhance the availability of food sources for bears making these areas particularly important in early summer season. Female bears and cubs may use the ski area as secure habitat from aggressive males with the proximity of ski area development and human use acting as a deterrent to male bears. At higher elevations Bighorn sheep use subalpine forests and alpine ridges during the summer season. Snow free slopes on the south side of Lipalian Mountain may serve as wintering habitat for local herds. Mountain goats were once more prevalent on and around the developed ski area utilizing a wide range of habitat including a mineral lick in the Purple and Wolverine bowl area. Mountain goat presence within the developed ski area has disappeared and local observations have declined since the 1980's. Recent observations however, confirm that mountain goats continue to use the Hidden Lake area and small groups up to several individuals are occasionally observed on other areas adjacent to the developed ski area including Wolverine and Purple bowls and Mt Redoubt.

Current and proposed use and development for the Lake Louise Ski area has been discussed in detail in Section 5. However there is also significant visitor use in areas immediately adjacent to the ski area. The winter season sees significant backcountry use from skiers and snowboarders. Some of this use originates as a result of sidecountry use by patrons of the ski area. Some of the use comes from skiers moving through the ski area to popular backcountry areas such as Skoki or Hidden Bowl or as part of touring routes such as the Pumpkin Traverse around Mt Redoubt. Improvements in ski gear and the popularity of ski media have driven recent trends in increased sidecountry and backcountry use from ski areas.

In the summer season Hidden Lake and Hidden campground, accessed through the ski area, are some of the busiest sites in the Banff backcountry. Virtually all access to the popular Skoki area uses the same access route to the point of Halfway Hut. Backcountry visitors park at the Fish Creek trailhead and must walk a considerable distance along the Temple access road through the ski area before gaining the Skoki trail above Temple lodge. Other than the use of these designated trails there is little backcountry access from the ski area in the summer.

Summer visitor use on the ski area is significant in numbers but limited to designated areas and trails on the front side of Whitehorn Mountain. Considerable effort in the past has gone towards managing and monitoring bear/human interactions in and around the ski area. Management protocols and predictable patterns of spatial and temporal use



applied to visitor and ski area operational use have been successful at preventing significant human/bear encounters for many years. The management system serves as a successful example of how visitor use and bears may coexist within relatively close proximity. The success of the bear program at Lake Louise provides safe opportunities for bear viewing and highlights importance of current management protocols and management approaches. While the bear program has been successful to date, there is a potential need for current and improved knowledge on the impacts of human use and development on other sensitive species such as Mountain goats and wintering Bighorn sheep populations.

6.3 *Climate Change*

The potential impacts of climate change on winter recreation, national parks and the ski industry in western Canada have been researched and documented by Scott and Suffling 2000, Scott and Jones 2005, and Scott and Jones 2006. The research in these papers outlines broad scale climate change scenarios developed from the application of General Circulation Models; three dimensional mathematical models that simulate the large-scale physical processes governing the global climate system.

Climate scenarios for the 2020s predict reduced snowfall and higher melt-rates as a result of warmer temperatures, reducing the natural snow pack at lower elevations (~1,600 m – the approximate base elevation of Lake Louise Ski Area). The predicted reduction in natural snow pack could potentially result in marginal conditions necessary to support ski operations at lower elevations during some winters. Efficient snowmaking systems would be required to ensure adequate snow conditions near the base of ski runs, especially in early season. While low early season snowfall has been an on-going issue at Lake Louise for many years, warming temperatures, low snow, and early season rain events are predicted to occur more often by the 2020s.

By the 2050's, average natural snow depth at low elevations (1,600 m) is predicted to be reduced by over 50% throughout most of the winter tourism season under most climate change scenarios and becomes largely unsuitable for ski operations unless augmented with snowmaking. However, average temperatures will predictably remain below freezing, making snowmaking operations feasible from a technical standpoint. With snowmaking factored in, average ski seasons at low elevations are projected to be 7% to 15% shorter in the 2020s. Predictions for the 2050s are far more variable, ranging between a minor reduction of 9% in average ski season length, to a 43% reduction under the warmest scenarios.

The findings of research based on General Circulation Models is supported through more recent fine scale modelling at the sub regional level conducted by Schneider (2013). Schneider's modelling predicts patterns similar to the general models including increases in mean annual temperature, and mean annual precipitation with most of the precipitation increase coming in spring and fall seasons. The duration of winter snow cover will likely be shortened and summer conditions could be significantly drier. For the Rocky Mountain ecological sub region vegetative communities may be expected to blend and shift over time to higher elevations.

The predictions of lower natural snowfall, warmer temperatures and shorter ski seasons have been recently supported by Reynolds (2010) in research conducted on the ski industry. Reynolds notes that there may be insufficient reliable natural snow cover in the future, at both high and low elevations to maintain quality ski conditions, unless



snowmaking is able to maintain snow cover and the length of the ski season. The future success of ski areas depends on snowmaking, which in turn relies on a sufficient water supply. While climate predictions include increases in overall precipitation levels for Banff, in combination with other factors such as temperature change and snowmelt, it is not clear that changes in precipitation will affect water availability for snowmaking or potable use at Lake Louise Ski Area one way or another.

In summary, warming climate is expected to affect the length of the winter ski season, onset of temperatures and elevations appropriate for snowmaking, timing and state of precipitation, peak and low flows in streams, stream temperatures, forest wildfire and disease risk, avalanche patterns, timing of onset and emergence from hibernation for bears and a potential range of shifts in vegetation affecting a variety of wildlife species. These shifts present operation and environmental management implications that will have to be considered in reaching viable ski area planning and development decisions.



7 Valued Components for Environmental Assessment

The valued components (VCs) selected for assessment represent the expected outcomes associated with maintaining ecological integrity, visitor experience and infrastructure capacity outlined in Section 4. Consistent with the approach to the assessment outlined in section 4.1, the VCs selected for evaluating ecological integrity function as indicators of known threats and are associated with maintaining ecological integrity. Expected outcomes for visitor experience and infrastructure capacity can be evaluated directly and do not require an indicator approach for the purposes of this SEA.

7.1 *Valued Components of Ecological Integrity*

VCs for evaluating ecological integrity were chosen based on known ecological issues related to past ski area development and in consultation with BNP science staff. The following criteria were applied to identify the VCs used to evaluate potential impacts to ecological integrity. As a group the VCs:

- Reflect known threats and cumulative effects to Ecological Integrity
- Serve an “umbrella” role where protecting the valued component will inherently protect other ecological values
- Are likely sensitive to ski area development and activity
- Reflect both local and regional ecosystem scales
- Represent a broad range of biodiversity and cumulative effects concerns including vegetation, soils and terrain, aquatic systems and wildlife

The VCs selected to evaluate the potential implications to ecological integrity are:

- Native vegetation with a focus on forest structure, fire disturbance regime, White bark pine, rare and sensitive species, and alpine bowl habitat
- Wildlife species and habitat including consideration of Grizzly bear, Mountain goat, Wolverine, Canada lynx, and recovery of Mountain caribou
- White Horn Wildlife Corridor with a focus on wary carnivore movement e.g. bears, wolves, wolverine
- Aquatic Ecosystems with a focus on Westslope Cutthroat and Bull trout, surface and subsurface flow regimes, riparian habitat, fens/tarns/ponds, and water quality.

7.2 *Valued Components of Visitor Experience*

VCs for the evaluation of potential impacts to visitor experience directly reflect the visitor experience quality objectives outlined earlier in section 4.6. The potential impacts to visitor experience will be evaluated with respect to the following VCs:

- Safe, comfortable and enjoyable visitor experience
- Visitor education
- Viewsapes and aesthetics
- Compatibility of visitor use
- Visitor perception and wilderness character.

7.3 *Valued Components – Regional Infrastructure Capacity*

VCs for the evaluation of potential impacts to regional infrastructure capacity directly reflect the expected outcomes of the Management Guidelines outlined earlier in Section 4.7. The potential impacts to regional infrastructure capacity will be evaluated with respect to the following VCs:

- road and transportation system capacity
- water supply and demand



- downstream water quality
- electrical supply and demand
- visitor and staff accommodation capacity.



8 Impact Assessment – Ecological Integrity

Each valued component of ecological integrity is discussed below with respect to:

- the current status and ecology of the VC in relation to the local and regional ecosystems
- existing and potential interactions between ski area development activity and the VC, and the resulting potential impacts
- knowledge requirements that are important to current and future management decisions.

Mitigations are presented as ecological management parameters, long range planning and/or operational parameters, or environmental assessment and information requirements that contribute to the realization of expected ecological outcomes. Ecological management parameters developed through the Strategic Environmental Assessment were incorporated directly into the Site Guidelines.

Residual environmental effects – those remaining after the successful implementation of mitigation – are identified and evaluated in terms of the potential cumulative effects on the VC as a result of all ski area development activities. The impact assessment of each VC concludes with a discussion on the cumulative potential to realize expected ecological outcomes associated with the VC as a result of implementing the Site Guidelines.

8.1 *Whitehorn Wildlife Corridor*

Current status

Wildlife corridors, or landscape linkages, are widely considered to serve important roles in wildlife conservation (Chester et al. 2013, Lidicker and Koenig 1996). Animal use of wildlife corridors can be categorized into several types along a continuum from short, localized movements to long-distance movements over 10s or 100s of kilometers. Short term movements occur as animals strive to meet their daily foraging and other life requirements. Medium and longer distance movements occur as part of seasonal migrations to access food resources and mating/reproductive opportunities, and for dispersal required to maintain gene flow or to colonize unoccupied habitat patches (Chester et al. 2013).

According to some definitions a wildlife corridor facilitates movement but does not provide habitat for breeding populations of the species of concern (Lidzicker, Jr. and Koenig 1996). However, corridors may also serve as landscape “linkages” providing habitat for resident animals while also facilitating movement across the landscape (Chetkiewicz et al. 2006, Turchin 1998). Thus, corridors are not just strips of non-habitat that animals travel through quickly to get from one patch of habitat to another; animals may need to forage, avoid mortality, find resting places, and avoid human disturbance while moving across landscapes at any scale (Chetkiewicz et al. 2006). Accordingly, for the purposes of this SEA, wildlife corridors are considered to be “...spaces in which connectivity between species, ecosystems, and ecological processes is maintained or restored at various levels” (Anderson and Jenkins 2006).

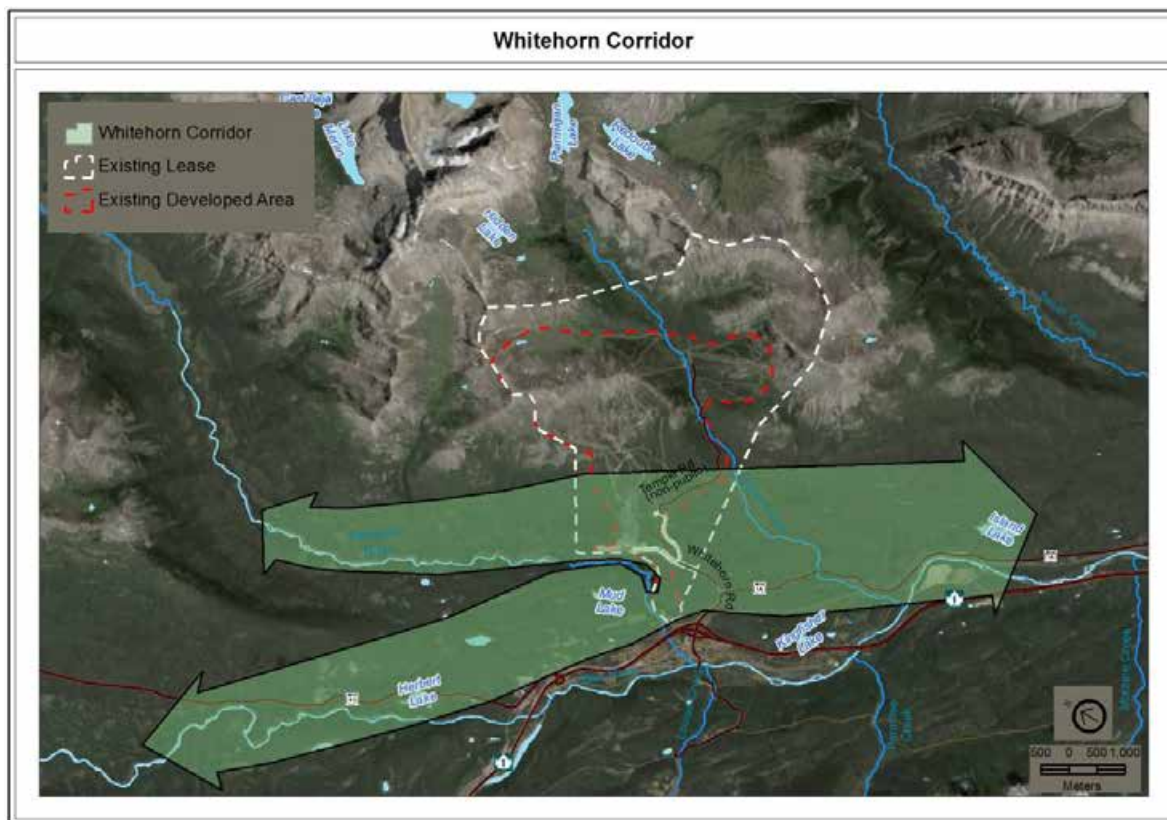
Multi-species wildlife corridors adjacent to developed areas are more likely to be successful if they are sufficiently wide to buffer animals from disturbance, have flat topography, and retain sufficient vegetation cover to provide security for animal movement between habitat patches (BCEAG 2012). It is difficult to prescribe a particular corridor width that will serve for all species of concern, but research has shown that wary



mammals such as grizzly bears, wolves, and wolverines may exhibit avoidance behavior at distances of 1-2 km from a source of disturbance. Clevenger et al (2002) have highlighted the importance of minimizing human disturbance at crossing structures intended to facilitate animal movement across highways. At the same time there is considerable evidence illustrating that even sensitive and wary wildlife species may readily inhabit and move through both natural and modified landscapes that do not even closely match idealized conditions.

In the Lake Louise area, the Bow River valley and the lower reaches of its main tributaries provide natural movement routes along the valley bottom and adjacent slopes for many species of large and medium-sized animals due to gentle terrain, relatively low snowfall, and suitable habitats (Tremblay 2001). In addition to facilitating animal movement at local scales, the Bow Valley in the Lake Louise area is considered important for ecological connectivity at large spatial scales, occurring as it does at the confluence of several major drainages (upper Bow Valley, middle Bow Valley, Pipestone River, Bath Creek, and Corral Creek). For example, wildlife movement corridors along the Bow Valley allow wildlife to move through the Lake Louise area to Kicking Horse Pass, 8 km west of Lake Louise on the Yoho National Park boundary. As one of only a few low-elevation, forested passes across the continental divide, Kicking Horse pass provides important wildlife habitat connectivity between British Columbia and Alberta. The Bow Valley also connects to major north-south drainages, such as the Pipestone/Siffleur Valleys and the Mistaya Valley, providing ecological connectivity to the North Saskatchewan drainage and, ultimately, Jasper National Park.

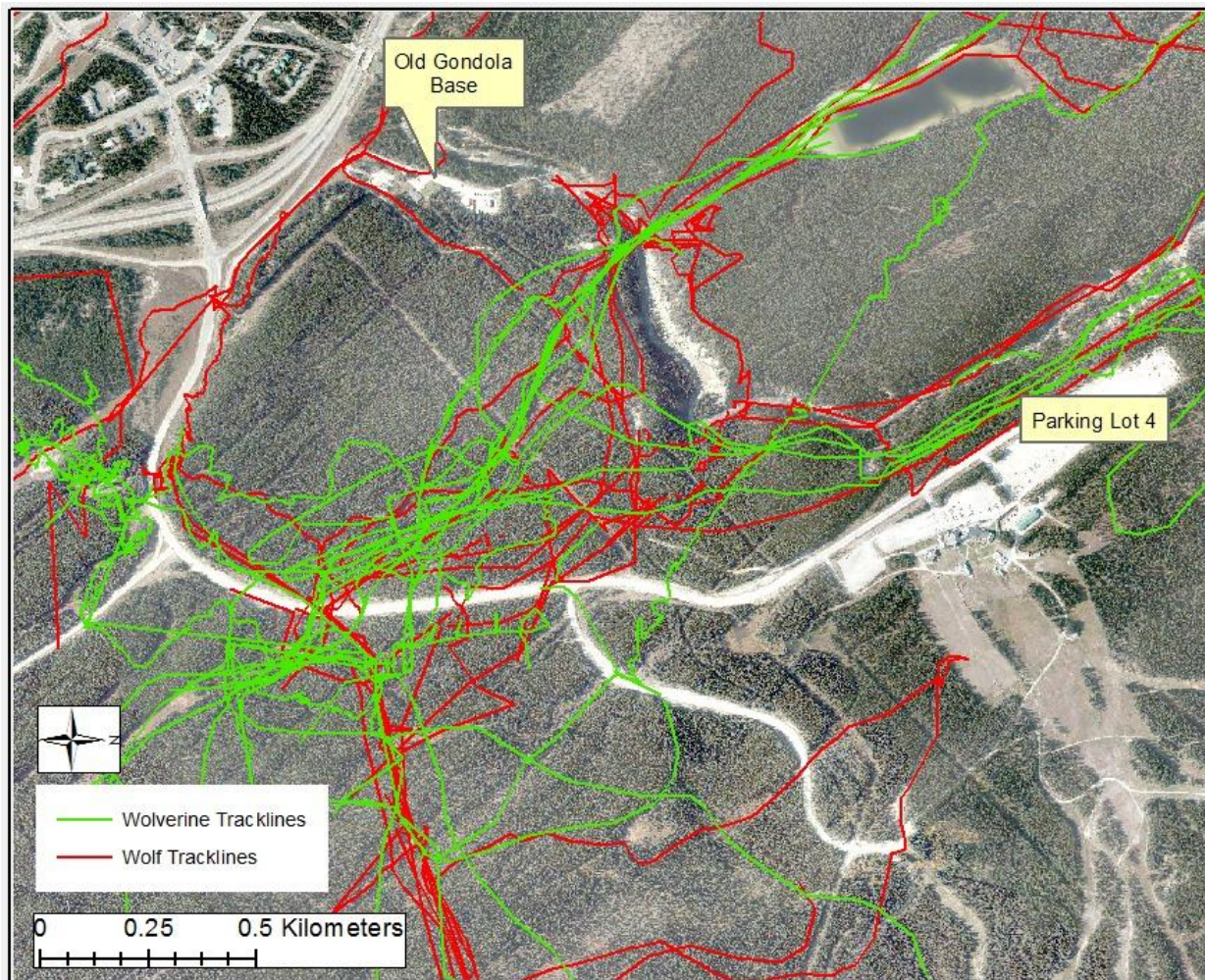
Several distinct wildlife corridors have been identified in the Lake Louise area (Percy 2006, Tremblay 2001). The Whitehorn Corridor is the primary wildlife movement corridor located on the northeast side of the Bow valley. The Whitehorn Corridor is bounded by the Trans-Canada Highway (TCH) and the forested mid-slope of Whitehorn Mountain. The Fairview Wildlife Corridor, located on the southwest side of the valley between the TCH and Upper Lake Louise, is also an important movement corridor. The two corridors run approximately north-south along the Bow River in the Lake Louise area and extend southward toward Castle Junction. The Whitehorn Corridor splits into two forks north of Lake Louise – one following the upper Bow River and the other following the Pipestone River (Map 1). Both corridors are characterized by undulating terrain, and are forested with lodgepole pine, Engelmann spruce and sub-alpine fir. Several small, scattered ponds and meadows provide additional habitat diversity within the Whitehorn Corridor. The Whitehorn Corridor has higher use levels by most large mammals than does the Fairview Corridor (Tremblay 2001, C. Apps, pers. comm.)



Map 1: The Whitehorn Wildlife Corridor in the Lake Louise Area

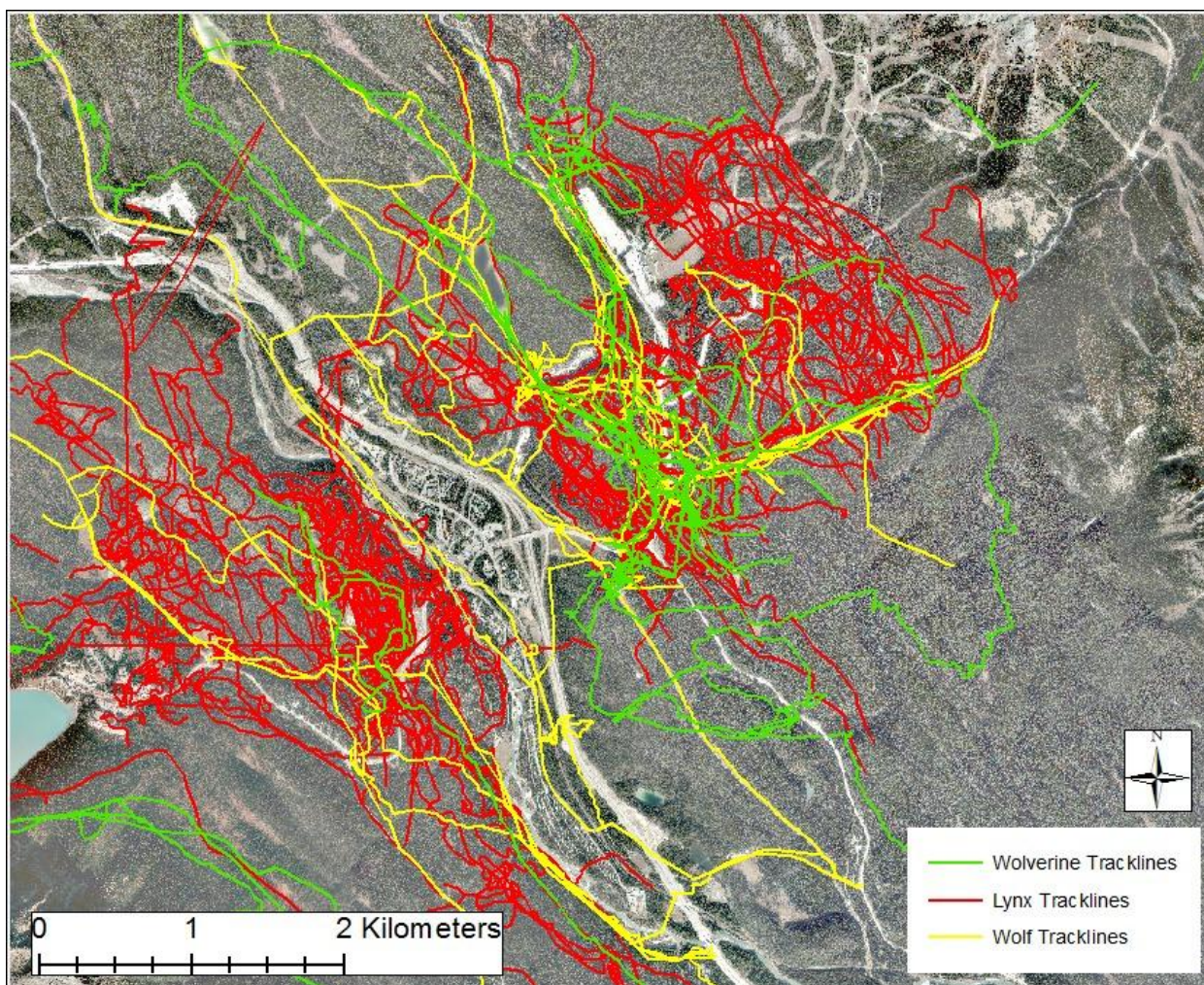
Wildlife Studies in the Whitehorn Corridor

Winter wildlife use of the Whitehorn and Fairview corridors has been documented through a number of snow-tracking studies conducted from 1993 to 2002 (LeBlanc 1994, Heuer 1995, Stevens and Owchar 1996, Owchar and Heuer 1997, Heuer et al. 1998, Owchar 2001, Owchar 2002). Study results record the use of the Whitehorn corridor by lynx, wolf, wolverine, coyote, moose, elk, and deer, as well as occasional isolated crossings by species uncommon in the corridor during winter, including grizzly bear and bighorn sheep (Percy 2006). The data from snow tracking studies capture precise movement routes used by nearly 300 individual animals collectively delineating the spatial extent of the Whitehorn and Fairview corridors in the Lake Louise area (Maps 2 & 3).



Map 2: Winter Tracklines of Wildlife in the Lake Louise Area – Whitehorn Corridor

In general, multi-species snow-tracking data show that animals tend to avoid the Hamlet of Lake Louise, the TCH right-of-way, the old gondola base, a short, steep canyon on the Pipestone River, and the ski area base lodge area and parking lots. Most animal movement is channeled along two routes: an area between the TCH and Mud Lake, including a concentration between the old gondola base and the Pipestone canyon and a narrow band between the Pipestone River and the western edge of the main ski hill parking lots. Lynx patterns show a broader distribution with numerous crossings of ski runs on the lower front side of the ski hill, however, most of these crossings likely occur at night when human activity is at lower levels (Percy 2006). Successful crossings of the front side of the ski hill by other species of large and medium-sized animals were not recorded in snow-tracking surveys.



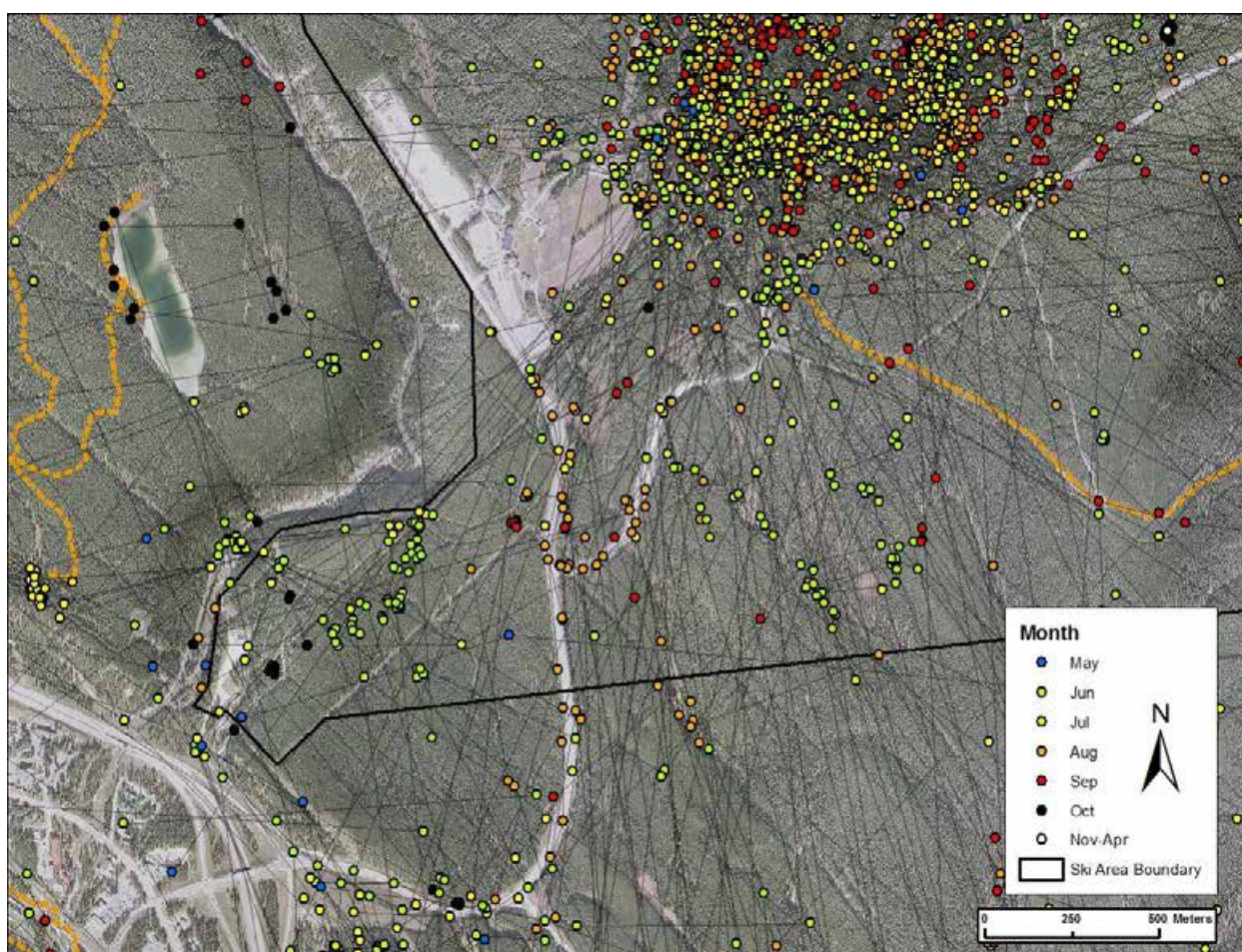
Map 3: Winter Tracklines of Wildlife in the Lake Louise Area – Fairview (lower left) and Whitehorn (upper right) Corridors.

Crossings of the Whitehorn Road by wolves and wolverines were recorded between the Bow Valley Parkway (BVP) junction and the Fish Creek road, with a particular concentration of crossings occurring at a point 400 m NE of the BVP junction. Lynx crossings were recorded along most of Whitehorn Road except at and near the ski hill parking lots, but most crossings occurred between 150 metres W of the BVP junction and 500 metres NE of it.

Grizzly bear research in Banff National Park has been summarized by Gibeau (2000) and Whittington et al. (2012) and is more comprehensively reviewed in the grizzly bear section of this document. Grizzly bears make heavy use of the front side of the ski hill in summer travelling to and from the ski area slopes from all directions. Map 4 illustrates grizzly bear movement by connecting consecutive GPS telemetry locations (coloured dots) with straight line segments (grey lines). In most cases several hours elapsed between consecutive GPS locations and actual bear movement trajectories would have been complex, non-linear pathways as opposed to the straight lines depicted. Nonetheless, it is clear that considerable grizzly bear movement took place through the Whitehorn Corridor. Given the concentration of bear activity above the base lodge area



of the ski hill, it is not surprising that grizzlies tend to use the upper portion of the Whitehorn Corridor, travelling north into the Pipestone drainage and south toward other important feeding sites in the Bow Valley SE of Lake Louise. However, many grizzlies also used the lower portion of the Whitehorn Corridor between the TCH and the ski hill parking lot, thereby crossing the Whitehorn road. In some cases grizzly movement through the corridor is associated with long-distance movements. For example, over the first two weeks of June 2013, male grizzly #128 travelled approximately 83 km from just south of Ottertail Creek in Yoho National Park to Bourgeau Creek in Banff National Park. Telemetry data shows that in the Lake Louise area this bear travelled through the Whitehorn corridor between Mud Lake and the highway.



Map 4: Grizzly bear location data from GPS collars. (2000-2014)

Grizzly bears are sometimes observed foraging along the cleared rights-of-way and adjacent meadows and wetlands of the Whitehorn road and the Fish Creek road leading to occasional bear jams. No grizzly bear mortalities have been recorded along the Whitehorn road, although in May 2012 a grizzly was struck by a vehicle 500 metres south on the Bow Valley Parkway. Grizzly bears in other study areas have been reported to avoid roads (e.g., McLellan and Shackleton 1988) or buffers around roads (e.g., Mace et al. 1996). In the Lake Louise area however, some bears exploit roadside habitats because of food sources that are of higher quality or at a different phenological stage



than in adjacent closed forests. In general, such bears are likely to face higher risk of mortality and a higher likelihood of habituation to humans.

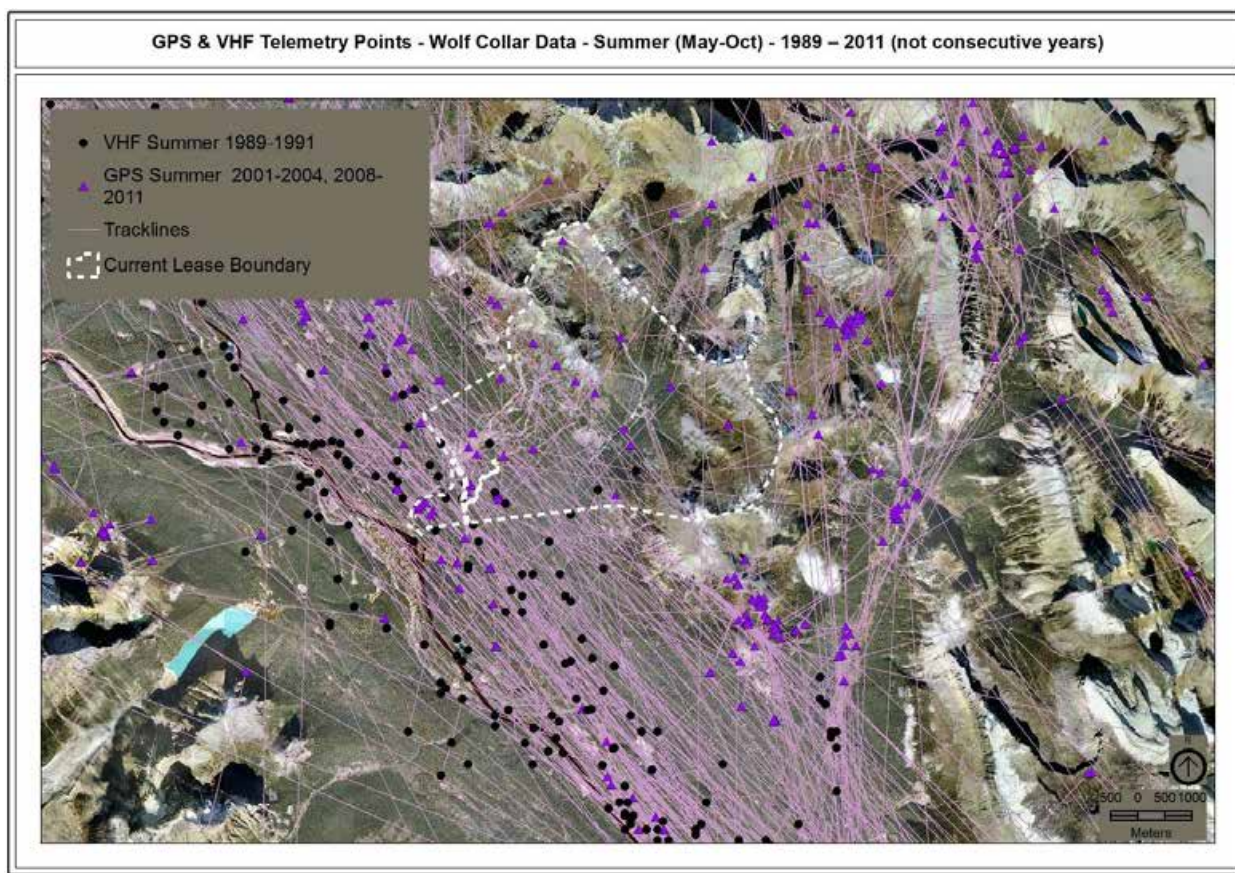
Lynx research took place in Banff, Yoho, and Kootenay National Parks from 1996 to 2001 using VHF radio-telemetry on 12 radio-collared individuals, of which 4 used the Lake Louise area (Apps 2007). The radio-telemetry data from these studies are somewhat limited in understanding detailed animal movement patterns because of the relatively long interval (one to several days) between successive points. The mean daily movements of lynx averaged 3.5 km for females and 4.0 for males (Apps 2000), making it difficult to determine precise movement routes from telemetry data.

Despite the limitations described above, radio-telemetry data shows that most lynx activity in the Whitehorn Corridor occurred in the forested zone upslope of the base lodge area, on the east side of the Pipestone River. Radio-telemetry and snow-tracking data also show crossings of the Whitehorn Road and in January of 2013 a lynx was struck and killed by a motor vehicle on the Whitehorn road. Most lynx crossings of the front side ski runs probably occur at night although lynx are still potentially subject to disturbance from activities such as night-time run grooming. In 2010 a lynx was killed in a collision with a grooming machine on the Wiwaxy ski run and lynx have been recently observed on the ski area during open hours in the middle of the ski season.

Tremblay (2001) summarized lynx status in the Lake Louise area and made the following observations:

- Lynx populations fluctuate in response to snowshoe hare population cycles and, in the Lake Louise area, the lynx population can be expected to drop to very low levels or even be extirpated during the low phase of the hare cycle. Regional habitat connectivity is important to allow for re-colonization of vacant habitat after a local extirpation event
- Lynx prefer forested habitats for travelling and tend to avoid large, open areas. However, they may cross openings under cover of darkness
- The primary dispersal route in the Lake Louise area for lynx is the Bow Valley.

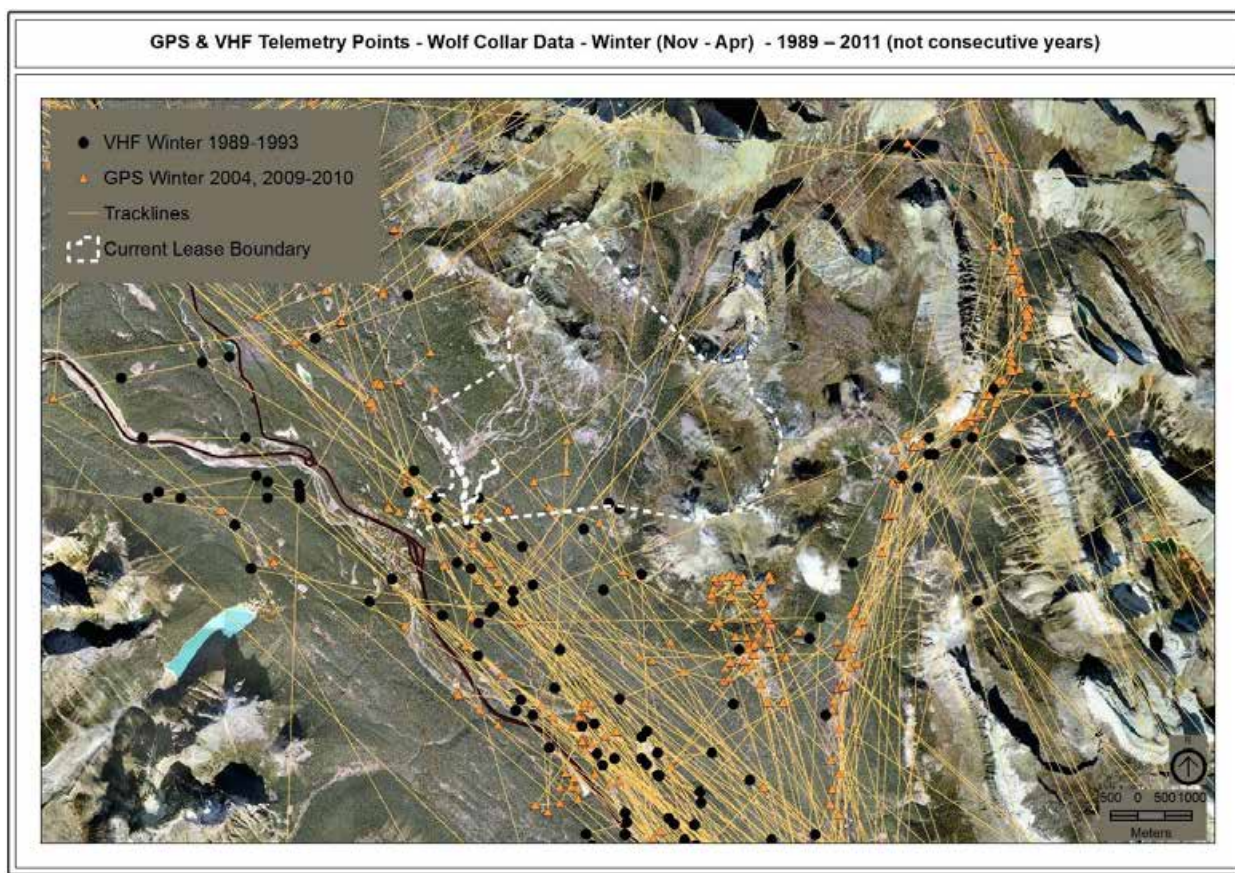
Wolf radio-telemetry studies have occurred intermittently from the time of wolf recolonization of Banff National Park in 1987 to the present, including GPS telemetry wolf monitoring since 2001. In the early part of this period a resident wolf pack used the Lake Louise area (The “Castle Pack”; Paquet 1993) but over most of the period wolves occurring near Lake Louise were not part of a local breeding population. Members of the Bow Valley pack, which typically denned east of Castle Junction, commonly ranged as far west as Lake Louise, and wolves from packs in the Clearwater and Red Deer drainages also used the Lake Louise area.



Map 5: Wolf Collar Data Summer 1989-2011

Telemetry studies demonstrate that wolves prefer elevations below 1850m, flat valley bottoms, and south to south-west facing slopes (Paquet et al. 1996), and avoid areas where winter human use is >10,000 visitors per month (Paquet 1993).

Wolf location data collected from GPS and VHF collars are shown on Maps 5 & 6. As with the grizzly bear data, lines connecting location points are an approximation, with hours or even days passing between recorded observations. In the Lake Louise area, more of the wolf data is from the Whitehorn Corridor than the Fairview Corridor, and within the Whitehorn Corridor it appears that wolves prefer to stay below the ski area base lodge and parking lots. Wolves do not tend to cross ski runs on the front side during winter, but a few crossings have been recorded in summer.



Map 6: Wolf Collar Data Winter 1989-2011

The discussion above leads to some broad conclusions about wildlife use of the Whitehorn Corridor:

- The Whitehorn Corridor is more heavily used by wildlife year-round than the Fairview corridor likely due to better habitat quality, lower snow depths, overall lower human use levels in the summer, and lower winter use between the Whitehorn Road and Trans Canada Highway below the ski area
- The Whitehorn corridor is a multi-species wildlife corridor
- Wildlife generally avoid areas of heavy human use and infrastructure in the corridor, including the old gondola base and the ski hill base area. Although the ski hill base area is isolated by an electric fence that excludes large wildlife in summer, snow tracking data indicate that wildlife avoid the base area in winter as well
- During the winter most carnivore movement along the corridor occurs between the TCH and the ski area base and parking lots, with the exception of lynx which also use the mid-slope portions of the ski area
- Along the Whitehorn Road most animal crossings appear to occur from just below the intersection with the Bow Valley Parkway to the junction with the Fish Creek road. (Percy 2006).



Traffic Volumes on Whitehorn Road

A traffic counter was installed in 2001 on the Whitehorn Road north of the junction with the Bow Valley Parkway, and has been maintained continuously since. Annual traffic volumes have remained fairly consistent over this period, with some downward fluctuation occurring from 2008-2010 (Figure 1). Total annual traffic recorded in 2002 (the first full year of data) and 2013 varies by only 0.001%. Throughout a typical year, traffic volumes are highest in March and lowest in October (Figure 2).

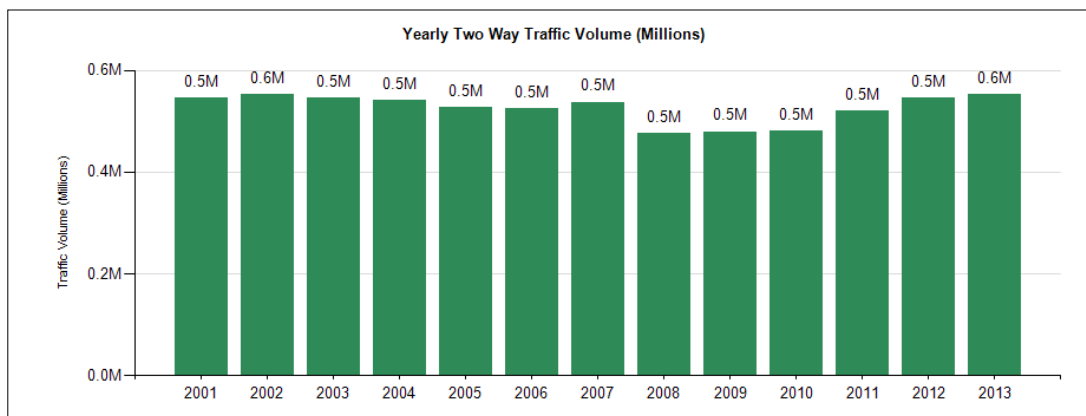


Figure 1: Annual Recorded Vehicle Volume on Whitehorn Road North of the Bow Valley Parkway

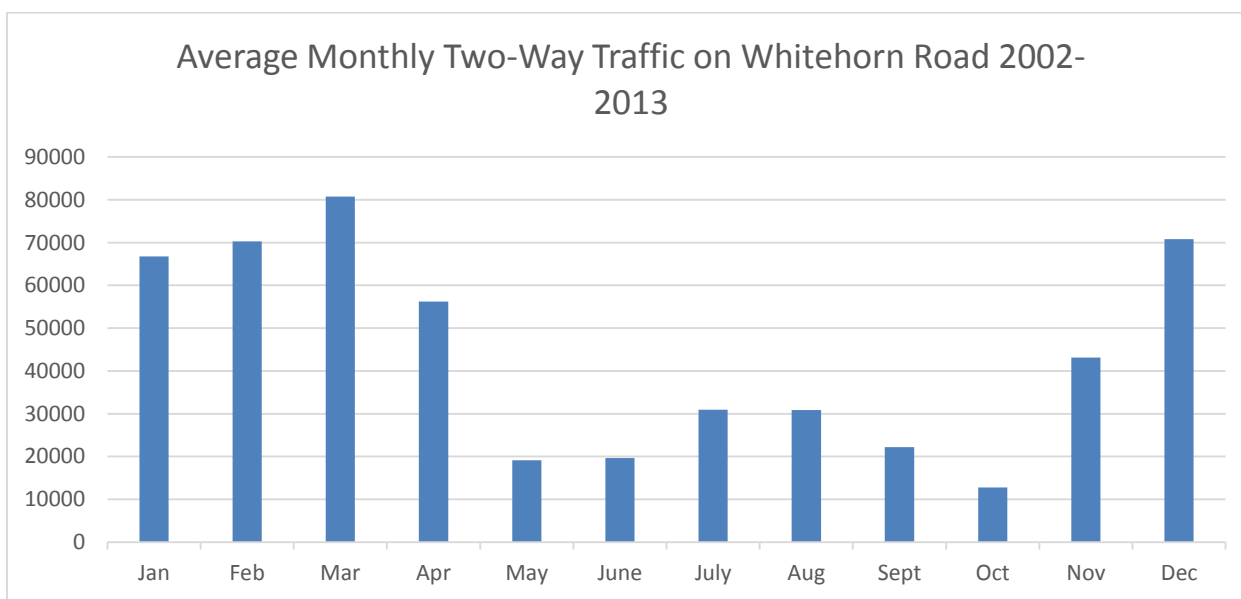


Figure 2: Average Monthly Two-Way Traffic Volume on Whitehorn Road for 2002 to 2013 (Data for 2001 and 2014 are incomplete).

