

Jumbo Glacier Resort Master Plan

Appendix 8-G

PROJECT REPORT VOLUME 3

Jumbo Glacier Resort **Project Report**

VOLUME 3

PART D: ENVIRONMENTAL, RESOURCE AND
TECHNICAL ISSUES

3

Jumbo Glacier Resort Project Report

VOLUME 3

PART D: ENVIRONMENTAL, RESOURCE AND TECHNICAL ISSUES

December, 2003

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Jumbo Glacier Resort Master Plan Concept:¹

- Volume 1: Introduction
- Volume 2: The Site
- Volume 3: Environment
- Volume 4: Project Components
- Volume 5: Infrastructure
- Volume 6: Socio-Economic and Market Analysis
- Volume 7: Approval Process and Governance
- Volume 8: Map Volume

¹ The Master Plan is the primary Appendix to the Project Report. Because of its size, and the fact that it is applicable to all Volumes of this Project Report, it is published as a free-standing or “floating” document for ease of reading.

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Prepared by Norecol, Dames & Moore, Inc.Appendix 3-A

- Wildlife Resources
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PART D. ENVIRONMENTAL, RESOURCE AND TECHNICAL ISSUES

D.1 Waste Management

Five specific topics of interest and concern have been identified with respect to waste generation and disposal and the management of point-source and non-point-source (NPS) contaminants originating from the project and its associated infrastructure:

- solid waste treatment and disposal - section D.1(A);
- liquid waste treatment and disposal, including NPS waste discharges to water - section D.1(B);
- management of special wastes and fuel storage sites - section D.1(C);
- water quality impacts - section D.1(D); and
- air quality impacts - section D.1(E).

D.1(A) Solid Waste Treatment and Disposal

EA Issues Profile

Topic

Solid waste disposal management for resort.

Issues

- Proposed location, design and functioning of solid waste collection, treatment and disposal facilities.
- Potential environmental impacts of solid waste disposal, and available mitigation options.
- Arrangements to dispose of solid waste at RDEK landfill facilities.

Relevant Project Components

Solid waste disposal for all on-site components, including on-site (and if necessary, off-site) disposal facilities and systems.

Lead Agency

Ministry of Environment, Lands and Parks (MELP) – Pollution Prevention and Remediation Program.

Comments also Received From

- Fisheries and Oceans Canada (DFO)
- Ministry of Health (MoH).
- Regional District of East Kootenay (RDEK)
- Ministry of Employment and Investment (MEI)

Relevant Public Comments on Application and Draft Specifications

- Technologies exist to satisfy any environmental standard needed to protect land and water from the effects of waste disposal systems. (6d)
- Proposal does not mention recycling initiatives, but assumes that all garbage will be compacted. Invermere's landfill site capacity is already strained. (6g)
- Both project's liquid waste and solid waste would have serious impact on local fish populations. (6h)
- Re. draft spec. #3 – need details of how to bear-proof garbage.
- Re. draft spec. #5 – what happens if proponent decides, on reflection, to reintroduce proposal for equestrian facility.

Relevant Public Advisory Committee Comments on Draft Specifications

Add spec., requiring independent review for bear-proofing measures.

Relevant Proponent Comments on Draft Specifications and Specifications Feedback

- Draft specs go into unnecessary detail. Proponent has documented issue clearly, proposing compactors in every unit, collection system, special building for temporary storage (odourless and completely self contained), and haulage to off-site disposal site.
- Re. draft spec. #3 - wildlife will not be exposed to any wastes.
- Re. draft spec. #4 – RDEK knows of project, but contract with RDEK and MELP is not yet possible – they will not enter into any contracts before approvals.
- RDEK is required to accept solid waste from resort development at regional landfill, so there will not be any permanent storage of garbage at resort site.
- Re. draft conditional spec. #5 - unfair requirement. Horses and stables are used even in National Parks, without significant complaint or damage. To

avoid further controversy, proponent has withdrawn equestrian facility proposal, but is there a provincial policy objection?

- Resort can adopt a '3-R's Policy' to minimise volume of solid waste generated, and target a future date to eliminate need for solid waste disposal.

Related Issues and Relevant Specifications

- Re. other waste disposal issues, see other parts of section D.1.
- In particular, re. related water quality issues, see section D.1.D.
- Re. wildlife/human conflicts, see also section D.3.G.
- Re. solid waste disposal costs, see section E.7.B.

Additional EA Reporting Requirements?

Yes – see below; draft spec. on equestrian facility eliminated.

Review Focus

MELP wishes to be in a position to determine whether or not the proponent has an acceptable solid waste management plan for the project, which will meet the MELP and RDEK goals to reduce, re-use and recycle solid wastes. Specific issues include how the proponent will deal with residual wastes, that is, whether the RDEK landfills will be used, or whether a landfill or incinerator will be part of the project. A wildlife-proof residual waste management system is essential.

From RDEK's perspective, whether or not the Jumbo Glacier project proceeds will not materially affect programs carried out under the RDEK Regional Solid Waste Management Plan. RDEK notes two issues – landfill capacity and wildlife conflict management. Landfill capacity is a regional issue. RDEK must select a new landfill site for the upper Columbia valley, regardless of the future of the resort proposal. To meet long-term needs, the largest practicable site is likely to be favoured by RDEK. The province, not RDEK, is responsible for operations management. RDEK would appreciate information on projected volumes for planning purposes, and the proponent will be encouraged to participate in regional waste reduction initiatives.

Review of Application

The proponent's 1995 application indicated that it planned to handle solid waste using compactors and indoor temporary storage, prior to transport to an RDEK landfill site. The proponent also indicated that it would investigate innovative ways to deal with solid waste, with emphasis on compaction, recycling and minimisation. A subsequent report from the proponent (dated November 1995) gave additional details on solid waste disposal for the first phase of the project (i.e. development of the Glacier Dome Lodge).

MELP (Pollution Prevention and Remediation Program - PPRP) generally supports this approach, together with predator-proof storage of all solid waste to prevent attraction of wildlife. MELP also supports use of an off-site landfill, owned and operated by the RDEK. The proponent needs to obtain some preliminary commitment from the RDEK regarding the use of its landfills or solid waste systems.

Evaluation

Refuse Collection and Disposal

As with other developments in BC where a potentially significant volume of solid waste could be generated, MELP (PPRPBC Environment and Lands) expects the proponent to adopt strategies for solid waste disposal which incorporate the philosophy of reducing, reusing or recycling solid wastes to the extent possible, and also for minimising disposal to any landfill site.

The solid waste disposal option identified by the proponent on page 131 of the application (*Volume 2*) is acceptable to MELP (Pollution Prevention and RPPesticide Management). However, temporary storage of the garbage must be managed in such a way that it does not pose a health or safety concern, and the temporary storage structures must be predator-proof. From a public health perspective, careful thought needs to be given to the temporary on-site storage of solid waste in order to reduce the risk of mechanical or biological transmission of pathogens from compactors to food services.

Household Hazardous Waste

A review of the application did not reveal how the resort intends to minimise and dispose of household hazardous wastes. By way of definition, "...Household hazardous waste (HHW) includes all common consumer products that are corrosive, toxic, reactive or flammable. This definition covers a long and varied list of products, ranging from paints and solvents to lubricants and household cleaners, that are potentially harmful to human health and the natural environment when disposed of improperly..." (quoted from the MELP publication: *Household Hazardous Waste Strategy Discussion Paper*, 1993). HHW must be handled with care. The public needs to know "...how to use them safely, how to get rid of them, and how to get along without them..." (quoted from the MELP publication: *Household Hazardous Products Guide*). Educating the public is necessary in order to protect the environment, and MELP (PPRP) MELP (BC Environment and Lands) can provide educational material to the proponent.

It is recommended that the proponent develop, and have approved by MELP, written procedures for all employees and guests concerning the safe handling and disposal of household hazardous wastes.

Bear Proofing

Bear-proofing should be specifically provided for in more detailed solid waste management planning, both at source (individual residences, etc.) and at any central storage areas. MELP has advised the project committee that it is sufficient for the proponent to commit that refuse collection and disposal will be conducted in a clean and efficient manner which will not attract wildlife, as well as being compatible with the solid waste management programs of RDEK and MELP. If the project is granted a project approval certificate at the conclusion of EA review, specific bear-proofing measures will have to be mutually agreed upon between the proponent, RDEK and MELP at the pre-construction stage, and will have to incorporate state-of-the-art technology which is available at that time. See also section D.3.G – *Potential Human Conflicts with Wildlife*.

Use of RDEK Landfill

MELP ((PPRP) Pollution Prevention and Pesticide Management) supports the option of trucking the garbage off-site to the designated RDEK landfill site for the area. Arrangements for landfill disposal will have to be made in consultation with the RDEK. The proposed Solid Waste Management Plan of the RDEK indicates that a new sub-regional landfill is to be developed in the Columbia Valley Subregion. MELP (PPRP) (BC Environment and Lands) and RDEK, through the solid waste management planning process, will be involved in the siting and development of the facility, and will consider the environmental, social and economic issues relevant to this process.