Daily and hourly traffic patterns are markedly different between seasons, reflecting the different nature of the winter and summer visitor offers. The winter pattern is characterized by high weekend traffic flows with lower weekday totals (Figure 3). The



daily pattern is bi-modal, with high volume periods each morning and late afternoon (Figure 4).

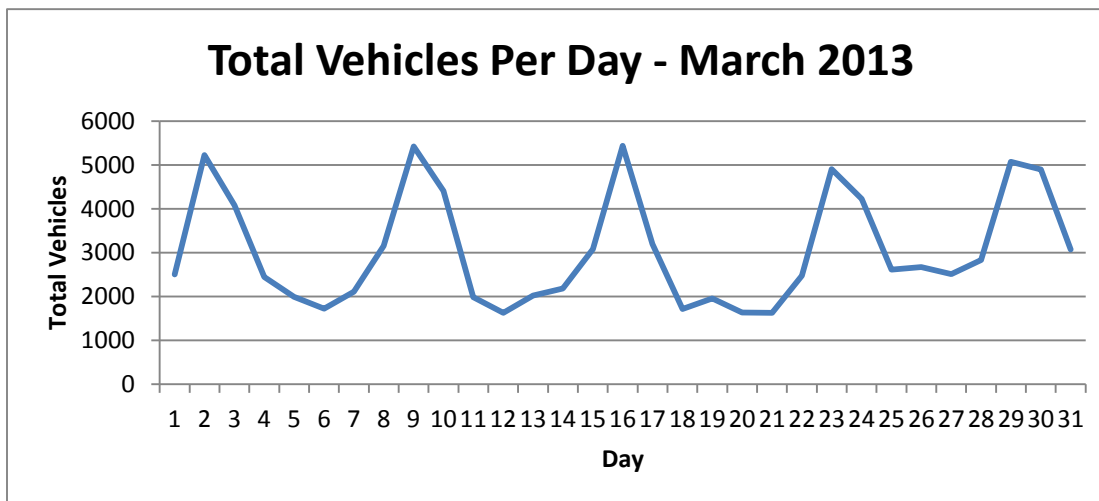


Figure 3: Typical Daily Traffic Pattern on Whitehorn Road in Winter

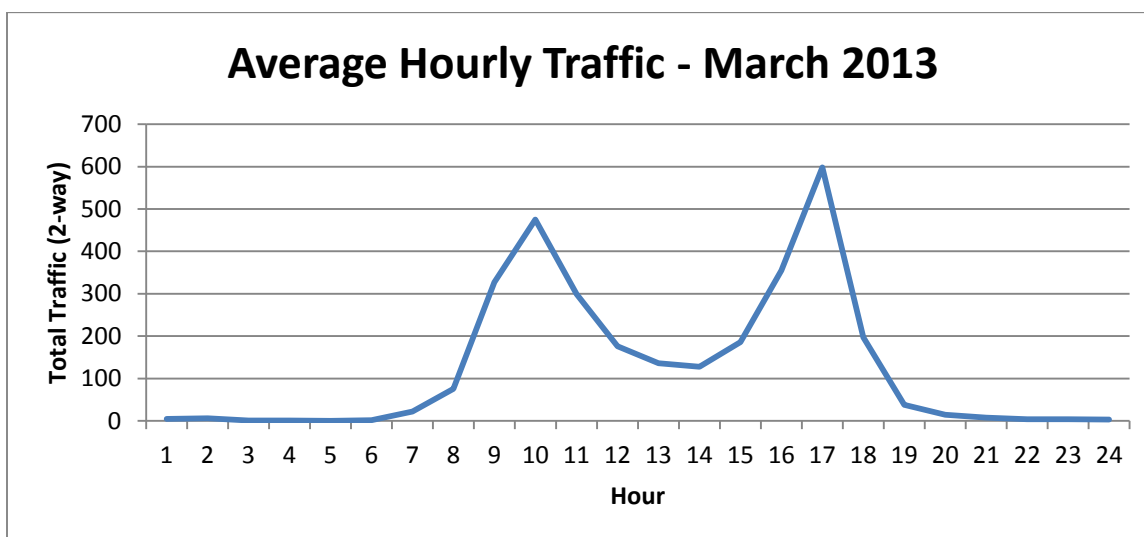


Figure 4: Typical Hourly Traffic Pattern on Whitehorn Road in Winter

During the summer the day-to-day pattern is more erratic but less pronounced, with peaks and lows probably reflecting weather conditions (Figure 5). The summer hourly traffic volume is skewed toward the afternoon and early evening, with volume rising steadily throughout the morning and then declining rapidly in the evening (Figure 6).

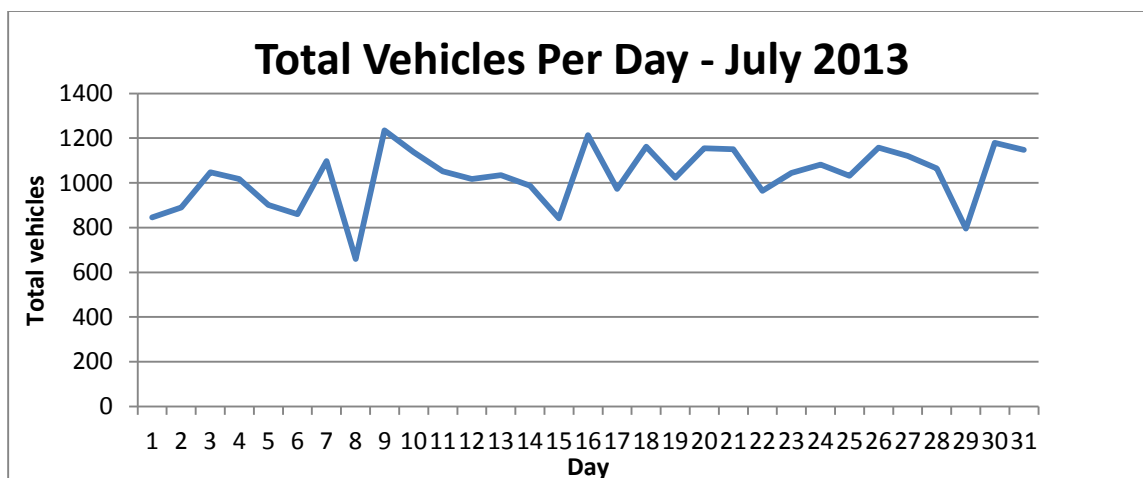


Figure 5: Typical Daily Traffic Pattern on Whitehorn Road in Summer

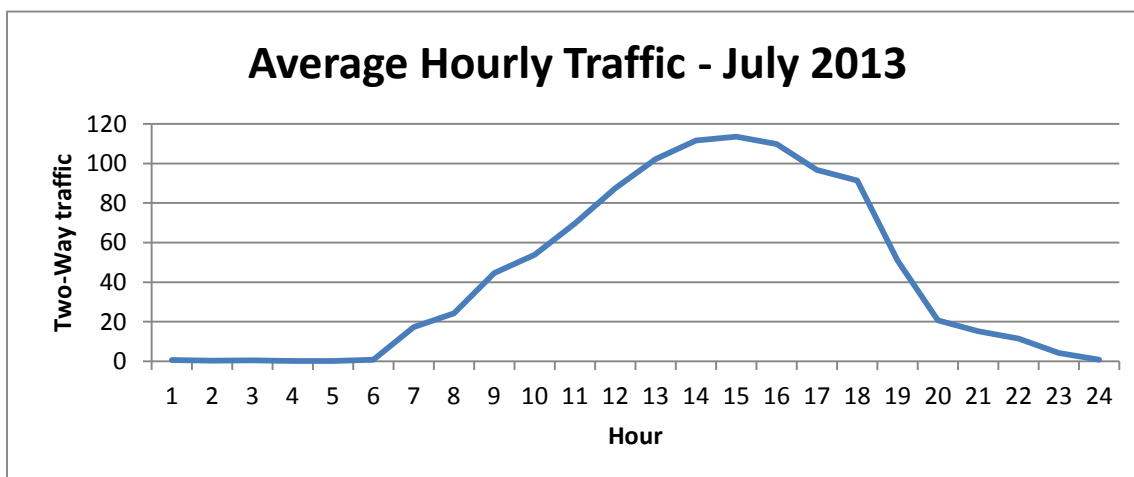


Figure 6: Typical Hourly Traffic Pattern on Whitehorn Road in Summer

Wildlife – Vehicle Collisions in the Whitehorn Corridor

Wildlife-vehicle collisions on the Whitehorn Road are expected to occur at low levels relative to other park roads because of its relatively low speed limit of 50 kph and short length (approximately 2 km from the TCH interchange to the ski area). Nonetheless, wildlife mortality records for Banff National Park show a total of six collisions on the Whitehorn Road over the past 30 years (two mule deer, one white-tailed deer, one unknown deer, two marten). In addition, 1 grizzly bear collision occurred in 2012 on the Bow Valley Parkway approximately 500 metres from the Whitehorn Road junction, and one black bear was struck on Temple Road approximately 500m from Whitehorn Road. In spite of these relative low wildlife-vehicle collision rates, traffic volumes are believed to be a deterrent to wildlife road crossings, particularly for wary species.

Management Objectives and Considerations for the Whitehorn Corridor

The importance of the Whitehorn Corridor is recognized in the 2010 Banff National Park Management Plan which includes an objective to maintain or improve the effectiveness



of the Whitehorn wildlife corridor. The Management Plan, and the Lake Louise Area Strategy prepared in 2004, provide specific direction to “monitor, maintain and improve, if necessary, the effectiveness of the Whitehorn wildlife corridor”.

A number of conditions related to summer use and operation at the ski hill have been put in place to ensure that wary carnivores are still able to move through the Whitehorn Corridor. These include the use of an electric fence surrounding the base area to prevent bear-human conflicts; timing restrictions on the use of lifts, the summer sight-seeing operation, and use of base-area facilities; and seasonal protocols on maintenance and construction activities.

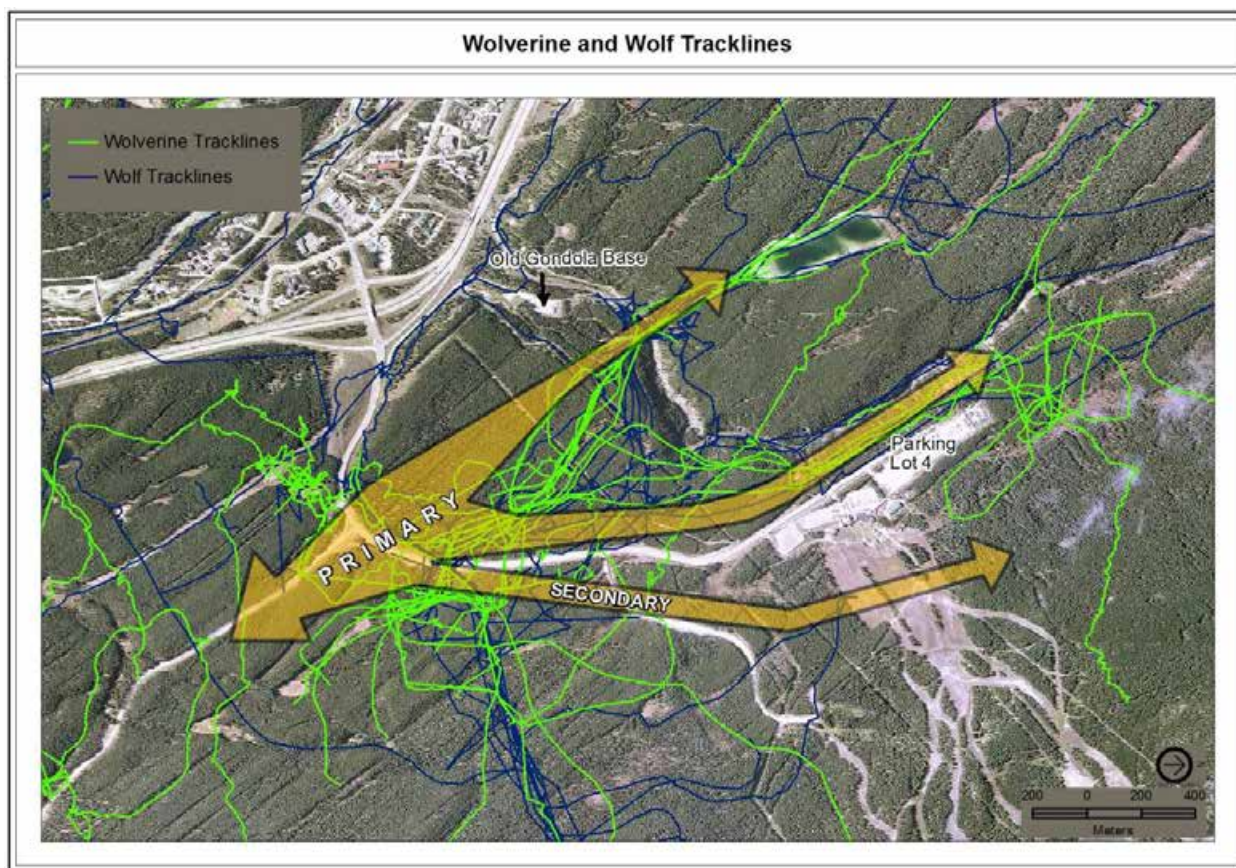
Existing and Potential Interactions and Impact Analysis

Potential activities associated with the Lake Louise Ski Area Site Guidelines that have implications for wildlife use of the Whitehorn Corridor include:

- Adjustments to the Lease and Developed Area;
- Development of New Ski Terrain;
- Increase in Winter Skier Volume and Summer Visitor Volume;
- Changes to Summer Use Program;
- Facilities and Infrastructure (esp. new base pod, new parking, and water reservoir);
- Ski Area Operations (grooming and snowmaking); and,
- Races and Other Special Events.

Adjustments to the Lease and Developed Area

As discussed above, the concentration of physical infrastructure, together with high levels of human use and an electrified fence within the base area of the lease, is a barrier to wildlife movement. This is good for visitor safety, but it means that wildlife movement is restricted to movement pathways above and below the base area. Changes to the lease and developed area are not expected to have any direct influence on this issue. However, the removal of the Lower Front Side, Ford Hill, and a portion of the Olympic West Side from the current lease boundary will provide long term security for existing wildlife movement patterns in these areas by removing the potential for future run development and increases in human activity. These adjustments provide greater security for roughly 350ha of habitat within the lower and mid-slope portion of the corridor.



Map 7: Whitehorn Wildlife Corridor – Key Movement Pathways

The formal inclusion of controlled sidecountry skiing and riding in West Bowl through a License of Occupation is not expected to affect function of the corridor. The lower elevation boundary and egress trail for this area will be placed relatively high on the mountain, in order to avoid impinging on the lower elevation terrain favored by wildlife. The development of a clear egress trail is anticipated to effectively capture and direct skiers back to the developed ski area reducing the potential for skiers to inadvertently descend into the lower reaches of the corridor.

Development of New Ski Terrain

The development of new ski terrain within the lower front-side of the ski area is limited to the Juniper area - a small area northwest of the current base area; some new terrain east of the learning area; and, new runs parallel to Meadowlark. New ski runs in the Juniper and learning area will lead to a spatial expansion in human use within a lower elevation portion of the corridor.

Given the proximity to the existing base area, wildlife already appear to make limited use of these areas in winter, likely due to the disturbance effects of ski area use and operation. Developing this new ski terrain will push the disturbance envelope further to the northwest and southeast, resulting in impacts related to wildlife habitat use and corridor function that are similar to existing disturbance. Parameters for forest vegetation management including run width, distance between runs and patch size are expected to maintain the ability of wildlife to move across the ski area landscape during



low use times. Conversely, clearing of new ski runs in these areas has the potential to increase summer foraging habitat for grizzly bears and provide opportunities for bears to forage in areas further away from the core of summer visitor use.

Increase in Winter Skier Volume and Summer Visitor Volume

The Site Guidelines allow for an expansion of ski terrain and increased lift capacity which, if implemented, would result in a substantial increase in total skier visits to the hill during the winter season. The impact of an increased number of skiers on wildlife is not expected to be significantly different than the current situation as most animals already avoid the ski area during the main winter operating hours. As such, the key times with potential to maintain or improve wildlife movement effectiveness are in the shoulder hours before open, and especially after lifts close. Redevelopment of the summer use program may also be considered under the Site Guidelines and may be reasonably expected to lead to changes in visitor use timing patterns and/or an increase in summer visitation.

Increases in both winter and summer visitation to the hill can be expected to result in increases to existing traffic volumes on the Whitehorn Road. These increases may reasonably be expected to affect wildlife use of habitat adjacent to the road, reduce permeability of the road to wildlife, and increase the risk of wildlife-vehicle collisions. Research in the Bow Valley has demonstrated that both wary carnivores and ungulates begin to avoid roadways when traffic reaches certain thresholds. Percy (2003) found that wildlife movement across roads was reduced for carnivores when traffic ranged from 300 to 500 vehicles per day and for ungulates between 500 and 5,000 vehicles per day. The same research also found that 93% of wolf crossings of the Bow Valley Parkway occurred when traffic volumes were lower than 30 vehicles per hour. These values, while not precise thresholds, represent ranges that can be used as cautionary guidance when considering the impact of traffic volumes on wildlife.

In 2013 traffic volumes on the Whitehorn Road exceeded 500 vehicles per day for all of July, August and September, and for most of June (Figure 7). Winter traffic volumes far exceed 500 vehicles per day from November to April. Only May and October have significant periods where traffic remains below 500 vehicles per day. Traffic volume on the Whitehorn Road generally exceeds 30 vehicles per hour from 8am to 7pm in both summer and winter (see Figure 4, page 46).

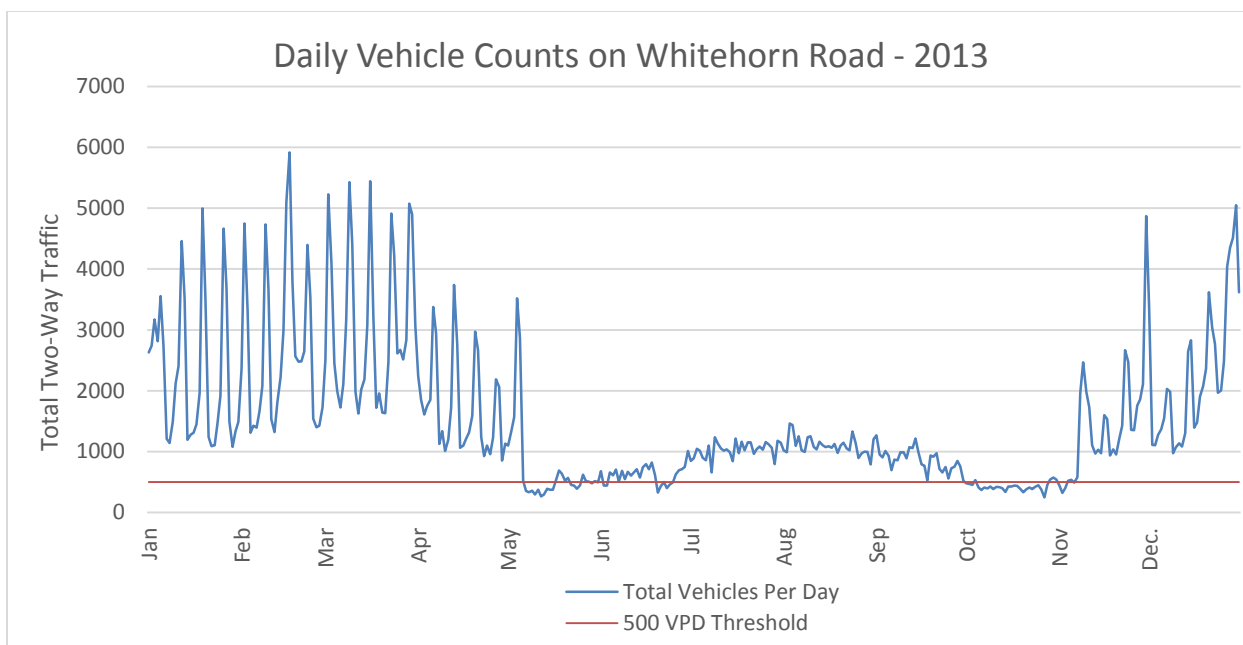


Figure 7: Daily Vehicle Counts for 2013 Relative to a 500 VPD Threshold

The traffic counter data indicate that the dusk-to-dawn period throughout the year, and the months of October and April during day time hours, may be the only times when traffic levels are reliably below the threshold at which wildlife movement patterns are noticeably and adversely affected. Increases in winter and summer visitor volume at the ski area will likely lead to increases in traffic volume mainly during the time periods that are already significantly above this threshold, which will likely have a small, incremental effect on wildlife disturbance. However, increased visitation may also lead to a corresponding increase in traffic volume during shoulder periods that are currently below threshold (early and late in the day), potentially increasing the length of time that traffic becomes an obstacle to wildlife movement across the road.

In the Bow Valley it has been observed that although wolves will use corridors and cross roads during daylight hours, black and grizzly bears use wildlife corridors primarily at night and during crepuscular periods (Percy 2003). Low-disturbance crepuscular and nocturnal periods that remain below threshold levels allow bears and other sensitive wildlife to move through the Whitehorn Corridor and across the Whitehorn Road with minimal risk of encountering human activities or hazards. Even seemingly minor increases in traffic volume through the corridor during these low use times may increase disturbance levels to the point where successful wildlife crossings for sensitive species are not possible. Increases in vehicle disturbance during times that wildlife rely on as secure periods, including night-time and crepuscular periods, may be reasonably expected to increase the risk of vehicle collisions or disruption to movement patterns that are crucial to corridor function.

Changes to the Summer Use Program

Research on radio collared bears in the early to mid-2000s has shown a marked spatial and temporal separation between bears and people on the front side of Whitehorn Mountain during the summer visitor use season. Grizzly bears do not utilise habitat on the front side as much as expected during the day when people are present. However,



grizzly bears use front side habitat more than expected during early morning, evening and at night. During darkness, bear use is up to 176% higher than expected, while during daylight when visitors are present it is up to 86% below expected levels of use (Donelon, 2004). Although the current summer use program has been successful at minimizing potential conflicts between visitors and bears, changes to summer use that would improve habitat effectiveness and availability during the day, such as moving visitors out of high-quality foraging habitat, could be expected to help restore more natural habitat conditions for bears and other wildlife. Maintaining a long, predictable, disturbance-free period between dusk and dawn each day would also help to maintain foraging opportunities for bears.

The Site Guidelines allow for the consideration of relocating the summer visitor program from the current mid-mountain location around Whitehorn Lodge to the top of the Grizzly Gondola. The relocated program would be based out of a new lodge on Eagle Ridge at the top of the gondola, and would include the development of new hiking trails on the upper portion of Whitehorn Mountain. The physical relocation of the summer use program to the upper mountain will remove most human disturbance from mid-mountain and accordingly is expected to have positive effects for wildlife use and movement in the upper Whitehorn Corridor in summer. The relocation is also expected to result in considerably less human disturbance in an area that is known to be important for grizzly bear foraging on the mid-slopes of Whitehorn Mountain.

While the relocation of the on-mountain program is expected to have positive impacts to corridor effectiveness above the base lodge, changes to summer operating hours for the base area or on-mountain visitor programs, nevertheless, have the potential to offset any gains made through relocation. Although at upper elevations, a new lodge and trail system would not be completely outside areas of habitat or movement that would be used by bears or other wary species such as wolves, cougar or wolverine. Visitor use on the upper mountain would still be facilitated by the use of lifts from the base area and visitors would still arrive to the ski area along the Whitehorn Road. Proposals to extend the total period of open visitor use on the ski area would further restrict the already limited low disturbance times available to wildlife. In turn, the reduction in low disturbance times may be reasonably expected to reduce the effectiveness of the Whitehorn Wildlife Corridor, both on the ski area itself and along the Whitehorn Road. Reduced corridor effectiveness as a result of increasing summer visitor use hours not only reduces the success of the existing program, but may also be reasonably expected to offset any gains achieved by physical relocation of the summer use program.

The current summer visitor program is considered successful with respect to wildlife disturbance and corridor effectiveness, due in large part to maintaining predictable patterns of human use that allow wildlife to navigate and use the ski area during low visitor use times (Gibeau pers com). Summer visitor use hours at the ski area have been managed to concentrate human use outside of daily and seasonal periods that are considered to be important to wildlife movement and habitat use. Of particular significance to wildlife are the low-light, early morning, evening and nocturnal periods which, in a mountain environment, may be considered to encompass a time frame from approximately 1 hour before sunset, through the night, until 1 hour after sunrise. To a certain degree, early morning, evening and nocturnal periods have become important for wildlife due to the fact that sensitive wildlife have been displaced from the ski area during the day, just as they are displaced from other areas of intensive human use in the parks. The differences between expected and actual bear use on the ski area discussed earlier as highlighted by Donelon



(2004) suggest that despite the crepuscular and nocturnal pattern of use on the ski area, low disturbance day light hours should be considered an important aspect of maintaining habitat effectiveness for bears and other wildlife.

With respect to changes to summer use, the Ski Area Management Guidelines require the management of factors such as wildlife-human conflict, habituation, displacement, protection of habitat and movement patterns, and concentration of visitor use in a way that ensures that ski area environment continues to function effectively as part of local and regional wildlife habitat. With respect to the Whitehorn Wildlife Corridor, a number of more specific factors are important in the design and assessment of any proposed changes to summer visitor use:

- Predictable timing and location of visitor use is important so that wildlife are able to establish and maintain secure patterns of movement and habitat use
- Consideration of seasonal, spatial and temporal patterns of wildlife use and movement is an important aspect of determining where and when visitor activities may be placed to afford the least potential for wildlife disturbance, displacement and conflict
- A range of low disturbance sunlight conditions that includes daylight, crepuscular and nocturnal periods is important to maintaining natural patterns of movement and habitat use for a wide range of wildlife species
- Consideration of seasonal variation in snow cover, daylight, growing seasons, food availability and wildlife life stages is important to ensuring that wildlife have access to habitat during sensitive seasons or times of restricted resources
- Managing vehicle disturbances and on-hill visitor traffic, is important to ensuring that wildlife have low disturbance opportunities to navigate the Whitehorn wildlife corridor and access road
- Measures to reduce and prevent wildlife/human conflict, especially bear/human conflict is an important aspect of secure wildlife movement and preventing wildlife habituation and mortality
- Limiting sensory disturbances such as noise and night lighting, and sensory attractants such as food smells is an important element of maintaining low disturbance and displacement conditions and limiting wildlife habituation and mortality.

The factors discussed above should be taken into account for any Long Range Plan proposal that is brought forward for the development of a new upper mountain lodge, relocation of the summer use program, changes to summer use activities, or changes to summer hours of operation.

Facilities and Infrastructure

There are three aspects of the Site Guidelines associated with the development of additional facilities and infrastructure that have implications for the function of the Whitehorn Wildlife Corridor:

- Development of new lifts and cleared run ski runs
- Reconfiguration and development of additional parking and out of base capacity
- Redevelopment and operational use at the old gondola base.

Each of these factors are interrelated and the configuration of various facility elements has implications for comfortable carrying capacity, infrastructure balance, and the ability to maintain effective wildlife movement over time.



The Site Guidelines outline a potential leasehold reconfiguration on the lower slopes of the Whitehorn Front side. The reconfiguration removes currently undeveloped lands from the northwest and southeast boundaries of the current leasehold, and the portion of land below the Whitehorn access road including the old gondola base. Parks Canada considers the reduction in leasehold as an enhancement to the long term security of the wildlife corridor. Undeveloped lands that remain in the leasehold can be developed and used for ski area purposes including new lifts and cleared ski runs.

The Site Guidelines allow for the consideration of new or replacements lifts and runs in the Juniper area immediately northwest of the current developed area on the lower front side. One or more various lift configurations are possible including:

- a new Juniper lift to serve intermediate skiers on the lower mountain
- replacement of the old Olympic chair on the existing, or on a new alignment
- a lift from the base area to Whitehorn summit.

The area remaining within the leasehold in this area is relatively small and may support only a few more cleared ski runs. Cleared ski lift lines can be used for skiing but may not always be suitable for the needs of target skiers. There is not a lot of room in this area to support multiple ski lifts and cleared runs while maintaining forest cover conditions that will allow wildlife to successfully move through, and inhabit the area. Rather than multiple lifts, a multiple stage lift would minimize the need for clearing ski lift right-of-ways and maximize the terrain available to configure ski runs. A single lift line would leave more space to successfully plan and configure ski terrain to support wildlife corridor function. For instance, a lift could be developed with mid-load station at the top of the new Juniper area and then continue on to the upper mountain. In addition to maintaining wildlife parameters, such a configuration would serve multiple skier types, cost less, require a smaller clearing footprint, and be less intrusive visually, while serving the same terrain as multiple lifts.

The Site Guidelines also allow for the consideration of a new lift and runs along the southeast boundary of the reconfigured lease serving the Meadowlark area. A new lift line in this area would be located within the current developed area. The Site Guidelines allow for the consideration of a single run parallel to and then crossing to the inside of the existing Meadowlark run. As there is considerable undeveloped forest cover in this area it is expected that both the lift and run can be configured in such a way that effective wildlife movement through this area is maintained.

Finally with respect to terrain and lifts, the Site Guidelines allow for the consideration of expanding the existing Sunny T beginner area to the south. As with the Meadowlark lift and terrain, an expansion of the Sunny T area can likely be configured in such a way that key wildlife movement routes remain effective for wildlife movement above and around the base area.

The location of new ski terrain and lifts influences the configuration, comfortable capacity and balance of ski area parking and commercial space facilities in the base area. The configuration of expanded or new parking areas is central to establishing an effective suite of lift and commercial space alternatives that address ski area development and wildlife movement issues.

Current parking capacity at the ski area exceeds the balanced carrying capacity of base area commercial space and out-of-base lift capacity. However a considerable portion of



the existing parking Lot 4 is located outside of a comfortable walking distance of 500m used as an industry standard. Currently, on busy days many skiers preferentially park along the Whitehorn access road to minimize walking rather than using Lot 4. This practice however also leads to long walks, poor visitor experience and creates a public safety hazard. The capacity of Lot 4 is not considered to be an effective part of the comfortable carrying capacity of the ski area. While shuttles and other people mover technologies may be used to convey people from far lots, the most effective way to utilize the far reaches of the current Lot 4 would be to provide direct lift access to the ski hill from this area.

Lot 4 lies immediately below the new Juniper area that may be considered under the Site Guidelines and discussed earlier. The Site Guidelines also allow for the possibility of developing a satellite ticket center that would facilitate direct lift access within a comfortable walking distance from Lot 4. This would in turn result in an immediate increase in comfortable carrying capacity for the ski area without the need for any additional parking. When considered in combination with a single lift line from this area, ski run clearing that maintains wildlife habitat connectivity, and the existing parking capacity, the development of a satellite ticket center is likely to be the most effective and least impactful means of facilitating an increase in ski area capacity. Development of a satellite ticket center would encompass a far smaller footprint than additional parking development. Ensuring the effective use of Lot 4, including a satellite ticket center should be considered as a priority before any other parking lot development is considered.

Potential areas for parking lot expansion were also considered as part of the strategic assessment process. Potential parking nodes were considered in the area of the Fish Creek parking lot and on the west side of the Whitehorn road across from the entrance to Lot 1. Both of these potential areas were rejected as unsuitable as they lie in areas that are being removed from the lease as part of substantial environmental gains. Development of parking in these areas and the level of visitor use associated with parking would be considered to offset the gains. Accordingly these areas were not considered further as part of the strategic assessment.

Other parking development alternatives were considered in greater detail as part of the strategic assessment including:

- extending Lot 4 to the northwest of the existing parking lot
- extending Lot 1 to the southeast of the existing lot
- expansion of existing parking lot edges, conversion of parking lot islands and roadways.

Each of these potential parking nodes was considered with respect to:

- the magnitude and extent of physical and biological modification required to facilitate parking
- disruption of existing wildlife movement routes through the corridor
- the location and extent of sensory impacts affecting corridor effectiveness
- comfortable walking distance
- site-specific factors.

Lot 4 Extension – an extension of Lot 4 to the northwest on a parcel of land that is primarily undisturbed was considered as part of Site Guidelines development. The area considered is on a shallow forested ridge a few metres above the existing Lot 4. Removal of contiguous forest cover would be required and grading would be required to provide a



level lot. The overall configuration of terrain would however remain similar to the existing area and could be readily restored if necessary. This area of potential expansion is a relatively flat, low elevation area of the Whitehorn Corridor providing a wildlife movement connection between the Pipestone River canyon and the steeper slopes of Whitehorn Mountain. The area receives regular use by wildlife (see Map 3 page 40 earlier in this document).

Development of new parking in this area would be expected to extend sensory impacts further into the undeveloped corridor, and likely displace wildlife movement to the end of the new parking node. Depending on other factors such as the location of new Juniper lift or satellite ticket building much of the parking available in this area could be beyond comfortable walking distance. If outside of comfortable walking distance other changes would be necessary in order to have the area contribute effectively to comfortable carrying capacity. For instance lifts and ticket centers would have to be located closer to the edge of the leasehold. While there may be potential for some limited expansion within comfortable distance parameters, overall the extension of Lot 4 could be reasonably expected to result in a loss of currently effective corridor habitat.

Lot 1 Extension – an extension of Lot 1 to the southeast could occur on a partly disturbed parcel of land, bisected by the old gondola lift line, between the Whitehorn Road and the developed ski area. Removal of forest cover would be required. This area is more irregular in terrain and elevation configuration than the potential Lot 4 extension and significant terrain modification and fill would be required to utilize the entire area. Wildlife do move through this area but the convoluted terrain and adjacency to the road and ski area base make the area less than ideal for movement. Sensory impacts of parking development and use are not considered likely to extend into areas that wildlife consistently move through that are not already affected. Perhaps the most significant impact of potential parking development in this area would be the location on top of steep slopes immediately above the seasonal watercourse that drains the ski area base area. Erosion and runoff control would be key design and environmental management challenges. Considering cost and proximity for visitors to the ski area, the north half of this area could likely be developed for increased parking without discernibly affecting key movement routes across the Whitehorn road or around the ski area.

Parking Lot Edges and Roadways – Existing parking lots, roads, berms and operational areas all have potential to be reconfigured into additional parking areas providing considerable potential for expansion within areas that are already within comfortable walking distance from the ski area base. The Site Guidelines allow for the potential reconfiguration of facilities within the base area including major modifications such as moving the operations area and replacing it with parking or a parking structure. Redevelopment of such areas would have little impact on the movement of wildlife around the ski area related to disturbance of existing routes or additional sensory disturbance. Many of these area have been previously disturbed.

The preferred environmental alternative for enhancing parking capacity for future ski area development is simply locating Juniper runs and lifts to optimize the effectiveness of the current Lot 4 at the time of expansion into this area. Another alternative to bring the ski area parking configuration into balance would be to provide a people mover lift or shuttle system to the main base area from remote regions of the existing parking area. The reconfiguration of existing parking lot edges, roadways and operational areas may be planned in combination with Juniper development to provide considerable expansion of



effective parking capacity with very minimal changes to current wildlife movement or corridor effectiveness. Any of these options also provide opportunity to limit parking on the Whitehorn Road outside of the lease area improving visitor experience, public safety and corridor effectiveness. Maximizing the effectiveness of existing parking alternatives before other expansion options are considered would minimize the potential impacts to corridor effectiveness to the degree possible.

Reconfiguration of edges, berms and roadways in Lot 3 is considered preferable to expansion of Lot 4. Limiting the extent of any expansion to within comfortable walking distance should be considered to be a hard limit. It is doubtful that any significant expansion of Lot 4 could be considered to be consistent with the Management Plan requirement to maintain or enhance the effectiveness of the Whitehorn Wildlife Corridor. Accordingly this alternative was removed from the Site Guidelines.

The final element of the Site Guidelines with implications to the Whitehorn Wildlife Corridor is development and operational use at the old gondola base. While the old gondola base itself has been out of operation for many years the site is still used for indoor and outdoor storage, for special events support, and occasionally for bus parking. The gondola base area is also the site of the ski area water intake and pumphouse providing all snowmaking and potable water supply for front side facilities. The Site Guidelines include the potential development of a water reservoir in this area. The primary purpose of the reservoir would be to ensure a sustainable water supply for early season snowmaking operations by reducing the reliance on direct withdrawals from the Pipestone River. Reducing the need for direct withdrawal may be anticipated to reduce stresses on the aquatic ecosystem during the late fall and early winter low flow periods while providing a reliable source for ski area operations. When considered along with the development of potential alternate water systems or sources such as trickle charging a reservoir during high flow seasons, groundwater, or surface drainage capture, development of a reservoir may be considered to be a substantial gain in long term protection of the Pipestone River.

No other suitable sites for water extraction from the Pipestone River are available within close proximity to the ski area on the Whitehorn side of the Trans-Canada Highway. Winter tracking studies indicate that carnivores avoid the current disturbed area at the old gondola base but that they use the adjacent area above the primary pumphouse frequently (Map 2). Telemetry data also indicates use of the area above the pumphouse by wolves (Maps 5 & 6). Reduction of natural habitat resulting from the construction of a reservoir in this area would have potential negative impacts on corridor effectiveness as it would further constrain the movement pathway that exists between the Pipestone canyon and the TCH. This may potentially be mitigated by locating the reservoir on existing disturbed land outside of the primary wildlife movement routes, or by constructing an earth-covered reservoir that can be designed to function as natural habitat so that it does not impede wildlife movement.

Ski Area Grooming and Snowmaking Operations

Most grooming and snowmaking on the ski hill occurs at night, increasing the period of time that human disturbance may affect wildlife movement through the corridor. Noise, and potentially light, from both grooming and snowmaking equipment may be reasonably expected to disrupt and displace wildlife from habitat and movement through the corridor. Although specific data on the impacts of noise on wildlife is not available for the ski area, a significant body of research indicates that both chronic and



intermittent, unpredictable anthropogenic noise can have negative impacts on wildlife (Francis and Barber, 2013).

Continuous snow fencing placed along the margins of runs and race courses can present an impenetrable barrier to wildlife if not installed with wildlife use in mind. Modifications to fencing, fence sections, or improvements to wildlife movement through and across adjacent forest patches that direct and facilitate wildlife movements may be put in place to ensure wildlife can continue to move through the landscape.

Races and Other Special Events

Lake Louise is host to a number of special events and activities operating within the parameters of their business license including the first FIS World Cup ski races of the international race season. Large outdoor special events, winter or summer, have the potential to affect wildlife corridor effectiveness through increased traffic volumes, increased noise disturbance, and increased human activity along race courses and in the base area. While most special events are relatively short in duration resulting in a pulse or perhaps several pulses of intensified disturbance, they may be expected to contribute incrementally and cumulatively to existing corridor impacts. Managing numbers, seasonal timing and daily scheduling of special events can be considered a necessary component of maintaining low-disturbance, predictable times that facilitate wildlife movement through the local landscape.

Traffic counters for the Whitehorn Road have shown an increase of approximately 9.6% in traffic volumes over the past two years. During this same period, special events that take place in the Whitehorn corridor have also seen an increase. There are currently 5 scheduled special events that intersect portions of the Whitehorn Corridor during the calendar year (Banff-Jasper Relay, GrandFondo, Bike Fest, Sir Norman Watson Relay and the Lake Louise to Banff Loppet). An increased public and special events demand on the Whitehorn Corridor paired with proposed LLSA developments will have cumulative negative effects on the ability for wildlife to utilize this area with limited or predictable disturbance. If traffic trends continue we are likely to see more disturbance for wildlife during their crepuscular period, leading to a shorter period for undisturbed forage and other life requisites. An increase in traffic in this area will also lead to more constraints in wildlife movement.

Mitigating Measures

The mitigations for the Whitehorn Wildlife Corridor identify ecological management parameters, future planning and/or operational requirements, or future knowledge requirements that are needed to realize expected ecological outcomes.

Ecological Management Parameters

Ecological management parameters serve as the on-the-ground benchmarks against which the environmental impacts of future development and use proposals will be assessed. In order to realize expected ecological outcomes important to maintaining the function of the Whitehorn Wildlife Corridor, the following ecological management parameters have been incorporated into the Site Guidelines:

- The timing of visitor use facilitates predictable, seasonally-based, periods and patterns for wildlife to establish and maintain secure patterns of movement and habitat use



- Daily and seasonal spatial patterns of wildlife use and movement are maintained by avoiding development or visitor activities likely to result in potential displacement of wildlife from established movement routes
- Wildlife have low disturbance access to, and through the wildlife corridor, through a range of natural daylight conditions including morning and evening daylight periods where feasible according to season, crepuscular and nocturnal periods
- Wildlife have low disturbance access to, and through the wildlife corridor, during sensitive seasons, or times of restricted resources
- Wildlife have daily, low vehicle disturbance opportunities to cross the Whitehorn Road
- Permanent developments, or seasonal or temporary structures maintain long term physical corridor permeability and connectivity for all potentially affected species.

Long Range Planning and Operational Parameters

Specific planning and operational parameters are identified to provide greater clarity for project design and planning, and ski area operations. These parameters should be considered as part of future planning proposals or management initiatives as appropriate.

Winter Visitor Use

The Site Guidelines include guidelines and conditions that apply to winter visitor activities and services. Best management practices are prescribed in the Site Guidelines as part of Long Range Plans for race course management, and special events. With regard to potential impacts to the Whitehorn wildlife corridor, best practices are to address noise, visual and other impacts to wildlife. Base area winter visitor activity guidelines preclude the consideration of lighted night skiing or other lighted activities on-hill and establish predictable hours of use that ensure low disturbance times that encompass twilight and nocturnal periods.

The winter operating season sees significant variation in daylight hours from the shortest days of the year mid-November through January, to extended day light hours following the spring equinox. The Site Guidelines provide guidance ensuring that winter season visitor operations are managed to maintain an uninterrupted low use period of approximately 12 hours per day. The following guidelines and conditions of the Site Guidelines provide clarity on the management of visitor activities during winter season low use periods:

- vehicle disturbances on Whitehorn Road are gradually reduced to below 30 vehicles per hour within 2-3 hours after lifts close
- visitor activities or functions following the close of lifts are restricted to base area buildings, the proposed Eagle lodge and approved facilities
- base area visitor operations cease by 2:30 am
- after-hours, on-hill visitor activities permitted only as approved by Superintendent
- Noise from outdoor visitor use is contained at decibel levels that would not displace wildlife beyond 100m from base area facilities
- Direct or ambient lighting from base area facilities is contained so as to not penetrate into wildlife movement pathways.



No parameters in addition to the guidelines and conditions identified by the Site Guidelines are identified with respect to winter visitor use and potential impacts to wildlife movement.

Summer Visitor Use

The Site Guidelines indicate that the existing summer use program may continue under current hours and conditions. At such time that there is a new day lodge built at the top of Grizzly Gondola, the summer program may be relocated to the upper mountain. Detailed proposals concerning the relocation of the summer program, any proposed changes to the summer use program, the nature or type of summer visitor activities, or hours of summer operation will be brought forward as part of a Long Range Plan.

Mitigating measures for managing impacts of summer use to Grizzly bears and the Whitehorn Wildlife Corridor are closely related, and many parameters and conditions that apply to Grizzly bears will also apply to achieving the ecological management parameters for the Whitehorn wildlife corridor. As with winter visitor use, a key aspect of managing summer visitor use is the designation and management of periods of low intensity visitor use that:

- provide predictable times for secure wildlife movement and habitat utilisation when visitor use is confined to fenced or indoor areas
- encompass a contiguous time span that includes late daylight, crepuscular, nocturnal, and early morning daylight periods
- maintain vehicle disturbance levels below identified thresholds that facilitate ease of wildlife movement across Whitehorn road
- provide effective physical separation between visitors and wildlife that prevent the potential for wildlife/human conflict
- provide effective management of artificial sensory disturbances that would displace, attract or habituate wildlife
- maintain or improve the effectiveness of existing wildlife movement routes that are potentially impacted
- maintain established seasonal, spatial and temporal patterns of wildlife use.

The Site Guidelines include guidelines and conditions on the management of visitor activities during summer season low use periods that must be included as part of Long Range Plan proposals. These conditions are not repeated here. The reader should refer to the Site Guidelines for specific details. As a group the conditions of the Site Guidelines address the objectives of low intensity visitor use by:

- Restricting visitor use locations and timing during twilight and nocturnal periods
- Identifying predictable daily times of low use as well as no visitor use
- Managing vehicle disturbances along the Whitehorn road
- Making physical improvements to the effectiveness of the Whitehorn corridor including rerouting of Fish Creek road and a large mammal wildlife underpass
- Limiting sensory disturbances from outdoor lighting and noise and other human activity.

The management of fenced areas, or other means of physically separating visitors and wildlife is also an important element of any summer use proposal. The positioning of electric fencing in the summer must be sufficient to protect facilities and visitors, while ensuring that effective opportunities remain for wildlife to move through the corridor.



No parameters in addition to the guidelines and conditions identified in the Site Guidelines are identified with respect to managing summer visitor use and potential impacts to wildlife movement.

Facilities and Infrastructure

With respect to wildlife corridor effectiveness the primary area of concern is the Juniper area along the northwest extent of the reconfigured leasehold. The configuration of ski area parking, run development, lift and satellite ticket center are important elements of maintaining existing corridor effectiveness. Long Range Plan proposals for development in this area should be consistent with the following parameters:

- New run development is consistent with the ecological management parameters for run and vegetation management providing a mosaic of cleared and forest patches that facilitate wildlife movement, provide cover and provide habitat
- Plans for new runs or lift development make use of existing cleared disturbed areas to the extent feasible; unneeded, previously disturbed areas are restored to natural forest cover conditions
- A Juniper lift base and/or satellite ticket center is located so as to bring existing parking areas within the comfortable walking distance accepted by industry (500m)
- Any parking expansion removes the need to park on the Whitehorn Road outside of the lease area
- Parking expansion to the NW of the existing Lot 4 is not considered in order to protect existing wildlife movement patterns
- Parking expansion on the southwest side of the Whitehorn Road and parking lot access road (i.e., between the Pipestone River and the base area) will not be considered.
- Parking expansion is prioritized to the modification of existing parking lot edges and reconfiguration of roadways, tree islands and berms
- Parking expansion to the SE of Lot 1 is considered as other parking alternatives are exhausted; expansion into this area is only considered in order to facilitate resort balance in alignment with approved design capacity.

With respect to development at the old gondola base Long Range Plan proposals should be consistent with the following parameters:

- Unneeded, previously disturbed areas are restored to natural forest conditions
- Development of a water reservoir and all other redevelopment or modification of existing facilities is located within the designated License of Occupation, below the existing pump house, and preferably on previously disturbed ground.

Grooming and Snowmaking

Grooming and snowmaking are necessary elements of modern ski area operation. With respect to the effectiveness of the Whitehorn Wildlife Corridor existing activities are not anticipated to change in a substantive way that results in further impacts to the corridor. However some parameters should be considered in association with the ski area environmental management systems. Environmental management of grooming and snowmaking operations should be consistent with the following parameters:

- Grooming operations are planned and conducted to efficiently minimize travel and grooming time on the Whitehorn Front Side
- Snowmaking technologies on the Front side – especially at lower elevations – are selected to minimize noise and operational disturbances such as snowmobile use



- Snow and safety fencing along ski runs have frequent openings that facilitate wildlife movement.

Races and Special events

The development and implementation of Best Management Practices, combined with Parks Canada special events review processes, is expected to provide adequate oversight for proposed competitive and other special events. While the Site Guidelines do not specify how many events may take place, nor how often, proposed events will be assessed against other parameters and conditions of the Site Guidelines and SEA. As a guiding principle the approval and management of cumulative events should maintain the objective of providing predictable periods for wildlife to move through the Whitehorn wildlife corridor.

Environmental Assessment and Information Requirements

Changes to the summer use program and the development of new ski runs along with supporting facilities and infrastructure, may reasonably be expected to affect the Whitehorn Corridor in ways that are different from the current situation. Plans and decisions should be based on wildlife research and information specific to the proposals being considered and areas of the wildlife corridor that may be impacted.

Some of the wildlife data considered pre-dates recent developments and activities in the Lake Louise area that may affect wildlife movement. These include twinning and fencing of the TCH, the construction of wildlife crossing structures, changing patterns of human use, and creation of fire guards around the community. Newer data, including snow tracking, remote camera, and GPS telemetry data, would be useful in understanding whether and how wildlife movement patterns have changed over time.

The development, design and assessment of future Long Range Plan proposals should be informed by comprehensive, year-round data on wildlife activity in the corridor including assessment of:

- existing wildlife movement routes within the corridor that identify and describe how wildlife movement may be impacted
- existing seasonal and other temporal patterns of wildlife movement that identify and describe how wildlife movement may be impacted
- characteristics of existing effective movement routes to inform management and restoration, or enhancement of existing or new routes
- opportunities for habitat restoration or enhancements to corridor effectiveness
- natural changes in forest cover and other ecological conditions that may impact corridor effectiveness
- wildlife response to existing ski area activity including human use and sensory disturbances including noise thresholds
- changes to patterns of use on the Whitehorn road driven by increases or changes in visitation and operational use of the ski area.

Residual and Cumulative Effects

The expected ecological outcomes that apply to mitigating potential impacts to the Whitehorn Wildlife Corridor include:

- Vegetation composition and structure function as habitat for an expected range of native species;
- Sensitive and/or valued wildlife are not displaced from important habitat;



- Wildlife mortality does not increase, directly or indirectly, as a result of human contact and activity;
- The function of important wildlife movement corridors is maintained or restored.

The proposed changes to the leasehold and developed area are expected to support the overall maintenance or improvement of the effectiveness of the Whitehorn Corridor. Significant areas within the lower and mid-elevation portion of the corridor will be removed from future development considerations providing long term security for these areas of the corridor.

The Site Guidelines allow for the expansion of ski terrain at lower elevation locations on the Whitehorn front side and within the Whitehorn corridor above the base area. Clearing of new terrain for ski runs and ski lifts will change the pattern of vegetation cover to a patchwork of cleared and forested areas. While vegetation patterns will change, parameters for run width, distance between runs and patch size may be reasonably expected to maintain habitat conditions that allow wildlife to move through and inhabit the ski area as they do currently.

The increase in human use related to the development of new ski terrain adjacent to the Sunny T and Juniper areas, accompanied by a new base pod and base area parking is unlikely to have any significant cumulative effect on corridor effectiveness, as most use will occur at times of day when wildlife currently avoid using these areas of the corridor. Although the disturbance envelope will expand slightly in these areas, there are still opportunities for wildlife to move around the base area and through the corridor. Areas that were considered important to maintaining wildlife movement opportunities such as areas to the west of Whitehorn road and to the north of parking lot 4 were removed from development consideration as the Site Guidelines were developed.

The relocation of summer use to higher elevations of Whitehorn Mountain is considered to be a substantial environmental gain. Relocating summer use activities moves on-hill visitor use away from the upper elevations of the Whitehorn Corridor and to the upper elevations of Grizzly bear habitat. Relocation reduces visitor activity in and adjacent to the wildlife corridor and reduces the opportunity for human wildlife encounters. Reduced daytime disturbance in the central part of the corridor, may be expected to improve the ability of animals to travel through the ski area in the summer. The additional visitor opportunities proposed for Eagle Ridge and the Whitehorn summit area are also outside of the corridor, and therefore are not considered to have any negative effect.

However, relocation of summer use comes with potential adjustments to summer use hours of operation that hold some potential to offset potential gains. With respect to the Whitehorn Wildlife Corridor the primary concern with changing hours of operation is related to increased vehicle disturbances on the Whitehorn road. In response, the Site Guidelines provide clear direction on managing low intensity visitor use hours and the number of vehicle disturbances in order to maintain predictable times for wildlife movement that encompass daylight, twilight and nocturnal periods. In order to consider expanding low intensity visitor use into twilight and nocturnal periods the Site Guidelines require physical improvements to the effectiveness of the Whitehorn corridor including relocation and restoration of the Fish Creek road and installation of a large mammal wildlife underpass at a key location along the Whitehorn road.



Increases in vehicle numbers on the Whitehorn road during existing peak visitor use periods could potentially lead to a greater likelihood of vehicle-wildlife collisions. However wildlife are unlikely to be present near roads during peak disturbance periods and the risk of increased collision is considered to be low. The Site Guidelines also limit vehicle disturbances during low use periods to levels that are considered unlikely to impair wildlife movement. Low vehicle traffic levels, low speed limits and physical corridor improvements related to any proposed nocturnal use are expected to effectively limit potential increases in wildlife mortality.

Considering the full suite of guidelines and mitigations it is anticipated that the expected ecological outcomes related to wildlife corridors will be achieved under the Site Guidelines:

- Significant areas within the lower and mid-elevation portion of the corridor will be removed from future development considerations providing long term security for these areas of the corridor
- The function of vegetation and forest cover in wildlife movement is expected to be maintained through the application of parameters for run and vegetation management that permit wildlife to move through and use the ski area as habitat during periods of low intensity visitor use
- The relocation of summer use decreases the potential for wildlife disturbance and displacement and the potential for human/wildlife encounters in and adjacent to the upper elevations of the corridor
- Significant periods of low visitor use intensity, and no visitor use, through all seasons provide predictable times for sensitive wildlife to move through and use the ski area landscape
- Limits to vehicle disturbances during low intensity use, and physical improvements to movement across the Whitehorn Road are expected to limit any potential for increases in wildlife mortality
- Limits to the footprint of development in and around the old gondola and the main base areas are expected to maintain the ability for wildlife to move around the ski area along existing pathways.

8.2 Grizzly bear

Current Status

The Western Population of grizzly bears in Canada has been designated as a species of “Special Concern” by COSEWIC due to a greater than 50% decline in population numbers since the 1800s (COSEWIC 2012). Grizzly bears are considered to be sensitive to human disturbance and mortality risks associated with transportation corridors due to their naturally low rates of reproduction and requirements for large home ranges (Garshelis et al. 2005, COSEWIC 2012). The local population in Alberta was listed as “Threatened” in 2002 due to increasing anthropogenic strains on grizzly bear populations including harvest pressures, human attractants, highway and railway mortalities, habitat loss and fragmentation and fire suppression (Festa-Bianchet 2010). Within Banff National Park, grizzly bears are considered an important element of ecological integrity and the Management Plan has established a goal of maintaining a non-declining grizzly bear population (PCA, 2010).

Grizzly bears are omnivorous and vary their diets based on seasonal resource availability (Festa-Bianchet 2010). Grizzlies that live in the foothills tend to ingest more meat protein than mountain bears, which spend more of their foraging time consuming roots and migrating in elevation to prolong feeding opportunities (Munro et al. 2006). Three



distinctive feeding seasons have been identified for grizzlies based on their foraging habits (Weaver et al. 1996, McLellan and Hovey 2001, Nielsen 2005, Munro et al. 2006). Upon den emergence in April-May, bears tend to consume roots, tubers and herbaceous materials as well as scavenge ungulate carrion. In the spring and early summer, Grizzly bears forage on fresh vegetation and some will prey on ungulate young-of-year. In the late summer and fall, bears consume mostly berries and then return to digging roots.

Overall, the Mountain National Parks do not contain large areas of high quality habitat for grizzly bears since a large proportion of the available landscape consists of rock and ice environments (Gibeau 1998). Due to limited food resources, grizzly bears in the Bow Valley were found to have some of the lowest densities in North America. Sawaya (2012) reported a decreasing annual abundance of 74 individuals in 2006 to 50 individuals in 2008. Garshelis et al. (2005) found that grizzly bears in Banff National Park and Kananaskis Country had the lowest potential lifetime cub production of any population recorded. Having to reach an older age before first reproduction, longer rearing period and lower cub litter size all contribute to maintaining small population sizes in the Rocky Mountains (Weaver et al. 1996, Garshelis et al. 2005). However, the female survival rate of 95% estimated in 2005 is high enough to sustain existing population numbers (Garshelis et al. 2005). Despite the low reproductive rates of grizzly bears in the Rocky Mountains, the Mountain Parks have been identified as a source population for sink habitats outside the Parks where mortality rates are higher (Apps et al. 2004, Nielsen et al. 2006). The ski area itself is located in the Skoki Landscape Management Unit (LMU) and has been specifically identified as good and very good grizzly bear habitat in all 3 seasons including the slopes of Richardson Ridge and Wolverine Shoulder (Jalkotzy et al. 1999, PCA 2010). Grizzly bears strongly select for the south facing, early seral forest stage vegetation provided by the maintained ski runs on the front side of the ski hill during the summer (B. Burley, pers. comm., Mueller 2001).

Grizzly bears in general require large areas of interconnected habitat to maintain population dynamics (Festa-Bianchet 2010). When grizzly bears emerge from their dens in the Rocky Mountains, they require high nutrient foods in an efficient foraging area and therefore tend to select for disturbed areas (Berland et al. 2008, Milakovic et al. 2012, Bourbonnais 2013). When spring vegetation emerges, low traffic volume roadsides and other altered landscapes offer resources to maximize body condition quickly (Chruszcz et al. 2003). The social hierarchy of bears results in adult males occupying the highest quality habitat while females with cubs, adult females and finally subadult bears partition the remaining suboptimal resources (Gibeau and Stevens 2005, Nielsen 2005).

The result is that adult males generally maintain their distance from human disturbance while females and subadults take advantage of developed areas (Gibeau et al. 2002, Nielsen 2005, Berland et al. 2008). In general, subadults were found closer to high-use features than adults, and females were found closer to development than males when the features were located in high quality habitat (Gibeau et al. 2002, Mueller et al. 2004). Both age classes demonstrated temporal avoidance by increasing foraging during periods of low human-use and moving away during periods of high human-use. Jalkotzy et al. (1999) also found that bears tended to be closer to the ski runs than the gondola base and that the front side of the ski hill was more heavily used at night than during the day. Furthermore, grizzly bears strongly selected for ski runs which were adjacent to closed forest, indicating the importance of security cover.



Similarly, Donelan (2004) studied how grizzly bears use the Lake Louise ski hill as a function of vehicle traffic on Whitehorn and Temple Roads and human traffic on the Summit Trail. He found that bears were observed significantly more than expected during darkness and significantly less than expected during daylight. He also concluded that grizzly bears in the Bow Valley modify their fine temporal and spatial activity to avoid high human activity

Habitats near humans offer a trade-off that provides security from infanticide by adult males as well as high-quality foraging opportunities in exchange for increased mortality risk from humans (Benn and Herrero 2002, Laberee et al. 2014). Bourbonnais (2013) found that female grizzly bears in Alberta had elevated stress responses in relation to high-quality habitat with minor levels of human disturbance and low mortality risk. In contrast, areas with a higher proportion of anthropogenic disturbance such as roads and forestry blocks induced only low to moderate stress levels in female bears. This pattern in habitat selection suggests that females select for disturbed habitats as they provide a survival advantage.

The resource partitioning between adult male grizzly bears and females with cubs, single females and subadults has resulted in an increased abundance of bears near human developments, settlements and roads (Nielsen 2005, Gibeau and Stevens 2005, McKay et al. 2014). This subsequently increases the proximity of humans and bears to each other which results in a higher proportion of human-bear conflicts (Herrero 1976, Gunther et al 2004).

In the Lake Louise, Yoho & Kootenay National Parks Field Unit, the Human-Wildlife Conflict (HWC) program is dedicated to implementing both proactive and reactive measures of bear and wildlife management (Herrero et al. 2005, Honeyman 2008, Mazur 2010). Proactive methods include educating visitors and staff about bear safety and campsite management, establishing bear-proof garbage containers, implementing seasonal closures of critical bear habitat, removing attractive vegetation from high-use areas, maintaining sight-lines along hiking trails, removing carcasses from transportation corridors, implementing diversionary feeding, using prescribed burns and brushing to enhance grizzly bear habitat away from high human-use areas and conducting research into bear ecology (Schirokauer and Boyd 1998, WSPA 2009, Can et al. 2014). Reactive measures include establishing physical barriers such as electric fences, immediately hazing individual bears that demonstrate undesirable behaviors, implementing aversive conditioning programs on “problem bears” and relocating or removing bears that continue to have escalating conflicts (Heuer 1993, Ciarniello 1997, Herrero et al. 2005, Homstol 2011).

The Lake Louise Ski Area has implemented electric fencing around high human-use areas and bear-viewing is conducted from a chairlift or within an electric fence that prevents human-bear interactions (B. Burley, pers. comm.). The current level of use and method of grizzly bear viewing that operates at the ski hill has reduced the number of human-wildlife conflicts and requires very little operational time on the part of Parks Canada human/wildlife conflict specialists (B. Spreadbury, pers. comm.).

Despite management measures, proximity to human development is associated with an increase in mortality risk. In Banff and Yoho National Parks, 80% of grizzly bear mortalities were human-caused and all of those occurred within 500m from roads or 200m from trails (Benn and Herrero 2002). Increased visitation rates at the ski area



would likely increase traffic on Whitehorn road which is heavily used by grizzly bears (Tremblay 2001). While low-volume roads maintain permeability to grizzly bear movement, high-volume roads create a barrier for movement and induce avoidance behavior (Chruszcz et al. 2003, Graves et al. 2011). Grizzly bears can also be displaced by human presence, which may also increase with expanded use and development at the ski area. In the Greater Yellowstone Ecosystem, grizzly bears that lived mostly in the backcountry were found to use certain areas when human-use was low but become displaced when human-use was high (Coleman et al. 2013). In Sweden and Norway, resorts, towns and backcountry cabins were avoided by 10 km by female and adult brown bears while subadults tended to use the area within the 10km buffer more readily (Nellemann et al. 2007).

Grizzly bears will also alter their temporal use of human disturbed areas to reduce potential interactions. In the Bow Valley, wary bears used high quality habitat more efficiently in the absence of humans while habituated bears travelled further in sub-optimal habitats during high-human use (Gibeau and Stevens 2005). Male grizzlies, which are more sensitive to human presence, were found to be closer to the Trans-Canada Highway during the human inactive period and all age classes tended to move away from human developments during high activity periods (Gibeau et al. 2002, Mueller et al. 2004). Grizzly bears in Yellowstone National Park have been documented to avoid human recreation areas in the backcountry during high-use times and return during low-use periods (Fortin et al 2013, Coleman et al. 2013). Oil and gas features were used more consistently at night and in the spring in west-central Alberta when human activity levels were lowest (Laberee et al. 2014).

Human disturbance can also negatively affect grizzly bear denning and influence den abandonment. Grizzly bears have been documented to den 1-2km from human use areas without apparent disturbance but activity within 1km produces a significant risk that bears will abandon their dens (Linnell et al. 2000). In Sweden and Norway, human presence such as hunters, fisherman, and skiers passing within 50-100m of den sites resulted in 12 of the 18 den abandonments by brown (grizzly) bears (Swenson et al. 1997). In addition, abandonments by sows with cubs had a negative effect on reproductive success resulting in the death of one or more cubs after the relocation (Swenson et al. 1997). In west-central Alberta, grizzly bears selected den sites away from human disturbance with low road densities and no den sites were found within 300m of oil and gas developments (Pigeon et al. 2014). Grizzlies in Sweden maintained distance and low visibility of den sites to villages and roads and appeared to select for more rugged terrain when closer to human developments (Sahlen et al. 2011). Goldstein et al. (2010) studied 207 den sites in Alaska and discovered that den sites were selected away from human disturbance and activity but that the location mid-slope on 35° slopes away from roads had significant overlap with backcountry skier terrain.

In the Canadian Rockies, the majority of dens were located between 2000-2450 meters with slope angles of 26-39 degrees and predominantly on north-east to south-east aspects (Russell et al. 1979, Vroom et al. 1980, Hamer and Herrero 1983, Stevens and Gibeau 2005). Grizzly bears have a high site fidelity for denning locations and clusters of dens have been observed in various studies (Vroom et al. 1980, Servheen and Klaver 1983, Van Daele et al. 1990, Ciarniello et al. 2005). This is likely related to the limited availability of suitable den characteristics and learned behaviours to return to sites with appropriate den features (Servheen and Klaver 1983). Grizzly bear dens in Banff National Park that were identified by aerial telemetry or GPS collar locations were



analyzed and mapped over the period of 1994-2014. It was found that 30% (26/86) of grizzly bear dens were located in the Slate Range, which contains only 2.7% (187 km²/6857 km²) of the total area of the Park. When a 15 km x 15 km grid was superimposed on Banff National Park, the Slate Range had 25 dens/225 km² and the second largest concentration of bear dens was 9 dens/225 km². All together, 27% (9/33) of the individual grizzly bears that use Banff National Park denned in the Slate Range, indicating that the range provides important denning characteristics and is not simply being used multiple times by a few individuals. In relation to the ski hill, 92% (24/26) of the bear dens in the Slate Range were located further than 2.5 km from the top of the “Top of the World Express” chair and 80% (21/26) were located further than 4 km. This may indicate that grizzly bears select sites to maintain a buffer from human development when choosing winter den locations.

Existing and Potential Interactions and Impacts

Potential activities associated with the Lake Louise Ski Area Site Guidelines that have strategic implications for Grizzly bear and grizzly bear habitat include:

- Adjustments to the lease and developed area
- Development of new ski terrain
- Changes to the summer use program.

Adjustments to the lease and developed areas

A key aspect of the Site Guidelines is the removal of Purple and Wolverine Bowls, and a significant portion of the lower east side in the Whitehorn wildlife corridor and lower Corral Creek valleys from the leasehold. This change to the leasehold is considered to be a substantial environmental gain by Parks Canada providing long term security for bear habitat in these areas and for bear movement through the affected portions of the Whitehorn Wildlife Corridor.

Environmental gains associated with Purple and Wolverine Bowls and the lower east side allow for the consideration of exceptions to the Ski Area Management Guidelines including the development of new ski terrain for Richardson’s Ridge, Hidden Bowl/Corral slides area, and West bowl. New development and use in these new areas is not considered likely to directly affect Grizzly bears, or the quality of bear habitat in Purple and Wolverine Bowls. Consideration of impacts to grizzly bear movement and habitat within the Whitehorn Wildlife Corridor have been considered previously in Section 8.1 and are not considered further here.

Other than direct impacts, a key strategic consideration for the Site Guidelines is to not offset the gains to grizzly bears and habitat in Purple and Wolverine Bowls and the lower east side with impacts to bears in areas of new development and use. The nature of physical development of new terrain, and changes to patterns and intensity of visitor use, both have implications for continued grizzly bear habitat effectiveness.

Development of new ski terrain

Disturbance features with limited human-use may provide high quality forage for grizzly bears and the developed Lake Louise Ski Area has become an important habitat for grizzly bears. The current human-augmented habitat that occurs on the south aspect of the ski hill provides important foraging habitat for grizzlies with minimal levels of human disturbance. The managed ski runs on the front side of the ski area are strongly selected for within the Skoki LMU by grizzlies (Jalkotzy et al. 1999). The early green up of important vegetation and the south aspect, steep slope, open canopy and high



greenness index qualities are all important factors that increase food availability in Northern landscapes (Ciarniello 2007). Mueller (2001) identified that the ski area attracts females and subadult grizzlies with adult females typically using the best habitat further from the gondola base.

Grizzly bear use of the Lake Louise ski area reflects broader patterns in bear use throughout the foothills and Rockies. In the foothills, bears have been found to use recently disturbed sites such as clear-cuts, roadsides and burns to feed on clover, peavine, dandelion and alfalfa (Munro et al. 2006, Milakovic et al. 2012). In Alberta, adult females were found closer to all oil and gas features such as roads, pipelines, active and inactive well sites in spring and summer, but selected more strongly for inactive features (Laberee et al. 2014). McKay et al. (2014) found that the likelihood of grizzly bears selecting for well sites increased with decreasing human activity and road density and increasing security cover to provide concealment. Nielsen (2005) found that bears used clear-cuts in the Rockies during den emergence and in the fall due to an increase in food sources such as horsetail, sweetvetch, dandelion, clover and blueberries in those habitats. Grizzly bears in west-central Alberta select for disturbed areas at a higher frequency than available within their home range (Stewart et al. 2012). Females and males also used these disturbed areas differently, with females using the features in the summer and fall and selecting anthropogenic edges over natural ones and males selecting against the fall and for natural over anthropogenic edges (Stewart et al. 2012, Stewart et al. 2013).

The Site Guidelines contain ecological management parameters that pertain to the planning and development of new ski runs, glades and lift infrastructure. Maximum run widths, distance between runs and forest patch cover parameters were identified, primarily with the needs of wary predators in mind such as lynx and pine martin. These same parameters provide new meadow and open forest foraging opportunities for Grizzly bears while maintaining access to security cover and ability to move through the landscape.

Potential development in West Bowl is limited to the construction of an egress trail. It would not be unreasonable to expect that Grizzly bears would make use of this trail in the summer season. However no other run clearing or development activities are considered for West Bowl and loss of secure habitat is not considered to be an issue.

Both cleared runs and glades may be brought forward in a Long Range Plan for the Richardson's ridge and Prunepickers area. Ski run and glade development on Richardson's Ridge that maintains run parameters and maintains native ground cover can be reasonably be expected to enhance habitat conditions on slope aspects favorable to grizzly bear. Similarly, run clearing in the Prunepickers development is likely to benefits overall grizzly bear habitat conditions. While future patterns of bear use cannot be precisely predicted these newly managed areas may provide additional and alternative feeding habitat to the clearings on the front side of the ski area.

Ski area development in Hidden Bowl is likely to result in little change to Hidden Bowl forest cover vegetation as most of the bowl proper is above treeline. Below the bowl run development is limited to the clearing of existing grown-in avalanche paths and glading. The Site Guidelines allow for the consideration of a lift base terminal in the Hidden bowl flats area above treeline, or in the Valley bottom maintaining natural vegetation buffer between the lift base and Corral Creek. Each of these development possibilities can be completed in



accordance with the run and vegetation management parameters of the Site Guidelines or can be managed to mimic natural vegetation patterns in the local landscape.

It is quite clear that the physical landscape at ski areas may be managed to maintain and even enhance the effectiveness of grizzly bear habitat. The key factor to ensuring that substantial environmental gains are maintained and that bears are able to use available natural or managed habitat is the timing and intensity of human use.

Changes to the summer use program

As discussed previously in 8.2.1, human disturbance on the landscape may be generally considered to result in a decreased ability to support healthy bear populations (Gibeau 1998, Linke et al. 2013). Overall, Grizzly bears have been well documented to avoid human development and select for terrain that would inhibit human encroachment (Apps et al. 2004, Ciarniello 2007). Both wary and habituated grizzly bears have been found to respond negatively to high levels of human-use (Gibeau and Stevens 2005). Habitat effectiveness and connectivity of high quality habitat patches on either side of the ski lease were found to be compromised by ski area activity (Jalkotzy et al. 1999).

The GPS and telemetry data of grizzly bears using the LLSA collected discontinuously from 2000 to 2014 supports the findings of other studies (PCA, 2014). Although collared bears tended to use the LLSA more during the day than during the night, the bears demonstrated trends in spatial and temporal variation in avoidance of high levels of human activity. During the day, locations were more heavily clustered at higher elevations while at night the locations were found closer to the gondola base. During the day, bears appeared to select for ski runs with smaller widths and higher edge habitat, presumably to provide security cover, while at night bears used the larger, more open slopes near the base. Finally, grizzly bear GPS telemetry data indicate high use of the front side of the ski hill during the summer with 22% of points located there in July and August and low use during the fall with 4% in September. Data for spring indicates an intermediate amount of use by bears with 9.5% in June, but is likely an under representation of the actual amount of use due to trapping and collaring operations occurring in the spring and therefore not reflecting all collared bears. Heavy use of the front side of the ski hill in the spring has been previously documented and is likely an important resource for bears during this season (Jalkotzy et al. 1999, B. Burley pers. comm.).

As discussed earlier however, despite the tendency to avoid human development, the social hierarchy of bear populations enables females and subadults to take advantage of high quality habitat if it occurs near disturbances (Gibeau et al. 2002, Laberee et al. 2014). Currently, segregation between humans and grizzly bears on the front side of Mt. Whitehorn is effectively maintained. And while human activity may benefit and provide for additional habitat for female and submature bears, it is uncertain at what point an increase in facilities and visitation would cause grizzlies to adopt an increased level of avoidance and negate any beneficial effects.

Regardless of the potential benefits of ski area activity, displacement of bears takes place at some level and creates patterns of use that are perhaps not optimal, relegating bears to increased use of twilight and nocturnal periods. Human use also certainly creates potential for habituation and bear/human conflict.

Relocation of the summer use program to the upper elevations of the east ridge of Whitehorn Mountain provides new and enhanced summer visitor opportunities with a



focus on hiking, site-seeing and heritage interpretation opportunities. But the relocation also has benefits for grizzly bear security removing visitor disturbance from the center of high quality grizzly habitat on the mid elevation slopes of Whitehorn mountain.

Relocation of the summer visitor program will remove a large area of high quality bear habitat from hiking and other potential direct disturbances, limiting on-hill visitor use to designated trails on upper slopes of Whitehorn located above high quality habitat. The relocation is anticipated to result in a significantly improved situation reducing potential for disturbance, displacement and direct interaction between visitors and bears.

While the relocation is anticipated to have overall positive benefits to grizzly bear habitat security it does not entirely eliminate concerns about grizzly bear/visitor interactions. Grizzly bear GPS telemetry data do not show heavy grizzly bear use of the Eagle Shoulder area. However, there is some evidence that bears travel over the shoulder when moving between important habitat patches on the ski hill. In particular, seasonally important habitat appears to occur immediately north of Ptarmigan Chair, as well as in Purple/Wolverine Bowls and upper Corral Creek, and bears may travel over Eagle Shoulder in order to move between these locations and the front side.

The upper gondola unload and the site of the new lodge on Eagle Shoulder are not completely outside, but on the upper limits of Grizzly bear habitat and movement routes. While the Shoulder is considered to be a better location for the summer use program the potential for bear/human interaction and sensory disturbance remain as key considerations that must be managed effectively to ensure that the anticipated gains to bear habitat effectiveness are achieved.

Mitigating Measures

The suite of mitigations for grizzly bears identify ecological management parameters, Long-Range Plan and operational parameters, and environmental assessment and information requirements that are needed to realize the desired ecological integrity outcomes of the Site Guidelines.

Ecological Management Parameters

Ecological management parameters serve as the on-the-ground benchmarks against which the environmental impacts of future development and use proposals will be assessed. The following ecological management parameters have been incorporated into the Site Guidelines in order to realize desired outcomes and priorities for grizzly bears:

- Winter and summer operational and construction activities do not displace or habituate grizzly bears or other wildlife.
- Changes in development, operations and visitor use result in an overall improvement for grizzly bears, including reduced potential for displacement, habituation or bear-human conflicts.
- Development preserves natural food sources for grizzly bears and does not create non-native sources of food that would attract them.
- Ski area operations and visitor use provide low disturbance periods for wildlife that respond to winter and summer seasonal patterns and sensitivities
- Ski area use and operations maintain wildlife habitat effectiveness and security outside of ski area lease and licenses of occupation.

Long Range Planning and Operational Parameters

Specific planning and operational parameters are identified to provide greater clarity for project design and planning, and ski area operations. These parameters should be included as part of future planning proposals or management initiatives as appropriate.



New Terrain Development

Adherence to the run and vegetation management parameters are expected to provide a mosaic of open meadow and forest cover that facilitates Grizzly bear movement and habitat use. In addition to these parameters and wherever feasible, development of new runs, modification of existing runs and development of glades should be planned consistent with the following parameters:

- creation of open meadows on new or modified ski runs should contain a mix of natural graminoid and herbaceous species utilized by grizzlies whether through natural regeneration or active reclamation
- where feasible, run widths and openings that exceed 50m in width should be restored to 50m or less in conjunction with run development or expansion in other locations
- where applicable thinning or opening of the forest canopy for glading should be 45-50% to enhance buffalo berry production in areas away from visitor use
- known bear den sites will be avoided and buffered from permanent development and intensive winter use or disturbance.

Summer Use Relocation

The relocation of summer use in the Site Guidelines is associated with a range of guidelines and conditions that address seasonal timing of visitor use, the management of on-hill visitor use, and sensory impacts that would impact Grizzly bears and other wildlife. Together the guidelines and conditions of the Site Guidelines provide predictable low visitor use, and no visitor use, periods on the ski area in accordance with seasonal patterns and sensitivities. Key conditions of the Site Guidelines include:

- Designation of predictable opening and closing times for on-hill visitor use of the trail system that provide low disturbance daylight, twilight and nocturnal periods for bears and other wildlife
- Undisrupted periods encompass contiguous periods of 6-8 hours a day in the summer season when grizzly bears are active on the ski area
- Extension of summer use hours are contingent on improvements to the Whitehorn wildlife Corridor as outlined in Section 8.1
- Low visitor use times are managed in such a way that sensory disturbances such as human presence, noise and light do not displace bears or other wildlife from movement routes or high quality habitat.

For additional clarity the following conditions should be applied to the development and management of summer use as part of relocation:

- The designated trails systems will be generally routed at or above treeline from the elevation of the lodge and Eagle Shoulder area so as to reduce bear-human conflict and minimize human disturbance to grizzly bears in more favorable bear habitats below
- Established trails should be managed in compliance with current LLYK FU Bear Management Plan and Operational Guidelines.
- Areas below the elevation of the shoulder and lodge will be closed to off trail hiking or other summer visitor activities
- Constructed pathways and lookouts at the lodge area should be located to maintain good sightlines and avoid high quality bear habitat. Electric fence may be necessary depending on the final location of the lodge and the footprint associated with the lodge to ensure safety from bear-people interactions.



- Ensure the development of new bear/wildlife interpretive displays, presentations, brochures, etc. are consistent with Parks Canada bear and wildlife research and messaging.

Other activities associated with the construction and daily operation of the lodge, trail systems and other features are not expected to have long term strategic level impacts to Grizzly bear. Considerations such as construction techniques, construction timing and operational management will be addressed at the Long Range Plan stage and through the application of established best management practices.

Environmental Assessment and Information Requirements

The development, design and assessment of future Long Range Plan proposals should be informed by updated, on-site information on grizzly bear habitat use and disturbance thresholds including assessment of:

- Site-specific Grizzly bear movement pathways, patterns, frequency and importance that link high quality habitats on either side of the ski area including assessment of Grizzly bear movement over Eagle Shoulder
- Noise decibel and lighting disturbance levels that would disturb grizzly bears from habitat or adjacent movement routes
- Thresholds and patterns of Grizzly bear use that would provide indication of the success of the summer use visitor program and management protocols
- The presence of den sites in the surrounding area of the lease and licenses of occupation that may be impacted by ski area use and operations such as avalanche control or out-of-bounds backcountry skiing from the ski area.

Residual and Cumulative Effects

Desired Outcomes and Priorities from the Site Guidelines that apply to mitigating potential impacts to grizzly bears include:

- Land use decisions contribute to local region ecological integrity goals including fire and vegetation management, wildlife movement, grizzly bear habitat security and species at risk protection and recovery.
- Terrestrial and aquatic habitat conditions for sensitive species including Whitebark pine, grizzly bear, wolverine, mountain goat, west slope cutthroat trout, bull trout and mountain caribou are conserved or restored.
- Habitat security is ensured by maintaining or reducing the potential for grizzly bear/human conflict, displacement and habituation.

As part of the Site Guidelines, Purple and Wolverine Bowls, areas that have long been considered important to Grizzly bears and other wildlife are removed from potential future development consideration. Similarly, reducing the ski area lease on the lower east side provides greater security for affected areas of the Whitehorn Wildlife corridor.

Development of new ski terrain considered as exceptions in the Site Guidelines is not considered to be likely to impair the gains of leasehold reduction by impacting Grizzly bears or habitat use of the Whitehorn wildlife corridor, or of Purple and Wolverine Bowls. New ski terrain development, in and of itself, may be reasonably expected to improve or expand high quality Grizzly habitat for female, cub and subadult bears. Although specific patterns of Grizzly bear use cannot be accurately predicted, ski terrain development in the Richardson's ridge and Prunepickers areas and in the Corral slides area below Hidden Bowl may increase overall habitat effectiveness and provide additional space for Grizzly bears to find separation from visitors. Specific habitat



features such as den sites or important food sources will be identified through the long range plan process and associated environmental impact assessment.

The primary concern with respect to Grizzly bears on the ski area is summer visitor use. Development and the presence of visitors may provide some security for female and subadult bears from adult males. However at a certain point human disturbances are likely to turn from a benefit to habitat, to displacement, habituation or increased mortality risk. Accordingly management of summer visitor use, timing, location, intensity and sensory disturbance is the key factor to maintaining Grizzly bear habitat effectiveness on the ski area.

Relocating the summer use program to higher elevations on the East Ridge of Whitehorn Mountain can be considered a substantial environmental gain, removing visitor use from key, high quality mid-mountain Grizzly habitat and making this habitat more accessible to bears during all periods of day. Maintaining this gain in relation to use of the gondola and a new lodge on Eagle Shoulder requires effective design and management of visitor use and sensory disturbances on the upper mountain.

Considering the full suite of guidelines and mitigations it is anticipated that the expected ecological outcomes related to Grizzly bears will be achieved under the Site Guidelines:

- Significant areas within the lower and mid-elevation portion of the Whitehorn wildlife corridor will be removed from future development considerations providing long term security for Grizzly bear and habitat use in these areas of the corridor
- The return of Purple and Wolverine Bowls to park wilderness will provide increased long term security for bear habitat and use in areas that have long been valued by Parks Canada
- Development of new ski terrain consistent with established Run and Vegetation management parameters and other conditions of the Site Guidelines is expected to improve the amount of high quality foraging habitat for Grizzly bears on the front and back sides of the ski area
- The relocation of summer use improves daily and seasonal accessibility to a significant amount of high quality Grizzly bear habitat on the Front side of Whitehorn Mountain, decreases the potential for Grizzly bear disturbance and displacement and the potential for human/bear encounters
- Significant periods of low visitor use intensity, and no visitor use, through all seasons provide predictable times for Grizzly bears to move through and use the ski area landscape
- The design and management of facilities and visitor use activities around the gondola and upper lodge locations limits sensory disturbances to levels that will not displace Grizzly bears and ensure that habitat effectiveness is maintained.

8.3 Mountain Goat

Current Status

Mountain goats occupy alpine and subalpine areas throughout northwestern North America. The jurisdictions with the largest estimated numbers of mountain goats are British Columbia (39,000 – 65,500) and Alaska (24,000 – 33,500), with much smaller numbers present in other states, provinces and territories (BCMOE 2010, Myatt and Larkins 2010). In Alberta, provincial goat numbers are estimated at 2,000 to 3,000 including national parks (Smith and Hobson 2008, Myatt and Larkins 2010). Mountain goat populations in Alberta are believed to have drastically declined in the 1960s and

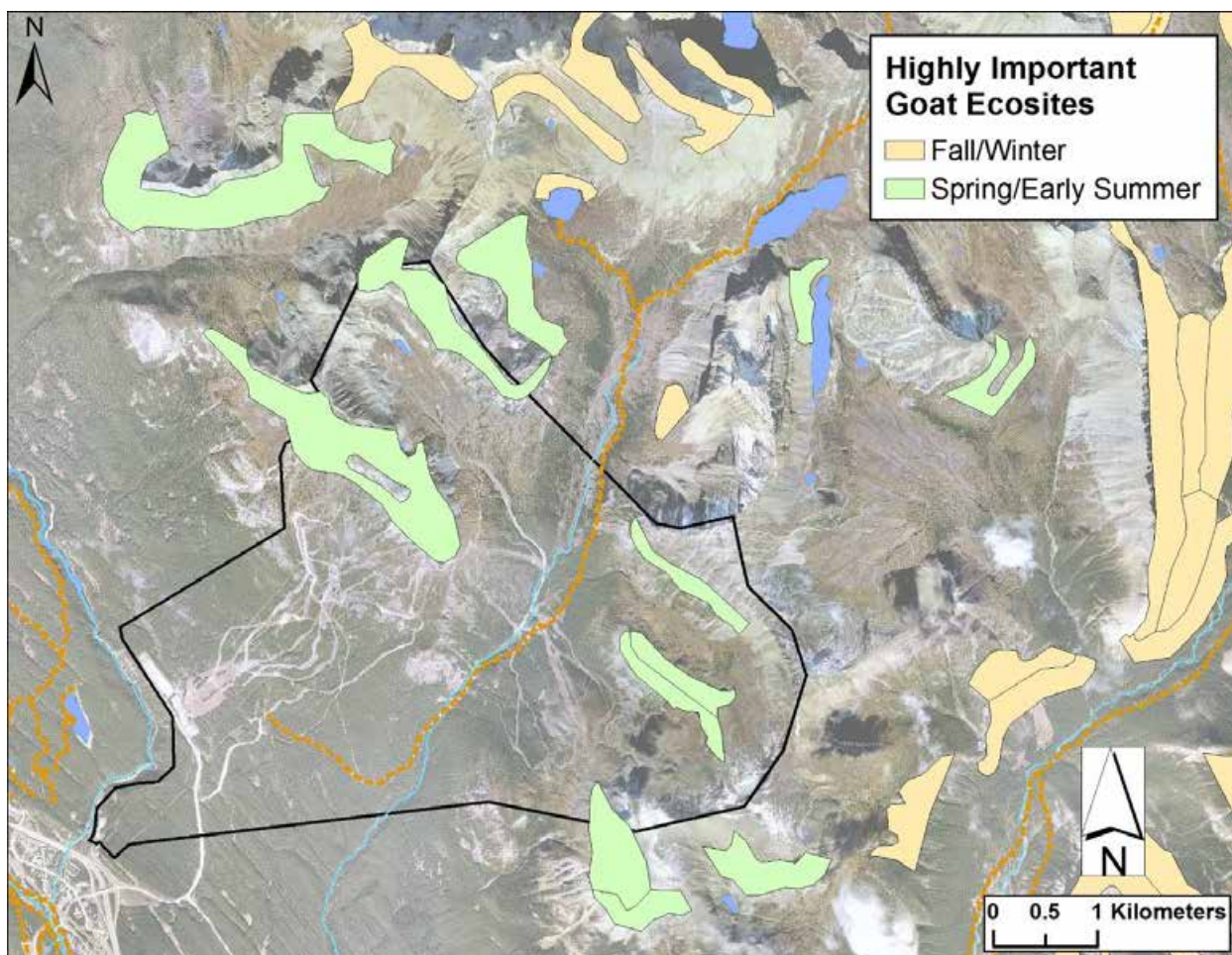


have been slow to recover despite more stringent management programs adopted in the 1980s (ASRD 2003). The ability to monitor goat population abundance, however, is limited by the remote characteristics of goat habitat and the high variability of goat sightability during aerial surveys (Poole 2007; Gonzalez-Voyer et al. 2001).

The Lake Louise Ski Hill is located within the Slate Range, a range bounded by the Bow Valley, Baker Creek, upper Red Deer River, and the Pipestone River. Jacobson and Loewen (1980) suggested that this range was large enough to comprise all seasonal ranges of mountain goats resident near the ski hill. Mountain goats have never been recorded crossing the Bow Valley in the Lake Louise area, including at wildlife crossing structures on the Trans-Canada Highway (Parks Canada Agency, unpublished data), but it is uncertain how much goat movement occurs across other boundaries of the Slate Range. Based on average mountain goat home range sizes in other study areas ranging from 5 to 25 km² (Cote and Festa-Bianchet 2000) it appears likely that most seasonal movements of resident goats could be limited to the Slate Range.

Parks Canada's wildlife database includes several different sources of mountain goat data. Random observations of wildlife have been recorded by park staff going back to at least the 1950s, although records are extremely limited prior to the mid-1970s. In some cases, observations were not necessarily truly "random", but were collected as part of targeted patrols to collect data in areas of management interest. Aerial surveys using helicopters commenced in the 1970s and provided obvious advantages for collecting relatively unbiased data (compared to ground-based random observations or surveys) and for covering rugged, high elevation, and/or remote locations. Beginning in the 2000s infrared-triggered remote cameras were deployed in some areas to collect wildlife data without the need for a human observer.

In the late 1970s and early 1980s ungulate pellet group counts were conducted widely throughout Banff and Jasper National Parks as part of the wildlife inventory of the Ecological Land Classification for these two parks (Holroyd and Van Tighem 1983). These data were used to estimate the relative importance of ecosites to mountain goats in 2 seasons: fall/winter and spring/summer. Important ecosites for spring/summer occurred within or near the current boundaries of the LLSA, including Mt. Whitehorn/Eagle Ridge, Richardson Ridge, Hidden Bowl, Wolverine Bowl, Purple Bowl, and Mt. Lipalian (Map 8). Important ecosites for fall/winter occurred at Hidden Lake, S and SW aspects on Mts. Richardson, Pika, and Ptarmigan, on the west slope of Mt. Redoubt, and at tree-line on the east side of Mt. Lipalian.