Equestrian Facilities

The application had indicated noted the proponent's interests in catering to equestrian activities at the resort, and that the "...stable by-products could be used for local landscaping as an alternative to chemical fertilisers..." (Volume 2, page 265). However, since filing the application, the proponent has advised the project committee that it has now abandoned these plans, most recently, in its letter of January 22, 1998. On the basis that there are to be no equestrian facilities at the resort, no reporting on this issue is required in the project report.

Project Report Specifications – D.1(A)

In its project report, the proponent must:

1. Document its proposed policies and proposed infrastructure for the reducing, reusing or recycling of solid wastes.
2. Include the following:
 - plans for the temporary storage of solid waste prior to off-site disposal; identifying

Part D: Environmental, Resource Management and Technical Issues

- measures to minimise public health and safety concerns; and
- plans for the minimisation, collection, handling and disposal of household hazardous wastes
3. Make a commitment that refuse collection and disposal will be conducted in a clean and efficient manner which will not attract wildlife, as well as being compatible with the solid waste management programs of RDEK and MELP.
4. Provide an update on the status of its solid waste discussions with the RDEK, providing details of any firm arrangements which may have been reached by the time that the project report is submitted.

RESPONSE – D.1(A)

1. Jumbo Glacier Resort (JGR) will focus on waste minimization and recycling programs. To match the recycling programs in place in the Regional District, JGR will provide for collection of:

- paper (newspaper, magazines, envelopes, telephone books, fax paper);
- cardboard;
- tin and aluminum cans;
- plastic milk jugs; and
- plastics numbered 1, 2, 3, 4, 5 and 6 (except styrofoam).

JGR will not provide curbside collection of recyclable materials because of the presence of wildlife and the potential for animal/human conflicts. Instead, an enclosed recycling depot will be strategically located within the resort complex to ensure cooperation of residents and guests and to keep garbage away from scavenging wildlife. In addition, dedicated bins for recyclable products will be provided at ski lifts and at the Teahouse and on-mountain facilities. These bins will be emptied daily and their contents dropped off at the central waste storage facility.

The Master Plan explains the proposed policies and infrastructure for the reducing, reusing and recycling of solid wastes in Section 5.6 of Volume 5, Infrastructure. Further information on solid waste management also is provided in Section 4.0 of Appendix 3-C Environmental Management Plans.

2. Plans for the temporary storage of solid waste prior to off-site disposal are made clear by the inclusion of at least one transfer station building, which will be a closed, odourless and predator proof structure. Management and organization discussions with the contractor that will be hauling the garbage will determine whether more than one transfer station will be appropriate. The minimization, collection, handling and disposal of household hazardous waste will also be carried out in a dedicated and separate area of the waste transfer station building, which will be designed in consultation with the waste removal contractor for maximum efficiency.

Temporary Storage

A conceptual plan is provided for temporary storage of solid waste prior to off-site disposal. Public health and safety concerns have been considered in the preparation of the conceptual plan, particularly with respect to bear and rodent problems. Therefore, JGR will commit to the

following:

- All domestic waste will be placed in a fully enclosed waste transfer station, which will be designed as a closed, odourless, and predator proof structure.
- To assist in reducing odours from the waste transit building, consideration will be given to freezing waste in the main transfer station, especially during the summer months.
- Due to the presence of wildlife and the potential for animal/human conflicts resulting from unsecured garbage containers, there will be no curbside collection of garbage. Residents will be required to deposit garbage at the waste transfer stations within the resort.
- All overnight visitors will be required to keep refuse in enclosed predator-proof areas before dropping it off at the resort transfer station.
- Separate food waste containers will be provided at catering and restaurant facilities at the hotel and commercial facilities and at the mountain top Teahouse.
- Refuse bins will be provided at ski lifts and at the Teahouse and on-mountain facilities. These bins will be emptied daily and the collected waste dropped off at the central waste storage facility.
- A recognized waste management hauler will be retained to collect and remove the solid waste and recyclable materials from the resort. The non-recyclable refuse will be disposed of at the Columbia Valley Landfill operated by the Regional District.
- Although not always necessary, future consideration may be given to staffing the site, and fencing to restrict or control access and materials deposited.

Hazardous and Special Wastes

Plans for the minimization, collection, handling and storage of hazardous and special waste include the following components:

- Storage collection and disposal of hazardous and special wastes may be another area of service under the administrative jurisdiction of a Mountain Resort Improvement District. Alternatively, those who generate that refuse will have to contract directly for its proper disposal.
- Special waste that will be generated includes waste oils and lubricants, refuse from the First Aid facility, and refuse from certain commercial facilities. As refuse from the first aid facility may be considered as Bio-Medical waste, JGR will consider co-management of this waste with the nearest hospital.
- JGR will consult with the Ministry of Water, Land and Air Protection on appropriate ways to handle special waste and handling will comply with established legislation and regulation.
- JGR will equip maintenance facilities with conventional storage and handling equipment for used oils and lubricants. These used oils and lubricants will be collected and managed by a recognized recycling facility.

3. The Proponent is committed to a clean and efficient manner to collect and dispose refuse, in particular so that it will not attract wildlife, and it will coordinate solid waste management with the programs of local and provincial government agencies. Typically, this is a program that becomes part of the undertakings included in a Master Development Agreement between the Proponent and the Province. JGR will consider public health and safety concerns in the preparation of the

conceptual plan, particularly with respect to bear and rodent problems.

4. Discussions with RDEK have been on going since 1991, and the relationship with their staff has been excellent. Firm arrangements are in place thanks to provincial and local government policies, which prescribe the same treatment for all potential users of landfill sites in the Regional District. The Manager of Planning and Development Services, Robert D. Whetham, confirms that RDEK does not require any special agreements for the transportation of solid waste to its designated landfill site, where any contractor can haul solid waste from the Regional District's territory provided the required fees are paid. In a letter dated September 17, 2003 (copy of the correspondence and of the attached policy document has been sent to the EA Office) he confirmed that: "The Draft Regional Solid Waste Management Plan outlines the solid waste management program for the RDEK. The proposed Jumbo Glacier Resort is located within the Columbia Valley subregion of the RDEK and is subject to policies set for this region." In a subsequent telephone conversation he reiterated that the existing policies and provisions of the RDEK cover the potential requirements of JGR, which would be accommodated equally to any other user upon payment of the appropriate fees. He also reiterated that no special agreements or considerations will be necessary and that the additional fees will only facilitate the operations of the RDEK programs.

D.1(B) Liquid Waste Treatment and Disposal

EA Issues Profile

Topic

Liquid waste disposal and non-point-source (NPS) liquid waste management at resort.

Issues

- Adequacy of proponent's proposed liquid waste treatment facilities for resort, given constraints in Jumbo valley, and phased construction of project?
- Proposed location, design and functioning of liquid waste collection, treatment and disposal facilities.
- Adequacy of capacity of on-site ground disposal areas for secondary-treated or tertiary-treated wastewater.
- Preparation of liquid waste management plan for project.
- Potential environmental impacts of liquid waste disposal, and available mitigation options, notably respecting water quality and fishery impacts.
- Need for NPS wastewater discharge control plan.
- Collection, treatment and disposal of stormwater and snowmelt runoff.
- EA review of potential NPS discharges associated with construction of road upgrade and transmission line.

Relevant Project Components

- Liquid waste disposal for all on-site components, including on-site (and if necessary, off-site) disposal facilities and systems.
- For NPS liquid wastes, all on-site facilities.
- For NPS liquid wastes, off-site physical infrastructure in Toby/Jumbo Creek drainages.

Lead Agency

Ministry of Environment, Lands and Parks (MELP) – Pollution Prevention and Remediation Program.

Comments also Received From

- District of Invermere
- Columbia Lake Indian Band (CLIB)
- Ktunaxa/Kinbasket Tribal Council (KKTC)
- Ministry of Health (MoH)
- Fisheries and Oceans Canada (DFO)
- Ministry of Employment and Investment (MEI)

Relevant Public Comments on Application and Draft Procedures

- Difficult to successfully operate sewage treatment plant in winter environment (6a).
- Concern is expressed over sensitivity of alpine and subalpine environments, but sewerage and other protection technologies are available to minimise risk (6b).
- Amount of sewage to be produced cannot be managed in high-altitude valley (6c).
- Technologies exist to satisfy any environmental standard needed to protect land and water from effects of waste disposal systems (6d).
- Specific sites for tile fields have not been identified, nor has their effectiveness in harsh local environment been established. (6e).
- Only one site appears to be suitable for ground disposal. This site might be able to handle first phase of development, but even this is uncertain. (6f)
- What effect would waste and sewage disposal have on surrounding watersheds? (6i).
- Need to ensure adequate provision to dispose of sewage at all stages of project.
- Re. draft spec. #1 – need more complete attention to treatment/disposal of domestic effluent and stormwater/snowmelt runoff.

Relevant Public Advisory Committee Comments on Draft Specifications

- Add new spec. to section D.1(B) of draft specs - project report must include hydrology study for proposed area.
- Add new spec. to section D.1(E) of draft specs - requiring identification of any

NPS contaminants which could be generated by the resort from list in first paragraph of section below entitled: *Context for Issue*. Add herbicides, pesticides and fertilisers to list.