Map 8: Mountain Goat Ecosites

The earliest records of mountain goats in and near the ski area in Parks Canada's wildlife database date back to the mid-1970s, although there are some earlier anecdotal reports. For example, goats occurred continuously on Ford Hill during winters from 1967 on, but only sporadically after 1976 (D. Loewen, pers. comm. cited in Jacobson and Loewen 1980). Park wardens during this same era also reported goat observations in Eagle Valley and on Whitehorn Ridge, and several large groups of goats (up to 42 animals in a single observation) in the Hidden Lake area.

The first aerial surveys in the Slate Range occurred in 1978 and 1979 (Jacobson and Loewen 1980). In the 1980s surveys took place in late fall or early winter of 1983, 1984, 1985, and 1987 (Bertch 1988). No surveys were then conducted until the fall of 1999 (Parks Canada, unpublished data). Since 2009 surveys have been flown in the Slate Range each fall through 2014 (Parks Canada, unpublished data).

The highest unduplicated count reported from the 1978 and 1979 surveys was 26 goats (Jacobson and Loewen, 1980). The highest aerial survey counts¹ of mountain goats over the entire 36 year period from 1978 to 2014 occurred in the mid-1980s when greater than 40 animals were observed during the 1984 survey and in two separate surveys in 1987.



By contrast, counts made during the 6 surveys completed from 2009 to 2014 ranged from 3 to 14 goats. It is difficult, however, to use these data to track population trend because of changes from survey to survey in weather conditions, time of year, observer experience, pilot experience, survey objectives, funding constraints, and randomness in animal movement and behavior patterns.

Jacobson and Loewen (1980) reported a goat population decline in the Slate Range based on a drop in the average herd size from 14.1 in the 1948-1960 period to 5.9 in the 1970-1978 period, and attributed this decline to expansion of the ski hill into goat habitat, avalanche control activities, and increased ski touring. In so doing they also noted that evidence of decline was not found in other goat ranges in Banff National Park. They recommended that the ski hill should not expand beyond its then-present boundaries, that visitor numbers should be controlled, and that recreational activities should be confined to valley bottoms. Leeson and Israelson (1982) reported that mountain goats formerly occupied Whitehorn Mountain and Eagle Ridge, but “appear to have mostly forsaken this range as ski area development expanded onto this habitat”. Jacobson and Loewen (1980) and Leeson and Israelson (1982) identified an important mountain goat mineral lick in Wolverine/Purple Bowl.

Leeson and Israelson (1982, p. 77-78) state that this important lick “exists in the Temple area – up the valley to Purple Bowl², and near the base of the waterfall cliff. This area is heavily visited by goats (and other animals) during the spring and summer”. Jacobson and Loewen (1980) discuss the importance of mineral licks to wildlife and go on to state that “to our knowledge this is the only known mineral lick located in the Slate Range and is probably used by the entire population at one time or another”.¹

Based on goat sightings and aerial surveys, Jacobson and Loewen (1980) described the attributes of goat winter range in the Slate Range. They described it as occurring at approximately 2800 m on windswept ridges, and on SSW aspects of scrub timber slopes close to escape terrain at approximately 2450 m. Three pockets of winter range were mapped within or close to the ski area: the slopes of Eagle Ridge above Ford Hill, a slope just NE of the confluence of Corral Creek and the creek draining Wolverine Bowl, and the upper reaches of Richardson’s Ridge. Summer habitat was described as having a wider distribution and included Hidden Lake, the east slope of Redoubt Mtn., Mt. Lipalian, and a slope in upper Pipestone Bowl. Goats reportedly returned to winter range by the end of November and began “drifting” toward summer range in late April.²

Goat abundance and distribution appears to have changed in the Slate Range over the past 35-40 years, as indicated by the pattern of goat observations and surveys over time. Although the intensity, timing, and methods of goat surveys have changed over the years, it seems clear that goats no longer occur within the developed footprint of the ski hill, and rarely occur within a 2 km buffer of the developed footprint. Holroyd and Van

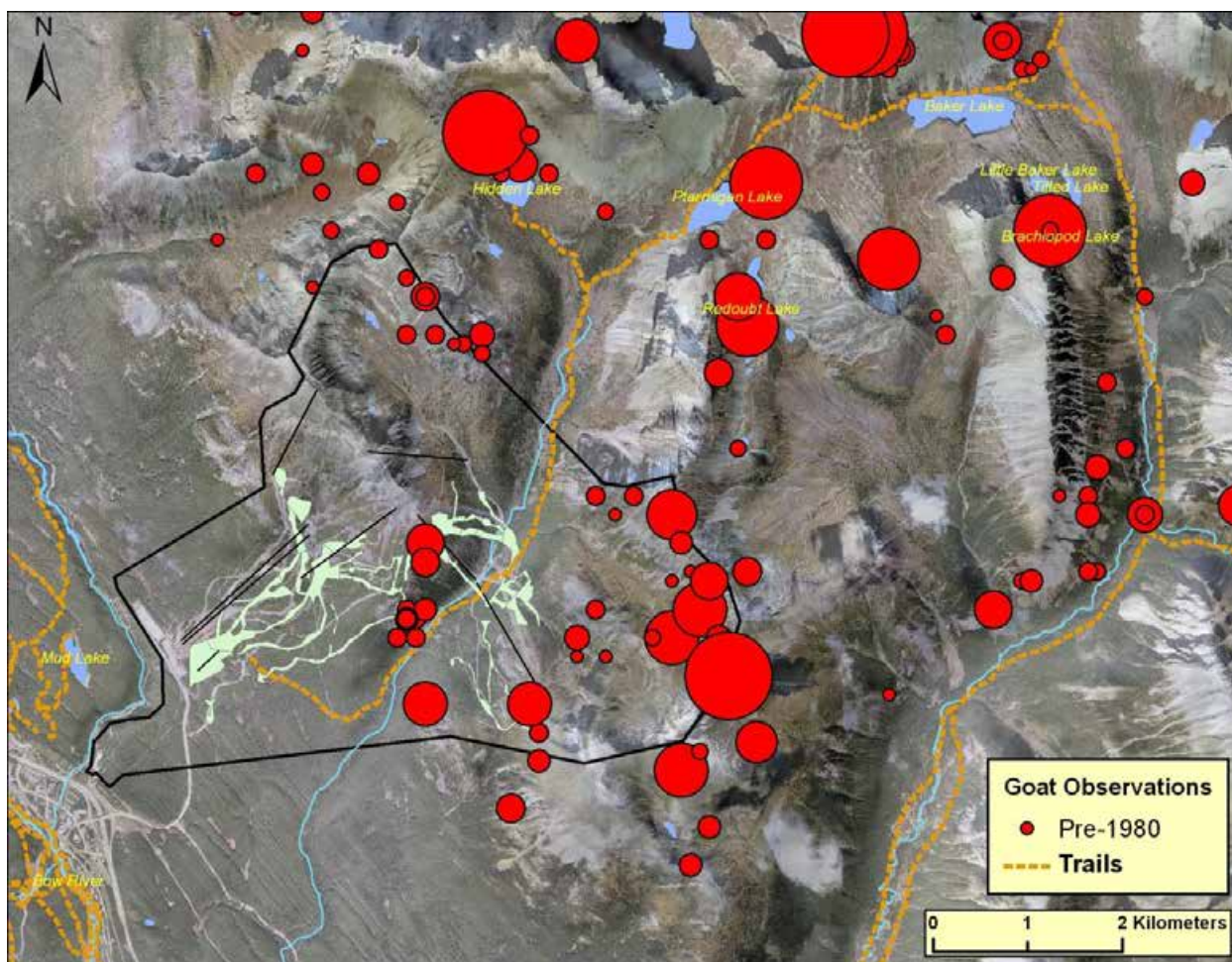
¹ “Counts” refers to only to the number of animals actually seen, and does not include sightings of animal snow tracks or other animal signs.

² There appears to be some confusion in the literature over nomenclature of Wolverine and Purple Bowls and the location of the mineral lick. Jacobson and Loewen (1980) mapped the mineral lick in Wolverine Bowl, ie, in the drainage north of Wolverine Ridge, whereas Leeson and Israelson (1982) refer to the location as being in Purple Bowl; ie, the drainage west of Wolverine Ridge. However, a map in Leeson and Israelson (1982) labels Wolverine Bowl as “Purple Bowl”. It appears that the actual location of the lick is in Purple Bowl (the drainage west of Wolverine Ridge) at the base of a prominent cliff and waterfall, just above the Rock Garden ski run.



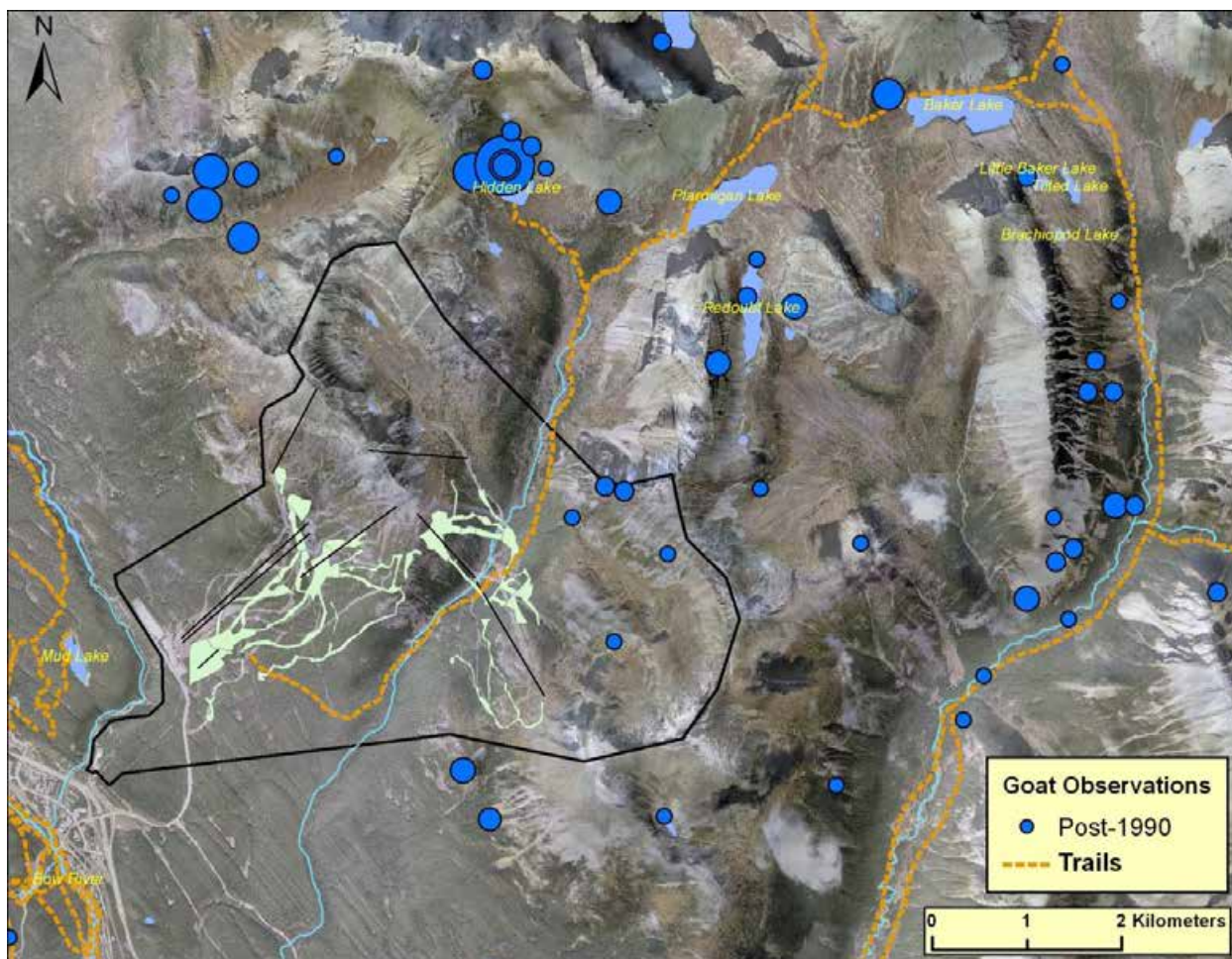
Tighem (1983) listed the Slate Range as one of 6 goat ranges in BNP with the largest goat populations, however, that may no longer be the case based on aerial survey results from the 1980s and since 2009 (Parks Canada Agency, unpublished data).

Map 9 shows the location of goat observations from all sources (random observation, aerial surveys, and ground surveys) in the Parks Canada wildlife database prior to 1980, with red circles representing goat sightings. Circle radius is proportional to group size with the range being 1 to 26.



Map 9: shows goat observations from all sources from 1990 through 2013, using blue circles to depict goat observations.

Ford Hill/Eagle Ridge. This includes the open slopes and avalanche paths between Ptarmigan Chair and Ford Hill. Goats were seen here on several November aerial surveys during the late 1970s in groups as large as 8 animals (Parks Canada, unpublished data). Several random observations were also recorded by park wardens between 1977 and 1981. In December 1987 a lone goat was seen on an aerial survey and this is Parks Canada's last record of mountain goats in this area. Aerial surveys in late fall of 2012, 2013, and 2014 took place in this area but failed to find goats. Jacobson and Loewen (1980) noted that avalanche control work with explosives began at nearby Ptarmigan Chutes in 1975 and that this activity displaced goats from the area.



Map 10: Mountain Goat Observations

Wolverine/Purple Bowls. Records of goat use of the Purple Bowl mineral lick first appear in 1977 and 1978. The mineral lick was not mentioned in Leeson (1973), but Jacobson and Holroyd (1978) hypothesized that the lick was used by all goats in the Slate Range based on the number of goat sightings at the lick and the extensive network of game trails leading to and from the lick. They reported a maximum count of 13 goats at this lick in the summer of 1978. No subsequent records exist in the Parks Canada database from the next 34 years, until a wildlife camera was placed at this location in the summer of 2012 and recorded a single goat travelling upslope toward Wolverine Ridge (Sherriff 2012). In 2013 a camera was deployed at this location again, but did not record any mountain goat activity (Sherriff 2013). In Wolverine Bowl, several large groups of 13-24 goats were recorded in the late 1970s, particularly on high elevation terrain along the eastern and northern sides of the bowl. This was the last area within the ski area leasehold boundary where large groups of goats were recorded, likely because this portion of the leasehold remained undeveloped and the nearest chairlift, the Larch double-chair, wasn't installed until 1974. After 1980, the largest group of goats recorded in this area was a group of 6 goats high on the ridge on the north side of Wolverine Bowl in 1982. Occasional sightings of 1-2 goats have been made subsequently during aerial surveys or targeted group surveys in this area, including a sighting of 2 goats on the



north side of Wolverine Bowl in 2012, but no group of 3 or larger has been recorded since 1984 (Parks Canada, unpublished data).

Richardson Ridge. The Parks Canada wildlife database contains no goat records for this area prior to the aerial surveys of 1977 to 1979 (Parks Canada Agency, unpublished data). However, Leeson (1973) noted that Richardson Ridge was “frequented by mountain goats” and therefore recommended against permitting ski area development on the southwest slopes of the ridge. The late 1970s goat aerial surveys and ground observations, however, only detected small groups of 1-2 goats, during winter and spring on the ridge crest or southwest slopes. No other goat records appear in the Parks Canada database for this area from 1979 through 2013. Sherriff (2014a) did not detect goats with a wildlife camera set up at the col between Richardson Ridge and Whitehorn Mountain during the summer of 2013. However, in the summer of 2014, a lone goat travelling south towards the LLSA was detected on this camera (Sherriff 2014b). It appears likely that mountain goats occasionally travel along the ridge systems in this area, particularly since relatively heavy goat use occurs at Hidden Lake, approximately 1.5 km from the ski area boundary on Richardson Ridge.

Hidden Lake. The Hidden Lake basin, based on recent and historic data, appears to be more heavily used by goats than any other area within or near the LLSA. Leeson (1973) reported that the cliffs and slopes surrounding Hidden Lake were “prime mountain goat habitat” and made reference to herd sizes of up to 40 animals. Another observation of 23 goats was reported in 1969 (Parks Canada Agency, unpublished data) and, unlike other areas discussed above, relatively large groups of goats continue to be recorded from this area in recent years, including 3 observations of 6 to 15 goats in 2011 and 2012. Staff observations of goats and wildlife camera results from Hidden Lake in 2013 and 2014 include a group of 8 goats above Hidden Lake, and several smaller groups of 1-2 animals (Sherriff 2014b). The area is relatively isolated from sounds associated with the ski area (Leeson 1973) and this may have helped goats to persist here. However, evidence suggests that the Hidden Lake area contains goat winter range, and so it may be particularly susceptible to impacts from operational activities during the ski season.

Existing and Potential Interactions and Impacts

Potential ski area development activities contemplated in the Site Guidelines that have strategic implications for mountain goats include:

- Development of new ski terrain in the Hidden Bowl area
- Development of new ski terrain on Richardson Ridge
- Backcountry skier access from West Bowl
- Avalanche control operations within and adjacent to the ski area.

Wildlife prey species such as Mountain goats have associated certain stimuli to predators, such as loud noises and directional movement, which causes disturbance and affects important decision-making processes (Lima and Dill, 1990; Frid and Dill, 2002). Disturbed animals can experience decreased foraging rates, nutritional deficits, habitat abandonment, increased energy expenditure due to displacement, altered daily feeding patterns, occupancy of marginal habitats, energetic costs and potential for injury associated with a chase (Christianson and Creel, 2010; Buchanan et al., 2014; Hutchins and Geist, 1987; White et al., 2014; Ydenberg and Dill, 1986; Cooper and Frederick, 2007). In addition, physiological effects such as rapid heart-rate have been demonstrated to increase with noise disturbance in ungulates whether an external reaction is observed or not (MacArthur et al, 1979; Weisenberger et al., 1996).



Gill et al. (2001) determined that the decision to abandon habitat by animals in response to disturbance is based on the availability and quality of alternative habitat. Although the factors influencing poor and high quality habitat may vary by species, variables such as high-quality forage, proximity to escape terrain, distance to other seasonal habitats, level of intra-specific occupancy and number of predators are likely to be important factors in the decision to relocate. Therefore, it is important to assess the habitat options available to animals faced with disruption and not simply assume that if they do not disperse they are not disturbed. In addition, certain animals such as bighorn sheep are inherently slow at colonizing new habitats and are very sensitive to barriers to dispersal (Singer et al., 2000; Bleich et al., 1990).

Anthropogenic noise has been found to affect animal communities by compounding habitat fragmentation, causing habitat abandonment or avoidance and decreasing overall fitness (Barber et al., 2009; Blickley and Patricelli, 2010). Sudden noises that startle animals can be perceived as a threat and elicit a predator-evasion response while chronic noise can reduce sensory capabilities and decrease intraspecific communication or put the animal at a higher risk of predation (Francis and Barber, 2013). The propagation of noise can impact areas beyond the initial disturbance. For example, Parks Canada staff have heard avalanche control from the Lake Louise Ski Area as far as Baker Lake in the backcountry during the winter of 2014 (Adam Sherriff, Pers. Comm.). Noise propagation on roads with low/moderate traffic volumes have been found to propagate 500-1000m from the road (Barber et al., 2011).

Helicopter disturbance has been well documented to cause distress in mountain goats (Cote, 1996). Variables influencing the severity of response in goats included the distance of the helicopter, the distance to escape terrain, the disturbance intensity and duration, the terrain, and the group dynamics such as age and sex ratios (Wilson and Shackleton, 2001; Cote, 1996; Foster and Rahs, 1983; Stankowich and Blumstein, 2005). Mountain goats responded to repeated helicopter disturbance by abandoning habitat, having decreased reproductive success, increasing energy expenditure through long-distance migrations and anomalous movements in winter, decreasing the frequency of feeding and resting, altering seasonality and becoming more vulnerable to predation (Joslin, 1986; Cadsand, 2012; Gordon and Wilson, 2004; Hurley, 2004). The negative effects on population dynamics have been suggested to be cumulative, such as continued decline in population numbers after disturbance cessation, and long-lasting, such as anomalous movements in winter 48 hours after the disturbance incident (Joslin, 1986; Cadsand, 2012). Furthermore, goats were found to become more sensitive to helicopter disturbance over time as opposed to becoming accustomed to it, indicating sensitization instead of habituation to disturbance (Cote et al., 2013; Foster and Rahs, 1983).

Studies on disturbances from resource extraction noises such as generators, drilling noises and gunshots indicate that mountain goats can habituate to indirect and persistent noise but remain affected by sudden or novel noises and visual cues resulting in habitat abandonment (Penner, 1988). Similarly, mountain goats have been found to abandon high-quality habitat when coal mines encroached due to a combination of machinery noise and hunting access from the developed roads (Pendergast and Bindernagel, 1977). Singer and Doherty (1985) found that during the construction of wildlife overpasses and underpasses, mountain goats abandoned traditional travel passages and tended to use less desirable alternatives to avoid the disturbance. The major variables influencing unsuccessful crossings or delays were high-frequency drill rigs, bridge construction and dynamite blasts. Mountain goats demonstrated a high



degree of learning and adaptability by changing their travel routes and timing their crossing attempts during construction breaks. However, critical habitats including winter range, parturition areas, and mineral licks require protection (Cote and Festa-Bianchet 2000).

Highways and roads are a significant part of many ecosystems and can cause habitat fragmentation and barriers to movement. Singer (1978) found that unsuccessful highway crossings by mountain goats were influenced by high visitor activity and high passing vehicles. Goats would habituate to the sounds of visitors and trains while visiting a roadside mineral lick but remained disturbed by passing vehicles, highway noise and large trucks. Mountain goats selected crossing locations which were shielded from vehicles and visitors and provided a direct route. Once underpasses were built in the same location, goats responded with decreased fear responses, decreased altered routes, an end to nanny and kid separations during crossings and increased number of lick visits as well as feeding, bedding and licking near the underpasses (Singer and Doherty, 1985). Furthermore, traffic flow was found to be the most significant variable that affected hourly rate of mountain goat crossings at the underpasses while the number of visitors and the sound levels did not significantly affect hourly rate yet did cause substantial time delays for the goats due to hesitation (Pedevillano and Wright, 1987).

Human disturbances such as hiking and camping have been found to cause negative effects in mammals due to trampling of vegetation, disturbance of direct encounters and discarded food and garbage (Boyle and Samson, 1985). At high visitor use areas, the time it took for mountain goats to complete a successful crossing using an underpass was significantly increased with the presence of visitors observing the goats (Pedevillano and Wright, 1987). Male chamois were found to be equally disturbed by hiking, jogging and mountain biking in the Swiss Alps and responded by leaving the pastures and distancing themselves from the hiking trails (Gander and Ingold, 1996). Duchesne et al. (2000) found that the presence of visitors caused caribou in Quebec to increase vigilance and decrease foraging time and rumination. An increase in size and frequency of the tour groups caused a subsequent increase in the disruption of the herds. In addition, the amount of winter range used by cross-country skiers and the length of use in days had a greater negative impact on elk in Yellowstone National Park than the total number of skiers, the frequency of skier groups, or the number of skiers in the first group (Cassirer et al., 1992).

The potential to displace mountain goats from winter range is a key consideration with respect to development and use of new ski terrain on Richardson Ridge and the Hidden Bowl and Corral slides areas. The noise from ski area avalanche control activities and the direct human disturbance resulting from convenient sidecountry and backcountry access to winter goat range are key interactions with potential to displace mountain goats. Potential pockets of winter range at the back of Hidden Lake, the SW slopes of Mt. Richardson, Pika and Ptarmigan Peaks, and potential movement routes along Richardson Ridge to the adjacent Pipestone Bowl immediately north of the existing lease boundary are areas of concern.

Mountain goat habitat in and adjacent to Purple and Wolverine Bowls including habitat on Mt Redoubt are located in areas that will be removed from the ski area lease. As has taken place for many years, occasional (sometimes less than annually) avalanche control operations may take place on Wolverine ridge above the lower runs of the Larch area and in a small bowl on the west slopes of Mt Redoubt for protection of the Skoki Trail.



Removing Purple and Wolverine Bowl from potential future development is considered to be an environmental gain by Parks Canada providing long term habitat security for Mountain goats using these areas in winter or summer seasons.

Mitigating Measures

The suite of mitigations for Mountain goats identify ecological management parameters, Long-Range Plan and operational parameters, and environmental assessment and information requirements that are needed to realize the desired ecological integrity outcomes of the Site Guidelines.

Ecological Management Parameters

Ecological management parameters serve as the on-the-ground benchmarks against which the environmental impacts of future development and use proposals will be assessed. The following ecological management parameters have been incorporated into the Site Guidelines in order to realize desired outcomes and priorities for Mountain goats:

- Winter and summer operational and construction activities do not displace or habituate grizzly bears or other wildlife.
- Ski area development and use does not displace ungulates from seasonally important habitat areas of features or travel routes essential to the regional population.
- Ski area use and operations maintain wildlife habitat effectiveness and security outside of ski area lease and licenses of occupation.

Long Range Planning and Operational Parameters

Specific planning and operational parameters are identified to provide greater clarity for project design and planning, and ski area operations. These parameters should be included as part of future planning proposals or management initiatives as appropriate.

Avalanche Control

- Employ low-noise or passive avalanche control measures to limit the need for explosives, to the extent feasible in accordance with industry standards.

Sidecountry and Backcountry Skier Disturbance

- Visitor education is an important component of gaining visitor understanding and contribution towards minimizing disturbance to mountain goats if encountered, particularly for potential sidecountry and backcountry riders; boundary fencing, signage and other appropriate media will be used to educate riders on protection of Mountain goats and other out of bounds wildlife.

Siting of Hidden Bowl Lift and Warming Hut

- Hidden bowl lift and warming hut will be sited so as to maintain movement effectiveness between mountain goat habitat nodes in Hidden Bowl and habitat nodes in the valley lying between the south slopes of Mt Richardson and the northwest ridge of Mt Whitehorn.

Operation and Visitor Management Protocols

- Management protocols for operational and visitor use activities will be developed to minimize disturbance to mountain goat habitat use and movement when goats are found to be present at affected sites within or adjacent to the managed ski area.



Environmental Assessment and Information Requirements

- Long-range plan proposals including lift siting, avalanche control measures, seasonal maintenance and operations, and visitor education will be informed by assessment of the Slate Range mountain goat population likely to be affected by ski area operations with a particular focus on goat use of Mt Richardson, Richardson's Ridge and Hidden Bowl areas and links to habitat nodes in Purple and Wolverine bowls and Mt Redoubt area
- Local assessment of Mountain goat habitat use should identify pockets of winter range and habitat use and other important seasonal nodes of use such as the use of mineral licks, kidding areas, travel routes and escape terrain.

Residual and Cumulative Effects

Desired Outcomes and Priorities from the Site Guidelines that apply to mitigating potential impacts to Mountain Goats include:

- Terrestrial and aquatic habitat conditions for sensitive species including Whitebark pine, grizzly bear, wolverine, mountain goat, westslope cutthroat trout, bull trout and mountain caribou are conserved or restored.

The removal of Purple and Wolverine Bowls from the ski area lease, secure areas that have long been considered important for Mountain goats by Parks Canada from potential future development. Elimination of potential development also minimizes the potential for future increases in sidecountry or backcountry rider access to known winter habitat for Mountain goats on the south and east slopes of Redoubt Mountain.

The effectiveness of winter range for Mountain goats in other locations, both in and adjacent to the ski area, may be adversely influenced by potential ski area development and use. The expanded development and use footprint in Hidden bowl and West bowl, along with disturbances related to avalanche control, sidecountry and backcountry access and routine maintenance and operations all have potential to disturb and disrupt wintering Mountain goats.

Although Mountain goat use in the area of the ski hill appears to have declined in conjunction with the past expansion of ski area activities, the specific cause of apparent decline or change in habitat use patterns remains speculative. In small populations, the mortality of even one or two mature breeding females from predation or accidental cause may result in a long term population decline. While there is some uncertainty as to the reason for observed changes in Mountain goat use, the literature on Mountain goat disturbance certainly supports cause for concern. There is little doubt that Mountain goats, like most other wildlife, are likely to be displaced from habitat when human use and activity reaches a threshold level. While remaining a cause for concern, Mountain goat populations continue to use Marmot Basin and areas in the vicinity of the Sunshine ski area despite the presence of skiers in close proximity to winter habitat, and despite being exposed to significant avalanche control operations at these ski areas and in many mountain highway avalanche control locations.

Despite the long term history of Mountain goats use in the Lake Louise area, there is a paucity of detailed information on the Slate Range Mountain goat population and use of local winter range nodes. More than any other valued component considered in this strategic assessment, there is a need to acquire additional information on wintering mountain goats, to inform the design of specific development, visitor use and management measures at the Long-Range Plan stage. A more detailed understanding of



where, how and when Mountain goats use winter habitat nodes and travel routes adjacent to the ski area may be expected to result in proposals and protection measures that address the specific risks, and likely impacts to wintering Mountain goats.

It should be noted that potential extirpation of Mountain goats from the Slate Range, or even a significant reduction in habitat effectiveness, is not an acceptable ecological integrity outcome. To be effective, additional information on Mountain goats habitat use should be compiled well in advance of Long-Range Plans and environmental assessments, and used in the development of proposals and alternatives most likely to maintain habitat effectiveness. An adaptive management approach, based on high quality, local habitat information, and based on an initial analysis and implementation of the best available alternatives, will be a necessary aspect of ensuring that Mountain goat populations continue to persist in the area.

Considering the full suite of guidelines and mitigations it is anticipated that the expected ecological outcomes related to Mountain Goats may be achieved under the Site Guidelines with the collection and application of information on wintering Mountain goat populations and habitat use, to the development of Long Range Plan proposals.

8.4 *Mountain Caribou Recovery*

Current status

Woodland caribou (*Rangifer tarandus caribou*) in the mountain national parks comprise part of the Southern Mountain population, which is listed as Threatened in Canada (COSEWIC) and occur on Schedule 1 of the *Species at Risk Act* (Thomas and Gray 2002). In the mountain national parks, over 800 caribou were present in the late 1980s but numbers have since declined to fewer than 250 (PCA 2011). In Banff National Park, caribou counts of greater than 20 animals were made as recently as 1989 (Dibb 2004) and the population was estimated at that time to be 25-40 animals (Kansas et al. 1991). The population appeared to decline through the next two decades until the last 5 animals were buried in an avalanche in the spring of 2009 (Dibb 2004, Hebblewhite et al. 2009). Since then there has been no verified evidence of caribou in Banff National Park.

Extirpation of the species from Banff National Park does not necessarily have to be permanent. Caribou could return to Banff as a result of dispersal from herds in a neighboring jurisdiction. However, this possibility seems unlikely at present given that the closest herds in southern Jasper National Park have also experienced substantial declines (Decesare et al. 2010). A more realistic avenue for the return of caribou to Banff is for reintroduction of caribou by translocation of animals from elsewhere to caribou ranges in the park. Kinley (2009) assessed the feasibility of using translocation to recover caribou in Banff National Park and reported that caribou had been trans located under at least 37 programs in North America, with at least two-thirds of those attempts resulting in established populations. Predation rate appears to be the key factor in success of re-introduction programs in western Canada. Kinley (2009) recommended prompt action on translocation because of presently favorable ecological conditions, including lower elk and wolf densities. Subsequent population viability analysis by Decesare et al. (2010) suggested that a reintroduced caribou population in Banff could be viable without additional translocation, although for two populations in Jasper (the Maligne and Brazeau populations) translocation may not be sufficient to reverse declines.

Caribou range in and adjacent to Banff National Park was described by Kansas et al. (1991) as including the Siffleur, Porcupine, Spreading, Dolomite, Mistaya, upper



Clearwater, and upper Pipestone drainages, although these authors acknowledged that additional survey effort in remote areas could reveal a broader distribution. From 2003 through 2009, radio-collared caribou were found to occupy areas further south and east than indicated by historical records, including the Mosquito, Molar, lower-mid Pipestone, and upper Red Deer drainages (Dibb 2004, PCA unpublished data). One of the most heavily used areas by radio-collared caribou (as well as unmarked animals accompanying them) in both summer and winter was an area between Mt. Hector and the Pipestone River, located 7-13 km north of the ski area. However, caribou also used habitat east of the Pipestone, particularly during winter. Some caribou migrated across the Pipestone in early winter to ranges near Skeleton Lake and the Valley of the Hidden Lakes in the Red Deer drainage, while others used high elevation habitat on the east side of the Pipestone River. Caribou have not been recorded within the boundaries of the ski area lease. A single VHF radio-telemetry record located in Pipestone Bowl 800 m from the ski hill lease is the closest recorded location to the ski area (PCA unpublished data).

Knowledge of caribou ecology indicates that caribou occur at low densities, range over large areas, and avoid areas with high human use (Bergerud 1992, Dyer et al. 2001, Nellemann et al. 2001, Frid and Dill 2002, Nellemann et al. 2003, Festa-Bianchet et al. 2011, McLellan et al. 2012, Hervieux et al. 2013). While caribou have not been recorded within the ski area leasehold, and have been recorded only twice near the ski hill, caribou are not commonly seen in general. While observational records may be informative for long-term trends, they are considered incomplete, biased, and unreliable for defining caribou habitat requirements. To address this, biologists have developed rigorous range-level models of caribou habitat selection patterns (Whittington et al. 2005). Resource selection function (RSF) models developed from several thousand radio-collar location points are statistically defensible, have been shown to effectively predict important caribou habitat, and should be used in preference to individual GPS caribou locations (Boyce et al. 2002, Manly et al. 2002, Johnson et al. 2004, Environment Canada 2011, Polfus et al. 2011, Leblond et al. 2014). RSF models were developed for Jasper and Banff using caribou GPS locations obtained from both parks (Whittington et al. 2005). These models indicate selection by caribou for a variety of habitat characteristics within the Park, and coupled with knowledge of caribou ecology, they allow interpretation of large-scale habitat requirements for caribou. Caribou require contiguous tracts of old forest that contain lichens, a food source not used by other ungulates, but used as a primary winter food source by caribou (Bjorge 1984, Stevenson 1990, Thomas et al. 1996). In mountainous environments, caribou select high elevations and old forest (depending on snow conditions) not only for forage, but to separate from other ungulate species and their predators (Bergerud 1974, Edmonds and Bloomfield 1984, Bergerud and Elliot 1986, Bergerud and Page 1987, Seip 1992, James et al. 2004, Wittmer et al. 2005a, Apps and McLellan 2006, Seip 2008, McLellan et al. 2012, Apps et al. 2013). The RSF model for Jasper and Banff caribou indicates that the Lake Louise ski hill and surrounding area is a region that caribou are likely to use. RSF models are reliable at the scale of the Park for identifying broad areas where caribou are more likely to be found or for identifying resources important to caribou at a coarse scale. However, current RSF models cannot accurately detect differences in the likelihood of caribou use at smaller scales, within the ski hill area for instance, or be used to assess impacts to caribou use of habitat at such scales. Although high probability caribou habitat occurs within and on all sides of the ski hill lease boundary, areas along the north boundary of the lease in the Pipestone and upper Corral drainage are likely to be the most important areas due to their proximity to historic caribou range in the Pipestone and Red Deer drainages and their adjacency to wilderness.



Bioregionally, caribou populations throughout the Rocky Mountains and foothills are in decline (Hebblewhite et al. 2007, Wittmer et al. 2005b, Semeniuk et al. 2012, Hervieux et al. 2013). Habitat loss and fragmentation, increasing primary prey for wolves and subsequent increases in predator populations have led to serious population declines, range retraction, and increased isolation and vulnerability of small sub-populations throughout the Southern Mountain range (Dzus 2001, Smith 2004, Smith et al. 2000, Alberta Caribou Recovery Team 2005, Wittmer et al. 2005). Provincial recovery plans have been developed for Alberta and BC and the national recovery strategy, developed by Environment Canada in cooperation with Parks Canada and provincial agencies, was completed in June 2014 (Environment Canada 2014)..

The 2008 State of the Park Report (PCA 2008), in discussing the condition of ecological integrity indicators, states that caribou are a notable Species at Risk concern. The Banff National Park Management Plan provides direction to complete investigation of the feasibility of restoring caribou to the park, and to act on the findings of that investigation (PCA 2010). Additionally, an objective for the North Saskatchewan Management Area is stated as “a self-sustaining population of caribou occupies traditional habitat”. In 2011 Parks Canada released the Conservation Strategy for Southern Mountain caribou in Canada’s National Parks (PCA 2011). This strategy includes the goal of achieving “an ecologically functioning local population of Southern Mountain caribou through maintenance of herds of 25-40 animals within historic range in and adjacent to the park...” and recommends re-introducing caribou in their former ranges in Banff National Park. The Conservation Strategy also states a desired conservation outcome of “minimizing the effects of human activity on caribou while facilitating a high quality visitor experience”.

Existing and Potential Interactions and Impacts

Disturbance Impacts

Caribou, throughout their circumpolar distribution, have been shown to be sensitive to disturbance (Klein 1971, Bradshaw et al. 1998, Wolfe et al. 2000, Dyer 2001). Several studies have identified effects of disturbance on displacement and interruption of daily activities, such as foraging and resting (Bradshaw et al. 1998, Webster 1997, Duchesne et al. 2000, Wolfe et al. 2000). In highly-impacted areas, full avoidance of infrastructure has been documented (Dyer et al. 2001, Nellemann et al. 2001, Frid and Dill 2002, Nellemann et al. 2003). In the last 30 years, studies on the disturbance of *Rangifer spp.* have been focusing on the long-term effects that occur over months, years and decades (Vistnes and Nellemann 2008). Of these research projects, 95% of the 204 studies have indicated a decline in population density within at least 5km of human infrastructure (ibid).

Vistnes et al. (2001) reported that densities of reindeer were significantly lower in developed quadrats (with power lines, roads, and ski trails) compared to undeveloped quadrats in south-central Norway. Development and the degree of development affected distribution, and therefore the availability, of habitat of wild reindeer (Vistnes et al. 2001). In southern Norway, reindeer remained a minimum of 4 km from roads, power lines and human infrastructure and demonstrated a decline in reproductive rates, cow to calf ratios and an increase in habitat abandonment following development (Nellemann et al. 2003). Polfus et al. (2011) found that caribou in northern BC had home ranges far from human activity and infrastructure, avoiding roads consistently across all seasons and maintaining a 9km buffer around the 450 resident village of Atlin in the energetically expensive winter months. Caribou in Quebec maintained a 4.5km buffer from cutovers and roads to avoid human and predator disturbance (Fortin et al. 2013).



In the Northwest Territories, caribou were four times more likely to be found beyond an 11-14km zone of influence from an open pit diamond mine than within it (Boulanger et al. 2012). Woodland caribou in Newfoundland maintained a 4km buffer around a gold mine and demonstrated a decline in average group size within 6km of the mine (Weir et al. 2007). Caribou in west central Alberta demonstrated seasonal energetic losses of 17% in the vicinity of industrial activity, nearing previously reported thresholds for unsuccessful reproduction at 20% (Semeniuk et al. 2012).

A number of studies have been conducted on the effects of winter activities on disturbance of caribou/reindeer. Vistnes and Nellemann (2001) noted significant avoidance by semi-domesticated reindeer during calving of areas within 4 km of resort areas used for snowmobiling and skiing. Nellemann et al. (2000) reported similar results for wild reindeer in winter near a cross-country skiing resort in southern Norway, despite the lack of forage available in areas to which they were apparently displaced. In addition, Nellemann et al. (2001) found that caribou maintained 5km buffers around ski resorts and associated roads. Furthermore, in 2010, Nellemann et al. reported that the larger the size of the ski resort the larger the amount of disturbance to caribou, identifying buffer zones up to 15-25km from the largest resorts. It was also determined that human activity is cumulative to reindeer disturbance and that during the 20 year study period no habituation was observed by the reindeer. Even lower human-use ski-in tourist cabins located on average 10km from nearby ski resorts were found to be avoided by reindeer by 3km (Dahle et al. 2008).

Recent research shows that free-riding snow sports can elevate stress in alpine animals, which represents potential consequences to fitness and survival costs (Arlettaz et al. 2007). Duchesne et al. (2000), in a study of the effects of ski or snowshoe winter activity on caribou behavior observed that caribou spent less time foraging and more time alert when encountering people. Also, in the winter months, when food availability and quality are more limited, a large number of skiers may negatively influence animal condition due to repeated displacement and disturbance (Reimers et al. 2006). Pruitt (1979) concluded that caribou leave their wintering range when approximately 70% of the snow cover in the area has been disturbed during a current winter. Bergerud (1974b) found that, in early winter, caribou left preferred habitats in situations of intense and persistent harassment. In the Selkirk Mountains, caribou use was lower in ski zones within heli-ski tenures during months and years when ski activity was high (Wilson and Hamilton 2003). Caribou were displaced significantly farther when approached by a skier (on average 970 m) than when approached by snowmobile, although overall provocations by skiers or snowmobiles resulted in similar behavioral responses (Reimers et al. 2003). However, Simpson and Terry (2000) reasoned that, compared to helicopter or snowcat skiing, the non-motorized nature of backcountry skiing as well as the slow pace at which skiers travel suggest this activity likely has relatively low impacts on B.C. mountain caribou populations, although no data were provided within this assessment. Reimers et al. (2006) concluded that approaches by hikers/skiers would not represent significant energy expenditure or serious negative consequences, although reindeer were still displaced during all seasons and the farthest during summer.

Although research into responses of caribou to specific human-use activities is not comprehensive, it is a key focus in recent work. For example, Seip et al. (2007) are the first to publish conclusive results showing displacement of caribou from an area of suitable habitat as a result of snowmobiling. Similar disturbance studies exist for the summer season; in Jasper National Park, caribou spent significantly more time active



and less time foraging/bedding in response to hiker encounters (McKay 2007). 44% of hiker encounters resulted in displacement of caribou to distances ranging from 200 to 2400 m and caribou reacted to hikers at an average distance of just over 200 m (McKay 2007). Similarly, Colman et al. (2001) found that approach by a person on foot elicited flight responses in wild reindeer. Tourist activities in the spring and early summer forced woodland caribou to move from the alpine tundra to the forest zone, increasing their risk to predation (Dumont 1993). Inferring from the literature, potential increases in off-piste and out-of bounds skiing that may be facilitated by new lift alignments may result in increased potential for displacement of caribou from important habitat.

Terrain Development Impacts

The development and modification of ski terrain may affect caribou on and adjacent to the leasehold by increasing the risk of predation. Caribou anti-predator strategies include the avoidance of areas with high densities of other ungulates and the early to mid-seral forest structure associated with them (Bergerud 1974, Bergerud and Elliot 1986, Bergerud and Page 1987, Seip 1992, James et al. 2004, Wittmer et al. 2007). In recent years, an extensive body of research has come to support apparent competition as the most important limiting factor in woodland caribou population decline (Bergerud et al. 1984, Bergerud et al. 1988, Apps and McLellan 2006, Seip 2008, McLellan et al. 2012, Apps 2013). As humans have modified the landscape, old growth forest has been replaced by younger seral stage forests and more fragmented habitats which support other prey species such as deer, elk and moose (Apps and McLellan 2006, Wittmer et al. 2007). When other ungulates colonize these areas, predators such as wolves and cougars subsequently increase and will opportunistically hunt caribou as well as the other prey species (Wittmer et al. 2005a, Wittmer et al. 2005b, Apps et al. 2013).

Since caribou have adapted to avoid predation by spatial separation which decreases overlap with prey species, their low population numbers and density create an “Allee effect” where adult survival is low and the population experiences reduced growth (Festa-Bianchet et al. 2011, Wittmer et al. 2005a). Although the amount of old growth forest is important to caribou survival, the effect of apparent competition is the limiting factor. McLellan et al. (2012) found that bone marrow fat content was not correlated to the amount of old growth forest per caribou and that rates of decline were highest in National Parks with relatively large amounts of old growth. In another study on the effects of apparent competition, 40-50% of the wolf population was removed from a caribou treatment area causing an increase in juvenile survival (Hervieux et al. 2014). Furthermore, the effects of apparent competition could be compounded by subpopulation segregation due to an aversion to dispersal causing genetic isolation, small herd sizes and fragmented population (Van Oort et al. 2011). Increasing or enhancing the developed ski area has the potential to increase early seral stage vegetation, consequently ameliorating available forage for other ungulates, and ultimately compromising caribou anti-predator strategies. With attraction of other ungulates and their predators, the potential exists for greater numbers of wolves to exploit caribou predator refuges, causing increased predation rates on caribou (e.g. Seip 1992, Stuart-Smith 2000, and James et al. 2004).

In addition to potential increases in prey abundance, linear features may reduce energetic demands of movement, creating attractive travel corridors for wide-ranging predators (Musiani et al. 1998). Wolves throughout the world, as well as within Jasper and Banff National Parks, have been shown to select linear disturbances (e.g. trails/roads) as travel routes, which allow facilitated and efficient travel during hunting



(James 1999, Whittington et al. 2004). Generally, wolves select roads and trails as travel routes, so long as levels of human use remain relatively low (Thurber et al. 1994, Musiani et al. 1998, James and Stuart-Smith 2000, Callaghan 2002, Ciucci et al. 2003, Whittington et al. 2004). Selection of secondary roads/trails by wolves in winter, when snow depths off-trail may preclude their movements (Mech 1970, Thurber et al. 1994, Singleton 1995, Paquet et al. 1996), is particularly relevant to trail creation around Lake Louise. Coupled with evidence that predation risk for caribou is greater near linear disturbances (James and Stuart-Smith 2000), risk to caribou is exacerbated with packed trails into caribou habitat. In Jasper National Park, models of caribou and wolf habitat selection indicate that caribou avoid trails while wolves select trails (Whittington et al. 2005). Woodland caribou in BC have been found to have increased mortality rates close to roads due to wolves using the roads as primary travel routes and thereby gaining access into previously inaccessible caribou habitat (Apps et al. 2013). The existing 11 km snowmobile trail from Temple Lodge to Skoki Lodge, combined with packed snow trails within the LLSA, currently facilitates access for wolves to caribou habitat in the upper Red Deer Lakes area.

In addition, the avoidance of caribou to human infrastructure may compound the effects of predation. As discussed above, caribou tend to maintain a buffer around human settlements and developments causing a larger density of caribou to occur beyond the zone of influence (Nellemann et al. 2003). Fortin et al. (2013) found that the higher density of animals beyond the zone of influence allows predators to focus their hunting towards these more profitable areas thereby increasing predation. Furthermore, Nellemann et al. (2003) discovered that larger groups which include females and offspring tend to remain further from disturbance while smaller groups containing bulls and subadults are more tolerant of human activity. This may add to the population decline due to low adult and female survival and small herd sizes.

Ski area development activities under the Site Guidelines that were considered with respect to potential implications for woodland caribou recovery include:

- Activity associated with the development of new ski terrain in Hidden Bowl and Corral slides
- Expanded sidecountry skiing and avalanche control activities in West Bowl

Map 11 illustrates caribou habitat probability in the Lake Louise area. Hidden Bowl itself is rated as low probability for caribou habitat while the Corral Creek valley below the Bowl and up to Boulder Pass have high habitat probability with small isolated patches of very high potential on the edge of Hidden Bowl and at higher elevations leading to Boulder Pass. It is noteworthy that there are substantial areas within the existing ski area lease in the Larch, Purple Bowl and Wolverine Bowl areas that are considered to have very high habitat probability. The removal of Purple and Wolverine Bowls from the ski area lease would return a considerable portion of these very high probability areas to park wilderness status.

Given the proximity of the ski area and levels of human activity there is little reason to think that the Hidden Bowl and Corral Creek area itself would contribute significantly to future caribou recovery. However the ski area lease, Hidden Bowl and the Corral creek valley fall within an area that contains caribou critical habitat designated as Type 2 matrix range. Type 2 matrix range has been designated as an area that must be managed for low predator densities to support caribou recovery. Adjacent areas over Boulder Pass into the Skoki backcountry are also designated as caribou critical habitat, although areas

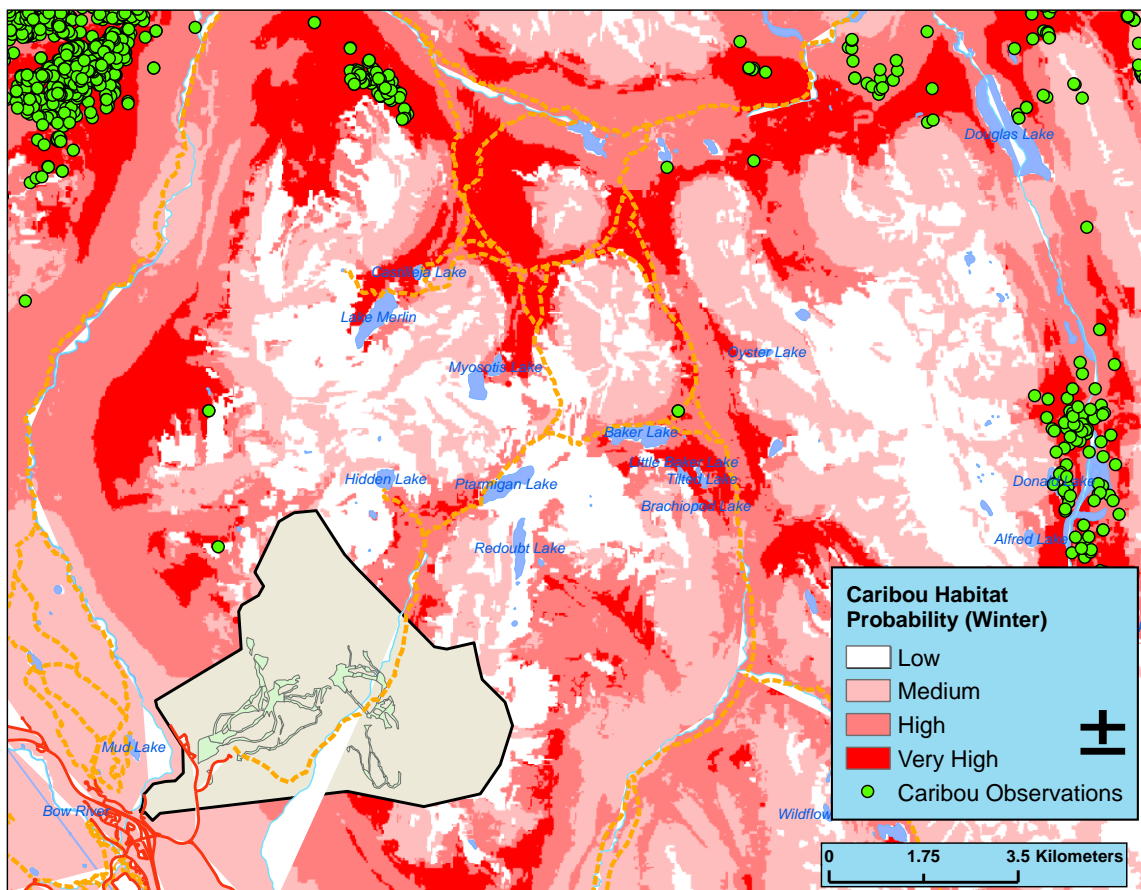


of High elevation range and/or Type 1 matrix range are not actually encountered until the shores of Baker Lake.

Potential incidental impacts to caribou in the Baker Lake area were considered including the potential impacts associated with avalanche control operations, direct disturbance as a result of increased backcountry skiing and facilitated predator access.

Under the right conditions noise from avalanche control operations may travel several kilometers and as noted earlier avalanche explosives use at the ski area have been noted from as far away as Baker Lake. The right combination of atmospheric conditions, control frequency, and actual presence of caribou combined with the right timing could conceivably result in disturbance or displacement of caribou moving through the Baker Lake area. However it is not known if occasional potential noise from avalanche operations would be sufficient to actually displace caribou, or any other wildlife, from such a distance. Alternatives to avalanche explosives such as GASX and passive control measures can be employed to reduce the frequency and level of noise disturbance from explosives.

Development of ski runs in new areas also has the potential to facilitate predator access and alter the predator-prey relationship between caribou and wolves. Wolves have been implicated in the decline of caribou in Banff National Park in the 1990s and 2000s (Hebblewhite et al. 2009), and wolves from several Banff National Park packs use the Slate Range including the ski hill area (Parks Canada Agency, unpublished data). The presence of packed snow trails has been linked to increased movement by wolves in other study areas (James and Stuart-Smith 2000, Whittington et al 2005, Apps et al. 2013, Hervieux et al. 2013).



Map 11: Caribou Habitat Probability

Existing ski and snowmobile trails to the Skoki area travel along valley bottoms and already facilitate potential predator access over Boulder Pass into the Skoki area. Development in Hidden Bowl including the development of an egress trail would not create additional, convenient, low disturbance routes leading to Boulder pass likely to facilitate additional predator access. The potential for expanded backcountry skiing out of Hidden Bowl may be speculated to result in the creation of higher elevation trails into Boulder Pass. However any such trails would be indirect, at high elevations and unlikely to attract predators such as wolves, when far easier and direct routes exist. It should also be noted that far easier and more direct routes into the Baker Lake area exist for wolves inhabiting and moving along the eastern slopes of the Rockies. The Baker Lake area is not isolated from predator access by any means, and potential access through the Corral creek valley is only one of several ways for predators and other wildlife to access this area.

Access through Boulder Pass is the main access to the Skoki backcountry area and Skoki lodge. It is conceivable that Hidden Bowl development would encourage more skiers to access the Skoki backcountry resulting in direct disturbance to caribou trying to move through the area in winter. While backcountry skiers may increase to some degree, and some of those may venture to the Baker Lake area, it is anticipated that the volume of such skiers will be minimal, as they are now in backcountry areas accessed from the ski area such as Wolverine Bowl. Management of the Skoki backcountry with respect to caribou recovery is an issue that extends beyond the possibility of increased backcountry use from the ski area, is beyond the scope of the Site Guidelines and SEA and is not addressed



further here. Effective management of this issue will need to be addressed holistically as part of any caribou reintroduction programs that may take place in the future.

The formalization of sidecountry skiing in West Bowl is likely to result in increased use of the area. Avalanche control operations again may be associated with noise impacts from the use of explosives. The development of an egress trail could conceivably facilitate wildlife movement into areas of potential caribou habitat in the West Bowl area.

The West Bowl area contains a range in habitat potential ranging from low in the Bowl itself, to areas of very high potential along and below the northwest ridge of Whitehorn Mountain. Leeson (1973) recommended against further ski hill development west of the LLSA Olympic chairlift because wolf and caribou sightings in the Pipestone suggested the possibility of the “establishment of resident populations of these animals in this area”. The skier egress trail may conceivably facilitate wolf access to areas of potential caribou habitat below the upper northwest ridge. However, as with Hidden Bowl and Corral Creek, the West Bowl area was not included as part of critical habitat in the Recovery Strategy and the egress trail does not provide direct access to identified critical habitat.

Pipestone Bowl and Semi Circular Bowl lie on the opposite side of the Whitehorn ridge, and the valley containing these bowls adjacent to the ski area lease occur within areas identified as critical caribou habitat.. Both High elevation range and Type 1 matrix range occur within this area. Although small in scale, and with a variable range of habitat potential, recorded caribou use of this valley suggests that it may contribute to caribou recovery by providing a location for secure winter range.

It is certainly conceivable that increased use of West Bowl will attract additional skiers to Pipestone Bowl and other backcountry areas in the valley. In addition to value for potential caribou recovery this valley has supported recent denning activity for Grizzly bear and may contain winter range for Mountain goats. Although backcountry use of this area may increase in attractiveness for a small number of experienced skiers, recent management of the area to close it to backcountry use and protect Grizzly bear den sites has been respected by the ski area and local skiers. Parks Canada legal authorities and enforcement powers provide appropriate means to manage potential impacts to caribou recovery or other wildlife habitat sensitivities as they arise.

Mitigating Measures

The suite of mitigations for Mountain caribou identify ecological management parameters, Long-Range Plan and operational parameters, and environmental assessment and information requirements that are needed to realize the desired ecological integrity outcomes of the Site Guidelines.

Ecological Management Parameters

Ecological management parameters serve as the on-the-ground benchmarks against which the environmental impacts of future development and use proposals will be assessed. The following ecological management parameters have been incorporated into the Site Guidelines in order to realize desired outcomes and priorities for Mountain caribou:

- Winter and summer operational and construction activities do not displace or habituate grizzly bears or other wildlife.



- Ski area development and use does not displace ungulates from seasonally important habitat areas of features or travel routes essential to the regional population.
- Ski area use and operations maintain wildlife habitat effectiveness and security outside of ski area lease and licenses of occupation.

Long Range Planning and Operational Parameters

Specific planning and operational parameters are identified to provide greater clarity for project design and planning, and ski area operations. These parameters should be included as part of future planning proposals or management initiatives as appropriate.

Avalanche Control

- Employ low-noise or passive avalanche control measures in Hidden Bowl or West Bowl areas to limit the need for explosives to the extent feasible in accordance with industry standards and maintaining visitor safety

Sidecountry and Backcountry Skier Disturbance

- Visitor education is an important component of gaining visitor understanding and contribution towards minimizing disturbance to Mountain caribou if they are reintroduced and likely to be encountered close to the ski area.

Environmental Assessment and Information Requirements

- Long-range plans should refer to the national recovery strategy for caribou (Environment Canada 2014) and any associated action plan(s) in the development of proposals and conduct of Long Range Plans environmental assessments
- Long range plan environmental assessments should consider the potential of ski area development proposals to contribute to changes in predator densities that would influence the function of Type 2 matrix range.

Residual and Cumulative Effects

Desired Outcomes and Priorities from the Site Guidelines that apply to mitigating potential impacts to Mountain caribou include:

- Terrestrial and aquatic habitat conditions for sensitive species including Whitebark pine, grizzly bear, wolverine, mountain goat, west slope cutthroat trout, bull trout and mountain caribou are conserved or restored.

Incidental impacts to caribou recovery may be associated with formalized sidecountry operations in West Bowl. Noise from the use of avalanche explosives and backcountry access into critical caribou habitat from the West Bowl area have some potential to influence the success of caribou recovery, in the event that caribou are reintroduced to, and actually use critical habitat adjacent to the West Bowl area. Avalanche control technologies exist to minimize the noise related to the use of explosives if necessary, and Parks Canada has the legal authorities and enforcement powers to prevent backcountry use from the West Bowl area that may disrupt potential use of critical habitat adjacent to the ski area.

Hidden Bowl issues are similar to those of West Bowl but noise from avalanche operations is far less likely to be a factor in effective recovery of caribou use in the Skoki area. Managing direct disturbance related to backcountry access to the Skoki area is an issue beyond the scope of the Site Guidelines that is only appropriately and effectively addressed as part of holistic visitor management in a future caribou reintroduction strategy.



The Lake Louise ski area occurs within a large area of Type 2 matrix critical caribou habitat in Banff National Park. Type 2 matrix range must be managed for an overall ecological condition that allows for low predation risk, measured by predator density. In Banff National Park, caribou predators are primarily wolves and cougars. Successful management of predation risk for caribou is an issue that extends well beyond the scale of the ski area; for example, the recovery strategy sets a threshold for wolf population densities in Type 2 matrix range of less than 3 wolves per 1,000 km². It is not anticipated that additional development and use at the ski area would directly increase predator density as intensive human use generally displaces predators. However, potential to increase predator populations does exist with respect to the potential creation of elk refugia – locations where elk populations are more secure from predation due to human use and predator displacement. However, expanding elk populations support greater fringe predation and in turn support greater predator densities. Wolves in particular are wide ranging and greater densities can result in greater predation on various ungulate populations, including caribou at distances remote from the original elk refuge areas.

Management of wildlife including caribou predators and predator densities in Banff National Park, is the responsibility of Parks Canada. The creation of elk refugia has been primarily an issue with respect to the Towns of Banff and Jasper. While the creation of elk refugia is not anticipated, ski area development will be considered at the long-range plan stage with respect to similar effects on predator/prey dynamics within Type 2 matrix range.

In summary there is minimal potential to adversely impact the success of potential caribou reintroduction as a result of development and use envisioned by the Site Guidelines. Long-range plan environmental assessments will consider the potential impacts to caribou recovery as per SARA requirements, and aligned with the recovery strategy and any associated action plan(s) for the species in this area. As the federal agency responsible for the species in federal protected heritage areas, Parks Canada will need to work with partners and stakeholders to manage potential influences of park communities, ski areas and other development and use to ensure low predation risk for caribou. Accordingly it is anticipated that the expected ecological outcomes for the ski area related to Mountain caribou will be effectively achieved.

8.5 *Wolverine*

Current Status and Ecology

Wolverines are wide-ranging, opportunistic scavengers and predators that occupy large home-ranges encompassing a diversity of habitat types (Weaver et al., 1996; COSEWIC, 2003). They are a holarctic species that has been delineated into two geographically separated populations in Canada. Wolverines in Banff National Park belong to the western population which has been designated as a species of special concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC, 2003).

Wolverines are solitary animals with large, overlapping home ranges which tend to occur in the upper elevations of subalpine and alpine habitats (May et al. 2006, Copeland et al. 2007). Wolverine have low population densities ranging from 1 wolverine/286 km² in Yellowstone to 1 wolverine/177 km² in the Yukon and low offspring to female ratios of 1:1 in Alaska (Banci and Harestad 1990, Weaver et al 1996, Inman et al. 2012). Low reproductive rates, small litter sizes, and relatively early age of reproductive senescence contribute to a high sensitivity of the species to human disturbance of habitat and



populations (Hornocker and Hash 1981, Weaver 1996, Krebs and Lewis 2000, Carrol et al. 2001). Long-distance dispersals help maintain population dynamics and national parks in the Rockies have been suggested to maintain source populations to colonize new habitats (Fisher et al. 2012).

Wolverines consume a variety of foods. A large component of their diet is carrion from ungulates such as moose, elk, caribou, deer, and mountain goats. Wolverines have also been reported to prey on snowshoe hares, porcupines, ground squirrels, marmots, small rodents, birds, and fish (Banci 1994). They appear to actively hunt smaller prey during the non-winter periods when carrion supplies might be more limited (Krebs and Lewis, 2000). Wolverines maintain relatively large home ranges, likely due to the dispersion of food resources, the distribution of habitat features such as den sites, and the need to maintain security from interspecific competitors (Copeland and Whitman 2000, Krebs et al. 2007). Male home ranges have been typically found to be three times the size of female home ranges. Krebs and Lewis (2000) estimated home range sizes of males and females in the Columbia Mountains to be 1005 km² and 311 km² respectively.

It is hypothesized that wolverine habitat is selected based on the distribution and abundance of food, including carrion, as well as suitable habitat/structures for denning (COSEWIC 2003). At a landscape level, adult female wolverines in the Columbia Mountains appeared to use higher elevation subalpine areas during winter, and alpine areas during the summer. Adult males, and subadult males and females appeared to use lower elevation montane and subalpine areas in the winter, and higher elevation subalpine areas during the summer (Krebs and Lewis 2000). In central Idaho, wolverine were found to occur between 2200-2600m consistently across seasons with a seasonal vertical migration of 400m from Whitebark pine forests in summer to Douglas fir and lodgepole pine forests in winter (Copeland et al. 2007). Hornocker & Hash (1981) found that cover may be important to wolverines and that observed individuals were reluctant to cross openings such as clearcuts. Wolverine telemetry data from northcentral British Columbia showed a high proportion of use of mature and old forest (Lofroth 2001). However, Lofroth (2001) also found that females used high elevation open areas during the rearing season while provisioning for their young.

Natal and maternal dens are believed to be the only small-scale structures for which wolverines exhibit selection. Female wolverines typically situate dens in snow tunnels leading to masses of fallen trees (coarse woody debris), or rocky colluvium in areas with little or no human disturbance (Krebs and Lewis 2000, Copeland 1996). Natal and maternal dens can be associated with various habitat types including small-scale forest openings (e.g., <100 m across) at high-elevations below treeline and high alpine cirques associated with talus slopes and boulder fields (Magoun and Copeland 1998, Krebs and Lewis 2000, Carroll et al. 2001, Lofroth 2001, Aubry et al. 2007). However, the persistence of snow cover into the spring and association with avalanche terrain have been found to be the most important factors in accounting for wolverine den sites and distribution across North America (Aubry et al., 2007, Krebs et al. 2007, Ruggerio et al. 2007, Fisher et al. 2014). The placement of dens within the landscape is believed to be important because these structures provide security for kits (i.e., snow cover) with proximity to food resources (i.e., late-winter carrion or prey) (COSEWIC 2003). Human disturbance at natal den sites has been found to cause den abandonment (Copeland 1996). Females occupied dens as early as February and used them as late as mid-May in the Columbia Mountains study (Krebs and Lewis 2000).



In Banff National Parks wolverine tend to occur in rugged, high-elevation terrain and there is a high probability that wolverine will be present in areas with snow and ice from January to March (Fisher et al. 2014). In the Lake Louise area, 50% of wolverine detections during occupancy tracking surveys have been located in the southern section of the 93N valley and the Bath Creek and Pipestone drainages (Bertch 2003). The Whitehorn corridor is used as a consistent travel route by wolverines, including crossing of the Whitehorn Road and travelling along the Pipestone ski trails (Tremblay 2001). In the past, at Kicking Horse Pass on the Yoho-Banff boundary, wolverines have been found to only cross the TCH where the right of way is narrow and forest cover is high, otherwise maintaining distances of up to 1000m of the highway (Austin 1998). During two seasons of occupancy tracking surveys in the Lake Louise area from 2001 to 2003, there was no occurrence of wolverine ever crossing the TCH (Bertch 2003). The Trans-Canada Highway has been documented as a barrier to female wolverines but not to males, creating sex-biased genetic dispersal within the population of approximately 64 individuals in the LLYK field unit (Sawaya and Clevenger 2014).

Existing and Potential Interactions and Impacts

Wolverine distribution and occurrence in the Canadian and US Rocky Mountains has been associated with areas far from human settlement (Carroll et al. 2001, Fisher et al. 2013). In the Willmore Wilderness Park in Alberta, the probability of wolverine occurrence was discovered to decrease in relation to increasing human development (Fisher et al. 2012). Human disturbances such as agriculture, resource exploration and development as well as human settlement and recreation have been found to negatively affect the productivity and integrity of wolverine habitat in northwestern America (Banci 1994, Gardner et al. 2010).

Gardner et al. (2010) discovered that wolverine distribution and occurrence were negatively correlated with human disturbance in Alaska. Of the areas surveyed, only two did not support any wolverine; one had a major highway and the other had a townsite. In Ontario, wolverines were found to be limited by human activities such as logging, road-building and fire suppression which were further compounded by road density (Bowman et al. 2010). Similarly, Kortello and Hausleitner (2014) identified distinct clusters of wolverine occurrence away from human infrastructure in the southern Purcell and Selkirk Mountain Ranges suggesting an effect of land use and recreational access. Studies from Norway found that human settlements such as cabins were avoided in wolverine home ranges and that there was an overall low occurrence in developed areas (May et al. 2006). Furthermore, wolverine den sites were discovered to be located an average of 7.5 km from public roads and 1.4 km from private roads and cabins (May et al. 2012). Weaver et al. (1996) also found that wolverine were especially sensitive to human disturbance during the denning period and actively avoided development.

Hornocker and Hash (1981) identified logging, snowmobiles and all-terrain vehicles as likely disturbances to wolverine during critical winter and spring periods. In the Columbia Mountains, heliskiing and backcountry skiing were negatively correlated with female use of habitat in winter (Krebs et al. 2007). In addition, females were found to select for food as well as against predation risk and human disturbance during habitat selection while males selected more strongly for food alone (Ibid.). Koskela et al. (2013) suggested that wolverine may avoid human settlements due to a decreased amount of available carrion since ungulates tend to use towns as a refuge from carnivores such as wolves. Fisher et al. (2013) came to similar conclusions, suspecting that the concentration of ungulates in



townsites creates a buffer of decreased available food to wolverines and developments such as seismic lines may provide access to inter-specific competition.

The fragmentation and elimination of habitat have greatly affected wolverine movement and genetic diversity (Banci 1994, Kortello and Hausleitner 2014). As generalists, wolverine diets consist of scavenged carrion and small mammal prey allowing them to exploit a niche with little predation risk or interspecific competition in high elevation environments that are unsuitable to other predators due to snow depth and limited ungulate prey (Inman et al. 2012, Rauset et al. 2013). Wolverine have low population densities, survive in fragmented high-elevation habitats and have an increased sensitivity to adult mortality making them a vulnerable species to disturbance (Ruggerio et al. 2007). Females have smaller home ranges than males and generally establish home ranges in the vicinity of their natal grounds while males disperse up to 900km to maintain genetic diversity (Banci and Harestad 1990, Copeland 1996, Weaver et al. 1996, Inman et al. 2009). The Canadian Rocky Mountains have been found to provide some of the best habitat for wolverine in the province of BC (Lofroth and Krebs 2007). The habitat niche, population dynamics and potential for genetic isolation make wolverines vulnerable to landscape developments and changes. Increasing the ski area boundary will introduce further disturbance into a potentially important source population of wolverines (Fisher et al. 2012, Kortello and Hausleitner 2014).

The inherent risk of surviving in mountainous terrain is the fragmentation between suitable habitat and the necessity for risky dispersals to maintain genetic cohesion between populations. Environmental conditions such as climate change and topographic or human-created obstacles such as prairies or highways can create barriers to the dispersal for wolverines (Zigouris et al. 2012, Kortello and Hausleitner 2014). Schwartz et al. (2009) discovered that historically, wolverine in the Sierra Nevada Mountains of California were genetically isolated from other populations in the Cascade Range, indicating a barrier effect due to geographical features. Similarly, the northern Ontario, Manitoba and Saskatchewan eastern peripheral populations of wolverines in Canada have been found to be genetically distinct from the core population in the Rocky Mountains of BC, Alberta and into the Yukon (Zigouris et al. 2012). In the southern Purcell and Selkirk Mountains, populations in close proximity to each other were found to be fragmented with only limited genetic exchange despite available dispersal corridors, a finding which could be partially attributed to man-made barriers such as roads (Kortello and Hausleitner 2014). Due to the diffused distribution of wolverines, populations are vulnerable to genetic isolation without adequate dispersal by subadult males.

Genetic isolation is compounded by low population numbers and fecundity. Female wolverines require high elevation subalpine and alpine habitats with large snowpacks to establish den sites and raise kits (Ruggerio et al. 2007). While the female hunts alone for long periods of time the snow provides some thermoregulation and safety for the kits through intricate snow tunnels that lead to the den (Magoun and Copeland 1998, May et al. 2012). Carroll et al. (2001) found a positive association between wolverine abundance and high alpine cirques with large boulder fields and high snowfall. In addition, the persistence of snow cover into the spring and association with avalanche terrain have been found to be the most important factors in accounting for wolverine distribution across North America (Aubry et al., 2007, Krebs et al. 2007, Ruggerio et al. 2007, Fisher et al. 2014).



The ski hill may also be a barrier to wolverine movement due to avoidance of human development, and expanding the extent of the skiable area may decrease the space available to wolverine for dispersals (May et al. 2012, Kortello and Hausleitner 2014). However for the purposes of this strategic assessment, potential impacts and issues related to Wolverine movement in and around the ski area on the front side of the ski area have been addressed in the section on the Whitehorn Wildlife Corridor and are not addressed further here.

Similarly, mitigations concerning Grizzly bear habituation and disturbance in the summer season are also applicable to Wolverine and these types of potential impacts are not considered further here.

The primary potential impact to Wolverine related to ski area development activities under the Site Guidelines is simply the expansion of terrain for ski and snowboarding activity. Wolverine are known to maintain a large distance from human developments, especially during winter (Weaver et al. 1996, May et al. 2012). The expansion of ski terrain may disrupt and fragment currently undisturbed wolverine territory in subalpine and alpine areas and result in decreased use or abandonment of habitat. Expansion of ski terrain may effectively push the zone that wolverine currently avoid around the ski hill further out, diminishing habitat effectiveness beyond the areas of proposed expansion. The ski area potentially overlaps with prime female denning locations although the abundance and distribution of maternal dens around the ski area is unknown. The specific characteristics required for female wolverine denning sites are similar to high quality ski terrain (Carroll et al. 2001). The expansion of the ski hill may indirectly encroach into critical denning habitat through noise dispersal and backcountry skier use.

Mitigating Measures

The mitigations for wolverine identify ecological management parameters, future planning and/or operational requirements, or future knowledge requirements that are needed to realize expected ecological outcomes.

Ecological Management Parameters

In order to realize expected ecological outcomes important to wolverine the following ecological management parameters have been incorporated into the Site Guidelines:

- Winter and summer operational and construction activities do not displace or habituate grizzly bears or other wildlife
- Ski area operations and visitor use provide low disturbance periods for wildlife that respond to winter and summer seasonal patterns and sensitivities
- Ski area use and operations maintain wildlife habitat effectiveness and security outside of ski area lease and licenses of occupation.

Long Range Planning and Operational Parameters

No additional, specific planning and operational requirements are identified to ensure that expected ecological outcomes are realized for Wolverine. Parameters for Grizzly bear, the Whitehorn Wildlife Corridor, vegetation management and mountain goat are anticipated to address issues related to wolverine.

Environmental Assessment and Information Requirements

- Environmental Long Range Plan proposals should be informed by current information on wolverine use and den potential in or adjacent to areas of ski terrain expansion



- Such information should be used to inform the location of facilities and management of new ski terrain in ways that are not likely to reduce the effectiveness of wolverine denning habitat adjacent to the ski area.

Residual and Cumulative Effects

The expected ecological outcomes that apply to mitigating potential impacts to wolverine include:

- Land use decisions contribute to local region ecological integrity goals including fire and vegetation management, wildlife movement, grizzly bear habitat security and species at risk protection and recovery.
- Terrestrial and aquatic habitat conditions for sensitive species including Whitebark pine, grizzly bear, wolverine, mountain goat, west slope cutthroat trout, bull trout and mountain caribou are conserved or restored.

The mitigations for wolverine include mitigation measures for the Whitehorn Wildlife Corridor, run and vegetation management, mountain goats and Grizzly bear. As a group mitigations for these other Valued Components also address many of the issues pertinent to wolverine. Parameters and conditions for these other Valued Components focus on maintaining movement across the ski area and preventing further displacement or mortality of wildlife including wolverine as a result of ski area expansion. At a local scale, maintaining vegetation composition and structure within parameters for medium sized mammals is expected to maintain the ability of wolverine, lynx and other wildlife to move across the ski area and forage during the off-season. As for bears, waste management best practices are expected to prevent attracting wolverine to the ski area and resulting subsequent habituation and mortality.

Wolverines have large home ranges (Krebs and Lewis 2000, Copeland 1996) and at a regional scale are unlikely to be affected by ski-hill scale development. Female denning sites, if present and affected by ski area activities, could speculatively affect local and more regional population dynamics of wolverine populations (Aubry et al. 2007, Krebs et al. 2007, Ruggerio et al. 2007, Fisher et al. 2014). Both the protection of wolverine denning habitat adjacent to the expanded ski area and persistence of local Mountain goat populations are key considerations to be brought forward to inform the Long Range Planning and environmental assessment stages of ski area planning and development.

Considering the full suite of guidelines and mitigations it is anticipated that the expected ecological outcomes related to wolverine may be achieved under the Site Guidelines:

- Wolverine movement through the Whitehorn wildlife corridor will be maintained consistent with parameters for Grizzly bear, other wary predators and small mammals
- Local Mountain goat populations will continue to persist as a food source for local Wolverine individuals
- Wolverine den locations in or adjacent to proposed ski terrain expansion will be identified and assessed through the Long Range Planning process.

8.6 Canada Lynx

Current Status and Ecology

Lynx populations are considered to be stable across most of their range in Canada although habitat loss may be affecting populations in southern areas (Poole 2003). In southeastern British Columbia there is concern for lynx because of a perceived failure of population levels to recover in the last decades of the 20th century (Apps 2007). The



situation in southern Canada bears some similarities to that in the northern contiguous United States, where the lynx was listed as a “threatened” species in 2000 (U.S. Fish and Wildlife Service 2000). In both areas, boreal forest is more patchily distributed than in northern Canada and supports lower densities of lynx. In the southern Canadian Rockies, including Banff National Park, landscapes capable of supporting lynx occur in patches in a complex mountainous environment. Here, lynx ecology bears resemblance to northern populations during the low phase of the hare population cycle (Apps 2005). As a consequence, resident lynx in the southern Rockies occur at low densities, move extensively, and occupy large home ranges (Apps 2007). This situation, combined with various threats and a growing human population in the region, has led to heightened conservation concern for lynx in the southern Canadian Rockies (Apps et al. 2003).

Maintaining a suitable mosaic of habitat necessary for foraging, denning and travel is essential for conserving lynx. Specific targets are not available for degree of fragmentation, but lynx are traditionally considered to avoid open areas (Koehler, 1990, Ruggieri 1994). There is little literature on the width of ski runs that lynx will cross, but it is documented that lynx typically do not cross areas wider than 100m (Koehler 1990). However in other studies lynx and snowshoe hare have been reported to preferentially use open terrain such as roadsides and pipeline right-of ways as travel corridors (AMEC 2005). Although lynx are generally considered to be fairly tolerant of the presence of humans (if dogs are not present) and infrastructure (Ruggieri et. al. 1994), the number of skiers during daily ski operations is another factor which could inhibit lynx from using the developed area. Tracking data has demonstrated that lynx cross the Lake Louise ski hill between dawn and dusk, even though the area is used by many skiers during the day (Stevens et al. 1996, Percy 2006); the widest runs here are approximately 100 m wide. An important consideration for maintaining lynx activity at night is the provision of secure winter daytime bedding sites. The USDA Forest Service (2012) reported that lynx may be able to adapt to concentrated human use during winter if security habitat is available which “allows lynx the ability to retreat from adjacent human disturbances during daytime hours, and emerge at dusk to hunt and travel when most human activity ceases”. They recommended a 50 metre buffer to protect diurnal security habitat.

Lynx are linked to their primary prey, snowshoe hare, and require a mosaic of habitat types to be successful, including young or mid-successional conifer forests for foraging, and older forests for denning and travel (Ruggiero 1994, Apps 2007). Mature coniferous forests are also important for red squirrel, a secondary prey species for lynx. The association of lynx with forest mosaics, and their response to habitat conditions at multiple spatial scales, makes the lynx a potentially useful focal species for biodiversity management strategies (Apps et al. 2003, Apps 2007). This consideration, along with conservation concern for local populations, led to the initiation of a radio-telemetry study of lynx in Kootenay, Yoho, and Banff National Parks, plus adjacent provincial lands in British Columbia, in 1996 (Apps et al. 2003, Apps 2007). Home ranges of 11 radio-collared lynx were investigated, of which 5 occurred in the Lake Louise area (4 females, 1 male) and 4 had home ranges that overlapped the Lake Louise Ski Area. Thus, a considerable set of data exists for the ski hill and area, showing that the front side of Whitehorn Mountain, particularly between the base lodge area and Whitehorn Lodge, is used year-round by resident lynx. Two of these lynx also used Corral Creek to or beyond the Temple Lodge area.

At the scale of the Apps (2007) study area, lynx home ranges appeared to be concentrated into several localized nodes, one of which was the Lake Louise area on the



NE side of the Bow River. These nodes are expected to be of high conservation value because (a) lynx may be able to persist here in spite of prey population fluctuations, and (b) these nodes may provide a source of dispersing animals to other areas. Lynx movement occurs at several spatial scales ranging from localized foraging movements to long distance dispersal events, and may be particularly important in southern populations because of the patchy distribution and spatial separation of habitat nodes. At a regional scale, lynx distribution is expected to conform to a metapopulation structure (Apps 2007), and maintaining landscape connectivity therefore becomes crucial to lynx conservation and persistence.

Lynx movement in the Lake Louise area has been studied and/or reviewed by Tremblay (2001), Percy (2006), and Apps (2007). Telemetry data and tracking data from these sources show that considerable movement, including daily foraging movements, takes place along the front side of the ski hill above the base lodge area, but some along-valley movement also occurs closer to the Trans-Canada Highway, typically crossing the Pipestone River just upstream of the old gondola base. Apps (2007) documented one instance of a radio-collared lynx dispersing from north of Lake Louise on the Icefields Parkway to an area east of Castle Junction on the Bow Valley Parkway, likely passing through the southwestern end of the current ski area leasehold. Male radio-collared lynx were reported to have average minimum convex polygon (MCP) home range estimates of 527 km² and 95% adaptive kernel utilization distribution (UD) home ranges estimates of 369 km². The corresponding estimates for female lynx were 211 km² and 313 km².

Although research and anecdotal information suggests that lynx may be relatively tolerant of human activity (Anderson and Lovallo 2000, Ruediger et al. 2000), biologists assume that thresholds of human use exist beyond which lynx activity is precluded (Ruediger et al. 2000). Presumably there are also intermediate levels of disturbance which affect lynx but do not completely displace them. Knowledge gaps exist regarding the thresholds at which ski area activities may displace lynx, including how behavioural responses may differ among individuals, or may differ in different types of habitat (e.g., foraging habitat versus denning habitat or movement routes).

Although a lynx study was conducted in Banff, Yoho and Kootenay National Parks between 1996 and 2000 (Apps 2007), this study was constrained by the lack of availability of detailed forest cover mapping, and by the use of VHF radio-telemetry rather than use of GPS radio-collars. Re-analysis of the existing lynx VHF telemetry data using forest cover mapping (likely available within the next several years) would enable predictive modelling based on terrain, forest structure, and forest composition attributes that are likely highly relevant to lynx ecology. Availability of GPS lynx data would further improve predictive modelling and would also help to fill knowledge gaps related to the precise patterns of lynx space-use within and near the ski hill, including movement routes, denning habitat, and other important habitat features.

Existing and Potential Interactions and Impacts

Potential impacts and risk factors for lynx for the southern portion of their range (i.e., including southern Canada and the northern contiguous US states) have been discussed by Ruggiero et al. (1999), Ruediger et al. (2000), and Apps (2007). Some impacts, such as direct mortality from hunting or trapping, and habitat loss from large-scale commercial forestry practices, are not applicable in the context of a protected area such as Banff National Park. Potential impacts that could apply in the context of a national park alpine ski area include:



- Forest Management Practices. Snowshoe hare populations achieve high densities in young, dense coniferous forests or mature forests with well-developed understory. Red squirrels also require mature conifer forests. Lynx require areas with large amounts of coarse woody debris, such as blowdowns and upturned root systems, for natal dens. Forest management practices which remove or alter such habitats may impact lynx. In addition, lynx avoid large openings (Anderson and Lovallo 2000) and may be reluctant to cross clear-cuts or wide ski runs. Snow tracking at the Lake Louise ski hill showed that lynx avoided crossing large open areas but could cross ski runs in places where there was sufficient tree cover (Tremblay 2001). Removal of understory vegetation may reduce foraging opportunities for hare and lynx. Ski hill forest management activities that could impact lynx and their prey include clearing forest stands for ski run development, glading, removal of shrubby cover from ski runs, and creation of fire guards around the ski hill or around particular facilities. In lynx habitat, wildfire is an important disturbance agent that helps to create early- to mid-seral conditions with high hare densities and abundant coarse woody debris, while maintaining all forest age classes and a diverse landscape structure. Fire suppression activities, including those intended to protect major infrastructure such as ski hills and townsites, may ultimately reduce the ability of these landscapes to support lynx.
- Recreation and Human Presence. Lynx may be able to exploit habitat close to human activity, particularly if that activity is concentrated during daytime allowing lynx to forage relatively undisturbed at night. However, lynx are likely to be more sensitive to disturbance in certain habitats. For example, human activity at den sites or at important security habitat may have greater effects on lynx than human activity near typical foraging habitat.
- Recreation and Snow Compaction. Packed snow trails created by skiers, snowmobiles, snowshoers, and other means are believed to increase access by coyotes (and potentially other competing predators) and thereby weaken the natural segregation of these species by snow condition (Buskirk et al. 1999). This can affect availability of prey species for lynx, interfere with lynx foraging, and result in direct mortality of lynx through predation by the competing species. Effects of packed snow trails can extend beyond the developed footprint of a ski area if lift access facilitates the passage of out-of-bounds skiers and ski-tourers into adjacent backcountry areas. Apps (2007) suggested that increased competition may be particularly harmful to lynx in late winter when hare numbers are typically at their lowest levels.
- Ski Resorts. Ruediger et al. (2000) noted that ski areas are often located in high quality lynx and snowshoe hare habitat, because such habitat typically occurs where terrain and snow conditions are sufficient to support long ski seasons. Ski run development, particularly at larger resorts, may fragment lynx habitat. Competitors such as coyotes may be drawn to ski hills to access food and garbage. Overall, disturbance levels associated with recreational activities at ski hills may preclude use by lynx (Ruediger et al. 2000). However, the nocturnal activity patterns of lynx may provide an opportunity for lynx to co-exist with diurnal recreational activities in the same area (USDA 2012).
- Roads. Lynx are vulnerable to human-caused mortality along roads and even on ski runs. In January of 2013 a lynx was struck and killed by a motor vehicle on the Whitehorn road. In 2010 a lynx was killed in a collision with a grooming machine on the Wiwaxy ski run. It is possible that other lynx deaths from collisions with motor vehicles have occurred but were not reported. Forest roads



may impact lynx habitat through tree removal and by facilitating the movements of competing predators. High volume roads may also fragment habitat for lynx by deterring movement. However, lynx may also use low-volume roads as efficient travel routes and foraging habitat.

Specific ski area development activities contemplated in the Site Guidelines that have potential strategic implications for Canada lynx include:

- New ski run development in forested areas
- Winter road access into Hidden Bowl and West Bowl
- Vehicle traffic increases on Whitehorn road
- Enhanced long term corridor and summer habitat security

The development of new ski runs below treeline on the Whitehorn front side and along Corral Creek valley in the Prunepickers, Richardson's Ridge and Corral slides all extend the forest/open-ski-run patchwork that currently exists on the ski area. Lynx currently successfully use the existing ski area patchwork, especially after-hours. With considered design and management in accordance with vegetation management parameters, and by minimizing after hours sensory disturbance to the extent feasible, lynx may be expected to continue the use of newly developed areas in a similar manner. Maintaining run widths less than 50m, maintaining significant patch size in between runs, and maintaining understory that supports snowshoe hare habitat and provides hiding and travel cover for lynx are key aspects of successful lynx habitat design for new and modified ski runs.

Ski run development may provide pathways for competing predators with lynx including coyote, cougar and wolf. Winter access and egress roads and trails into Hidden Bowl and West Bowl also potentially contribute to access for competing predators. While high levels of human use are generally deterrents to other predators during open hours, coyote, wolf and cougar can be reasonably expected to use packed trails during other times of the day. Creation of an egress trail from West Bowl does not change the current situation a great deal, as informally packed egress trails already exist. The creation of a formal egress trail, along with fencing signage and communication to limit skiing below the egress path, may be reasonably anticipated to reduce the number of informal trails that extend down into lower elevations where access by other predators into lynx habitat is more likely. A winter access and egress trail into Hidden Bowl may be expected to displace other predators during open hours but may facilitate better predator access into the Hidden lake area. However ski and snowmobile trails already exist in Corral creek and Hidden Lake valleys. A new Hidden Bowl winter access in and of itself, would not alter the current situation a great deal.

Potential expansion of ski area capacity is inevitably associated with increased use of existing ski runs, base area, and Whitehorn access road traffic. Increases in base area and road traffic during regular opening hours in either winter or summer are not anticipated to alter the current situation for lynx as these areas currently operate at levels that would be expected to displace lynx. Extension of summer use hours into later evening hours as envisioned in the Site Guidelines is likely to extend the timing envelope of potential lynx disturbance. To a limited degree the temporal extension of summer use disturbance is offset by the same factors that are anticipated to offset disturbance to bears on the ski area. The summer use area will be moved to the upper slopes of Whitehorn Mountain and trail system will be located well above expected lynx habitat. Noise and other sensory disturbance from later operating hours at a relocated summer lodge will be contained to levels that would not displace grizzly bears within relative



close proximity and will be well above core lynx habitat on the ski area. Traffic levels on the Whitehorn road will be managed to be below successful wildlife crossing thresholds and improvements to wildlife crossing effectiveness should also benefit lynx.

Mitigating Measures

The mitigations for Canada lynx identify ecological management parameters, future planning and/or operational requirements, or future knowledge requirements that are needed to realize expected ecological outcomes.

Ecological Management Parameters

In order to realize expected ecological outcomes important to Canada lynx the following ecological management parameters have been incorporated into the Site Guidelines:

- Winter and summer operational and construction activities do not displace or habituate grizzly bears or other wildlife
- Ski area operations and visitor use provide effective low disturbance periods for wildlife that respond to winter and summer seasonal patterns and sensitivities
- Ski area use and operations maintain wildlife habitat effectiveness and security outside of ski area lease and licenses of occupation.

Long Range Planning and Operational Parameters

Parameters for grizzly bear, the Whitehorn Wildlife Corridor, and vegetation management are anticipated to address many of the key issues related to Canada lynx. The following additional, specific planning and operational requirements are identified to ensure that expected ecological outcomes are realized for Canada lynx:

- Glading is sensitive to lynx habitat needs
 - Glading of patches in between runs will be planned to maintain cover and habitat connectivity for lynx across the ski area
 - Coarse woody debris and understory vegetation will be retained wherever feasible to support snowshoe hare habitat
- As new runs are developed on lower Whitehorn Front Side run and vegetation management strategies will give consideration to consolidating existing small forested patches into larger patches to maintain habitat effectiveness and connectivity across the ski area consistent with vegetation management parameters
- Site the West bowl egress route as high as feasible to minimize disturbance of forested terrain below the bowl
- Where feasible consider alternative avalanche control measures rather than use of explosives in West bowl or Hidden bowl.