Relevant Proponent Comments on Draft Specifications and Specifications Feedback

- Re. draft specs, section D.1(B) - Project will be equipped with best available wastewater treatment technology. Treatment objectives will largely exceed pollution control objectives set by MELP for municipal treatment plant effluent discharges to receiving waters.
- Opponents' claim that sewer will contaminate water is not true, since tertiary treatment will be used, which is more modern than Panorama's system. Benefits far outweigh costs. Section seems designed to indicate that project cannot resolve problems.
- Proponent filed sewage disposal application under *Waste Management Act* in 1995, and has done initial required soil testing, and placed public notice of application on-site. Is seeking concurrent permitting under *EA Act*, but application is not being processed by government, due to critical letter to MELP from environmental group.
- Re. draft spec. D.1(B)#2 – too detailed. Want the flexibility of phased approach to treatment issues, to take account of changes in technology and project circumstances, rather than designing everything now.
- Re. draft specs, section D.1(E) - drawings in application outline riparian areas. Collection system is simple, and nothing, during, or following, construction, would be allowed to flow directly into Jumbo Creek.
- Re. draft spec. #D.1(E)#2 - cannot provide liquid waste management plan at this stage, but can commit to it before construction.
- Re. draft spec. #D.1(E)#3 - no problems with spec.

Related Issues and Relevant Specifications

- Re. other waste disposal issues, see other parts of section D.1.
- In particular, re. related water quality issues, see section D.1(E)
- Re. related fisheries issues, see section D.3.(A)

Additional EA Reporting Requirements?

Yes – see *Volume 1*, section D.1(B); draft specs. from section D.1(E) – *Non-point Waste Sources* – incorporated into section D.1(B).

EA Review Focus

For EA review purposes, MELP wishes to be in a position to determine whether or not the proponent's proposed liquid waste treatment facilities plans for the resort are adequate, given the constraints of the valley and the phased construction of the project. The primary issue is the provision of adequate ground disposal systems for secondary- or tertiary-treated wastewater, and the preparation of a liquid waste management plan for the project. Chemistry and physical capability of the soil to handle wastewater are critical. The aim is to avoid impacts on water quality and fisheries. Following EA review, more detailed design information will be required at the permitting stage, if the project is approved.

Review of Application

The 1995 application indicated that the proponent had planned to handle liquid waste via secondary treatment and discharge to ground. The application also noted that the area required for ground disposal is significant, and could cover up to 8 ha (20 acres). The application stated that treated wastewater will not be discharged to Jumbo Creek, and acknowledged the sensitivity of Jumbo Creek to nutrient input, particularly phosphorus. MELP (Pollution Prevention and Remediation Program - PPRP) generally concurs with statements in the application with respect to the need for adequate ground disposal sites. The proponent must provide sufficient details on ground disposal sites to ensure adequate suitable land area for wastewater disposal at full project build-out.

Some additional soil testing data was collected from test pits and percolation pits in September 1995, and made available to MELP. A subsequent report from the proponent (dated November, 1995) gave additional details on liquid waste disposal for the first phase of the project, the Glacier Dome Lodge. The Glacier Dome Lodge represents approximately 10% of the total project. The proponent made application (dated July 26, 1995) for a waste management permit under the *Waste Management Act* for sewage disposal from the Glacier Dome Lodge. The application describes the type of treatment as advanced secondary treatment. The purpose of the application is to seek approval for a discharge permit for ground disposal and/or partial re-use of the treated effluent from the proposed Phase 1 sewage treatment plant (handling sewage from the lodge only). The proponent has recently signalled its intent to seek processing of the permit application in accordance with concurrent permitting provisions in the *EA Act*. In February 1996, MELP (PPRP) advised the proponent to submit a technical report in support of its permit application. The technical report has not yet been filed.

Since filing this documentation, the proponent has notified MELP of its intention to adopt tertiary treatment, but MELP has not received any technical details of this proposal.

The proponent's original application contained some information on drainage and runoff control, but did not address specific issues related to non-point-source

liquid waste management.

Evaluation – Sewage Disposal

Planning the Liquid Effluent Disposal System

MELP (BC Environment and Lands)(PPRP) has advised the project committee that it favours an approach to liquid waste management planning for this project which is similar to the process now used by local government to develop a Liquid Waste Management Plan (such as, for example, in the Okanagan area).

The applicable legislation, objectives, criteria and guidelines for sewage wastewater disposal are as follows: is the following:

- The Waste Management Act and Regulations;
- The Pollution Control Guidelines for Municipal Effluent Application to Land;
- The Pollution Control Objectives for Municipal Type Waste Discharges in BC; and
- Municipal Sewage Regulation Discharge Regulation Criteria (Draft);
- Guidelines for Developing a Liquid Waste Management Plan; and,
- Urban Runoff Quality Control Guidelines for British Columbia.; and
- the federal Fisheries Act (i.e. section 36(3)).

The proponent should consult these regulatory provisions in developing its approach to liquid effluent disposal.

Confirming the Locations of Wastewater Disposal Areas

Of prime importance to MELP with respect to effluent management is the need for the proponent to identify, on a sound technical basis, the entire area, including the additional 50% standby area, required for the disposal of treated effluent from the full facility (i.e. the approximately 7,000-bed proposal, including all private residences). Identifying one wastewater disposal area at a time for Phase I, then for Phase II, and finally for Phase III, is not an acceptable approach to MELP (Pollution Prevention and Pesticide Management). The required areas must be located, tested, found suitable to the Regional Waste Manager, and designated solely as wastewater disposal areas.

Although detailed design is not required at this stage, answers to various questions will need to be provided by the proponent in a comprehensive hydrogeological/geotechnical study in order to reach informed

conclusions about the achievability of viable on-site effluent disposal for the resort (see section D.1(B), specifications D.1(B) #1 to #7)2, below.

Residential Housing

The application indicates that there will be single family dwellings in the resort area. Although servicing of these buildings was not discussed in detail in the application, MELP expects the dwellings to be hooked into the overall wastewater treatment facility. Individual septic tile fields would not be desirable, given the potential cumulative impacts which these household discharges would have on the environment. Typical septic tank treatment does not result in a high quality effluent, and could potentially contaminate groundwater and surface waters, depending on the nature of the soils present in the area. Respecting public health implications, any individual on-site sewage disposal systems would have to comply with the *Sewage Disposal Regulations*, enacted pursuant to the *Health Act*.

Wastewater Treatment Facility

In the original EA application, and in its application for a waste management permit, the proponent proposed disposal of secondary-treated effluent to ground. More recently, the proponent has stated that it will install a tertiary wastewater treatment system. The proponent plans to dispose of secondary-treated effluent to ground. Preliminary soils investigative work was carried out in July, 1993 by Golder Associates Ltd. for five sites, and Site 3 was identified as the best prospect for the acceptance of treated wastewater.

However, information contained in *Appendix O* of the application (found in *Volume 4*) indicates that the soil conditions are as follows:

“...Because of the relatively coarse-grained soils, percolation rates would likely be rapid. Accordingly, the travel time to the water table is also inferred to be relatively rapid with corresponding poor to moderate natural renovation of effluent quality. The flow pathway and down-gradient discharge location for any effluent disposed of in the northern portion of Site 3 has not been determined by assessment of the water table gradient. However, based on surface topography, it appears that the discharge would likely occur into Jumbo Creek approximately due west of TP-3...” (page 6, Golder Associates report of September 1993, entitled: *Report on Preliminary Hydrogeological Assessment for In-ground Wastewater Disposal, Proposed Jumbo Valley Ski Resort, Invermere Area, British Columbia*).

“...the soils appear to be well drained. However, because of their coarse grained nature, they may have relatively limited capability for attenuation of wastewater effluent. Surface water and groundwater conditions would require further assessment including monitoring during spring melt and periods of heavy precipitation when conditions are anticipated to be less favourable for effluent disposal...” (page 6, same reference).

The application does not contain information concerning the method of treatment to be applied to the wastewater and its quality prior to ground disposal. However, KPA Engineering has discussed with MELP (Pollution Prevention and Pesticide Management) a proposal to use the tertiary Cycle-Let Wastewater Treatment and Recycling system, which operates on the principal of reverse osmosis.

Evaluation – Non-Point-Source (NPS) Liquid Waste Sources

Storm Water/Snowmelt Runoff

Context for Issue:

In addition to the point-source waste discharges which have traditionally been permitted under the *Waste Management Act* or the *Health Act* (sewage and refuse), a ski resort development, like many other types of significant development, could also be associated with the release of some non-point source (NPS) contaminants to the air, to water and to ground. These typically include the discharge of pollutants over a widespread area from non-end-of-pipe sources such as stormwater and snowmelt runoff, which could be contaminated with hydro-carbons, road salt, metals from automobiles, sediment from land clearing and roads, and spills of fuels, herbicides, fertilisers and pesticides.

MELP wishes to ensure protection of soil, water and air quality associated with NPS contaminants. There is no permitting process which addresses NPS wastes under the *Waste Management Act*. While MELP has identified the need to develop an overall plan to reduce NPS impacts in its Clean Water Program, NPS management in BC is in its infancy, and currently lacks any legislative framework.