Environmental Assessment and Information Requirements

It is expected that the ecological management parameters and other conditions and mitigations of the Site Guidelines will be applied wherever feasible to effectively address issues related to the persistence of lynx on and around the ski area. Parks Canada also recognizes that there may be situations where the parameters and conditions of the Site Guidelines may not be strictly feasible and where minor adjustments or other approaches to management of lynx habitat may be possible. Any proposed departure from the parameters or conditions of the Site Guidelines with respect to lynx habitat and persistence must be brought forward as part of a Long Range Plan. Long Range Plan proposals will as appropriate be informed by further research on lynx habitat and lynx use of the ski area including:

- denning and resident habitat



- movement routes and spatial temporal patterns
- lynx/snowshoe hare dynamics

Residual and Cumulative Effects

The expected ecological outcomes that apply to mitigating potential impacts to Canada lynx include:

- Land use decisions contribute to local region ecological integrity goals including fire and vegetation management, wildlife movement, grizzly bear habitat security and species at risk protection and recovery.
- Terrestrial and aquatic habitat conditions for sensitive species including Whitebark pine, grizzly bear, wolverine, mountain goat, west slope cutthroat trout, bull trout and mountain caribou are conserved or restored.

The mitigations for Canada lynx include mitigation measures for the Whitehorn Wildlife Corridor, run and vegetation management, and grizzly bear. Similar to wolverine, mitigations for these other Valued Components also address many of the issues pertinent to Canada lynx. Parameters and conditions for other Valued Components focus on maintaining movement across the ski area and preventing further displacement or mortality of wildlife including lynx as a result of ski area expansion.

Lynx may be somewhat more tolerant than other small predators such as wolverine as they appear to adapt to, and persist, on and around the ski area. At a local scale, maintaining vegetation composition and structure within parameters for medium sized mammals is expected to maintain the ability of lynx and other small wildlife to move across the ski area and forage during winter and summer seasons. However expansion of ski terrain below treeline will certainly affect lynx over a wider area on the front and backside of the ski area. Despite the potential expansion, ski area development could be done in such a way as to enhance habitat conditions for snowshoe hare and for lynx by considering lynx habitat needs as part of the design and development of new ski terrain.

Considering the full suite of guidelines and mitigations it is anticipated that expected ecological outcomes related to lynx may be achieved under the Site Guidelines:

- Lynx movement through the Whitehorn wildlife corridor and across the ski area will be maintained consistent with parameters for Grizzly bear, wolverine and other small mammals
- Habitat conditions for snowshoe hare will be maintained through planned run and glading development and continue to persist as a food source for local lynx individuals
- The Site Guidelines contain measures to limit the development of new service roads and trails and to consolidate existing trails where feasible; these measures to restrict packed roads and trails may be expected to somewhat limit the potential for winter competition from other predators
- Direct disturbance to resident lynx will be managed through predictable visitor use and operating seasons and hours, location of summer visitor use and management of sensory disturbance such as noise or outdoor music from lodge locations consistent with parameters and conditions for grizzly bear



8.7 Native Vegetation

Current Status and Ecology – General Considerations

Lake Louise Ski Area is situated within the Bow Valley, east of the continental divide. Vegetation communities within LLSA encompass montane, subalpine and alpine vegetation assemblies, with closed coniferous forests in the lower subalpine (1600 – 2000m), open coniferous forest in the upper subalpine (2000 – 2400 m), and dwarf shrub, herb, and lichen communities in the treeless alpine zone above 2400m (Holland and Coen 1982). A wide range of elevational and ecological gradients results in numerous vegetation types and plant community structures, as illustrated by the over 25 ecosites within the LLSA as per the 1982 Ecological Land Classification (ELC).

The vegetation communities of LLSA contain rare plant species. Plants are considered to be rare if they are ranked for conservation by the Alberta Conservation Information Management System (ACIMS) as S1, S2 or S3. While a complete synthesis has not been completed, the following rare plants are known to exist with the lease boundary:

- *Poa stenatha*, narrow-flower bluegrass (S1)
- *Arabis lemmonii*, Lemmon's rock cress (S2)
- *Draba ventosa*, Whitlow grass (S2)
- *Pinus albicaulis*, Whitebark pine (S2 and SARA listed)
- *Juncus parryi*, Parry's rush (S2)
- *Potentilla drummondii*, Drummond's cinquefoil (S2)
- *Botrychium lanceolatum*, lance-leaved grapefern (S2)
- *Agrostis humilis*, low bent grass (S2)
- *Agoseris lackschewitzii*, pink false dandelion (S2)
- *Epilobium clavatum*, tallus willowherb (S2)
- *Festuca minutiflora*, tiny-flowered fescue (S2)
- *Boloria astarte*, Astarte fritillary (S3)
- *Gentiana glauca*, alpine gentian (S3)

Native vegetation plays a number of important roles in local ecosystem function and is a key element of native biodiversity. Vegetation anchors soils and terrain against wind and water erosion and mass wasting, and functions to capture and release water as part of the hydrologic system. Native plant communities contribute to structural habitat diversity that supports local and regional food webs and wildlife life cycle requirements. Grizzly bear for example rely on seasonal diversity in grass, berry and root foods, on open habitat types that support ground squirrels as a food source, and on forest cover and structure that provide security for denning and hibernation.

Diversity of vegetation in the LLSA area was historically maintained by wildfire. While vegetation in the LLSA area is dominated by native species, the structure of vegetation communities has changed since park establishment and the start of active fire suppression. Extensive, even-aged stands of lodgepole pine or Engelmann spruce and subalpine fir dominate the landscape, while in the past there was likely more heterogeneity in the age structure of forest resulting from comparatively more frequent stand replacing fires.

Existing and Potential Interactions and Impact Analysis

Potential ski area development activities within the Site Guidelines that have the potential to impact native vegetation include:

- vegetation clearing



- terrain modification
- snow making and grooming
- ski area summer use
- fire suppression

Within the subalpine forests or alpine ecosystems of LLSA, vegetation clearing will have direct impacts on vegetative cover. Ski hill operations or development activities have the potential to impact value components such as native vegetation and rare plants. Removal or modification of forest cover occurs with lift development, terrain modification, run clearing, new facility development or expansion of existing facilities. Understory vegetation and ground cover may also be removed or modified to facilitate development activities.

Burt and Rice (2009) found that cleared, but ungraded, ski runs retain many ecological similarities to reference forests and may be found to contribute more positively to plant species and functional diversity than either natural forests or graded runs. Vegetation clearing associated with ski terrain development and maintenance can be consistent with the disturbance dynamics associated historically with wildfire or avalanche events.

Soil and vegetation disturbance associated with terrain modification can result in increased erosion and slumping potential where inadequate erosion control, drainage structures and vegetation reclamation occur. Removal of vegetation and disturbance of soils removes the physical anchor provided by native vegetation root systems but also adversely affects the water holding capacity of soils leading to soil saturation and potential slumping in areas that may otherwise have been stable. Diligent planning and reclamation is necessary to both predict and prevent erosion of any new sites subject to terrain modification.

Machine grading or mechanical ski run clearing has been found to directly impact existing vegetation and decrease plant cover, plant productivity and species diversity (Roux-Fouillet et al. 2011, Burt and Rice 2009, Wipf et al. 2005). Burt and Rice (2009) indicate that the disturbance intensity associated with grading results in considerably greater impacts to plant community composition and diversity, soil nutrient characteristics, and measures of erosion potential. As indicated earlier, cleared but ungraded ski runs retained many ecological similarities to reference forests and may be found to contribute more positively to plant species and functional diversity than either natural forests or graded runs.

Invasion by non-native vegetation is considered a potentially significant threat to native biodiversity (Groom 2006, Wonham 2006). Ground disturbance associated with potential terrain development, construction, and operational activities creates potential for the establishment of non-native vegetation that displace native species and reduce native vegetation diversity (Davis et al. 2000). Current extent and variety of non-native plant species has not been comprehensively documented within the ski area however several species of concern are found in the area.

Artificial snow making can negatively impact understory vegetation and ground cover as it shortens the growing season (Rixen et al 2003), increases the amount of water on site due to the increased water content of artificial snow (Mosimann 1998) and change mineral content and pH of snow melt (Kammer 2002). Wipf et al. (2005) found snow-making to cause deviations in natural plant species composition and a decrease in plant species composition however they did note that snow making can also help limit



disturbance to native vegetation in areas where damage from mechanical disturbance (snow grooming or ski edges) is a major problem.

Through the use of explosives, the primary objective of avalanche control at LLSA is to prevent large accumulations of snow and to in turn, mitigate the probability of large avalanches that can pose a threat to skier safety and/or ski area infrastructure. Avalanche control leads to more frequent but smaller avalanches that travel shorter distances down slope. Shorter run out zones in turn, lead to less removal of forest and tall shrub vegetation toward the bottom of avalanche-managed mountain slopes. The area of avalanche-maintained vegetation such as low shrub and grassland communities at the bottom of slide paths may be decreasing while forest and tall shrubs are likely encroaching on these communities.

Avalanche control activities also result in less snow accumulation in slide path run-out zones over the winter season. The decreased snowpack in these lower zones melts earlier in the spring, creating conditions potentially less favorable for mesic snowbed vegetation species that thrive in these zones. Avalanche control that results in less snow near the bottom of slide paths will also result in an increase in snow at middle and higher elevations leading to increased moisture conditions in these areas during the spring and early summer.

Summer use in the upper subalpine and alpine has the potential to impact vegetation communities through soil compaction, damage and destruction of plants, increased surface runoff and foot erosion.

Mitigating Measures

In order to realize expected ecological outcomes important to native vegetation diversity the following ecological management parameters have been incorporated into the Site Guidelines:

- native species and communities dominate vegetation throughout the ski area
- plant communities reflect regional and local vegetation structure and diversity
- glading and thinning simulate natural vegetation patterns and structure
- rare and sensitive vegetation communities and terrain features persist
- native vegetation serves as an anchor against soil and terrain erosion
- the composition and structure of vegetation provide habitat for the expected range of native species
- vegetation management and facility design support the restoration of fire as a natural process in the local region around the ski area
- construction and modification to vegetation and terrain do not alter natural rock flow features
- construction, terrain modification and vegetation removal avoid disturbance of saturated soils or surficial deposits where mitigation is unlikely to be successful.

The Site Guidelines also contain parameters for run development and vegetation management that are designed to ensure habitat effectiveness and connectivity across the ski area for a wide variety of wildlife including the movement of grizzly bears and wary carnivores such as lynx and wolverine:

- below treeline the maximum new run width or widening of existing runs is 50m
- on either side of new runs a strip of contiguous forest cover at least as wide as adjacent runs remains



- for all new runs or run modifications forested areas between runs are irregular in shape and of sufficient size to provide effective wildlife habitat and movement cover.

Long Range Planning and Operational Parameters

The ecological management parameters of the Site Guidelines are expected to address potential overall change in vegetation structure and function and ensure that wildlife habitat movement and habitat effectiveness are maintained in such a way that expected wildlife species continue to persist on and around the ski area environment. Some areas of ski run development on the lower Whitehorn Front Side do not currently meet these parameters. In addition to the parameters of the Site Guidelines Long Range Plans should give consideration to improving the effectiveness of the existing situation where feasible:

- as new runs are developed on lower Whitehorn Front Side run and vegetation management strategies will give consideration to consolidating existing small forested patches into larger patches to maintain habitat effectiveness and connectivity across the ski area consistent with vegetation management parameters.

In areas where grading and other soil disturbance has occurred, active vegetation reclamation and restoration is important (Urbanska and Chambers 2002, Urbanska et al. 1998, Bayfield 1996, Tsuyuzaki 1994). Research acknowledges that replication of exact pre-disturbance conditions is likely impossible and that the long term objective of restoration for alpine areas and ski runs is to establish self-sustaining ecosystems and maintain ecosystem function (Urbanska and Chambers 2002, Hunt 2009).

Specific planning and operational parameters are identified to provide greater clarity for project design and planning, and ski area operations. Overall, the research on ski area development and alpine restoration suggests a hierarchy of preferred ski run development and restoration practice considerations. The following parameters for ski run development should be considered as part of future planning proposals or management initiatives as appropriate:

- Forest and tall vegetation clearing without disturbance of soils, root systems or seed banks is the preferred method as it maintains important ecosystem properties and in some circumstances may even enhance functional diversity
- In circumstances where grading or soil disturbance must take place, such as removal of physical hazards, minimizing the disturbance footprint of soils and seed layers to the extent possible will minimize impacts to ecosystem function
- In circumstances where grading or disturbance over larger areas must take place, the separation, conservation and replacement of existing topsoil and seed layers will help to restore and maintain native species and functional diversity
- In areas where grading or other soils disturbance has taken place, active restoration with native and non-native species, and long term success monitoring, may also be required.

Environmental Assessment and Information Requirements

- Long Range Plans that include proposals for run and lift development, or other infrastructure development will be informed by rare plant surveys and mitigations as appropriate.



Whitebark pine - Current Status and Ecology

Whitebark pine is an essential element of ecosystem composition and function in many subalpine and treeline forests at high elevations throughout the mountain national parks including all four mountain park ski areas. Despite its' wide range Whitebark pine is susceptible to several key threats and has been listed as Endangered on Schedule 1 of the Species at Risk Act (SARA).

Whitebark pine is a slow growing, five needled stone pine that is rapidly declining throughout its range in North America due to the combined effects of historical and current mountain pine beetle (MPB) outbreaks, fire exclusion, climate change and the introduced pathogen *Cronartium ribicola*, which causes the disease white pine blister rust (Keane and Arno 1993, Smith et al. 2012, Keane et al. 2012). The loss of this tree species has implications for the integrity of subalpine ecosystems, both in the loss of biodiversity and the loss of ecosystem processes and services that provide habitat requirements for other species such as Clark's Nutcracker (Tomback and Achuff 2010). From a ski hill perspective, Whitebark pine and associated tree line communities are known to stabilize and shade snowpack thus regulating snow melt and downstream flow, stabilize loose, rocky soils and reduce erosion (Farnes 1990, Arno and Raymond 1990).

At the Lake Louise Ski Area Whitebark pine primarily occurs throughout an elevation band across the front side of Whitehorn Mountain that includes the lower slopes of West Bowl and the NW ridge beyond. The elevation band in which Whitebark pine occurs begins roughly at the 2000m level (approximately the level of the bottom of the Top of the World lift) and extends to treeline. Whitebark pine likely occurs in other similar habitats at the ski area such as the upper slopes of Richardson's ridge and upper elevations of the Larch area.

Historical ski area run clearing and lift development at the ski area is likely to have resulted in the removal of Whitebark pine long before the pine became a species at risk. Similarly, on-going vegetation maintenance at the ski area such as brushing, maintaining glades and hazard branch removal have undoubtedly impacted individual trees. Despite these likely impacts, Whitebark pine continues to persist on the ski area. To some degree the persistence of Whitebark pine on the ski area may be attributed to ski run clearing, glading and vegetation management that clears and leaves open spaces within maturing forest cover that may be preferentially colonized by Whitebark pine or that promotes maturation of individual trees.

Under SARA Sections 32 and 58(1), Whitebark pine individuals and their identified critical habitat are legally protected and the ski area has been taking proactive measures to identify and protect Whitebark pine from damage that may result from visitor and operational activity. While measures for protection of Whitebark pine individuals at the ski area are improving, it should be noted that any adverse impacts associated with ski area management contribute little if anything to the four main threats to the species (White Pine Blister Rust, Mountain Pine Beetle, fire and fire exclusion, and global climate change).

Existing and Potential Interactions and Impact Analysis

In general, impacts to Whitebark pine are similar to those associated with other vegetation including those associated with clearing, terrain modification, snowmaking and grooming and skiing/snowboarding. Other potential interactions that are particularly relevant to the management of Whitebark pine include:



- Reduced abundance of Whitebark pine and successional replacement of Whitebark pine trees by other tree species
- Effective or actual loss of high quality Whitebark pine habitat due to activities such as ski run expansion, terrain modification or permanent development
- Summer use activities including construction activities, vehicle use or trail use and development that result in damage to soils and root zones.

As discussed previously, ski area run development and vegetation maintenance activities may have inadvertently created or maintained habitat conditions that are favorable to Whitebark pine by removing competing tree species. To a certain degree these activities may be seen to replicate the stand-replacing function of natural wildfire on the ski area landscape. Recent adjustments by the ski area to focus on the identification and protection of Whitebark pine may be reasonably expected to enhance the benefits of operational vegetation management, while reducing inadvertent impacts to Whitebark pine that may have previously occurred.

Traditional ski run development has typically involved wholesale clearing of all trees and understory vegetation across a planned ski run. Continuation of these practices as part of future ski area development at Lake Louise would likely involve additional removal of Whitebark pine. Development of lifts and lodges or terrain modification may require the removal of Whitebark pine that occur in the planned development footprint and result in the loss of potential habitat even if impacts to individual trees are avoided.

However, ski area run development activities may be expected to result in similar positive impacts to those of ski run maintenance activities if consideration is given to the preferential protection of Whitebark pine during run design and implementation. Whitebark pine do not occur in dense stands on the ski area but rather occur primarily as scattered individuals throughout the upper subalpine treeline band across the west slopes of Whitehorn Mountain. New run development identified by the Site Guidelines for the Juniper and Meadowlark areas on Whitehorn Mountain primarily occurs below the expected elevation band for Whitebark pine. Other areas including Prunepickers and Richardson's ridge hold habitat potential for Whitebark pine as well. The scattered nature of Whitebark pine across the ski area provides opportunity for run development that selectively avoids existing trees. Approaches to run design and development in Whitebark pine zones that leave existing trees and that create openings for the establishment of seedlings and immature trees may be reasonably be expected to enhance habitat conditions for Whitebark pine.

During winter use activities, the most vulnerable of Whitebark pine age classes are immature trees that are exposed to damage from activities such as grooming, skiing or snowmobiling. Trees that are taller than the snow base and have live branches that are above the snow and exposed to impact from ski edges or equipment can be effectively prevented from growing taller or reaching seed-bearing maturity. For regular ski hill winter activities it can be assumed that there will be no potential damage to seedlings provided that snow depth is 20cm greater than seedling height. In addition, there is very little potential for regular grooming and skiing activities to damage mature trees (dbh >20cm) where the height from snow pack to live branches is greater than 2m.

A key consideration for Whitebark pine management on ski areas is protecting immature exposed trees so that they can mature into cone bearing individuals capable of sustaining the local population. Typically ski area run development has been focused on creating



relatively permanent runs and terrain features that are consistent over time. A more dynamic approach to ski run development and maintenance of ski terrain that identifies and allows for the maturation of Whitebark pine individuals, and adjusts ski terrain over time by protecting Whitebark pine trees and selectively removing competitive trees to maintain ski terrain, should be anticipated to result in greater and sustained presence of Whitebark pine on the ski area.

Whitebark pine are known to have extended root systems, a characteristic that may account in part for the success of these trees at high elevations and in dry rocky terrain. Ski area development, maintenance and summer use visitor activities including construction, off road vehicle use, creation of new trails or off-trail foot traffic have potential to impact Whitebark pine individuals or alter Whitebark pine habitat conditions as a result of soil disturbance and compaction, root damage or altered surface and subsurface water drainage patterns (Jones et al. 2014). As a result, activities that appear to take place well away from an individual tree, may be well within an extended root zone that is many times that of other tree species.

Mitigating Measures

The protection and recovery of Whitebark pine as a Species at Risk is a key legal responsibility and ecosystem management priority of Parks Canada. Ecological outcomes and mitigations that apply to overall vegetation and fire management are anticipated to contribute to the on-going protection and recovery of Whitebark pine both on and off of the ski area. However, the unique sensitivities and ecological characteristics of Whitebark pine require additional consideration as part of ski area planning and operations.

While protection of Whitebark pine is a key priority for Parks Canada, the Agency recognizes that natural vegetation must be altered and managed over time to maintain the ski area winter and summer experiences desired by visitors, and sanctioned by the *Canada National Parks Act*. Fortunately the ecological characteristics of Whitebark pine and the requirements of ski area vegetation management can be combined to provide management approaches and opportunities that are not easily applied in more wild landscapes. The Parks Canada approach to mitigating potential impacts to Whitebark pine recognizes and takes advantage of the fact that the ski area is a managed landscape. The overall approach to mitigation and management is to identify ways in which Whitebark pine populations can be successfully sustained and enhanced through on-going planning and management, without imposing conditions that would negate the ability of the ski area to dynamically manage development and operations over time.

Ecological Management Parameters

Ecological management parameters serve as the on-the-ground benchmarks against which the environmental impacts of future development and use proposals will be assessed. Ecological management parameters that apply to overall vegetation and fire management will contribute to the on-going management and recovery of Whitebark pine. The following ecological management parameter specific to Whitebark pine has also been incorporated into the Site Guidelines:

- Favorable habitat conditions, stand and age distribution of Whitebark pine that sustain the ecological function of the species are enhanced and maintained over time across the expected range at the ski area.



Long Range Planning and Operational Parameters

Ski Area Long Range Plans contain two primary elements that provide a focus for planning and operational management related to Whitebark pine. The actual planning of infrastructure and terrain development project proposals provides opportunity to consider impacts to Whitebark pine individuals, or quality Whitebark pine habitat that may result from project development and implementation. Long-Range Plans also contain the requirement to develop Run and Vegetation Management Strategies that are used to direct the on-going management of vegetation, and may include specific management approaches that support Whitebark pine ecological management parameters.

Development of Long-Range Plan Project Proposals

The following parameters and approaches should be incorporated into the planning of individual infrastructure or terrain development proposals brought forward in Long-Range Plans:

- Where feasible, the siting or location of infrastructure including buildings, lifts, trails or other structures will avoid the need to remove or damage existing Whitebark pine individuals including damage to extended root zones, soils and supporting drainage patterns
- Where Whitebark pine must be unavoidably removed, or damaged to an extent that maturation or cone production is compromised, restoration plans for transplanting or replanting, and the long term survival of at least an equal number of trees will be implemented in advance of, or in conjunction with, project implementation
- If available, proven rust-resistant seedlings will be used for planting
- Proposals for new ski run, glading or other ski terrain development will be planned to effectively protect, existing Whitebark pine trees and stands with a focus on the preferential removal of shade tolerant competing species such as Engelmann spruce and subalpine fir
- Where the location or siting of infrastructure, or the clearing of ski terrain eliminates quality habitat that could potentially support Whitebark pine, an equal or greater amount of quality habitat will be enhanced or restored to a state favorable to the colonization and maturation of Whitebark pine. Measures to enhance or restore Whitebark pine habitat may include measures, or combinations of measures such as:
 - planting of young trees in suitable areas
 - thinning areas around existing trees to remove shade-tolerant competition
 - protection of existing trees or stands that allows for maturation or stand expansion
 - using prescribed fire to promote natural regeneration.
- Long Range Plans will include measures to create awareness and educate skiers and staff on Whitebark pine ecology and the protection of trees as part of the visitor experience.

Run and Vegetation Management Strategies

Run and vegetation management strategies are a key aspect of Whitebark pine management and may be anticipated to hold the greatest potential to enhance Whitebark pine communities on the ski area over time. The requirements for Run and Vegetation Management Strategies as applied to vegetation in general are outlined in the Site Guidelines. Particular consideration for Whitebark pine in any Run and Vegetation Management Strategy should also include:



- Identification and health assessment of cone bearing trees and seed dispersal stands
- Identification and physical protection of any existing trees susceptible to damage
- Measures for the early identification and management of mountain pine beetle
- Approaches to the dynamic adaptation of ski terrain to the growth and maturation of young trees involving measures such as:
 - On-going reconfiguring of runs or glades to allow regeneration, growth and maturation of Whitebark pine
 - Transplanting of trees from areas of likely impact
- The development and application of best management practices for tree removal, brushing, limbing or transplanting as necessary that prevent functional long term damage
- Identification of effective planting or transplanting guidelines and techniques for Whitebark pine such as those from McCaughey, Scott & Izlar, 2009 or as based on other professional advice
- On-going monitoring and mapping of Whitebark pine distribution, abundance and tree health on the ski area and surrounding licenses of occupation.

Together the Long Range Planning and Operational parameters for the development of project proposals, and run and vegetation management strategies, facilitate a dynamic and flexible approach to the health and distribution of Whitebark pine communities across the ski area over time. This managed landscape approach to Whitebark pine includes replanting and survival of lost or significantly damaged trees, the restoration or enhancement of habitat that has been effectively lost to other purposes, and an adaptive management approach oriented to a gradual improvement in protection, habitat conditions and Whitebark pine distribution over time.

It should be noted that the recovery strategy for Whitebark Pine was under development at the time of writing. SARA legislation, legal requirements, recovery strategies and subsequent action plans may be developed or change over time. *Where applicable the legal requirements of SARA will always take precedent over the direction provided by the Site Guidelines or this strategic assessment.*

Environmental Assessment and Information Requirements

Detailed information on Whitebark pine on the ski area has been underdevelopment since species listing under SARA. As vegetation cover and health are dynamic over time there is a need for on-going monitoring of Whitebark pine on the ski area. Vegetation management strategies in Long range plans, and other individual project proposals should be informed by an annual Whitebark pine monitoring program that:

- Tracks all known locations and age classes of all Whitebark pine
- Tracks incidental damage, trees at risk, and success of protection measures
- Records actions to replace and restore individual trees and habitat conditions.

Historic Fire Regime - Current Status

Historically, fire regimes of LLSA were dominated by high severity, low frequency fires (White et al. 2005, Rogeau 2004). Within the ski area, lower elevation subalpine lodgepole pine forests of the Bow Valley were characterized by moderately long fire cycles (100-150 years) that were high intensity and stand replacing. Higher elevation Engelmann spruce and subalpine forests were also characterized by high intensity and stand replacing fires however the fire cycle was likely greater than 150 years (White et al. 2005).



Banff National Park's historic fire regime changed significantly in the 1940's with reductions to human-caused burning as a result of fire prevention programs and suppression of lightning-caused fires. A reduction in area burned has most impacted ecosystems with the shortest fire cycle, such as those in the bottom of the Bow Valley. Longer fire cycles associated with LLSA reduce, but do not remove the impact of the dramatic fire regime change.

Given its mandate to protect ecological integrity, Parks Canada is working to maintain or restore fire as an ecological process in all national parks with fire-adapted vegetation. The Fire Management Plan (FMP) for Lake Louise, Yoho and Kootenay field unit provides key direction on fire management in the area, including appropriate response to wildfire, priorities for prescribed fire and facility protection. In addition the FMP sets area burned targets for each Landscape Management Unit in order to achieve objective of the Banff National Park Management Plan of maintaining 50% of the long-term fire cycle. The annual and 20-year area burned targets for the Lake Louise area are 26ha and 512ha respectively.

Appropriate strategies must be selected to meet ecological objectives while protecting values at risk. These strategies include: selecting appropriate response to wildfire, prescribed burning to meet specific ecological or protection objectives, and completing community or facility protection. When used in combination these strategies allow fire management to meet both ecological and social goals effectively. The manner in which these strategies are applied is termed the "Mixed Restoration Approach". This approach allows for appropriately managed wildfires and management of prescribed fires to reach area burned targets while utilizing facility protection to minimize the risk of wildfire impacting human values.

Existing and Potential Interactions and Impacts

Potential ski area activities contemplated in the Site Guidelines that have strategic level implications for the historic fire regime include:

- Fire suppression
- Vegetation clearing and maintenance
- Building and infrastructure development
- Summer visitor use.

As a result of the significant values-at-risk, the area surrounding LLSA is zoned as intensive fire management, meaning that wildfires are suppressed and kept as small as possible. Ongoing fire suppression in this area is resulting in a number of ecological or fire management impacts:

- Encroachment of forests on natural shrublands and grasslands and associated loss of quality bear and ungulate habitat
- Aging and increasing density of forest cover that reduces the quality of buffalo-berry for grizzly bears and black bears (Hamer 1996)
- Increases in forest insect and disease occurrence, such as mountain pine beetle, particularly on lower slopes
- Increasing biomass accumulation that increases the potential risk of high intensity fire.

Planning ski area development to minimize the risk of loss due to wildfire or prescribed fire with respect to vegetation, infra-structure and facilities may provide an opportunity to help restore the regional fire regime and achieve area burn targets. Run clearing,



glading and other vegetation management practices may be designed to contribute to the partial restoration of vegetation diversity and ecological function associated with the historic fire regime, as well as to the protection of facilities.

Building and infrastructure development can affect the historic fire regime and limit options for fire management because of the need for fire suppression strategies to protect values-at-risk. Wildfires on steep slopes with continuous forest fuels can be very challenging to stop. In the event of a wildfire in the Lake Louise area, indirect attack and burnout strategies may be required which could bring the wildfire to the LLSA, utilizing cleared ski runs to contain the wildfire. Applying Fire Smart principles to buildings and lifts within the ski area, ensuring access to water for sprinkler systems, and other fuel control work would enable Parks Canada to manage wildfires across the broader landscape.

Summer use to the upper mountain through operation of the lifts implies a relatively high number of visitors on the ski hill. The use of upper parts of the mountain in summer months presents a potentially difficult evacuation scenario in the event of wildfire. On an extreme fire day a wildfire starting in the valley bottom might be expected to cut off power to the lifts and other facilities and quickly travel upslope towards visitor use areas.

Mitigating Measures

The mitigations for historic fire regime identify ecological management parameters, specific planning requirements, and specific information requirements that are needed to realize expected ecological outcomes as outlined in Section 4.4.

Ecological Management Parameters

Ecological management parameters serve as the on-the-ground benchmarks against which the environmental impacts of future development and use proposals will be assessed. In order to realize expected ecological outcomes important to restoring the historic fire regime the following ecological management parameters have been incorporated into the Site Guidelines:

- Vegetation management, facility design and summer visitor use programs support the restoration of fire as a natural process
- Glading and run clearing simulate native vegetation succession and patterns of natural disturbance
- The composition and structure of vegetation provide habitat for a range of native species including grizzly bear and ungulates.

Long Range Planning and Operational Parameters

The Ski area Management Guidelines and the Site Guidelines both identify a requirement for a run and vegetation management strategy to be produced as part of the Long Range Planning process. Specific planning requirements related to the historic fire regime are to be included as part of the scope of a run and vegetation management strategy including:

- integration with broader landscape vegetation, fire and wildlife management strategies
- support objectives for wildlife habitat improvement
- ensure facility protection from wildfire while maintaining a mosaic of forest class structure that reflects the historic fire regime
- address fire prevention, suppression and apply Fire Smart principles
- reflect naturally and historically occurring vegetation patterns in the Lake Louise area through a spatial and compositional analysis.



Other planning requirements include:

- the application of Fire Smart principles, and planning for fire prevention and suppression, into ski area development proposals for facility design, water development, ski run and lift development
- fire prevention, suppression and emergency evacuation procedures are to be developed, approved by Parks Canada, and implemented prior to the outset of any summer visitor use program.

Fire prevention and control proposals including Fire Smart, fuel control, fire suppression and evacuation are to be based on a comprehensive wildfire hazard assessment and risk management strategy conducted in collaboration with Parks Canada.

Environmental Assessment and Information Requirements

The development of run and vegetation management strategies associated with Long-Range Plans will be based on integration with Parks Canada fire program. No additional requirements for environmental assessment or supplemental information are identified as part of the strategic environmental assessment.

Residual and Cumulative Effects – Native Vegetation

The expected ecological outcomes that apply to mitigating potential impacts to Native Vegetation include:

- Land use decisions contribute to local region ecological integrity goals including fire and vegetation management, wildlife movement, grizzly bear habitat security and species at risk protection and recovery.
- Terrestrial and aquatic habitat conditions for sensitive species including Whitebark pine, grizzly bear, wolverine, mountain goat, west slope cutthroat trout, bull trout and mountain caribou are conserved or restored.
- Vegetation is managed to reflect natural composition, diversity and patterns and maintain function of sensitive soil-vegetation complexes, including rare plants, wet soils, and alpine plant communities.
- Demonstrated leadership is applied to environmental management, stewardship, monitoring and best practices.

The Site Guidelines have been developed in recognition of the key vegetation factors that contribute to ecological integrity in the Lake Louise region. Rare plants, invasive species, the historic fire regime are all addressed through the parameters and conditions of the Site Guidelines. Managing these elements of the native vegetation regime in accordance with the Site Guidelines is expected to maintain a range of conditions that not only protects native vegetation but also results in a vegetation compositions and structure that supports the expected range of wildlife species and wildlife movement across the ski area.

Assessment and management of sites for rare and sensitive vegetation species, and control of invasive species, is common practice in environmental assessment for Parks Canada and in Best Management Practices applied by ski areas in the mountain parks. Special consideration has been given to the management of Whitebark pine in the Site Guidelines in recognition that ski area use and operations require the dynamic management of forest and other vegetation cover over time.

The Parks Canada approach to mitigating potential impacts to Whitebark pine recognizes and takes advantage of the fact that the ski area is a managed landscape. Together, the



Long-Range Planning and Operational parameters for the development of project proposals, and the development of specific Run and Vegetation management strategies, facilitate a dynamic and flexible approach to the health and distribution of Whitebark pine communities across the ski area over time. This managed landscape approach to Whitebark pine includes replanting and survival of lost or significantly damaged trees, the restoration or enhancement of habitat that has been effectively lost to other purposes, and an adaptive management approach oriented to a gradual improvement in protection, habitat conditions and Whitebark pine distribution over time.

Considering the full suite of guidelines and mitigations it is anticipated that the expected ecological outcomes related to native vegetation will be achieved under the Site Guidelines:

- Local region ecological integrity goals including fire management, wildlife movement and species at risk protection and recovery will be addressed through a dynamic run and vegetation management system that retains native vegetation to the degree possible and replicates natural landscape patterns in ways that facilitate habitat effectiveness and movement for native species of wildlife
- Habitat conditions for rare and sensitive species, including Whitebark pine, will be protected through environmental assessment and best practices employed by the ski area. The dynamic approach to management and monitoring of Whitebark pine is anticipated to result in a long term increase in the distribution and density of Whitebark pine on the ski area and to contribute to overall species protection and recovery in the broader landscape
- The unique combination of planning, monitoring and management of vegetation to sustain the ecological function of native vegetation, and the recovery of species at risk demonstrates an industry leading approach to ski area design and development in support of ecological integrity.

8.7 Aquatic Ecosystems

Ski area development and operations have the potential to influence the structure and function of aquatic ecosystems, in turn affecting ecological composition and habitat conditions for a variety of aquatic and riparian vegetation, fish and wildlife. The Pipestone River, Hidden Lake and Corral Creek are habitat for the threatened Westslope cutthroat trout and Bull trout. The withdrawal of water from the Pipestone River and Corral Creek, changes to vegetation structure and cover as a result of vegetation clearing and management, and modification of physical watercourse characteristics are key activities that must be carefully considered and managed in order to maintain the integrity of aquatic ecosystems.

Current Status

The discussion on the current status of aquatic ecosystems in relation to ski area development at Lake Louise is presented in two main parts. The first deals with the natural characteristics of the affected aquatic ecosystem focusing on overall watershed characteristics, flow regimes in the Pipestone River and Corral Creek, water quality and habitat for Westslope cutthroat trout and Bull trout. The second part of the discussion focuses on ski area use and management of water.

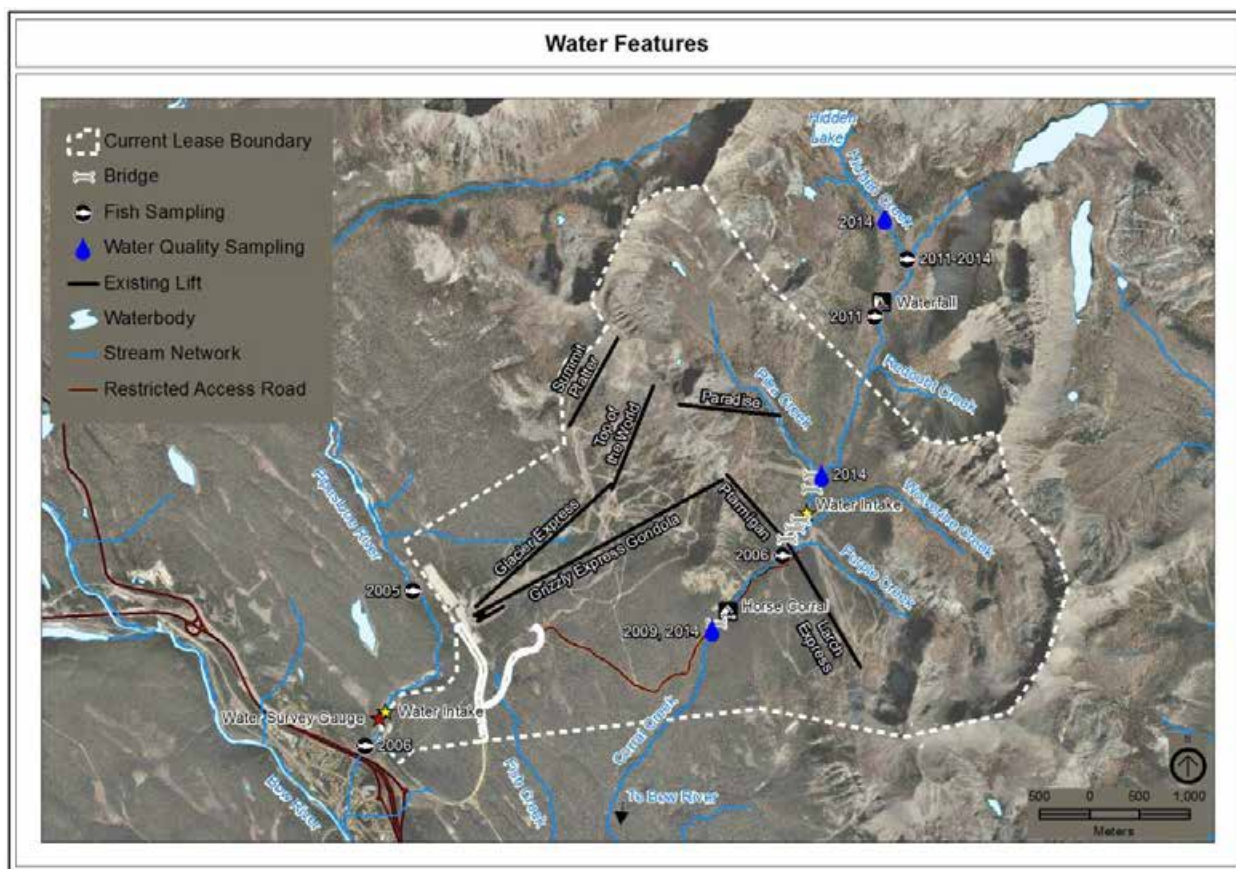
Watersheds

The Lake Louise Ski Area is located within the Bow River watershed, in a local area featuring several creeks and one river that cross or lie directly adjacent to the developed parts of the ski area (Map 12). These include the Pipestone River, as well as Fish, Pika,



Corral, Wolverine, Redoubt, and Hidden Creeks. There are also many unnamed small permanent, intermittent and ephemeral streams, springs and seeps that transmit rain, snowmelt and ground water into the larger water courses. A few permanent ponds, fens, and wetland environments of various sizes and configurations, occur in and adjacent to the existing ski area, along Corral Creek towards Boulder Pass, and within the adjacent Hidden Bowl valley. Hidden Lake, lying outside the existing ski area in Hidden Bowl valley is the largest and most significant of these standing water bodies.

In addition to surface water sources, several areas within and adjacent to the ski area lease feature low angled basins and water retaining vegetation complexes and peatlands. Basins in Wolverine Bowl and Purple Bowl as well as other smaller areas capture snowmelt and precipitation runoff and release it slowly to adjacent watercourses and may be expected to play an important role in sustaining late season and dry season surface flows.



Map 12: Surface Water Features in the Lake Louise Ski Area

Stream Flow Regimes _ Pipestone River

The Pipestone River serves as the main water source for the Lake Louise Ski area, particularly for snowmaking operation discussed later in this section. The gross drainage area is 306.1 km².

Historic stream flow data sources for Pipestone River include the Water Survey of Canada hydrometric station (05BA002) which has been in intermittent operation since



1911 and located just across the river and downstream of the ski area water intake (see Figure 8).

<i>Period of operation</i>	<i>Type</i>	<i>Operation schedule</i>	<i>Gauge type</i>
2012 - 2015	Flow & Level	Continuous	Recorder
1984 - 2011	Flow	Continuous	Recorder
1972 - 1977	Flow	Seasonal	Recorder
1911 - 1920	Flow	Continuous	Manual

Figure 8: Hydrometric Data Collection Records

Data presented are from the Water Survey Canada website (wateroffice.ec.gc.ca) corresponding to 45 years of data recorded from 1911 to 2012.

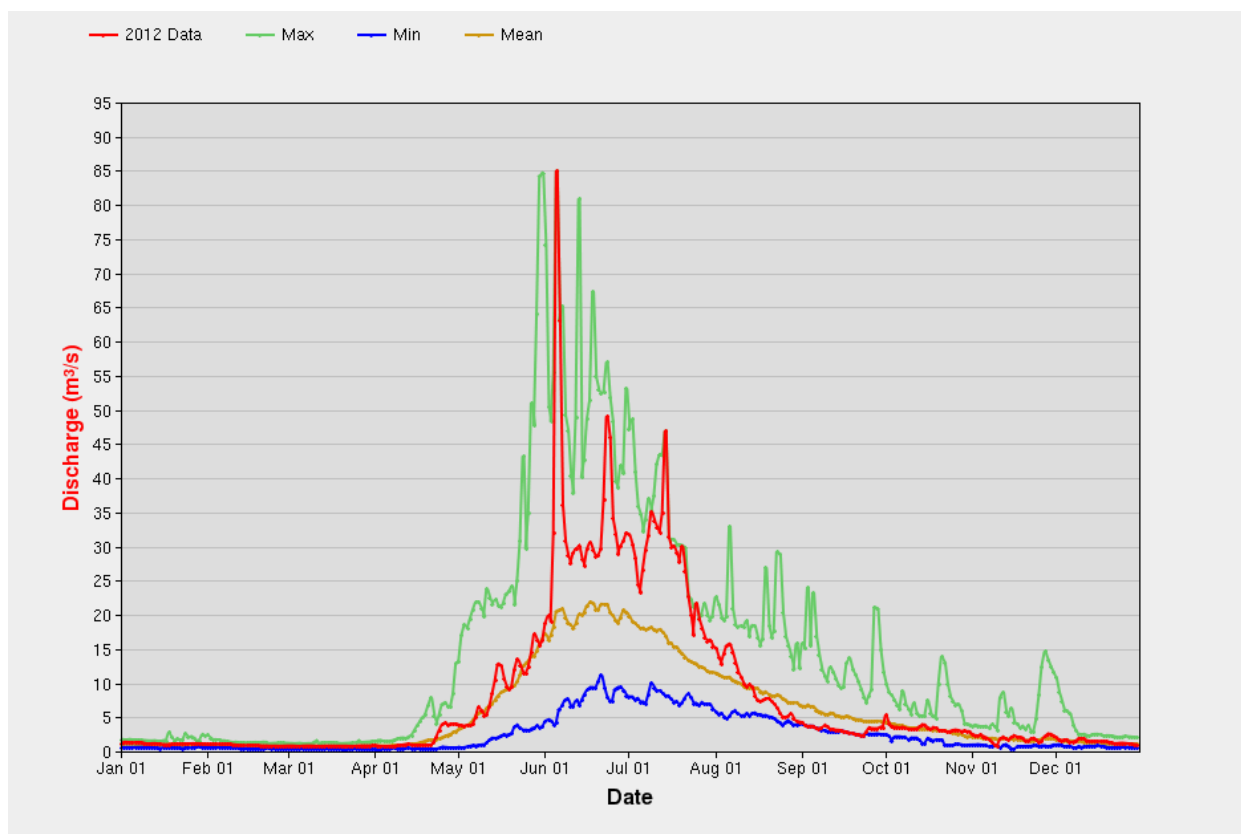


Figure 9: Pipestone Discharge 2012

The following information is based on the data collected from 1985-2012 as this is the most consistent and continuous data set. Peak flows and flooding generally occur in June with a mean June flow of 20.6 m³/s, and a range from 11.5-33 m³/s. In June 2012 there was a significant regional flood event with a single day maximum discharge of 85 m³/s and an instantaneous record of 107 m³/s. The results for the even larger flood in 2013 are not yet available and may be unreliable as the gauge was damaged during the peak flow, however direct observation indicates the 2013 flood volumes were greater than 2012.



Winter mean monthly flows between October and March range from 3.3 m³/s in October (coinciding with the start of snowmaking) declining to 0.86 m³/s in March. The lowest mean monthly flow was 0.598 m³/s recorded in 1999.

The Lake Louise Ski area also augments the Water Survey Canada data with direct measurements either completed by their own personnel or carried out by contractor. This additional monitoring occurs in part, because very challenging ice conditions routinely occur in the Pipestone River. Patterns of ice formation and release that include anchor and frazil ice, as well as ice jams and releases make the Water Survey Gauge or staff gauge challenging to relate to actual flow and water availability.

Ski hill personnel read a staff gauge daily and a qualified hydrologist takes a direct measurement approximately once every 2-3 weeks. A significant change in river level can trigger the need for additional measurements from the hydrologist. Additional measurements generally occur during the snow making period from mid-October to February or March. Detailed flow records have been taken since 2003 and are used to create weekly calculations of water availability based on current water levels and the typical behavior of the river. Physical characteristics of the river such as ice formation are also recorded.

The flow pattern established by the Water Survey of Canada data is not unexpected. The Pipestone River is a 4th order river with a relatively large but mostly unglaciated catchment running to, and east of the Bow River before it joins with the Bow in Lake Louise. High water typically occurs in spring and early summer associated with snowmelt runoff. Water levels generally decline throughout the summer, fall and winter towards annual lows that typically occur from mid to late winter prior to spring melt. The Pipestone has large fluctuations in flow between summer and winter and flooding in the summer and ice jamming in the winter are typical events.

The size of the river and the changing ice and water level conditions make it a challenge to monitor for water levels and well as biotic components such as fish. It is also provides year round habitat to several important species of fish which are covered in more detail below.

Stream Flow Regimes – Corral Creek

Corral Creek is another stream that flows through the Lake Louise ski area and is important to ski hill operations. A small seasonal pump in Corral Creek provides potable water for Temple lodge winter operations. Corral Creek is a small second order stream sourced by watercourses from Hidden Bowl, Hidden Lake and Boulder pass. Tributary watercourses from Pika Creek, Wolverine valley and Purple Bowl provide significant volumes to Corral creek flows within the ski area lease. Corral Creek flows into the Bow River below the ski area near the Corral Creek Day Use area located off Highway 1A.

Corral creek has never had permanent gauging and measurement. Some limited measurements were made in 1989, 1990, 1991, and 1992 and are summarized in Iris 1999 and appendices and sub reports within. Winter flow measurements from December 2, 1998 and January 20, 1999 were 0.051 and 0.021 m³/s respectively (Iris 1999). The ice formation made accurate measurements a challenge.



Within the ski area lease, the creek channel is typically 5-6 m across with lots of boulders creating a stepped pool habitat. Typical late summer depth of the creek would be approximately 35 cm, with pools being considerably deeper. Creek banks in some areas are armored to prevent erosion and protect ski area infrastructure. Ski runs in some areas end at the creek or run parallel to it. Several log and snow bridges cross the creek in the vicinity of Temple Lodge to allow skiers to navigate from one side of the stream to the other.



Top image: Corral Creek at the base of Exhibition run looking up Ptarmigan lift line. Purpose of visit, electrofishing for nonlethal Westslope cutthroat trout DNA samples.

Bottom image: Corral Creek just upstream of the current developed ski runs approximately 200 m. Purpose of visit – to establish a CABIN site for water quality monitoring.



Currently the ski area uses water from Corral Creek for potable use in Temple lodge and emergency firefighting. Formerly the Creek was used as a source for limited snowmaking operation in the Temple area. Iris (1999), recommended additional flow measurements in Corral Creek be undertaken to determine appropriate withdrawal volumes that would protect aquatic life in relation to the snowmaking operation. However the ski area no longer uses this creek as a source of water for snowmaking and the flow measurement work was never undertaken.

Corral Creek features high densities of Westslope cutthroat trout. Because of the naturally high densities of cutthroat in the creek, this population likely functions as a regional source of fish recruitment for the Bow River. The high densities also mean that this creek would be able to sustain some removals for translocation to other places as part of restoration and recovery activities for this species.

Water Quality

The quality of water is based on its physical, chemical and biological characteristics. Water quality related to the Lake Louise Ski Area can be viewed as three separate yet connected elements. These include natural water quality in the area's natural stream courses and standing waters; water quality related to potable (drinking) water, and; water quality related to wastewater management practices. Water quality may be affected by ski area use and development, in turn affecting aquatic ecosystems and wildlife, or downstream human uses of water. Conversely, water quality may influence how the ski area accesses, treats and uses water for operational, domestic and potable purposes.

The ski area draws water for potable use on the Front side of the ski area from the Pipestone River using the snowmaking system. Potable water for Temple lodge is drawn from Corral Creek as noted earlier. The ski area treats water on-site to potable standards and report on this aspect of water quality to the Regional Health Authority.

Wastewater from the ski area is treated at the Lake Louise Wastewater Treatment Plant. The waste water treatment plant was upgraded in 2003 to meet with Parks Canada leadership targets. Upgrades to the plant have resulted in a gradual improvement in the metrics used to measure the health of the Bow River which is the discharge location for the water treatment plant. Prior to upgrades, the benthic macro invertebrate community was generally enriched and the species composition was different from the upstream controls. Following upgrades, benthic communities upstream and downstream of the waste water plant are now similar. Amounts of algae downstream of the wastewater treatment plant have also improved, but as measured by the amount of chlorophyll are still elevated at the first monitoring site downstream.

In addition to the point sources of nutrients and pollution such as wastewater treatment plants, there are also diffuse and non-point sources of potential nutrients and pollution across the landscape. Flooding, stream constriction and sedimentation can decrease biotic water quality conditions. Biological waste from visitors who do not use ski area restroom facilities and local horse operations, hydrocarbons from machinery operations, and the use of fertilizers for race course management are other examples of potential non-point pollution sources.

Parks Canada has been working with Environment Canada to develop a predictive water quality model based on a reference condition approach. The Canadian Aquatic Bio monitoring Network (CABIN) predictive model was developed and tested for the



mountain parks in 2011 (Bailey and Reynoldson 2011) with verification work completed in 2012 (Scrimgeour 2012). As part of model development and verification a small number of sites that were suspected of being impacted were assessed including a site from Corral Creek just downstream of the horse corral and bridge crossing on the Temple access road. The benthic community at this site was not consistent with reference sites and may be considered to be stressed in comparison with reference conditions (Bailey and Reynoldson 2011, Scrimgeour 2012).

Westslope cutthroat trout and Bull trout

Several species of fish including both native and introduced species are located in streams and rivers located within and around the ski area. It is clear that Bull trout and Westslope cutthroat trout were historically present and abundant in the Bow River, connected stream and river tributaries, and several of the lakes in the upper Bow basin including Consolation, Moraine, Lake Louise, Margaret, Hector and Bow Lakes (Vick 1913). Both species of trout prefer cold water and the long term persistence of both species is not guaranteed without management intervention. Historic overharvest, stocking of other species leading to competition and genetic issues and large scale habitat changes and aquatic fragmentation are impacting these two species of fish within Banff National Park.

Conservation Status – Westslope cutthroat trout

Westslope cutthroat trout are both provincially and federally listed as threatened. In 2013 the Alberta population of Westslope cutthroat trout was added to Schedule 1 of Canada's Species at Risk Act as "threatened" (The Alberta Westslope cutthroat trout Recovery Team 2013). Parks Canada participated in a joint federal provincial recovery team for cutthroat trout that resulted in the completion of a provincial recovery plan and national recovery strategy. The national recovery strategy for Westslope cutthroat trout was completed in 2014 (Fisheries and Oceans Canada 2014). The population and distribution objective for Westslope Cutthroat Trout is to:

"Protect and maintain the existing ≥ 0.99 pure populations (currently believed to be approximately 51) at self-sustaining levels, and re-establish additional pure populations to self-sustaining levels, within the species' original distribution in Alberta." (Fisheries and Ocean Canada 2014).

Approximately 27 km of stream was identified as critical habitat in Banff National Park in the current recovery strategy. Neither the Pipestone River nor Corral Creek are part of the current critical habitat description for Westslope cutthroat trout based on genetic results. However, the recovery team recognized that the amount of critical habitat initially identified was insufficient to provide long term protection of the species and that future critical habitat would be added through one or more action plans.

Parks Canada considers both Corral Creek and the Pipestone River to be important for maintenance and recovery of this fish species. Parks Canada is actively working in Hidden Lake and the streams in the upper basin including Hidden Creek, Corral Creek and some unnamed permanent creeks that emanate from ponds in Hidden bowl. The purpose of this effort is to remove all non-native eastern brook trout from the upper basin and then reintroduce Westslope cutthroat trout above an existing waterfall barrier. It is expected that this project will have a positive long term impact on cutthroat trout lower down in the creek by removing the immediate threat from brook trout in the upper basin, and providing a high quality source of genetic stock in the upper headwaters (Humphries and Dickinson 2011).



Historic and Current Distribution – Westslope cutthroat trout

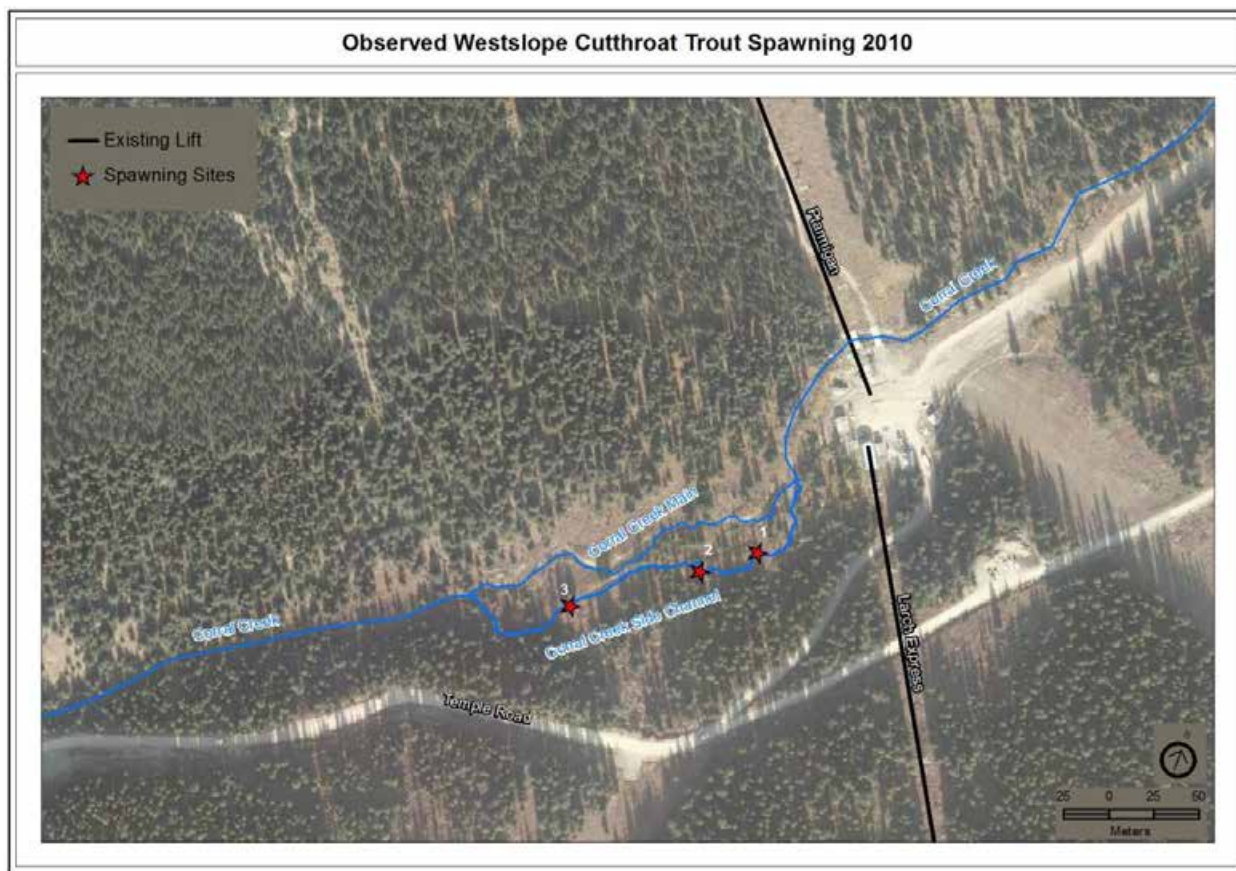
Extensive fish stocking occurred early in mountain parks history with cutthroat trout stocked in the Pipestone River in 1921 and in Corral Creek in 1923. Hidden Lake was stocked with cutthroat in 1933. It was common practice to stock hatchery cutthroat trout over existing natural populations of cutthroat that had been depleted from over harvest. Early fisheries managers made an effort to maintain a line of pure Westslope cutthroat trout with origins from Banff. DNA analysis indicates that they were successful in many locations, with many lakes that were historically fishless now containing pure Westslope cutthroat trout (e.g. Watchman Lake).

Life History - Cutthroat

Cutthroat trout follow three potential life history strategies that may be characterized as non-migratory stream, migratory fluvial or migratory adfluvial strategies (Prince and Morris, 2003). While Corral Creek contains stream residents, it is unclear whether fish in the Pipestone are fluvial, stream resident or both.

Stream resident cutthroat trout make use of different types of habitat through seasonal movements. Female fish do not usually achieve body condition sufficient for spawning until they are between 3-5 years and males are 2- 4 years (Downs *et al.* 1997). Spawning typically occurs in June in the Rockies. Eggs incubate in gravel redds for 6-7 weeks, with a further period where the alevins have hatched but remain in the gravel. During this time period cutthroat eggs and young are vulnerable to potential impacts such as sedimentation, flooding, pollution or dewatering and overheating causing low oxygen concentration (Cleator *et al.* 2009). After spawning stream resident cutthroat move to find suitable feeding habitats. In late summer and early fall they seek deep pools and areas of ground discharge for overwintering (Cleator *et al.* 2009). When riparian cover is lacking adult fish are more vulnerable to predation from birds of prey and mustelids [such as mink] (Cleator *et al.* 2009). The extended maturation period for cutthroat may result in delayed population recovery, in the event of significant predation, environmentally related fish kills, or unsuccessful spawning seasons.

The presence of all sizes and ages of cutthroat trout in Corral Creek indicates that spawning does occur in Corral Creek. In 2010, Parks Canada confirmed spawning in Corral Creek in a side channel directly downstream of base loading area for the Larch and Ptarmigan chairs (Map 13. Observed Westslope cutthroat trout Spawning 2010). Iris Environmental thought spawning likely occurred upstream of the Temple Lodge area based on the presence of small fish (Iris Environmental Systems 1999). There are likely to be many other locations where cutthroat spawn up and downstream of these reaches. Cutthroat are expected to select small pockets of gravel with correct flow and depth at the tail-outs of pools throughout the stream as suitable spawning habitat.



Map 13: Cutthroat Trout Spawning Locations

No spawning has been visually confirmed in the Pipestone River but there are a number of potential spawning areas in the vicinity and upstream of the old gondola base area that may have appropriate water levels, flow and substrate size during the June spawning season.

Population Status

Parks Canada completed fish population estimates in Corral Creek in 2007 and 2011. Both estimates achieved similar results with estimates of 48.9 cutthroat trout/100 m in 2007 and 47+/- 5 fish/100 m in 2011. These estimates are higher than estimates conducted by Courtney and Lightle in 1998 (1999). Differences in sampling techniques and seasonal timing likely account for this variation.

There are no known quantitative fish population estimates for the Pipestone River. However single pass electrofishing provide indication of species presence and relative abundance. For example, in October 2006, Parks Canada sampled the Pipestone River below the location of the water intake for snow making resulting in 10 Westslope cutthroat trout, 3 bull trout, 4 mountain whitefish, 1 brook trout and 1 suspected bull trout/ brook trout hybrid. Courtney and Lightle also sampled the Pipestone in 1998 and 1999 finding the same species present, and also noting the presence of whitefish in spawning condition (Courtney and Lightle 1999).



While the population of cutthroat trout in Corral Creek is currently considered healthy, the security of both it and the Pipestone River population are threatened by the growing presence of brook trout. There are many locations in Banff where brook trout have displaced cutthroat including extensive parts of Moraine Creek and Louise Creek. The period from Courtney and Lightle's surveys in 1998 to present have seen steady increases in the number of brook trout in Corral creek. Brook trout appear to be moving from the upper headwaters where brook trout have already displaced cutthroat trout and appear to be spreading downstream.

Cutthroat genetic evidence shows that there is genetic independence at the level of the stream with little gene flow to adjacent streams (Potvin *et al.* 2003, Taylor *et al.* 2003, Taylor and Gow 2007). Individual streams often have fish with local adaptations, and adjacent streams can have fish with very different adaptations. In streams with high density (>0.3 fish/m) and using a population loss rate of 10% it has been estimated that 9 km stream is required to maintain a population for the long term (Hilderbrand and Kershner, 2000). While Corral Creek is 9.59 km from the confluence of the Bow to the barrier waterfall near Halfway Hut, just falling within this range, it is likely that large cascades and falls in the section downstream of Ford Hill are effectively segmenting the stream and the population, with downstream movement much more likely than upstream movement. While the population appears to be stable, recolonization from downstream seems unlikely in the event of a significant population loss.

Conservation Status – Bull trout

The conservation status of Bull trout is under national review. In 2012 – COSEWIC recommended that the Saskatchewan-Nelson rivers populations be listed as 'threatened' (COSEWIC 2012). The COSEWIC assessment is typically one of the early steps leading to listing under Canada's Species at Risk Act. In 2014 Alberta upgraded the provincial status of Bull trout from 'special concern' to 'threatened' under the Wildlife Act (ESRD 2014).

Similar to cutthroat, Bull trout have undergone extreme declines throughout their range including in Banff National Park. Many of the threats that have imperiled cutthroat trout are similar to Bull trout, although a few key differences exist mostly related to differences in life history. Bull trout are less tolerant to warming waters than cutthroat trout, so high elevation habitats such as those found in Banff National Park may play a very important role in future conservation initiatives.

The desired recovery outcomes for Bull trout are predicted to be similar to Cutthroat trout and include the securing of existing populations, and expand the distribution, density and relative abundance of Bull trout to the historic range. As with cutthroat trout, Parks Canada considers both lower Corral Creek and the Pipestone River to have a role in the maintenance and recovery of this fish species.

Historic and Current Distribution – Bull trout

As mentioned previously, Bull trout were widely distributed in Banff National Park including the connected streams, rivers and lakes in the Upper Bow River basin. Currently, Bull trout are not found in the portion of Corral Creek that is within the existing leasehold, but do occur downstream of the leasehold boundary. Bull trout are also found in the Pipestone River, routinely detected in the vicinity of the snowmaking intake and through the canyon area downhill of the parking lots.



The distribution pattern of Bull trout being confined to lower reaches of high gradient streams is likely a function of the poorer jumping ability of Bull trout and the timing of their seasonal spawning movements. Bull trout move to spawning areas during the late summer closer to base flow levels, while cutthroat move into spawning areas in the spring during peak flow periods. Lower water levels in late summer accentuate natural and manmade barriers to fish passage.

Life History – Bull trout

Bull trout also follow three potential life history strategies that may be characterized as non-migratory stream, migratory fluvial or migratory adfluvial strategies (ASRD and ACA 2009). Lower Corral Creek contains stream residents, and based on size variation it is likely that the Pipestone River contains both fluvial and stream residents.

Rieman and McIntyre (1993) have identified bull trout as having more specific habitat requirements than other salmonids. The five habitat features that consistently influence Bull trout distribution and abundance are: channel and hydraulic stability; substrate; cover; temperature; and the presence of migration corridors.

Stream resident bull trout generally remain small and use different habitats in a single stream to complete their life history while fluvial fish make migratory movements from smaller streams to larger rivers and back (ASRD and ACA 2009). Stream resident fish produce fewer offspring, while the larger fluvial fish produce more offspring (Johnston and Post 2009). The need to make larger scale seasonal movements to return to natal spawning areas and the lower water time of year that these movements are made, can make fluvial Bull trout more susceptible to aquatic fragmentation.

Unlike cutthroat – Bull trout are fall spawners (typically September – October), with eggs overwintering then hatching in the spring. Ground water influence and zones of upwelling are essential for successful Bull trout spawning, preventing eggs buried in the gravel from freezing over the winter. Bull trout are late to mature at 5-7 years (COSEWIC 2012) and in cold regions may be alternate year spawners requiring one or more years to replenish energy required for spawning (ASRD and ACA 2009). Similar to cutthroat, this makes them even more susceptible to delayed population recovery in the event of negative environmental perturbations.

The presence of all ages and sizes of Bull trout in the Pipestone River indicates that spawning does occur in the vicinity of the ski area. It is likely to occur upstream of the water intake based on visual habitat attributes but no spawning fish have been observed. Bull trout spawning is also suspected to occur in the lower reaches of Corral Creek.

Population Status – Bull trout

Parks Canada has not made any population estimates for Bull trout in the Pipestone River or lower Corral Creek. Results from single pass electrofishing detailed above indicate that Bull trout are present.

Ski Area Water Use – Snowmaking

Snowmaking is by far the greatest consumptive use of water by the ski area. The snowmaking system draws water from the Pipestone River in the area of the old gondola base. An in-stream infiltration system embedded in the river bank feeds a pump house adjacent to the Pipestone River which charges snowmaking lines to the ski area. The



snowmaking system is an on-demand system, in that water is not stored in the system but goes directly from the river to the snowmaking system as needed.

Water withdrawals for snowmaking are governed by the 10/90 Rule which was developed to ensure that water withdrawal for snow making has minimum impacts on aquatic habitats. The 10/90 Rule allows for up to 10% of the stream flow to be withdrawn as long as the flow in Pipestone River is at or above the flow that would typically occur in the creek 90% of the time for any given week. When the flow in the Pipestone River drops to 90% of normal or below, no further water extraction may take place.

Managing water withdrawal by the 10/90 rule is intended to preserve natural stream flow characteristics. The 90% normal flow level acts as a minimum flow requirement for the protection of fish and fish habitat ensuring that ski area withdrawals do not result in abnormally low water levels. Because it is based on the normal average flow, the 10/90 method acts to preserve the natural hydraulic cycle of wet and dry years and seasons. Maintaining the seasonal hydraulic cycle is important to the natural life cycles of various species in watersheds as well as to riparian vegetation and wildlife.

Parks Canada administers a water permit for snowmaking water supply at the Lake Louise Ski area. Conditions of the permit require regular monitoring and updates to flow and withdrawal calculations that account for real-time variations in flow and improvements of data over time.

Ski Area Water Use – Domestic

Water for domestic use is withdrawn from both the Pipestone River and Corral Creek. Domestic water use on the front side of the ski area draws water from the snowmaking line. Domestic use for Temple lodge relies on water withdrawal from Corral Creek. Domestic water systems use a small proportion of total water available to the ski area and contribute little to stream flow impacts in comparison to snowmaking. The sustainability of these systems is discussed in further detail in Section 10.2.

Existing and Potential Interactions and Impacts

Westslope cutthroat trout Recovery

Threats to cutthroat trout were documented as part of the recovery plan process and fall into six broad categories:

- invasive species (especially competing fish species)
- adverse effects on habitat
- consumptive use/exploitation
- stocking
- pollution
- climate change (The Alberta Westslope cutthroat trout Recovery Team 2013).

From a strategic perspective most of these factors are unlikely to be directly driven or influenced by ski area planning and operations with the exception of direct changes to important fish habitat parameters. Changes to the environment such as modification of vegetation cover, disturbance or soils or manipulation of water courses may have direct impacts to fish or fish habitat. Changes to habitat may also indirectly influence or compound the effects of other key threats to cutthroat recovery.

Neither fish stocking nor sport fishing have direct strategic implications for ski area management and planning. Fish stocking is carried out solely by Parks Canada in



relation to species recovery efforts. However, changes to the environment caused by ski area development may affect fish habitat which may, in turn, affect the potential success of fish stocking recovery efforts. Likewise, Parks Canada is solely responsible for sport fishing regulation and enforcement with no involvement of the ski area. Clearing of vegetation may facilitate angler access to areas not previously accessible and may conceivably raise angling pressure on cutthroat populations. However both of these interactions are ultimately associated to changes in environment and habitat. Specific concerns related to these issues will be most effectively addressed in relation to the planning and assessment of specific project proposals and these factors are not discussed further as part of this strategic assessment.

The influence of invasive species such as brook trout, on cutthroat trout populations is not itself a strategic issue that is caused by, nor can it be directly managed through, ski area development or operations. Changes in habitat parameters such as warming stream temperatures may reduce habitat quality for cutthroat while making conditions more favorable for rainbow and brook trout. Maintaining habitat parameters for cutthroat is a strategically important consideration to address competition from other species. However the management of these competing species is not otherwise a strategic consideration with respect to ski area planning beyond a strategic focus on maintaining habitat quality.

Invasive didymo algae, or fish pathogens such as whirling disease, may be introduced to streams through in-water work or activities. While these are important environmental management issues anywhere in-water work takes place, they are not unique to ski area operations. Mitigations and practices to minimize the potential for direct transmission are most effectively identified in relation to the planning and assessment of specific project proposals and the application of best practices and environmental management systems are not addressed further here as part of this strategic assessment.

Potential pollution sources such as accidental spills are issues anywhere that work takes place and are best dealt with at a project level. Ski areas can be sources of water contamination associated with parking lots, wastewater treatment systems, unmanaged human waste, and use of chemical additives for snow hardening or ski waxing. However these potential issues are not particular to cutthroat trout and are addressed further below in relation to ski area operations.

Climate change is a potential compounding factor for cutthroat trout in terms of seasonal water flows and with respect to habitat quality such as water temperature parameters. As a global trend, climate change is not a factor that can be directly influenced by ski area planning or management. Ski area water use technologies and management systems can however be applied to minimize the compounding effects of climate change and ski area water use on seasonal flows. Ski area water management and climate change issues associated with changing water flow regimes is discussed further below as part of ski area water use.

Maintaining, securing and in some cases improving habitat conditions in favor of cutthroat trout is a strategic issue that can effectively be influenced by ski area development and operational use decisions. Development and management of ski terrain, modification of riparian vegetation cover and direct modification of water bodies or watercourses are the primary pathways that may result in adverse effects and are discussed below as the key strategic focus for cutthroat trout.



Cutthroat Trout Habitat

Ski area run development and vegetation management along with other infrastructure development typically involves the removal and modification of forest cover upslope of watercourses and may involve the removal and modification of ground cover, soils and terrain modification. These development and maintenance activities can result in increased speed of surface runoff, changes to drainage patterns, erosion of soils and associated sedimentation in watercourses.

The development and modification of ski terrain has the potential to affect patterns of storm and melt water runoff. Removal of vegetation, especially over large areas may result in less water retention on slopes and increased runoff peak flows. Ditching or other surface drainage works have the effect of moving water more quickly out of an area thereby decreasing availability of water to vegetation communities and increasing the intensity of storm and melt water runoff. Similarly, terrain modification activities may change surface drainage patterns and channels, in turn affecting vegetation and dependent wildlife.

Excavation and contouring of soils for terrain development has the potential to release subsurface flows to the ground surface, resulting in surface erosion and sediment transport, decreased slope stability, creation of unnatural wet areas on the slope and decreased subsurface flows down-slope of the incursion. Again, downstream or downslope vegetation communities and associated wildlife may also be directly or indirectly affected (Newcombe and Macdonald 1991). The potential loss of soils stability and slope failure have been an issue with run development at Lake Louise and other ski areas in the past and may be reasonably expected to occur in conjunction with future development in the absence of proper consideration and design. Wet areas subject to potential development of ski runs on the Whitehorn front side, Richardson's Ridge and into the Corral creek valley feature wet and saturated slopes that may be susceptible to significant terrain or vegetation modification.

The disturbance of soils and vegetation associated with ski terrain development may have impacts on downslope water quality related to increased sediment in water due as a result of soil erosion, vegetation removal or damage, ground disturbance or increased seasonal flows. Increased sedimentation can lead to increases in water temperature as well as loss of interstitial habitats. The direct removal of shading vegetation and reduced water flows may impact water temperatures affecting aquatic and riparian flora and fauna.

Similarly, removal or modification of riparian vegetation cover can significantly change runoff and sedimentation parameters. Changes to riparian vegetation also directly affect habitat parameters such as shade, temperature, food sources and cover for cutthroat trout. Changes to stream temperature may be particularly significant as warming temperatures may favor the competitiveness of Brook and Rainbow trout.

Ski area development at Lake Louise has historically taken place in close proximity to Pika Creek (an important tributary to Corral Creek), Corral Creek and the Pipestone River. Stream courses and riparian environments have been altered in the past to accommodate water withdrawal at the old gondola base area, for multiple stream crossings along the Temple Road and Temple Ski Out, and to facilitate ski area run development and lift infrastructure along Corral Creek and Pika Creek. Direct changes to



watercourses can result in increased erosion and attendant sedimentation, changes to flow patterns and sediment deposition, remove cover and habitat features such as spawning redds or habitat pools, increase flow velocities making fish movement more difficult, or result in channel blockage and habitat fragmentation. These types of adverse impacts are not unavoidable and fish habitat conditions may be maintained, restored or even enhanced through intentional planning.

The Site Guidelines allow for the consideration of new ski terrain and associated supporting development in a few areas that have potential to affect habitat for cutthroat trout including:

- the consideration of new ski terrain and lift development in the old Prunepickers Area, Richardson's Ridge, the Corral Creek slides area and Hidden Bowl.
- the consideration of new ski terrain as part of the Hidden Bowl and Temple concepts that will involve crossings of Corral Creek and tributary streams, and development in close proximity to these watercourses
- continued operational and visitor use, and potential modification of the Temple Road and Ski-out trail.

The Site Guidelines also allow for the consideration of water reservoirs that would allow for the extraction and storage of water during high flow times minimizing the need for – on-demand withdrawal during low flow times. A well designed reservoir system has potential to reduce impacts on fish and fish habitat, secure water sources for the ski area – especially during early or low flow seasons - and may mitigate some of the predicted impacts of climate change related to changing stream flow regimes.

Ski Area Operations

Daily ski area operational activities have potential to impact water quality and therefore the integrity of aquatic and riparian ecosystems. Snow compaction, artificial snow use and the use of potentially hazardous or polluting materials have potential implications for water quality. Accidents or malfunctions may present unforeseen impacts that may directly impact aquatic ecosystems.

Snow compaction through skiing, grooming and vehicle use may affect seasonal flows in terms of the seasonal timing and rate of release. Snow compaction decreases snow permeability allowing melt water to pass through more quickly and delays snowmelt in the spring (Fahey and Wardle 1998, Rixen et al. 2004). Aquatic wildlife and vegetation that are reliant on seasonal flow patterns and volume for completion of life cycle requirements may be adversely affected by seemingly minor changes to flow regimes.

Ski area operations make use of a variety of hazardous and polluting materials. Potential exists for spills or releases of hydrocarbons or other hazardous materials from equipment, storage tanks, operational and commercial areas. Perfluorooctanoic Acid (PFOA) and Fluorinated Telomers are present in some ski waxes and are also found in non-stick coatings, carpets, Gortex, and thousands of other commercial products. These compounds are persistent in the environment. Their potential for toxicity is unclear (Swedish Chemicals Agency 2006, Betts 2006, Bergfald and Co. 2005) and is currently being reviewed by American and Canadian government authorities including Environment Canada and Health Canada (Environment Canada 2006). Despite uncertainty as to the potential for serious environmental or health effects, these chemicals are voluntarily being phased out by many industrial manufacturers. Non-



fluorinated ski waxes alternative are available (Bioglide 2007, Ethica Enviro Wax 2007, Enviro Mountain Sports Inc 2007).

Accidents and malfunctions associated with water systems may have potentially significant impacts on vegetation, soils and downslope aquatic systems. The potential release of subsurface water due to excavation and terrain modification activities was discussed earlier. Pipeline leaks or breaks may result in the rapid release of large amounts of water with damaging effects due to direct erosion, or the saturation of soils and subsequent erosion, slumping or mass wasting.

Ski Area Water Use

Water withdrawal for snowmaking from the Pipestone River has potential implications for the effectiveness of fish habitat and the survival of fish. The potential impacts of naturally low rates of water flow and low winter temperatures on fish and fish habitat may be amplified by increasing water withdrawal demands associated with snowmaking.

Typically, the months of October and November have the greatest variability in discharge. By December flows become more predictable and recede considerably over January to March. Low natural flows during this period are a critical time for aquatic species survival. Both the quantity of suitable winter habitat such as deep pools, and the ability to move between habitats may be compromised by low flows and ice formation during cold periods. Snow making, which is most efficient at low temperatures, could result in the combination of low flows, water withdrawals and cold temperatures, cumulatively reducing available habitat and amplifying potential impacts.

The minimum level thresholds of the 10/90 rule have been encountered in recent records. In October 2001, natural snowfall in both the Mount Norquay and Lake Louise ski area was limited and flows in both the Pipestone River and Forty Mile Creek were lower than previously recorded. These levels were below the threshold levels established by the 10/90 rule. Monitoring of Forty Mile Creek during 2003/2004 showed that weekly withdrawals may have approached the threshold levels of the 10-90 rule when stream flows were low and the air temperatures were low or decreased rapidly (Bartlett 2004).

Pressures related to snowmaking water supply are expected to increase over time. As outlined earlier in Section 6.3, climate change scenarios predict a shorter winter season, higher temperatures, and increased probability of early winter season rainfall. Overall lower annual precipitation as a result of regional level drought may also affect the eastern slopes of the Rockies perhaps including the mountain park ski areas. Potential climatic changes may result in the need for more snowmaking, while at the same time, occurring during conditions of lower runoff and stream flow. This in turn presents the possibility that that 10/90 minimum flow thresholds may be encountered more often.

The possibility of decreased precipitation associated with climate change also presents the potential that average flows over time may drop to levels that are below minimum in-stream flow requirements for protecting fish and fish habitat. In this scenario management by the 10/90 rule would no longer be effective as a guide to either fish habitat protection or snow making as average flows, which the 10/90 rule is based on, would have dropped below an absolute threshold required to sustain winter fish populations. Identification of the minimum in-stream flow capacity necessary to maintain fish and fish habitat would serve as a marker to compare to changing average



conditions and as an absolute minimum threshold in addition to the application of the 10/90 rule.

Snowmaking additives, such as Snomax, have the potential to significantly increase snow making equipment efficiency and could be employed to reduce the volume of water required to provide adequate snow cover. Use of snowmaking additives may also result in a snowpack with lower density (Walker and Wilkinson 1999) potentially offsetting to some degree the impacts of snow compaction. Snow making additives or other nucleating agents, such as Snowmax, have been suggested to have potential effects on human and animal health and on vegetation. Research efforts have failed to substantiate these concerns and have demonstrated environmental benefits of reduced water and energy consumption (Walker and Wilkinson 1999, Wallis et al. 1988, Rixen et al. 2003).

Off-season water withdrawal and storage strategies are employed by other ski areas such as Whistler, with low winter flow conditions (Smith pers com). Winter season withdrawal for snowmaking may be limited to certain thresholds, however flows could be stored continuously in the spring and summer off-season or during higher flow periods. This type of strategy could potentially lessen the impact on winter season flow needs (Khanna 2001). The Site Guidelines allow for the consideration of water reservoir systems to replace or supplement existing systems along the Pipestone River and in the Temple Lodge area.

Mitigating Measures

The mitigations for aquatic ecosystems identify ecological management parameters, specific planning requirements, or specific environmental information and assessment requirements that are needed to realize expected ecological outcomes as outlined in Section 4.4.

Ecological Management Parameters

Ecological management parameters serve as the on-the-ground benchmarks against which the environmental impacts of future development and use proposals will be assessed. In order to realize expected ecological outcomes important to aquatic ecosystems the following ecological management parameters have been incorporated into the Site Guidelines:

- development does not impair the effectiveness of natural surface and subsurface water flows and water course connectivity
- minimum in-stream flows and seasonal variability are maintained in support of aquatic fish and wildlife
- flooding and seasonal flow patterns maintain riparian vegetation communities
- riparian and aquatic habitat structure important to Westslope cutthroat trout, Bull trout or other rare and sensitive aquatic and riparian species is maintained or restored
- withdrawal of surface water maintains the natural flow paradigm for riparian, aquatic invertebrate and native fish ecosystems
- water quality on, adjacent to, and downstream of the leasehold, is maintained
- terrestrial and aquatic ecosystem processes function within the natural range of variation.



Long Range Planning and Operational Requirements

Long range planning requirements are identified for changes to water management systems, habitat conservation and restoration, and watercourse management to ensure that expected ecological outcomes are realized.

Water Use and Management

- Long range plan water management strategies, best management practices and environmental management systems are to collectively address the maintenance of minimum in-stream flow volumes, seasonal flow patterns, and fish habitat implications of water withdrawal from the Pipestone River and Corral Creek
- Ongoing application of the 10/90 rule for water withdrawal from the Pipestone River will be contingent on on-going monitoring that shows maintenance of minimum in-stream flows required for cutthroat and bull trout habitat
- Proposed increases in on-demand water withdrawal capacity or total water volume will be based on using alternative water sources to surface flows in the Pipestone or Corral Creek watersheds
- The design of water reservoir systems will account for maintaining seasonal variations in stream flow that support the needs of fish and riparian communities
- The use of snowmaking additives, if considered, will be evaluated as part of the water management strategies and environmental management system
- Long range plans and associated water strategies will address the potential impacts of climate change on water availability and hydrologic regimes specific to Lake Louise Ski Area including the consideration of minimum in-stream flow requirements necessary for the protection of fish habitat.

Habitat Conservation and Restoration

- Clearing of open ski runs into the Corral Creek valley will be limited to existing natural avalanche paths to minimize reduction of forest cover, limit potential erosion and sedimentation issues, and maintain natural appearances for off-site visitors
- Glades may be developed in the Corral creek valley where the design mimics local patterns in native forest cover in order to maintain forest cover consistent with natural variation, maintain a natural appearance and limit soil erosion and sedimentation issues
- Avalanche control operations on cleared avalanche path runs will be managed to limit the potential for regular avalanche run out into Corral Creek.
- Where feasible, and where it provides the best overall environmental protection, a 100m buffer will be maintained between the edge of the Hidden Bowl winter road and the high water mark of Corral Creek
- The 100m buffer may be less where maintaining a suitable 5-10% grade is not feasible or where the location of the road would result in significant removal of forest cover or terrain modification
- In the event that a 100m buffer cannot be maintained the winter road will be located and or designed to prevent sedimentation and to protect native riparian cover so that shade, cover and temperature conditions are not affected
- A 30m buffer will be maintained between the edge of the road and any wetlands, fens or ponds.



Watercourse Management

- Existing crossings should be used and improved wherever possible in the planning and design of new ski terrain in order to minimize the total number of crossings
- Any new crossings will:
 - Consist of a single span bridge or similar structure that does not result in a disturbance or alteration to the active creek channel, banks or riparian area
 - be designed and managed in conjunction with improvements to existing crossings
- The design of replacement crossing structures will include site improvements to restore or enhance fish habitat characteristics.

Visitor education is an important component of gaining visitor cooperation and contribution towards achieving ecological management parameters pertaining to water flows. The following educational goals should be addressed in a visitor education program to be brought forward as part of the long range planning process:

- Visitors are informed of the potential impacts associated with water use and are encouraged to support water conservation measures.

Environmental Information and Impact Analysis Requirements

Uncertainty exists with respect to localized climate change as existing climate model predictions may not be reflected at the scale of the ski area. If early winter season flows were to generally increase, withdrawal affects would be lessened. If early season flows were to generally decrease the effects of any water withdrawals on stream environments would be compounded.

A scientifically rigorous alternative to the 10/90 rule has not been identified through past work. Alternatives to the 10/90 rule, if proposed, should be based on an assessment of in-stream flow needs based on the concept of the natural flow paradigm to align with both the ecological integrity mandate and Provincial efforts to manage for native trout species. Such work will provide a scientifically credible minimum flow criteria to guard against a declining average flow scenario. The Site Guidelines address the potential for alternative approaches to water withdrawal indicating that:

- where the long range plan proposes to increase water withdrawal limits or adjust conditions the review of the water limits will:
- allow for seasonal variations in downstream water flow that corresponds to the needs of aquatic life and riparian communities.
- consider in-stream flow, seasonal flow and natural drainage (specific hydrological studies will need to be undertaken to adequately determine requirements).

Specific environmental information and assessment requirements are identified to ensure that expected ecological outcomes are realized. These should be included as part of future planning proposals or environmental assessments as indicated:

- an adaptive management approach based on on-going monitoring of climate trends including precipitation, temperatures, snowpack and runoff, and surface and groundwater flows at a scale relevant to ski area water management will be required as part of a water management strategy.



Residual and Cumulative Effects

The expected ecological outcomes that apply to mitigating potential impacts to aquatic ecosystems include:

- Land use decisions contribute to local region ecological integrity goals including fire and vegetation management, wildlife movement, grizzly bear habitat security and species at risk protection and recovery.
- Terrestrial and aquatic habitat conditions for sensitive species including Whitebark pine, grizzly bear, wolverine, mountain goat, west slope cutthroat trout, bull trout and mountain caribou are conserved or restored.
- Vegetation is managed to reflect natural composition, diversity and patterns and maintain function of sensitive soil-vegetation complexes, including rare plants, wet soils, and alpine plant communities.
- Demonstrated leadership applied to environmental management, stewardship, monitoring and best practices.

The mitigations for aquatic ecosystems are intended to maintain natural variability in stream flow, maintain minimum in-stream flows and water quality, and maintain habitat conditions that support aquatic and riparian flora and fauna.

Habitat conservation and restoration for Westslope cutthroat trout and Bull trout are expected to be key Long-Range Plan issues for proposed developments in the Corral Creek Valley and its tributaries. While Westslope cutthroat trout are currently doing very well in Corral creek existing development could be improved to more effectively protect and secure aquatic and riparian habitat conditions. New development associated with Richardson's Ridge and Corral Slides has the potential to degrade habitat conditions in Corral creek in areas that may not be able to be fully buffered from the impacts of development and use.

The Site Guidelines include a number of key guidelines and conditions pertinent to the planning, protection and restoration of the Corral Creek environment. New development on Richardson's Ridge and Corral slides will be sited to maintain a significant 100m buffer of undisturbed native vegetation between development and the creek channel wherever possible. In areas where it is not possible to maintain such a buffer, development will be designed to maintain key fish habitat parameters such as shade, cover and temperature. New development will be linked to making improvements to existing and new crossings of Corral creek and to increasing the effectiveness of existing riparian buffers where ski runs are adjacent to Corral Creek. Further away from the Creek, run development and vegetation management parameters are focused on glading and clearing of existing avalanche paths; approaches to ski terrain management that mimic natural conditions of local environment and may be expected to effectively mitigate many impacts associated with run clearing such as erosion and sedimentation.

As it has in the past water withdrawal for snowmaking will continue to be a key issue for ski area water management. Water withdrawal in low flow seasons has potential to impact both Westslope cutthroat and Bull trout in the Pipestone River. While management of water withdrawal using the 10/90 Rule has been effective to date, future stream flows, seasonal temperature variations, and snowmaking needs may combine to create a scenario where the 10/90 management system is no longer effective for fish habitat or for ski area needs. The Site Guidelines include the potential consideration of alternate water sources and systems that would provide ski area operations with



necessary water while maintaining minimal flows necessary to sustain fish and other aquatic habitat conditions.

The design of alternative water systems, including the potential use of reservoirs to stockpile water in the off season, should focus on designs that maintain the in-stream flow regime in the Pipestone River. Potential alternatives such as the use of snowmaking additives may be considered to maximize the efficiency of water use. An objective snowmaking needs analysis and in-stream flow analysis based on the concept of maintaining the natural flow paradigm will provide the necessary background to determining minimal flows and identifying additional water source alternatives.

Seasonal variations and long term climatic trends may reduce the total amount of water in the Pipestone River system making it operationally difficult to conduct snowmaking operations during low flow periods. The Site Guidelines include the requirement for science-based monitoring and planning in response to changing climate scenarios. On-going stream flow, water withdrawal and habitat monitoring is required to document trends, and to identify and justify the need for alternative approaches if proposed.

Some water will always continue to be withdrawn, used and returned to the hydrological system. The timing of water release back into the hydrologic system and alterations to drainage patterns will be residual effects of ski area operations. The compaction of snow by grooming and skiing activity may result in the delay, and increase the intensity of, spring runoff. However, climate change predictions are for shorter ski seasons and earlier spring runoff. These various factors may potentially offset each other. Snow making additives if used by the ski area may partially mitigate the intensity of runoff by increasing the porosity of the snowpack. The interplay of these factors will be more fully explored as part of specific Long-Range Plan proposals.

The mitigations for water quality are intended to maintain water and wastewater quality within accepted established guidelines, to maintain or restore natural nutrient levels downstream of the ski area and to minimize the potential operational/accidental impacts of hazardous and polluting substances. Compliance with established guidelines sets a reasonable and attainable standard that addresses potential ecological and health issues. Managing and monitoring water and wastewater quality through the environmental management system and water permitting process assures on-going water quality standards and compliance with National Park Regulations. The preferential use of eco-friendly product alternatives minimizes the potential for cumulative or accidental releases of toxic materials to water courses.

Considering the full suite of guidelines and mitigations it is anticipated that the expected ecological outcomes related to Aquatic Ecosystems will be achieved under the Site Guidelines:

- Habitat conditions and parameters for key sensitive species including Westslope Cutthroat and Bull trout will be maintained and enhanced with respect to ski area development through run and vegetation management that mimics natural conditions, maintains significant buffers, restores degraded sites, and enhances the effectiveness of existing infrastructure in support of fish habitat as it is renewed or modified over time
- Corral Creek and the Pipestone River will continue to function as key inputs to the integrity of the Bow River watershed supporting secure aquatic habitat conditions, natural seasonal flow regimes and sustainable fish populations.



- A focus on long term monitoring and science-based approaches to changing water and climate scenarios is anticipated to provide a solid basis for the management of aquatic environments and for the design and development of alternative water management scenarios if required.
- Daily flow monitoring and response in accordance with the 10/90 rule, or in accordance with alternative management systems, is expected to maintain minimum flow conditions and demonstrates leadership in aquatic system management and protection of species at risk.



9 Impact Assessment – Visitor Experience

The assessment of Valued Components of visitor experience focuses on potential changes to both the built and natural environments, and on changing patterns of visitor use. Key elements of the Site guidelines are considered with respect to:

- Safe, comfortable and enjoyable visitor experience
- Visitor education
- Viewscapes and visitor perceptions
- Wilderness Character.