A significant amount of information on NPS management exists in literature published by the US Environmental Protection Agency, in MELP's *Urban Runoff Quality Control Guidelines for BC*, and also in the DFO/MELP publication *Land Development Guidelines for the Protection of Aquatic Habitat*. If approved, this resort village should incorporate up-to-date urban/environmental design and pollution control technology, thereby avoiding the impacts of historical urban planning. NPS management should be designed into all aspects of the project, from commencement of construction to completion of the final phase.

By way of illustration, sediment is the most common NPS contaminant. Fine sand, transported as bedload and not captured by the standard water column non-filterable residue analysis, is the sediment fraction most damaging to fish spawning habitat. This fraction is also easiest to control with stormwater catchment ponds or sumps. Prior to development, these can readily be incorporated into the village stormwater design, but are much more difficult and costly to retrofit later. It should be noted that there are currently no regulations which permit the deposition of sediment into fish-bearing streams, and therefore, levels above accepted guidelines

could be contrary to section 36(3) of the *Fisheries Act*.

The proponent did not discuss any aspects of runoff control in any detail in the submitted documentation. It is recognised that Sstorm water/snowmelt runoff can have a significant effect on the receiving environment. The following quote is an excerpt from the *Urban Runoff Control Guidelines for the Province of BC*:

“...In addition to the pollutants generated by urban activities, the development of a catchment results in an increase in impervious area, through the construction of roads, parking lots, roofs, etc. Increasing the impervious area of a catchment changes the pre-development hydrologic cycle, by preventing precipitation from infiltrating through surface soils to the groundwater table; the result is an increase in surface runoff volumes and peak flow rates, which can cause flooding and erosion, habitat damage, reduced species diversity, lower dry season base flows in water courses, and lower groundwater reserves. It has been found that the hydrologic aspects of urban runoff can be more harmful to receiving water environments than the effects of toxic pollutants...” (page 4).

The proponent may obtain the document: *Urban Runoff Control Guidelines for the Province of BC* by contacting the MELP (PPRPBC Environment and Lands) office in Cranbrook, and the *Land Development Guidelines for the Protection of Aquatic Habitat* (DFO/MELP) from either DFO or MELP for guidance on erosion and sediment control measures. MELP notes that, in the East Kootenay region, urban runoff projects have been implemented by some municipalities.

Access road upgrading may also be associated with NPS discharges to water.

Project Report Specifications – D.1(B): Liquid Waste Management Planning

1. The project report must include a plan for liquid waste disposal which is similar to a Liquid Waste Management Plan (LWMP), and which considers all aspects of liquid waste treatment and disposal. This plan must address the collection, treatment and disposal of stormwater/snowmelt runoff, as well as domestic effluent and biosolids (sludge), from all components of the project.
2. The LWMP must identify options for wastewater collection, treatment and disposal, present the proponent’s preferred option in detail, and include forecasts of the volume of wastewater requiring treatment and disposal at each phase of the project. The plan must show that the preferred treatment and disposal system is capable of successful operation at full build-out.
3. The LWMP must contain the pre-design information needed to ensure that treated wastewater can be discharged to the receiving environment without significant impact. Potential impacts on water quality, fish and fish habitat in Jumbo Creek must be assessed and, where significant, mitigated.

4. The plan must provide assurance either that there is adequate suitable land available for ground disposal of treated wastewater or that the treated effluent can be discharged to Jumbo Creek without significant impact. The plan must show that the receiving environment (either the ground or the creek) can assimilate the wastewater without significant impact.

Conditional Project Report Specifications – D.1(B): Liquid Waste Management Planning

5. If in ground disposal of treated wastewater is the preferred disposal option, the LWMP must identify adequate ground disposal site(s), including standby areas, for the full build out of the project. The plan must contain a detailed hydrogeological/ geotechnical study of the ground disposal site(s).

6. If discharge of treated wastewater to Jumbo Creek is the preferred option for disposal, the plan must address the sensitivity of Jumbo Creek to nutrient input by documenting the results of an “in situ” algal essay.

Project Report Specifications – D.1(B): Non-point-source (NPS) Liquid Wastes

7. The LWMP must include a conceptual description of the methods intended for NPS waste discharge control, addressing the collection, treatment and disposal of stormwater/snowmelt runoff originating from all parts of the project, and covering the period from initial construction to operations at full build-out. (note – Reference materials for such planning include MELP’s *Urban Runoff Quality Control Guidelines for BC*, the proposed *Stormwater Guidelines and Management Strategies for BC*, and the DFO/MELP *Land Development Guidelines for the Protection of Aquatic Habitat*.) In addition, the proponent must commit to developing and submitting a NPS waste discharge control plan with site-specific details for approval by MELP and implementation before any aspect of construction begins, if the project is approved under the EA Act.

8. The environmental implications of NPS discharges to water bodies associated with access road upgrading and transmission line construction must either be addressed as part of the overall environmental assessment of the road upgrading plans or included in the LWMP.

RESPONSE – D.1(B)

Ski resorts developed in the past, from Whistler to Big White to Panorama, and many other projects initiated in the sixties and the seventies, were built with more rudimentary technologies and design provisions than those available and normally used today according to prevailing management and design guidelines. These past examples have given rise to the notion that development inevitably will create problems. This is not necessarily true and we will try to explain that JGR will use up to date best practices technology and is planned to be a true example of sustainable project, as it is required by regulations and best practices today and for the future.

The history of the Jumbo Glacier Resort project is such that the Master Plan concept has evolved

and has been scaled down so that all development, except for ski lifts and Daylodge supporting facilities, will be concentrated in the area immediately surrounding the sawmill site. In the previous plans it was proposed that the project would start with an opening phase that would have a more remote hotel and overnight accommodation centre at the base of Glacier Dome. This had produced a concentration of detailed engineering in the mid nineties for an opening phase that was different from the final and more compact plan presented in the current Master Plan concept, but the principles remain the same.

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1. Liquid Waste Management Plan

The *Liquid Waste Management Plan (LWMP)* is included as Appendix 3-N of this report. It describes liquid waste treatment and disposal including domestic effluent and biosolids, as well as management of storm water and snow melt runoff. Additionally, Volume 5, Sections 5.4 and 5.5 of the Master Plan discuss Sewer, Stormwater and Snowmelt Management. Considerable study of this subject has been carried out by the consulting team over the years and it is recognized that the change of the first phase and the change in Government agencies' distribution of responsibilities requires some effort of revised considerations not only from the project team but also from the reviewing agencies. A summary of the history of the work done is as follows:

- Soil investigations have been under the main responsibility of Golder Associates since the beginning, but EBA Consulting Engineers, KPA Engineering, and Agra Earth and Environmental also collaborated. The initial review of treatment options and the Liquid Waste Management Plan for the 1995 Master Plan were done by Ferdinand Beulac, P.Eng. of UMA KPA Engineering. Finally the conceptual design for the current and updated Master Plan has been done by McElhanney Consultants in cooperation with Golder Associates and Ecofluid.
- Initial soil testing and an examination of five locations by Golder Associates produced a "Report On Preliminary Assessment For In –Ground Wastewater Disposal" dated September 1993. Six more test holes were dug in September 1995, in support of an Application for a permit under the provisions of the Waste Management Act, submitted by Fernand Beulac, P.Eng., of KPA Engineering on August 8, 1995 to the Ministry of Environment, Lands and Parks, Environmental Protection, Kootenay Region. The in situ testing was carried out by Don McKinley of Agra Earth and Environmental, in the presence of John Balfour, P.Eng. of EBA Engineering Consultants and of Fernand Beulac of KPA Engineering, and the required posting at the test hole locations was done as directed by MELP. In November 1995, Fernand Beulac of KPA Engineering submitted a Liquid Waste and Solid Waste Management Plan (included as Appendix 3-S) which outlined the servicing plans for the 1995 Master Plan in support of the Waste Management Act application and in response to the questions of the EA Project Committee.
- In March 1996, Fernand Beulac reported to Pheidias Project Management Corporation that Gary Lawrence of MELP indicated that the Waste Management Act application would not be processed prior to an Environmental Certificate by the EA Office, and additional detailed engineering work in this direction was suspended. The KPA Engineering's Liquid Waste and Solid Waste Management Plan remains a valid description of engineering design options that satisfy the questions of the EA Project Committee, outlined in the Project Specifications, although the current Master Plan is for a resort reduced in size and locations (reduced in size because the number of bed units and of commercial activities has been reduced, and reduced in locations because the forward development of the Glacier Lodge hotel complex at the base

of Glacier Dome has been eliminated). The preferred option for sewage treatment has also been changed to a tertiary treatment facility by Ecofluid, similar to the one described as an example in the LWMP (Appendix 3-N) and in Volume 5, Section 5.4.2.4 of the Master Plan.

Since the initial application for a Waste Management Permit, the permitting process has been replaced by the requirement for an operational certificate under the Municipal Sewage Regulation. An Environmental Impact Study of the wastewater treatment system for JGR will be completed in compliance with the new process.