9.1 *Visitor Safety, Comfort and Enjoyment*

As an overall package intended to enhance the skiing and snowboarding experience, the potential development options that can be considered under the Site Guidelines are intended to provide:

- high quality beginner and intermediate terrain options
- managed sidecountry experiences to respond to identified target markets
- balanced day lodge facilities and other services that meet industry standards
- reduced parking congestion, access road hazard, and foot distance from lifts.

There are no published standards for ski terrain design but ski area planners utilize common rules of thumb for run mix and terrain design that are intended to account for visitor comfort, aesthetics, skill levels, safety and general environmental concerns (Devlin, pers com). Designers for modern ski areas typically plan so that a 35/65 ratio is maintained between cleared areas for ski runs and natural forest cover. As part of this approach, ski area designers typically design ski runs to fall within a 30-50m width range depending on the desired level of skiing experience. Cleared runs are then typically spaced so that the distance between runs meets or exceeds the typical 30-50 m width of adjoining ski runs. This approach facilitates the needs of a variety of skier skill levels, maintains a comfortable aesthetic experience, maximizes snow retention, and reduces the potential for wind throw. Key areas that may be brought forward for new run development including Juniper, Meadowlark and Richardson's Ridge, are located in terrain that is highly suitable as beginner and intermediate terrain. New development in these areas may be expected to enhance the balance and variety of beginner and intermediate ski terrain, while reducing overall congestion and enhancing safety in existing terrain.

“Out-of-bounds” skiing has always been part of ski area management. However recent advances in ski equipment have made un-groomed, natural terrain more attractive and accessible to a greater range of skiers. At the time of writing, the sidecountry and backcountry skier and snowboarder is the fastest growing segment of the equipment industry. Two of the biggest challenges for ski area and surrounding land managers with respect to sidecountry visitor safety are avalanche hazard and lost skiers. With respect to the managed sidecountry concept for West Bowl the Site Guidelines emphasize a focus on skier and boarder avalanche education and equipping properly for sidecountry terrain. The development of an egress trail is anticipated to capture most skiers and direct them back to the ski area. Ski area avalanche control operations will make the West Bowl area safer for skiers, especially in the large alpine expanse of West Bowl proper. The elements of the Site Guidelines facilitate a safer and more enjoyable sidecountry experience while reducing avalanche risk and the potential for lost skiers.



Industry design standards are also incorporated into calculations for ski lift, food services and other commercial services capacity. The key purpose of industry standards is to provide enough space, prevent crowding, and prevent extended wait times for ski area customers based on the 5th or 10th busiest day of the season. The growth limits for commercial space and lift capacity established in the Site Guidelines are expected to accommodate ski area growth as well as enhance commercial space capacity from the low end of accepted industry standards to the higher end. A move to the higher end of the commercial space range is appropriate in consideration that the ski area does not have on-site overnight accommodation where guests could use their accommodation for storage, lunch, post ski activity and so on. The increase in commercial space can be expected to provide a more comfortable and enjoyable experience for skiers during peak holiday and weekend periods.

Reconfiguration and expansion of parking, in combination with satellite ticket centers and lift base locations, can be expected to eliminate the need for confusing and unnecessary parking along the Whitehorn access road. The intensification of parking within existing lots, and bringing the furthest reaches of Lot 4 into comfortable walking reach in accordance with industry standards are key factors that facilitate the elimination of road parking. These types of adjustments are a required component of the first Long Range Plan and may be expected to result in immediate improvements to visitor pedestrian safety, reductions in traffic congestion, and a more enjoyable experience.

The Site Guideline proposals for ski terrain, commercial space growth limits and other resort balancing parameters for the Lake Louise Ski Area are based on reasonable industry standards that are intended to ensure a comfortable, safe and enjoyable ski experience. It should also be noted that the design parameters for ski run width, distance between runs and developed/undeveloped terrain are less than, or similar to, the parameters required to maintain wildlife habitat structure and wildlife movement as discussed previously. Concentration of parking within the existing base area combined with elimination of parking along the Whitehorn Road is anticipated to improve corridor effectiveness. Opportunities to enhance the skier experience do not have to take place at the cost of wildlife habitat and corridor security.

9.2 Visitor Education

In general, the Site Guidelines include direction on visitor educational and national park experience that supplement the ski experience and reinforce national park messages and management objectives consistent with existing park management direction. The Site Guidelines create expectations in the long range plan, and in the development of best management practices, for managing viewscapes, noise and external lighting, signage, advertisement and special events, developing a heritage tourism and winter education strategy, and encouraging a consistent architectural theme. These expectations are consistent with those required of communities and outlying commercial accommodations and will be fully evaluated as part of the long range planning process.

Three aspects of the Site Guidelines offer potential opportunities for new and enhanced visitor education:

- West bowl sidecountry
- Relocation of the summer use program
- Development of Eagle shoulder lodge.



The formalization of managed sidecountry skiing in West Bowl is intended to enhance visitor education, particularly with respect to mountain safety awareness. Fencing and signage provide opportunity for both notification and messaging to skiers about avalanche awareness, equipping for backcountry conditions, and other hazards and considerations. The inclusion of this area in ski area operations provides additional opportunities for educational programs focused on avalanche awareness and safe travel.

Relocation of the summer use program to the upper mountain provides similar opportunities to the existing program. Location on the upper mountain in the transition between subalpine and alpine ecosystems and on the edge of different forest types provides additional scope and variation for new high elevation hiking opportunities, interpretation and educational programming. Location of the summer use program to this area also provides connection to the habitat of several species at risk that persist on, or adjacent to the ski area including Whitebark pine in the immediate area, and Westslope cutthroat trout in the Corral Creek valley.

As the hub of the summer use program, the development of Eagle Shoulder lodge provides perspectives and first-hand experience of a wide range of mountain park ecosystems that are not as accessible from mid mountain. A potentially wide range of lodge based educational and interpretation program opportunities can be directly experienced in close proximity, or in reference to the visual landscape, providing personal connection to the park environment.

Aside from the enhanced opportunities discussed above, visitor education in all seasons is an important component of gaining visitor cooperation and contribution towards achieving ski area ecological management parameters. The following educational objectives should be addressed in the visitor education program brought forward as part of the long range planning process:

- visitors are encouraged to follow practices that minimize grizzly bear disturbance and habitation, and that protect Whitebark pine
- visitors are made aware of the sensitivities of Cutthroat trout and or other sensitive species as they arise
- visitors support ski area environmental management initiatives such as water and energy conservation
- visitors connect with and support larger park management initiatives such as wildlife habitat and wildlife corridor protection and enhancement.

9.3 Viewscapes and Visitor Perceptions

Three primary strategic considerations are identified with respect to viewscapes and visitor perceptions:

- Natural forest cover and fragmentation
- New lift structures in Hidden Bowl area
- Interruption of mountain ridgelines associated with lifts, huts and lodges.

Potential ski run development on the front side of the ski area will involve clearing of new ski runs and lift lines. These development features are visible from the ski area but the primary concern are viewscapes from across the valley experienced by other park visitors. Ski run development in the Richardson's ridge and Hidden Bowl area are potentially visible from locations all along Skoki trail and beyond Boulder Pass.



Run development and vegetation management are dealt with in the Site Guidelines through ecological management parameters, general guidelines and specific guidelines and conditions that apply to the Whitehorn Front Side, Temple Area (including Richardson's Ridge) and Hidden Bowl. Overall the Site Guidelines address potential visual and aesthetic impacts with a focus on maintaining consistency with natural landscape patterns. Although new ski runs will be visible from across the valley on the Whitehorn front side these are not anticipated to substantively alter the view or experience from the current situation.

Guidelines and conditions for new runs and glades in the Richardson's Ridge, and Corral Slides areas, descending into Corral Creek valley, limit cleared ski runs to historic avalanche paths. Glading plans brought forward as part of a Long Range Plan in these same areas are to mimic natural patterns that may be found in the natural landscape. It is anticipated that these guidelines and conditions will result in a vegetation pattern that falls within natural parameters and that also falls within ecological parameters for wildlife habitat and movement.

One of the lift alternatives for Hidden Bowl considers a lower lift base located roughly in the area across the valley from Hidden Lake campground. Depending on location a lift base, lift towers and cleared lift line could be readily visible from the campground, Skoki and Hidden Lake Trails and from Boulder pass. To some degree a lift and cleared lift line in this area could be camouflaged by clearing and adjacent glading patterns that minimize the appearance of straight edges. Lift base location may be adjusted to take advantage of natural forest screening between the campground or key vantage points along trails. Although the visual impact of a proposed lift may be lessened to some degree, a location that is immediately visible from Hidden Lake campground is almost certain to adversely impact the wilderness experience of campground visitors.

The Site Guidelines allow for the consideration of new or replacement lifts and warming huts as well as the development of the Eagle shoulder lodge. These structures have the potential to result in the visual and aesthetic interruption of natural mountain ridgelines from long distances. Ridgeline lift terminals or a warming hut located on Richardson's Ridge may be highly visible from Boulder Pass, Ptarmigan Lake or other areas deeper into the Skoki wilderness area. Ridgetop lift terminal, warming huts, or Eagle shoulder lodge may be highly visible from across or considerable distances up and down the Bow Valley. The Site Guidelines address visual considerations with Guidelines for these specific facilities in the Whitehorn Front side and Hidden Bowl area concepts. The guidelines for these facilities are intended to ensure that:

- buildings are located as to be visually unobtrusive from key perspectives outside of the ski area
- buildings and lift structures are designed and located to be low profile – located below or blended into ridgelines
- building design and construction utilizes natural, non-reflective materials that blend into the overall landscape.

9.4 Wilderness Character

The Canada National Parks Act permits the Governor in Council, by regulation, to identify any area of a park that exists in a natural state to be declared a wilderness area (CNPA 2000, 14 (1)). Once declared, the Minister may not authorize any activity to be carried on in a wilderness area that is likely to impair the wilderness character of the area (CNPA 2000, 14 (2)).



Large areas of Banff National Park have been declared as wilderness under the CNPA and the Lake Louise Ski Area is surrounded by wilderness on all sides except for the portion connecting the ski area to the Trans-Canada Highway. The Site Guidelines allow for the consideration of reconfiguring declared wilderness both in and around the existing ski area lease to provide new ski opportunities in West Bowl and Hidden Bowl that could not otherwise be considered in these areas. The net result of implementing reconfiguration of the leasehold and the surrounding wilderness areas would be an increase in the total area of designated wilderness in Banff National Park. As part of the gains and exceptions considerations the reconfiguration of leasehold and designated wilderness is not addressed further here.

Development and use in West Bowl and Hidden Bowl may reasonably be expected to affect the wilderness character of adjacent declared wilderness. Ecological impacts to wilderness character are not addressed here. Two aspects of wilderness character related to visitor experience are considered including:

- evidence of modern human society
- a sense of remoteness or wildness.

West Bowl and the northwest ridge are generally not used except by sidecountry ski area visitors accessing the area from Whitehorn Summit. The areas surrounding West Bowl do not feature trails or facilities that provide expedited access for visitors such as ski tourers. The development of an egress track is expected to capture most skiers and return them to the main ski area. As such the formalization of managed sidecountry skiing in West Bowl may be considered to be unlikely to impact the experience of users in adjacent wilderness. The only development that may be considered in association with West Bowl is the return egress track. The track is likely to be visible in part, only from limited locations in the Bow Valley. Viewed in conjunction with other ski area development on Whitehorn Front side, the development of the egress track is unlikely to substantially add to the evidence of modern human society or alter the sense of remoteness in other wilderness locations.

Development and use on Richardson's Ridge and Corral Creek slides involve the development of cleared runs, glades and lift infrastructure as well as the development of a skier egress trail extending some 5 km beyond the current ski area boundary. As discussed previously visual impacts of development in this area may be limited through purposeful location, design and management of vegetation. Other aspects of ski area operations and visitor use in this area cannot be effectively mitigated. Visual, auditory and other sensory disturbances will be associated with more intensive use by skiers and snowboarders, avalanche control operations, snowmobiles and grooming machines. These impacts will extend up the Corral Creek valley into the Hidden Lake area and towards and into Boulder Pass.

As the activities will not take place within declared wilderness following leasehold reconfiguration they may be considered to be consistent with the requirements of the Canada National Parks Act. On the ground, the activities considered as part of the Hidden Bowl concept will introduce evidence of modern society and likely detract from a sense of remoteness or wildness in adjacent areas – particularly for users of the Skoki trail in winter. For summer season visitors, the evidence of modern society in the form of ski lift infrastructure is likely to be the main impairment to wilderness character. As with



visual impacts, location of the lift base in relation to the Hidden Lake Campground is a key factor to consider.

9.5 Visitor Use Impact Summary

The assessment of Valued Components of visitor experience focused on potential changes to both the built and natural environments, and on changing patterns of visitor use. Desired visitor experience outcomes and priorities of the Site Guidelines in support of the Ski Area Management Guidelines include:

- Develop and maintain authentic mountain national park experiences for all visitors in all seasons at the ski area
- Ensure a balance of ski area components in order to minimize congestion and crowding and maximize memorable visitor experience and connection
- Strengthen the connection of ski area winter and summer visitors to Banff National Park and the World Heritage Site through enhanced heritage interpretation, learning and experiential opportunities
- Maintain, and where feasible, restore visual and natural viewsapes and minimize other sensory disturbance such as noise and traffic for on and off-hill visitors.

Key elements of the Site guidelines were considered with respect to:

- Safe, comfortable and enjoyable visitor experience
- Visitor education
- Viewsapes and visitor perceptions
- Wilderness Character.

The elements of the Site Guidelines provide a range of expanded ski/snowboard opportunities that respond to imbalances in current ski terrain and the needs of growing sidecountry and backcountry markets. These terrain adjustments are anticipated to enhance and balance the snow riding experience for beginner and intermediate markets, reduce congestion and enhance safety. The inclusion of West Bowl provides managed opportunities for sidecountry riders, while Hidden Bowl provides a “back bowl” type of experience for less advanced skiers on the edge of mountain park wilderness. The enhanced winter opportunities envisioned by the Site Guidelines are focused on authentic mountain skiing and snowboarding experiences consistent with the tradition and nature of the mountain park environment.

The adjustments to the summer use program offer enhanced opportunities for heritage interpretation and learning located in a more diverse and spectacular environment. The focus on high elevation hiking and educational programming responds to the desired visitor experience outcomes of enhancing educational opportunities and of maximizing memorable experience and connection to Banff National Park and the World Heritage Site. Visitor activities on the upper mountain such as hiking, sightseeing and heritage interpretation are consistent with the tradition and nature of the mountain national park environment.

The Site Guidelines contain considerable measures aimed at minimizing the visual and sensory impacts of potential ski area development and use. It is expected that ski run, lift and facility development that occurs within the current developed area and lease, and that adheres to the measures in the Site Guidelines will not result in substantial changes to the ways that visitor experience and perceive the visual and sensory characteristics of the developed ski area.



While visual and sensory characteristics associated with changes to the current developed ski area are considered unlikely to impact visitor experience, some level of impact to wilderness character is an inevitable result of development and skier use in Hidden Bowl and Corral Creek valleys. The impacts of modern infrastructure and ski area winter use can be expected to affect the sense of remoteness and wildness that Skoki backcountry and Hidden Lake visitor's experience, from at least the current ski area boundary through to Boulder Pass. A key aspect of this potential development is the location of a bottom lift terminal for Hidden Bowl. A location in Hidden Bowl flats will be considerably less intrusive than a lift location along Corral Creek. A Corral Creek location located away from the Hidden Bowl campground will be less intrusive from the campground and from upper reaches of the Skoki Trail and Boulder Pass.



10 Impact Assessment – Infrastructure Capacity

VCs for the evaluation of potential impacts to regional infrastructure capacity directly reflect the expected outcomes of the Management Guidelines outlined earlier in Section 4.7. The expected outcome related to infrastructure capacity is that sufficient capacity and environmental standards are met before growth can take place.

10.1 Road and transportation system capacity

The following discussion does not include the potential impacts of roads and associated traffic on wildlife or habitat connectivity. Wildlife issues have been fully addressed in previous sections of the SEA and are not considered further here. As impacts to wildlife are addressed elsewhere (Section 8.4), the strategic environmental assessment focused on the capacity of roads to handle current and potential increases in visitor use.

The Trans-Canada Highway and Whitehorn Road were each considered with respect to potential impacts to driver safety and comfort. The potential for increased ski area traffic to trigger the need for upgraded or enhanced roadways was also considered.

Past and recent enhancements to the Trans-Canada Highway have considered the impacts of summer and winter traffic and taken into account potential increases in use from all sources. As the potential issues with the twinning of the highway have been previously considered, there is little potential for adverse impacts to driver safety and comfort, or little potential to trigger road upgrades or enhancements on the Trans-Canada Highway in order to handle increased ski area traffic.

Access to the ski area from the Trans-Canada Highway, the Bow Valley Parkway or from the village of Lake Louise is via the Whitehorn Road. The Whitehorn Road is a 2 lane scenic roadway considered to be a Class 2 road in accordance with the *Highway Capacity Manual* where the level of service is such that motorists do not expect to travel at high speeds. The Site Guidelines stipulate that the Whitehorn Road will provide sole visitor motor vehicle access to the ski area in winter and summer seasons. This roadway has provided an appropriate level of service for skiers and other visitors to the LL Ski Area for many years and the capacity of this road is anticipated to meet foreseeable growth in visitation.

The Site Guidelines include the consideration of mass transit as a key strategy for addressing increases in visitor use. Parking reconfiguration and limits to parking along the White Road are also part of the Site Guidelines intended to improve visitor experience and to reduce potential congestion along the Whitehorn Road. Parks and mass transit are addressed further in the section on Parking Lots.

Use of Temple Road by vehicles will continue to be limited to ski area operations and Parks Canada for operational access. The Temple Road and ski out will continue to facilitate backcountry visitor access by skiing and hiking through the ski area to the Skoki trail beyond Temple Lodge. The Site Guidelines provide the opportunity to remove and restore the Fish Creek Road and parking area in order to achieve gains to the Whitehorn wildlife corridor as discussed previously in Section 8.1. Changes to the use of Temple or Fish Creek roads will be addressed as part of the Long Range Plan process and are not considered further here.



10.2 *Water supply and demand and downstream water quality*

The Site Guidelines require that infrastructure capacity be in place prior to any on-hill visitor use capacity expansion. Potential issues related to wastewater and for firefighting and domestic water capacity will be addressed fully in long range plans that involve specific proposals for visitor use expansion.

The LLSA wastewater system is linked to the Lake Louise Waste Water Treatment Plant. The treatment system was upgraded in 2004 and is designed to exceed leadership targets. *Flow rate* is one measure of the treatment plant's capacity which is designed to process an average of 5,400 cubic meters per day of waste water; winter loads average 2,200 cubic meters per day (S. England pers comm, March 2015) from all sources in Lake Louise. Due to the current excess capacity, potential ski area development is not anticipated to exceed the capacity of the treatment plant nor is downstream water quality expected to be significantly impacted. The Site Guidelines require that sufficient infrastructure capacity be in place prior to any ski area capacity expansion. Long Range Plans will include analysis of wastewater capacities and treatment effectiveness in comparison to anticipated increases in ski area water use and wastewater treatment requirements as part of the required water management strategies.

Water withdrawal from the Pipestone River is required for firefighting, domestic water use, and snow making. Domestic water for the Lodge of the Ten Peaks and Whitehorn Lodge is diverted from the snowmaking mainline. LLSA water consumption reports from 2008 to 2014 indicate that domestic water use accounts for, on average, 2.2% (16,000 cubic meters) of the annual permitted withdrawal of 719,222 cubic meters. The ski area currently uses an average of 56% of their licensed allotment from the Pipestone River, leaving considerable excess total capacity for increased snowmaking needs that may result from climate change or ski area expansion. There is also excess capacity to meet any increased domestic water needs associated with potential ski area development or expansion.

Water withdrawal from Corral Creek is permitted for firefighting and domestic water use at Temple Lodge year round. A direct intake from the creek supplies a pressurized filtration and chlorination system in Temple Lodge which meets Canada Drinking Water Standards.

Habitat security along the creek during low flow seasons may be enhanced utilizing alternative water supplies from recycling, surface drainage, or groundwater sources in conjunction with water storage reservoirs. Further habitat security may be realized by reallocating the firefighting capacity from Corral Creek to the Pipestone River sourced snowmaking system.

It is expected that the outcomes related to the water supply and quality of water can be realized through the application of the site guidelines and previously identified mitigations. With effective planning, operation and monitoring, no downstream water supply or water quality issues are anticipated to arise with additional development at LLSA.

10.3 *Electrical supply and demand*

The *Ski Area Management Guidelines* indicate that electrical capacity increase can be considered but qualifies this by requiring that "infrastructure must have sufficient



capacity and meet environmental standards before ski area growth can take place”. The principle electrical power supply serving LLSA is the provincial power grid.

A requirement for significant additional winter season electrical power at the ski area is anticipated with the addition of lifts and the expansion of visitor facilities.

Correspondence with Altalink indicates that the capacity of the regional power grid that supplies the LLSA is 40MW and that current peak load from all sources in winter is 14MW (email from B. Jones Altalink Senior Environmental Coordinator to A. Kolesch Manager, Land Use, Policy & Planning, January 21, 2015). The remaining 26MW is expected to be well in excess of projected needs for the ski area, the Village of Lake Louise and surrounding operations such as outlying commercial accommodations and the Chateau Lake Louise. Increased energy efficiency and conservation measures may also be reasonably expected to offset potential increased demand.

The Site Guidelines also require an Environmental Management and Monitoring System, to be submitted as part of Long Range Plans, which includes considerations for energy conservation and fossil fuel emissions.

Outcomes related to electrical supply and demand can be realized through the application of the Site Guidelines and development of environmental management plans identified above. If additional power is required on-hill, alternative energy technologies such as clean power, green design or retro fitting of existing facilities, micro hydro or other minimal impact technologies may be considered as alternatives to local and regional utilities expansion.

10.4 Visitor and staff accommodation capacity.

Ski area employee housing is primarily provided in the community of Lake Louise and at the Great Divide Lodge. Staff also commute from Field, Banff and Canmore. One strategy currently employed by the commercial lessees in Lake Louise is to rent excess staff residence space to other employers during their slow season. On a smaller scale, commercial accommodation is rented by LLSA to supplement staff accommodation needs.

The Banff, Lake Louise and Field Community Plans and the OCA guidelines address local infrastructure capacity growth limits in relation to residential, seasonal and visitor accommodation. The need for additional staff as a result of ski area development will require careful consideration in relation to the current staff housing capacity of the community of Lake Louise. The Site Guidelines indicate that the Lake Louise Ski Area will prepare a Staff Housing Strategy that is consistent with the Site Guidelines and Lake Louise and Field Community Plans as part of its first Long-Range Plan.

Visitor accommodation is currently provided in the communities of Lake Louise, Banff, Field, at Outlying Commercial Accommodations (OCAs) and the town Canmore outside the Banff NP east gate. Significant visitation to the LLSA is in the form of day-skiers originating from Calgary and other Alberta communities.

The need for additional visitor accommodation along the Canmore, Banff and Lake Louise corridor as a result of development and use at the LLSA is not anticipated, although visitor accommodations in the community of Lake Louise may reach occupancy capacity. Long range plans will need to demonstrate that growth at the ski area respects the existing growth limits established for the communities and OCAs.



Summer use as outlined in the Site Guidelines is not likely to result in the need for additional visitor accommodation.

Expected outcomes related to visitor and staff accommodation capacity can be realized through the application of the Site Guidelines as discussed above. Increased accommodation demand, related to ski area growth will remain within the established infrastructure and environmental capacity defined in the Banff, Lake Louise and Field Community Plans and OCA Guidelines.

10.5 Environmental management system

An EMS provides an overall system for the management of an organization's environmental issues. It includes organizational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, and reviewing an organization's environmental management goals. An EMS also provides an auditable system for documenting, tracking, managing and improving environmental performance.

The development of Best Management Practices will provide the basic framework for an EMS for the ski area. Action plans and a monitoring program will be developed for key issues as part of a long range plan.

Incorporation of the above EMS components and issues is expected to ensure that the ski area EMS effectively addresses potential on-going operational impacts of ski area development and operation.

10.6 Infrastructure Capacity Impact Summary

Expected infrastructure capacity outcomes as outlined in section 4.7 can be realized through application of the site guidelines and mitigations in this SEA. The strategies and mitigations outlined in the site guidelines and the SEA are intended to ensure that ski area resource use falls within existing infrastructure capacity. Where additional capacity is required the mitigations are intended to ensure that ski areas resource use falls within existing environmental capacity.

The incorporation of sustainable design principles and products into ski area development plans is intended to ensure resource use efficiency and conservation. The implementation of an environmental management system is intended to ensure that ski area operational impacts are within accepted or agreed upon environmental parameters and standards.

11 Follow-up

A suite of assessment and information requirements are identified throughout the SEA in relation to the development and assessment of Long-Range Plans. The most important of these are:

- information on wildlife movement routes, seasonal and temporal wildlife movement patterns and characteristics of corridor effectiveness (see section 8.1.3)
- grizzly bear habitat use and disturbance thresholds (see section 8.2.3)
- assessment of winter mountain goat habitat use in the Richardson's Ridge/Hidden Bowl areas (see section 8.3.3)
- identification of wolverine den sites (see section 8.5.3)



- development of an on-going Whitebark pine monitoring program (see section 8.6.6)
- Adaptive management of water use and water resources in response to changing environmental conditions (see section 8.7.3).

Information from follow-up actions will be factored into subsequent stages of planning and used to identify and evaluate potential development options to be included in Long range plans. The environmental assessment process will use the information gathered to build on the SEA, confirming or altering the conclusions as appropriate. The development of best management practices and the implementation of an environmental management system will also be important elements of future Long-range planning and environmental assessment processes.



12 Summary and Conclusions

Potential impacts to valued components of ecological integrity, visitor experience and infrastructure capacity were identified and assessed in relation to desired outcomes. Desired outcomes were identified based on established legislation and policy direction for Parks Canada including the Banff National Park Management Plan and the Ski Area Management Guidelines. Ski area development that achieves the desired outcomes is considered to be consistent with policy and legislated direction.

12.1 Ecological Integrity

With respect to the potential impacts of the Site Guidelines ecological integrity will be maintained when the following desired outcomes are realized:

- Land use decisions contribute to local region ecological integrity goals including fire and vegetation management, wildlife movement, grizzly bear habitat security and species at risk protection and recovery.
- Terrestrial and aquatic habitat conditions for sensitive species including Whitebark pine, grizzly bear, wolverine, mountain goat, west slope cutthroat trout, bull trout and mountain caribou are conserved or restored.
- Habitat security is ensured by maintaining or reducing the potential for grizzly bear/human conflict, displacement and habituation
- The effectiveness of the Whitehorn Wildlife Corridor is maintained or improved.
- Vegetation is managed to reflect natural composition, diversity and patterns and maintain function of sensitive soil-vegetation complexes, including rare plants, wet soils, and alpine plant communities.
- Demonstrated leadership applied to environmental management, stewardship, monitoring and best practices.

A summary of the residual and cumulative effects associated with each of these outcomes follows.

Land Use

The removal of Purple and Wolverine Bowls, and areas of the lower east side of the existing lease within the Whitehorn wildlife corridor are considered to be substantial environmental gains consistent with the Ski Area Management Guidelines by Parks Canada. Removing these lands from the lease and adding them to designated wilderness provides the best long term protection and certainty for lands that have long been considered to be ecologically valuable by Parks Canada. Purple and Wolverine bowls feature, or adjoin, terrain and habitat considered to be valuable for Grizzly bear security, Slate Range mountain goat populations, and wolverine, and function to capture and release snowmelt and precipitation that help to sustain seasonal flows that support fish habitat in Corral Creek. Elimination of potential development also minimizes the potential for future increases in sidecountry or backcountry rider access to important wildlife habitat in the Baker Creek drainage, on south and east slopes of Redoubt Mountain and the south slopes of Purple Peak and Mount Lipalian.

Removing portions of the lower east side of the existing lease provide long term security for these portions of the Whitehorn Wildlife Corridor and provide opportunity for improvements to wildlife passage across the Whitehorn Road as discussed further below.

The existing ski area lease will be significantly decreased in size by approximately 50%. However this decrease is accompanied by an increase in developed ski terrain both



inside and outside the revised leasehold boundaries. Limited ski terrain and infrastructure development under a winter-use-only license of occupation for West Bowl and Hidden Bowl make up most of the increase in developed ski terrain footprint. The net result of the reconfiguration of the lease and licenses of occupation is a net gain to the wilderness areas of Banff National Park of approximately 669 hectares.

Sensitive Species habitat conditions

A number of sensitive species including Whitebark pine, grizzly bear, wolverine, mountain goat, west slope cutthroat trout, bull trout and mountain caribou have been considered in the development of the Site Guidelines and evaluated through the strategic environmental assessment. The combined parameters and conditions of the Site Guidelines, and the mitigations of the strategic assessment provide direction to the Long-Range Planning process to ensure that terrestrial and aquatic habitat conditions for these species are conserved or restored as necessary.

The Parks Canada approach to mitigating potential impacts to Whitebark pine recognizes and takes advantage of the fact that the ski area is a managed landscape. Long Range Planning and Operational parameters for the development of project proposals, and run and vegetation management strategies, facilitate a dynamic and flexible approach to the health and distribution of Whitebark pine communities across the ski area over time. The managed landscape approach to Whitebark pine includes replanting and survival of lost or significantly damaged trees, the restoration or enhancement of habitat that has been effectively lost to other purposes, and an adaptive management approach oriented to a gradual improvement in protection, habitat conditions and Whitebark pine distribution over time.

Westslope cutthroat trout and Bull trout are key species of concern inhabiting both Corral Creek and the Pipestone River. Past ski terrain development has physically impacted the riparian and aquatic environments of both watercourses through the clearing of ski runs, construction of roads and crossings and water extraction for snowmaking and potable water use. Despite these impacts both watercourses continue to support healthy fish populations that are considered to be important to long term species recovery. The parameters and conditions of the Site Guidelines allow for the consideration of alternative water sources in the future, including the construction of off-stream reservoirs that would reduce reliance on direct surface water extraction from the Pipestone River and Corral Creek. The adaptive management of water use and water resources in response to changing environmental conditions is expected to ensure that in-stream flow conditions continue to support native trout species while facilitating water use for ski area operations.

Despite the long term history of Mountain goats use in the Lake Louise area, there is a need to acquire additional information on wintering mountain goats, to inform the design of specific development, visitor use and management measures at the Long-Range Plan stage. A more detailed understanding of where, how and when Mountain goats use winter habitat nodes and travel routes adjacent to the ski area may be expected to result in proposals and protection measures that identify and address the specific risks, and likely impacts to wintering Mountain goats. An adaptive management approach, based on high quality, local habitat information, and based on an initial analysis and implementation of the best available alternatives, is intended to ensure that that Mountain goat populations continue to persist in the area.



Wolverine currently use habitat surrounding the developed ski area, and the Lake Louise village area in general, but appear to be reluctant to cross the ski area or busy roadways. Site Guideline conditions and parameters for the Whitehorn Wildlife Corridor, run and vegetation management, mountain goats and Grizzly bear also address many of the issues pertinent to wolverine. Parameters and conditions for these other Valued Components focus on maintaining movement across the ski area and preventing further displacement or mortality of wildlife including wolverine as a result of ski area expansion. The identification and protection of wolverine denning habitat adjacent to the expanded ski area is a key consideration to be brought forward to inform the Long Range Planning and environmental assessment stages of ski area planning and development.

The recovery of Mountain caribou, currently extirpated from Banff National Park was considered through the strategic assessment. Ski area development and use as envisioned under the Site Guidelines is not expected to directly impact critical habitat or the potential for recovery of Mountain caribou. Noise associated with avalanche control operation and potential backcountry skier access into critical caribou habitat have limited potential to influence the success of future caribou recovery. Avalanche control technologies exist to minimize the noise related to the use of explosives if necessary. Parks Canada has the legal authorities and enforcement powers to prevent backcountry use that may disrupt potential use of critical habitat adjacent to the ski area. However managing direct disturbance related to backcountry access is an issue beyond the scope of the Site Guidelines that is most appropriately and effectively addressed as part of holistic visitor management in a future caribou reintroduction strategy.

Long-range plan environmental assessments will consider the potential impacts to caribou recovery as per SARA requirements, and aligned with the recovery strategy and any associated action plan(s) for the species in this area. As the federal agency responsible for the species in federal protected heritage areas, Parks Canada will need to work with partners and stakeholders to manage potential influences of park communities, ski areas and other development and use to ensure low predation risk for caribou.

Many of the parameters and conditions of the Site Guidelines work synergistically to support the needs of sensitive species. Parameters and conditions for run and vegetation management for instance sustain native vegetation structure, support fire management objectives, facilitate wildlife movement, provide wildlife habitat, and protect aquatic ecosystems. The synergy of Site Guidelines parameters and conditions and future ski area development and use as envisioned by the Site Guidelines is particularly complex when considering potential impacts to Grizzly bear.

Grizzly bear habitat security

Development of new ski terrain considered as exceptions in the Site Guidelines is not considered to be likely to impair the gains of leasehold reduction by impacting Grizzly bears or habitat use of the Whitehorn wildlife corridor, or of Purple and Wolverine Bowls. New ski terrain development may in fact be reasonably expected to improve or expand high quality Grizzly habitat for female, cub and subadult bears. Although specific patterns of Grizzly bear use cannot be accurately predicted, ski terrain development in the Richardson's ridge and Prunepickers areas and in the Corral slides area below Hidden Bowl may increase overall habitat effectiveness and provide additional space for Grizzly bears to find separation from visitors.



The primary concern with respect to Grizzly bears on the ski area is summer visitor use. Development and the presence of visitors may provide some security for female and subadult bears from adult males. However at a certain point human disturbance levels change from providing security to the displacement, habituation and increased mortality risk. Accordingly management of summer visitor use, timing, location, intensity and sensory disturbance is a key factor to maintaining Grizzly bear habitat effectiveness on the ski area.

Relocating the summer use program to higher elevations on the East Ridge of Whitehorn Mountain can be considered a substantial environmental gain, removing visitor use from key, high quality mid-mountain Grizzly habitat and making this habitat more accessible to bears during all periods of day. Maintaining this gain in relation to use of the gondola and a new lodge on Eagle Shoulder requires effective design and management of visitor use and sensory disturbances on the upper mountain. Overall cumulative impacts to Grizzly bear habitat security may be summarized as follows:

- Significant areas within the lower and mid-elevation portion of the Whitehorn wildlife corridor will be removed from future development considerations providing long term security for Grizzly bear and habitat use in these areas of the corridor
- The return of Purple and Wolverine Bowls to park wilderness will provide increased long term security for bear habitat and use in areas that have long been valued as Grizzly habitat and movement routes by Parks Canada
- Development of new ski terrain consistent with established Run and Vegetation management parameters and other conditions of the Site Guidelines is expected to improve the amount of high quality foraging habitat for Grizzly bears on the front and back sides of the ski area
- The relocation of summer use improves daily and seasonal accessibility to a significant amount of high quality Grizzly bear habitat on the Front side of Whitehorn Mountain, decreases the potential for Grizzly bear disturbance and displacement and the potential for human/bear encounters
- Significant periods of low visitor use intensity, and no visitor use, through all seasons provide predictable times for Grizzly bears to move through and use the ski area landscape
- The design and management of facilities and visitor use activities around the gondola and upper lodge locations limits sensory disturbances to levels that will not displace Grizzly bears and ensure that habitat effectiveness is maintained.

Although there are potential improvements to bear habitat security associated with the Site Guidelines it should be noted that the effective management and timing of summer visitor use, sensory disturbances, and ensuring significant daily low and no visitor use periods are all critical to achieving the substantial gains asserted by the Site Guidelines and desired outcomes of the strategic assessment. Additional site-specific research and monitoring of disturbance impacts are essential to ensuring that desired gains are not offset by the increase of expansion of visitor use into sensitive time periods.

Whitehorn Wildlife corridor

As discussed previously, proposed changes to the leasehold and developed area are expected to support the overall maintenance or improvement of the effectiveness of the Whitehorn Corridor. Significant areas within the lower and mid-elevation portion of the corridor will be removed from future development considerations providing long term security for these areas of the corridor.



Clearing of new terrain for ski runs and ski lifts will change the pattern of vegetation cover but parameters for run width, distance between runs and patch size are expected to maintain habitat conditions that allow wildlife to move through and inhabit the ski area as they do currently. The relocation of summer use to higher elevations of Whitehorn Mountain is considered to be a substantial environmental gain as discussed for Grizzly bear. Relocation reduces visitor activity in and adjacent to the wildlife corridor and reduces the opportunity for human wildlife encounters. Reduced daytime disturbance in the central part of the corridor, may be expected to improve the ability of animals to travel through the ski area in the summer.

Relocation of summer use comes with potential adjustments to summer use hours of operation that hold some potential to offset potential gains. With respect to the Whitehorn Wildlife Corridor the primary concern with changing hours of operation is related to increased vehicle disturbances on the Whitehorn road. In response, the Site Guidelines provide clear direction on managing low intensity visitor use hours and the number of vehicle disturbances in order to maintain predictable times for wildlife movement that encompass daylight, twilight and nocturnal periods. In order to consider expanding low intensity visitor use into twilight and nocturnal periods the Site Guidelines require physical improvements to the effectiveness of the Whitehorn corridor including relocation and restoration of the Fish Creek road and installation of a large mammal wildlife underpass at a key location along the Whitehorn road.

Overall cumulative impacts to the Whitehorn Wildlife Corridor may be summarized as follows:

- Significant areas within the lower and mid-elevation portion of the corridor will be removed from future development considerations providing long term security for these areas of the corridor
- The function of vegetation and forest cover in wildlife movement is expected to be maintained through the application of parameters for run and vegetation management that permit wildlife to move through and use the ski area as habitat during periods of low intensity visitor use
- The relocation of summer use decreases the potential for wildlife disturbance and displacement and the potential for human/wildlife encounters in and adjacent to the upper elevations of the corridor
- Significant periods of low visitor use intensity, and no visitor use, including limits to vehicle disturbances, through all seasons provide predictable times for sensitive wildlife to move through and use the ski area landscape
- physical improvements to movement across the Whitehorn Road are expected to improve corridor effectiveness and limit potential for increases in wildlife mortality
- Limits to the footprint of development in and around the old gondola and the main base areas are expected to maintain the ability for wildlife to move around the ski area along existing pathways.

Native Vegetation

The Site Guidelines have been developed in recognition of the key vegetation factors that contribute to ecological integrity in the Lake Louise region. Rare plants, invasive species, the historic fire regime are all addressed through the parameters and conditions of the Site Guidelines. Managing these elements of the native vegetation regime in accordance with the Site Guidelines is expected to maintain a range of conditions that not only



protects native vegetation but also results in a vegetation compositions and structure that supports the expected range of wildlife species and wildlife movement across the ski area.

The management approach to Whitebark pine has been summarized previously in this section. Other elements of native vegetation management including parameters and conditions for ski run development and glading support a wide variety of ecological objectives including wildlife movement, grizzly bear habitat effectiveness, riparian and aquatic habitat protection, and park fire management objectives.

Environmental Management

The Site Guidelines contain the requirement to develop an environmental management system as part of the development of Long Range Plans. The Lake Louise Ski Area already has such a program in place. The Site Guidelines also contain the requirement to develop a series of specific environmental management strategies as part of Long Range Plans including strategies for run and vegetation management, and water management. A suite of assessment, monitoring and information requirements are identified throughout the SEA in relation to the development and assessment of Long-Range Plans and associated strategies including:

- information on wildlife movement routes, seasonal and temporal wildlife movement patterns and characteristics of corridor effectiveness
- grizzly bear habitat use and disturbance thresholds
- assessment of winter mountain goat habitat use in the Richardson's Ridge/Hidden Bowl areas
- identification of wolverine den sites
- development of an on-going Whitebark pine monitoring program
- Adaptive management of water use and water resources in response to changing environmental conditions.

Information gathered through assessment and monitoring initiatives will be used to inform the design of Long Range Plan proposals. The nature of specific Long Range Plan proposals will in turn provide the basis for monitoring and adaptive environmental management. Using this staged approach, environmental management at the ski area can be designed and modified over time to be specific and adaptive to the specific issues associated with specific proposals.

12.2 Visitor Experience

The assessment of Valued Components of visitor experience focused on potential changes to both the built and natural environments, and on changing patterns of visitor use. Desired outcomes and priorities of the Site Guidelines for visitor experience in support of the Ski Area Management Guidelines included:

- Develop and maintain authentic mountain national park experiences for all visitors in all seasons at the ski area
- Ensure a balance of ski area components in order to minimize congestion and crowding and maximize memorable visitor experience and connection
- Strengthen the connection of ski area winter and summer visitors to Banff National Park and the World Heritage Site through enhanced heritage interpretation, learning and experiential opportunities



- Maintain, and where feasible, restore visual and natural viewsapes and minimize other sensory disturbance such as noise and traffic for on and off-hill visitors.

The elements of the Site Guidelines provide a range of expanded ski/snowboard opportunities that respond to imbalances in current ski terrain and the needs of growing sidecountry and backcountry markets. These terrain adjustments are anticipated to enhance and balance the snow riding experience for beginner and intermediate markets, reduce congestion and enhance safety. The inclusion of West Bowl provides managed opportunities for sidecountry riders, while Hidden Bowl provides a “back bowl” type of experience for less advanced skiers on the edge of mountain park wilderness. The enhanced winter opportunities envisioned by the Site Guidelines are focused on authentic mountain skiing and snowboarding experiences consistent with the tradition and nature of the mountain park environment.

The adjustments to the summer use program offer enhanced opportunities for heritage interpretation and learning located in a more diverse and spectacular environment. The focus on high elevation hiking and educational programming responds to the desired visitor experience outcomes of enhancing educational opportunities and of maximizing memorable experience and connection to Banff National Park and the World Heritage Site. Visitor activities on the upper mountain such as hiking, sightseeing and heritage interpretation are consistent with the tradition and nature of the mountain national park environment.

The Site Guidelines contain considerable measures aimed at minimizing the visual and sensory impacts of potential ski area development and use. It is expected that ski run, lift and facility development that occurs within the current developed area and lease, and that adheres to the measures in the Site Guidelines will not result in substantial changes to the ways that visitor experience and perceive the visual and sensory characteristics of the developed ski area.

While visual and sensory characteristics associated with changes to the current developed ski area are considered unlikely to impact visitor experience, some level of impact to wilderness character is an inevitable result of development and skier use in Hidden Bowl and Corral Creek valleys. The impacts of modern infrastructure and ski area winter use can be expected to affect the sense of remoteness and wildness that Skoki backcountry and Hidden Lake visitor’s experience, from the current ski area boundary through to Boulder Pass. A key aspect of this potential development is the location of a bottom lift terminal for Hidden Bowl. A location in Hidden Bowl flats would be considerably less intrusive than a lift location along Corral Creek. A Corral Creek location located away from the Hidden Bowl campground will be less intrusive from the campground and from upper reaches of the Skoki Trail and Boulder Pass.

12.3 Infrastructure Capacity

Outcomes for infrastructure capacity as outlined in section 4.7 are likely to be realized through application of the site guidelines and mitigations in this SEA. The strategies and mitigations outlined in the site guidelines and the SEA are intended to ensure that ski area resource use falls within existing infrastructure capacity. Where additional capacity is required the mitigations are intended to ensure that ski areas resource use falls within existing environmental capacity. No strategic issues that would trigger the need for



increased infrastructure capacity were identified with respect to transportation, electrical power, domestic water or wastewater capacity, or staff accommodation.

The incorporation of sustainable design principles and products into ski area development plans is intended to ensure resource use efficiency and conservation. The implementation of an environmental management system is intended to ensure that ski area operational impacts are within accepted or agreed upon environmental parameters and standards.

12.4 Conclusion

Potential impacts to valued components of ecological integrity, visitor experience and infrastructure capacity associated with the draft Lake Louise Ski Area Site Guidelines for Development and Use were identified and assessed in relation to desired outcomes. Valued components and desired outcomes were identified based on established legislation and policy direction for Parks Canada including the Banff National Park Management Plan and the Ski Area Management Guidelines.

The parameters and conditions of the Site Guidelines in combination with the mitigation measures of the strategic assessment address key impacts to valued ecological components including the Whitehorn wildlife corridor, grizzly bear, wolverine, and mountain goat, and species at risk including Whitebark pine, Westslope cutthroat and Bull trout. Many aspects of the Site Guidelines are anticipated to enhance visitor experience while including consideration for adverse impacts to viewscape, sensory impact, and wilderness character experience of other visitors. Ski area development is not likely to trigger the need for regional infrastructure growth.

Ski area development as envisioned by the Site Guidelines is associated with land gains to Parks Canada while allowing the ski area to expand and enhance both summer and winter visitor experiences. It should be emphasized that potential environmental gains envisioned by the Site Guidelines may be easily lost without further research and planning consistent with the mitigations of this strategic assessment. However, Long-Range plan proposals that meet the conditions and parameters of the Site Guidelines and respond to the mitigation requirements of the strategic assessment may be reasonably expected to achieve desired ecological, visitor experience and infrastructure outcomes.



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