Stormwater/Snowmelt Runoff

Stormwater Volume Management

In general, JGR will manage stormwater at the resort as follows:

- Stormwater and snowmelt runoff from the uphill ski areas will occur primarily as overland sheet flow and concentrated flow in numerous channels and small creeks criss-crossing the development site. This run-off will be intercepted by cut-off ditches on the uphill side of the development and routed around into the closest receiving streams. In open areas outside of the development, the run-off will be intercepted by roadside ditches and pass through culverts under the roads.
- The concentrated base area of development near the central resort area will be serviced with piped storm drains. Where possible, the discharge from ditches and storm drains will be routed through the system of natural and man-made features downstream of the development site.
- Efforts will be made to maintain existing hydrological patterns at the site by reducing the amount of diversions. Drainage areas will remain unchanged. Although local diversions near the base facilities will be provided to reduce the risk of erosion and water quality problems, overall run-off patterns will be maintained.
- Appendix 3-N *Liquid Waste Management Plan (LWMP)* provides further details on stormwater management, which is based on the principles stated in *Stormwater Planning: A Guidebook for British Columbia* (Stephens et al. 2002).

Stormwater Quality Management

In the past it had often been assumed that stormwater is uncontaminated, and therefore discharged to the nearest watercourse without further concern. In recent years, however, it has been recognized that direct discharge of stormwater can have detrimental effects, on the receiving water, caused by the quality of the runoff, as well as the rate of discharge.

The potential for significant input of pollutants from urban runoff to the receiving water is now generally recognized. The runoff becomes contaminated through contact with street litter, eroded swales, de-icing chemicals, animal droppings, traffic residues, fertilizers, biocides, atmospheric dust fall and other substances. Major pollutants of street runoff have been found to be in the form of suspended settleable solids along with organic matter, nutrients, coliform bacteria, heavy metals, and pesticides.

In anticipation of provincial regulations JGR proposes the use of commonly accepted practices that can be found in a number of jurisdictions across North America. The practices will include a

series of BMP's being distinguished or categorized as follows:

- Source control BMP's involving street sweeping, catchbasin cleaning and animal litter removal;
- Lot-level BMP's involving reduced lot grading, use of soak-away pits for roof leader and weeping tile discharge;
- Conveyance system BMP's using pervious pipe and catchbasin systems plus grassed swales; and
- End-of-pipe BMP's using pond and wetland systems, infiltration and filtration systems plus oil/grit separators.

A review of the guidelines and practices recommended by other regulatory agencies and jurisdictions was undertaken. Information from the Department of Fisheries and Oceans (DFO, 1993), Environmental Protection Division of the Province of British Columbia (EPD, 1992), plus further information from the Metropolitan Washington Council of Governments (Schueler, 1987) and (Schueler, 1995) and (MWCOCG, 1995) was obtained and reviewed.

To limit the water quality degradation, water quality objectives would become a part of the design criteria for any additional stormwater discharges. It is these concerns that predicate the use of treatment systems to provide improvement in the quality of stormwater runoff.

JGR will implement BMP's with demonstrated effectiveness and longevity including wet ponds, extended detention (enhanced dry pond) systems, stormwater wetlands, multiple pond systems, and grassed swales. All of these systems are designed to remove sediment from stormwater runoff. The proposed infrastructure will reduce the potential for significant adverse impacts from non-point source discharges through implementation of stormwater BMP's that meet the current guidelines and regulations of the Province of British Columbia. It is economically and technically feasible to construct the proposed facilities.

Erosion and Sediment Control

The use of appropriate sediment control designs and facilities can minimize and potentially eliminate the environmental impacts resulting from the resort development. The formulation and implementation of an Erosion and Sediment Control Plan by JGR will include appropriate designs, contractor education, operational reviews and an adaptive approach to modify any components that are not providing the protection required to prevent adverse environmental impacts.

The sediment and erosion control plan will be based on an adaptive methodology that can be employed in developing the detailed design and construction techniques that will be utilized. Implementation of the Erosion and Sediment Control Plan will include the following ten elements, which represent a comprehensive and integrated approach for achieving stream protection during construction:

- minimize needless clearing and grading;
- protect waterways and stabilize drainage ways;
- phase construction to limit soil exposure;
- stabilize exposed soils immediately;

- protect steep slopes and cuts;
- install perimeter controls to filter sediments;
- employ advanced sediment settling controls;
- ensure contractors are trained;
- adjust the plan at the construction site; and
- practice adaptive management.

Erosion Control Technologies

JGR will employ commonly accepted erosion control technologies on a site-specific basis. These technologies include:

- Silt fencing
- Rock check dams
- Soil covers (e.g., matting)
- Hay bales

Portions of the resort may include a piped drainage system. This will be most common in the built-up areas where the impervious surface areas are greatest. In these areas the construction management of erosion and sediment control will require additional techniques and facilities. Inlets into the pipe system can be temporarily modified to limit the sediment entering the pipe system through the use of inlet installations. The treatment of runoff conveyed by the pipe system will be required, as the pipes do not provide sediment removal in the same way as grass lined channels. The *Land Development Guidelines* (DFO 1992) provide the basis for designing the end of pipe sediment basins.

In the limited areas where clearing for ski runs and lifts will be required, JGR will also consider incorporating the following specific recommendations for ski slopes from *Ski Area BMPs* (Sibbersen *et al.* 2001):

- All improvements on one part of the mountain should be completed before work begins on other parts of the ski area.
- Construction should be planned such that any slope started can be finished during one summer construction season and the area reclaimed permanently before winter snows cover the ground.
- A contingency plan for erosion control is necessary to address any possibility that finishing a run could be delayed by an early snowfall.
- Cross slope water bars should be the first choice for the control of hill slope runoff and erosion.
- On steeper slopes, frequent small waterbars work better than a few large ones.
- Waterbars should extend well off bare slopes into adjacent vegetation.
- Waterbars must be inspected and repaired during spring snowmelt and cleaned of sediment following large rainstorms.
- The most effective method of treating fine sediments is to disperse runoff through a thick

screen of live natural vegetation. Effluent from waterbars, silt fences and detention basins should be passed through a wide vegetation buffer strip before discharge into surface waters.

- Water discharged into buffer strips should be kept dispersed to maximize filtering and infiltration.
- Re-entry into previously disturbed areas with new construction should be delayed until vegetation has completely recovered.

Further information on erosion and sediment control is presented in Section 2.0 of Appendix 3-C Environmental Management Plans.

Domestic Effluent

The entire resort will be connected to a tertiary treatment plant. A sanitary sewer collection system will service the hotel, condominium, commercial, townhouse and single-family chalet areas of the resort. Wastewater from the Teahouse and other on-mountain facilities initially will be transported by snowcat or other mobile equipment to the treatment plant. Eventually, this means of transport will be replaced with a gravity piped system.

Biosolids

The treatment process will involve separating the solid fraction from the liquid fraction. The solid fraction will be concentrated to an estimated 4-6% of its initial volume, resulting in relatively low costs for trucking the sludge away for disposal.

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2. Options for wastewater collection, treatment and disposal:

The above noted Liquid Waste and Solid Waste Management plan prepared by Fernand Beaulac, P.Eng. of KPA Engineering in 1995 (Appendix 3-S) and presented in public meetings in 1995 already responded to the questions about wastewater collection, treatment and disposal. Fernand Beaulac outlined these matters in a letter published by the local paper, the Valley Echo, on October 25, 1995. The letter was published on November 8, 1995 (Appendix 3-R).

The updated *Liquid Waste Management Plan (LWMP)* included in Appendix 3-N outlines the current preferred option for the treatment plant and options for wastewater collection, treatment and disposal. The preferred option is also discussed in the Master Plan in Volume 5, Section 5.4.2.4. There is no doubt that any of the possible treatment plants approvable under the Waste Management Act in the earlier approval process and currently permissible under the Municipal Sewer Regulation registration and monitoring process would be capable of successful operation at build out, **as we are dealing with best management practices and proven technologies.** The plan reflected in the current Master Plan, LWMP and attached preliminary drawings, summarizing the contributions of McElhanney Consulting civil engineers and of Golder Associates geotechnical engineers over the last few years, indicate the preferred option.

The details of wastewater treatment and disposal will be finalized during detailed project design and assessed as part of the Environmental Impact Study required under the Municipal Sewage Regulation.

Summary

Wastewater Treatment Options Evaluated

The options considered for wastewater treatment and disposal are focused on ground disposal. Wastewater from JGR will not be discharged into Jumbo Creek.

The possibility of using an onsite sewage disposal system for each individual lot, or communal systems servicing one or more groups of lots was considered as an interim measure for the initial phase of the project. Single-family chalets may be developed initially on lots of sufficient size and in locations with suitable ground to permit septic field installations. Apart from single-family chalets initially using on-site sewage disposal, the rest of the resort would be connected to the tertiary sewer treatment plant. Gradually, the entire resort would be connected to the tertiary sewage treatment plant. This option was rejected in favour of immediately connecting all of the development, except the isolated Teahouse and Daylodges, to the wastewater treatment plant.

Preferred Wastewater Treatment Option

The entire resort will be connected to a tertiary treatment plant. The sewage treatment plant will be constructed pursuant to a design/build proposal from the wastewater industry. A possible option at this time is a sewage treatment system similar to one from Ecofluid, which has recently been constructed at the Kicking Horse Mountain Resort in Golden, BC. The system in Golden uses an Upflow Sludge Blanket Filtration process. A detailed description of this system is provided in the LWMP.

The sewage treatment plant will be built in stages to keep up with the progress of the resort development.

Wastewater Flow and Phasing

As described in the LWMP and Volume 5: Infrastructure, of the Master Plan, projected wastewater flow from the resort base is expected to average up to 80 m³/day in the initial development phase.

During the second phase, wastewater flows are estimated at an average flow of 100 m³/day and a peak flow of 225 m³/day. At maximum built out the average flow would be about 542 m³/day, with a peak flow of about 1,084 m³/day on a high season day. Depending on the number of visitors, the Teahouse/Restaurant is expected to produce 10 m³/day of wastewater during the initial phase. This discharge may double on a peak day at the completion of the resort. Preliminary Daylodge locations in the Commander and Farnham drainages are expected to generate similar wastewater volumes.

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3. The *Liquid Waste Management Plan* (Appendix 3-N) pre-design information summarized above indicates that treated wastewater can be discharged in a variety of environmentally safe ways, but particularly into appropriate soils below the resort and upstream of the road on the north side of the drainage, following additional tests to confirm the likely locations recommended after the previous tests and review of the valley geology. The engineering reports noted above and also summarized in the LWMP and Master Plan, and the additional Golder reports and disposal sites drawing contained in Appendix 3-I make clear that available technology ensures that treated wastewater can be discharged into the receiving environment without significant impact. Soil

Part D: Environmental, Resource Management and Technical Issues

reports and tertiary treatment technology give confidence that a successful treatment plant is feasible and that ground can be found where the discharge can be properly absorbed so that impact on water quality, fish and fish habitat in Jumbo Creek will not be significant.

The proposed effluent quality is as follows:

- BOD₅ < 10 mg/L
- Total suspended solids (TSS) < 10 mg/L
- Ammonia < 1 mg/L
- Phosphorus (total) < 1 mg/L.

The treatment process will involve separating the solid fraction from the liquid fraction. The solid fraction will be concentrated to an estimated 4-6% of its initial volume, resulting in relatively low costs for trucking the sludge away. The level of treatment for the liquid fraction is determined by the effluent criteria required in the MSR.

Ultraviolet light will be used for disinfection to avoid potential toxicity issues associated with chlorine. Ultraviolet light is the method of disinfection recommended in the MSR.

Regarding the risk of indirect effects on Jumbo Creek via groundwater seepage the conceptual proposed system ensures that there will be sufficient remoteness and natural ground filtration to avoid potential effects, because the treated water will drain by way of tight line pipe to an approved outfall and drainage field according to the Ministry of Water, Land and Air Protection application requirements based on the recommendations of the Environmental Impact Study required as part of the permitting process. Golder reports on in-ground disposal of treated effluent as follows:

[...] current assessment and review of the previous reports indicates that suitable, permeable granular soils are present along and at least locally upslope of the proposed access road. It is Golder's opinion that in-ground disposal of the tertiary treated wastewater can be achieved using either or a combination of conventional tile fields or deeper "rock pit" infiltration chambers, with the selection of the disposal method depending upon local subsoil and groundwater conditions, as well as topography.

Since there is a generally consistent downslope gradient along the Jumbo Valley below the proposed resort and treatment plant, it is considered feasible and practical, if desired or needed, to spread the in-ground disposal sites over a significant distance to the south and east along the valley. Further, the location of the discharge line and disposal sites along or parallel to the road will provide ready access for inspection and maintenance, if required.

The use of in-ground disposal of the sewage discharge from the resort after tertiary treatment will also result in return to the groundwater regime of an equivalent volume to that obtained from the water supply wells, which are to be located a short distance upstream of the resort site. As such, it is Golder's opinion that there will be no significant

or detrimental impact on the groundwater conditions within the Jumbo Valley. Equally, there will be no impact on the surface water conditions.²

The above information is reproduced in Section 1.4 of the LWMP (Appendix 3-N). The original Golder reports and mapping are included both as an appendix to the LWMP and as a stand-alone appendix to this Project Report (Appendix 3-I).

The proposed system surpasses the features included in the treatment of wastewater of most resorts and towns in the Province. Further discussion of this point and of any ancillary NPS issues is also included in the LWMP. It should be clarified, however, that by definition any possible groundwater seepage from the conceptual proposed wastewater treatment system is not a NPS issue, but rather a direct point-source (from the wastewater treatment system) issue scrutinized by the permitting process.

In conclusion, wastewater from the resort will not be discharged into Jumbo Creek; and the conceptual design explained above and in the Master Plan and the Appendixes indicates that potential impacts on water quality, fish and fish habitat are not expected to be significant. In addition, the potential for indirect effects on Jumbo Creek via groundwater seepage are also expected to be minimal and will be assessed again and verified as part of the Environmental Impact Study of the wastewater treatment system.

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4. Assurance that there is adequate suitable land available for ground disposal of treated wastewater is based on currently available information and will be proven with soil testing as part of the detailed design and for the required EIS as part of the MSR application.

Additional soil testing showing at least one location (Site 3 of original tests reported in the 1993 Golder Associates report) capable of receiving treated wastewater at least for the initial phase and with only secondary treatment, adequate for a Waste Management Act permit, was completed in September 1995. The Project Committee confirmed that no additional soil testing was necessary after that, and the three engineering companies involved, Golder Associates, KPA Engineering and EBA Engineering Consultants agreed that there is adequate space in the valley and there are geotechnical indications in the Jumbo Creek drainage to allow to anticipate that the project can be designed with the expectation to find with appropriate soil testing an adequate area with appropriate percolation for the required in-ground disposal of the effluent for the entire project (probably north of Site 4, or at Site 5 and below, of the Preliminary Hydrogeological Assessment for In-Ground Wastewater Disposal report of September 1993, by Golder Associates). The EA Office confirmed that the detailed engineering required to complete a Waste Management Act application and permit was not necessary for the purposes of the EA Act assessment, it being understood at the time that such permit would be necessary for the project to proceed. Under the current certification process, the detailed engineering (including any necessary soil testing) will be completed as part of the Environmental Impact Study. The Project Specifications do not require

²Golder Associates, Geotechnical and Hydrogeological Review and Summary, Jumbo Glacier Resort, Section 2.2, Dec. 10, 2003 (included in Appendix 3-I of this Project Report)

any additional soil testing.

The sewage treatment plant will be built in stages to keep up with the progress of the resort development. The treated water will drain by way of pipe to an approved outfall and drainage field according to the Ministry of Water, Land and Air Protection application requirements based on the recommendations of the Environmental Impact Study that will be prepared and filed as required with the registration process under the Municipal Sewage Regulation. As explained at the point above it is not planned for wastewater to be discharged into Jumbo Creek.

Following detailed design and prior to the above noted registration process under the Municipal Sewage Regulation, test holes will be carried out in the areas suggested by Golder Associates based on their earlier reports and examination of the valley below the resort area and above the road alignment. The purpose will be to confirm the area for the dispersal in the ground of the wastewater without the need to pump upstream in the areas between the resort and the Glacier Dome base that were identified earlier as suitable. **It should be highlighted that what is intended is not ground disposal of sewage, but the dispersal of the treated water derived from the tertiary treatment plant.** Areas of suitable percolation and size are not expected to be exceedingly difficult to find because of the geotechnical characteristics of the valley, a U shaped valley with large sedimentary deposits, and of the particular type of sedimentation that has been noted on the part of the drainage that is east and north of the road alignment. A further advantage of the chosen location is that the road itself represents an additional drainage protection relative to the position of the stream of Jumbo Creek. A recent meeting and report by Golder Associates, and the review of the years of past studies and field reconnaissance trips, confirm that this plan is geotechnically as sound as it can be prior to confirmation with final testing on site. **The size and shape of the valley confirm that the only question to be addressed by the soil tests that will accompany detailed design will not be whether there is a suitable area for the safe disposal of the treated water (water that is chemically reputed to be near potable water quality), but only how close it can be to minimize the length of the tight line.** The recent and specific hydrogeological/geotechnical report by Golder Associates on this subject, based on their numerous studies of the valley, has been added in Appendix 3-I. The Proponent is planning to do also an "in situ" algal assay as part of the submission for the Municipal Sewage Regulation application process in order to have initial conditions reporting to compare with future plant operating conditions.

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5. The in ground disposal of treated wastewater is the preferred disposal option. The LWMP described in Appendix 3-N indicates also that a tertiary treatment plant is the preferred option. The hydrogeological / geotechnical studies conducted by Golder Associates, and EBA Engineering and reviewed by KPA Engineering and by McElhanney Engineering with additional site inspections in the following years indicate that the Jumbo Creek drainage should not present significant or unusual problems locating areas of sufficient size for the in-ground disposal of the treated water of the tertiary treatment plant. Appropriate new site specific percolation tests will be provided with the Environmental Impact Study. The areas where the in-ground discharge is anticipated in the pre-design stage are outlined in the drawings included in Appendices to the LWMP (Appendix 3-N) and in Appendix 5-D of Volume 5 of the Master Plan.

The earlier Liquid Waste Management Plan described in the KPA Engineering report of 1995 (Appendix 3-S) and the current Liquid Waste Management Plan (Appendix 3-N) clearly indicate that proven technology exists and that it will be selected to ensure that treated wastewater will be

discharged into the receiving environment without significant impact. In particular, the Ecofluid treatment plant described in Volume 5, Section 5.4.2.3 of the Master Plan and the LWMP represents approved, permitted and tested technology. The Jumbo Creek valley has a large undeveloped area surrounding the proposed development site with hydrogeological potential for successful testing for the discharge in the ground of treated wastewater and for certification under the Municipal Sewage Regulation. Information on hydrogeological and geotechnical studies by Golder Associates is also available in Appendix 3-I.

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6. Wastewater will not be discharged into Jumbo Creek.

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7. The conceptual description of the methods intended for NPS waste discharge control, addressing the collection, treatment and disposal of stormwater/ snowmelt originating from all parts of the project, and covering the period from initial construction to operations at full build out is described as part of the LWMP (Appendix 3-N) and in the Master Plan Volume 5: Infrastructure at 5.3.7.5, and at 5.5, 5.5.1 and 5.5.2. The commitment to submit the NPS waste discharge control plan with site specific details for approval by the appropriate Ministry and implementation before any construction begins is typically made as part of the Master Development Agreement between the Proponent and the Province.

See also Project Report Specification D.1(B) #1 above and Appendix 3-C Environmental Management Plans.

Jumbo Glacier Resort will commit to developing and submitting a NPS waste discharge control plan with site-specific details for approval by MWLAP and implementation before any aspect of construction begins, if the project is approved under the EA Act.

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8. The environmental implications of NPS discharges to water bodies associated with road upgrading and transmission line construction are addressed at the pre-design stage in the LWMP (Appendix 3-N) and the Environmental Management Plans (Appendix 3-C). They will be addressed again as part of the overall environmental assessment of the road upgrading plans at the detailed design stage, following the preliminary concepts outlined in the Route Study (Appendix 5-A of Volume 5 of the Master Plan). Current provincial and federal policies cover the requirements to be followed in this regard, which are conditions for road work permits. Additional information is provided in response to the questions at D.3.(A).

Conceptually the road upgrading and the transmission line construction will mitigate NPS discharges to water bodies as follows:

- The road upgrading will create a drainage system based on the concepts outlined in this report, particularly in Appendix 3-N and in Appendix 3-C, and BMP engineering design practice. Existing natural drainage channels will be crossed using conduits of appropriate size and configuration for the flows. Overland drainage will be intercepted by roadside bio-filtration ditches and directed to natural drainage channels or allowed to continue down slope through cross culverts. Cross culverts will be provided as required or every 400 meters, whichever is

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less. On steep slopes, cross culvert spacing may be reduced to 200 meters.

- The transmission line will consist of single poles spaced to carry three conductors, and possibly a telephone line, along the road side. During construction precautions will be taken to prevent sediments from entering the natural drainage system. Construction precautions are explained in Section 2.2 of Appendix 3-C. It is not expected that its construction and maintenance will be capable of causing significant environmental impacts or NPS discharges.

See also the response to Project Report Specification D.1(B) #1 above.

D.1(C) Special Wastes and Fuel Storage Sites

EA Issues Profile

Topic

Management of special wastes and fuel storage at resort.

Issues

- Identification of special wastes to be generated/stored at resort.
- Collection, storage, treatment and disposal plans.
- Contingency plans for spills at resort and along access road.
- Amounts and types of fuel to be stored.
- Location and design of storage facilities.
- Contingency plans for spills at resort and along access road.

Relevant Project Components

- Special waste disposal for all on-site components, including on-site disposal (and if necessary, off-site transportation and disposal).
- Access road.
- All forms of on-site fuel storage (and, if planned, any off-site fuel storage associated with the transportation of people or goods).

Lead Agency

Ministry of Environment, Lands and Parks (MELP) - BC Environment and Lands.

Relevant Public Comments on Application and Draft Specifications

- Should identify location, exposure of fuel storage sites, and plans for controls and spill containment.

Relevant Public Advisory Committee Comments on Draft Specifications

- Re. section D.1(C) of draft specs – add spec. which requires study and report on liquid waste and human waste disposal in day lodges.
- Re. section D.1(C) of draft specs – add spec. which requires an analysis of impact of cold temperatures on waste water treatment.
- Re. section D.1(C) of draft specs – add spec. which requires identification of helicopter fuel caches associated with resort operation.

Relevant Proponent Comments on Draft Specifications and Specifications Feedback

- Re. draft specs, section D.1(C) - What would be transported that would be dangerous. Specs imply a danger which does not reflect project. Should be specific about which special wastes are relevant to resort. Other than waste oil, what would there be?
- Re. draft specs, section D.1(D) – require much more detailed project plan to meet specs, should be post-EA matter. Reference to non-EA issues is creating public impression that problem exists, when solutions are routine.

Related Issues and Relevant Specifications

- Re. other waste disposal issues, see other parts of section D.1.
- In particular, re. related water quality issues, see section D.1(D)
- Re. general emergency response planning issues, see section E.7(I).
- For federal requirements, see also section H.3 (Environmental Effects of Accidents and Malfunctions).

Additional EA Reporting Requirements?

Yes – see section D.1(C), which now includes fuel storage issues from draft section D.1(D) –*Fuel Storage Sites*; draft specs. refocused to seek commitment to provide post-EA reporting.

EA Review Focus

MELP wishes to be in a position to ensure safe storage, handling and

transportation of special wastes and fuels, and minimised risk of releasing fuels into the environment. Not all aspects of these issues are addressed through permitting processes.

Review of Application

An important topic which was not addressed in the proponent's application is the issue management of special wastes and fuel storage, either with respect to on-site generation and disposal of such special wastes, or on-site or off-site fuel storage, or their off-site transportation of special wastes and fuels.

Definition of Special Waste

MELP wishes to be in a position to ensure safe storage, handling and transportation of special wastes, and a minimised risk of releasing special wastes into the environment. There is no expected permitting associated with this issue.

Under the *Special Waste Regulation*, enacted pursuant to the *Waste Management Act*, "special waste" is defined as:

“(a) dangerous goods that are no longer being used for their original purpose, including those that are

(i) recycled, treated or disposed of, or

(ii) intended for recycle, treatment or disposal, or

(iii) in storage or transit before recycle, treatment or disposal,

(b) PCB wastes,

(c) wastes containing dioxins,

(d) waste oil,

(e) waste asbestos,

(f) waste pest control product containers and wastes containing pest control products, including wastes produced in the production of treated wood products using pest control products,

(g) leachable toxic wastes,

(h) waste containing tetrachloroethylene, and

(i) waste containing polycyclic aromatic hydrocarbon...”

This definition does not include household refuse which is collected from residential premises or domestic sewage. In addition, other exclusions from the definition of "special waste" are identified in the *Special Waste Regulation*.

For any significant development project, MELP is anxious to minimise introduction of special wastes into the receiving environment. Preventing this is

primarily the responsibility of the proponent. However, if, despite best efforts, a spill does occur, the spill must be reported in accordance with the *Spill Reporting Regulation*. Extensive information concerning special wastes is available to the proponent from MELP.

In summary, the applicable legislation is as follows:

- the Waste Management Act;
- the *Special Waste Regulation*;
- the Special Waste Legislation Guide; and
- the Spill Reporting Regulation.

Fuel Storage

Any on-site storage of fuel must be undertaken within an impervious bermed area with a minimum capacity of 110% of the volume stored on-site. With respect to fuel storage, MELP (Pollution Prevention & Remediation Program), as a matter of policy, refers clients to the Canadian Council of Ministers of the Environment (CCME) document entitled *Environmental Code of Practice for Aboveground Storage Tank Systems Containing Petroleum Products* for further technical guidance.

MELP will require the submission of a site plan and specifications prior to the construction and installation of any fuel storage facilities, including dispensing works.

Project Report Specifications – D.1(C)

In the project report, the proponent must make a commitment to prepare and submit detailed information to MELP (PPRP) for approval with respect to the matters itemised in specifications #1 to #3, below. The information must be submitted after issuance of a project approval certificate under the *EA Act* (should one be granted to the project) and prior to any site development/construction activity being undertaken.

1. Identification of any special wastes which may be generated at the proposed resort project. Plans for their collection, treatment and disposal, as well as spill contingency plans, must be presented at that time. Similarly, spill contingency plans must be prepared for any special wastes which are likely to be transported from the resort, and the plans must identify the means of transportation.

2. Identification of:

- the amounts and types of fuels and other dangerous goods, such as bulk oils, antifreeze, solvents, etc., to be stored on-site;
- the location of all proposed fuel storage sites; and
- conceptual plans for the storage of all fuels, including identification of any off-site fuel

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storage facilities associated with transportation to and from the resort;

3. Identification of spill contingency plans for all storage facilities on and off the site, including provision to respond effectively to transportation-related spills.

The project committee has combined section D.1(D) on fuel storage sites from the draft specifications with section D.1(C), which also deals with special wastes.

RESPONSE – D.1(C)

The Proponent is prepared to make the required commitment and to prepare the detailed information as requested and itemized in specifications #1 to #3 above prior to any site development/ construction activity to be undertaken. An initial *Spill Contingency Plan* is outlined in Section 11.0 of the Environmental Management Plans included in Appendix 3-C of this report. The Proponent comments, however, that there may be a misunderstanding regarding the type and size of operation proposed, as other resorts are dealing daily with these matters without incidents.

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1. Special wastes that may be generated at the Jumbo Resort include:

- concrete;
- paints and sealants;
- fuels and oils;
- explosives for use during construction of the resort and for avalanche control;
- cleaning products; and
- pesticides and fertilizers for use at the resort base area.

A more detailed list will be provided during the detailed design phase of the project. Special wastes and hazardous materials will be itemized in the resort's Contingency Plan.

Prior to the start of site development work, JGR will prepare a Spill Prevention Plan for the construction phase and a general Spill Contingency Plan for approval by the Regional Waste Manager. An overall Contingency Plan for accidents, malfunctions and other emergencies during operation of project will be drafted at the detailed design phase of the project. The plan will be consistent with the requirements of Canada Standards Association Standard Practice CAN/CSA-Z731-M91: Emergency Planning for Industry. The plan will target environmental risks from accidents/malfunctions the following project activities/facilities:

- transport of goods;
- wastewater treatment plant operation;
- chemical product storage;
- waste storage; and
- pollution control devices.

The Contingency Plan will be prepared according to the following standards for emergency planning:

- Canada's National Standard titled, *Emergency Planning for Industry* (CAN/CSA-Z73 I -M91), and
- the international Incident Command System (ICS) as *per* the standard for site (Command Post) level of the BC Emergency Response Management System.

The table of contents for the Spill Contingency Plan as recommended in the *BC Guidelines for Industry Emergency Response Plans* will be as follows:

1. Policy Statement
2. Purpose and Scope
3. Pre-Emergency Planning
 - 3.1 Hazard Identification
 - 3.2 Risk Analysis
 - 3.3 Legislation and Industry Standards
 - 3.4 Emergency Organization and Responsibilities
 - 3.5 Resources
 - 3.6 Internal Alerting
 - 3.7 External Alerting
 - 3.8 Communications
 - 3.9 Public Affairs
4. Emergency Response
 - 4.1 Response Action Decision
 - 4.2 Plan Activation and Response Mobilization
 - 4.3 Response Action/Containment/Cleanup
 - 4.4 Emergency Operations Centre
 - 4.5 Evacuation
 - 4.6 Disposal of Spilled Contaminants and Debris
 - 4.7 Site Restoration and Remediation
 - 4.8 Post-Incident Evaluation
5. Training and Practice
 - 5.1 Training
 - 5.2 Practice Drills
6. Plan Evaluation
7. Plan Updates

The overall Spill Contingency Plan will include both Spill Prevention Plans and Spill Response Plans.

Jumbo Glacier Resort will also pursue endorsement of the *Partnerships Towards Safer Communities* by the Canadian Association of Fire Chiefs. This is designed to foster close working relationships between industry and local communities to define risk, to mitigate impacts, and to understand response roles and capabilities.

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2. See response to Specification D.1(C) #1, above.

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3. As indicated at #1 above, prior to the start of site development work, JGR will prepare a Spill Prevention Plan for the construction phase and a general Spill Contingency Plan for approval by the Regional Waste Manager. An overall Contingency Plan for accidents, malfunctions and other emergencies during operation of the resort will be drafted at the detailed design phase of the project.

Transportation-Related Spills

The main hazards to the environment related to the transport of the above substances to and from the resort by road are:

- Chemical Spill/Release
- Fire
- Explosion

Mitigation Measures

Accidental Release/Spill

Spill prevention will be the primary mechanism of mitigating potential spills of chemicals during transport to and from the resort. Spill prevention measures include:

- use of certified disposal and transportation services;
- proper labeling of materials;
- inspection of containers prior to and after transport; and
- selection of safest means of transport and routing.

In BC, details for transporting special wastes are prescribed in the *BC Waste Management Act* and the associated *Special Waste Regulation* as well as in the *Transportation of Dangerous Goods Act* and Regulations.

The shipper(s) will ensure that each container of dangerous goods has the required safety marks. Containers will be labeled with the following information:

- diamond shaped hazard symbol (includes primary classification);
- shipping name and PIN;
- label for the subsidiary classification without the class number (if applicable); and
- if it is a liquid – an orientation label is required.

A waste manifest will be prepared for:

- waste paint > 205 L;
- waste oil >205 L;
- hazardous liquids > 5 L; and,

- hazardous solid waste > 5kg (except for batteries).

Spill kits will be kept and maintained on vehicles transporting hazardous goods.

In the event of a spill, the general response procedures provided in Table 10 of the *Spill Contingency Plan* included in Section 11.0 of the Environmental Management Plans (see Appendix 3-C), will be implemented.

Fire and/or Explosion

In the event of a fire and/or explosion of a vehicle transporting materials to and from the resort, the discoverer of the fire will contact relevant emergency agencies.

D.1(D) Water Quality Issues

EA Issues Profile

Topic

Water quality implications of resort development.

Issues

- Management of runoff, erosion and sedimentation from disturbed areas, including proposed mitigation measures.
- Design of baseline water quality monitoring program.
- Collection and analysis of additional baseline water quality information.
- Potential impacts of construction/operation of on-site and off-site facilities on surface water and groundwater, potability of water, fish and fish habitat.
- Nutrient release issues.

Relevant Project Components

- All on-site facilities.
- Off-site physical infrastructure in Toby/Jumbo Creek drainages.

Lead Agency

Ministry of Environment, Lands and Parks (MELP) – Pollution Prevention and Remediation Program.

Comments also Received From

- Ministry of Health (MoH).
- District of Invermere
- Fisheries and Oceans Canada (DFO)

Relevant Public Comments on Application and Draft Specifications

- If salt is used on glaciers at rate of 5 to 10 tonnes per day, how will this affect water quality? (5i) Need to address potential salt impacts.
- What effect would waste and sewage disposal have on surrounding watersheds? (6i).
- Salt issue is 'red herring' – not a concern,
- Should consider impacts of potential future project components which are not part of current project proposal (e.g. equestrian facilities).
- Re. draft spec. #3 – how much salt will be used?
- Re. draft spec. #4 – how will glacier grooming measures affect Lake of the Hanging Glacier?
- Re. draft specs #12-#14 – nutrient release potential should be considered for all project facilities, including equestrian and golf facilities.

Relevant Public Advisory Committee Comments on Draft Specifications

- Re. draft spec. #3 - second sentence should be amended to read "...If salt *and/or fertiliser* might be used, the potential use must be described (*including daily quantities*) and the impact..."
- Re. draft spec. #3, special focus should be given to Bull trout and any other endangered species.
- Re. draft spec. #13, add "...potential for nutrient loading *and/or other substances such as herbicides...*"

Relevant Proponent Comments on Draft Specifications and Specifications Feedback

- Re. draft section D.1(F) – in issue profile box, off-site infrastructure reference is too vague – should be clear that only road corridor is intended.
- Quote in 1st paragraph, p. 73, needs to be complemented by recognition that some information was provided in application on minimising erosion,

disturbance.

- Re. draft specs. D.1(F) #2-#14 - They deal with detailed project design concepts which are already addressed in principle in application, and will be further addressed at permitting.
- Re. draft specs. D.1(F) #3, #4, and #12-#14 – lead to unnecessary concern about glacier modification, salt use, blasting, equestrian facilities and golf course impacts which will not occur. Has already clearly committed that these are not part of project.
- Re. draft spec. D.1(F) #5 – obvious, did not need to state – information will be provided.
- Re. draft spec. D.1(F) #6 – one season missed in 1992, so why have to repeat whole year?
- Re. draft spec. D.1(F) #8 – is assay needed now, without confirming disposal method?
- Re. draft spec. D.1(F) #9 – unnecessary to state – will be included in project report.
- Re. draft spec. D.1(F) #10 – where is referenced collection? Spec. unnecessary.
- Re. draft spec. D.1(F) #11 – unnecessary spec.

Related Issues and Relevant Specifications

- Re. land use and related land use planning issues, see section A.7.
- Re. intended glacier grooming techniques, see section C.2.
- Re. management of stormwater runoff and non-point-source water quality contamination at resort, see section D.1(B)
- Re. related fisheries issues, see sections D.3(A) and H.1.
- Re. access road upgrading requirements, see section E.6(C)
- Re. possible federal cumulative water quality effects assessment requirements, see section H.2.

Additional EA Reporting Requirements?

Yes – see below in draft specs; draft specs revised, eliminating further EA field data collection requirements, and also specs related to equestrian facility, golf course, glacier modification and snowmaking.

EA Review Focus

Evaluation

MELP's focus of interest is the potential for impacts on surface and groundwater quality, potability, fish and fish habitat, associated with construction and operation of the project's on-site and off-site facilities. Sedimentation problems could result from ground disturbance related to construction of buildings, sewage and water systems, and access roads. Other potential water quality impacts relate to storm drain discharge and introduction to the environment of nutrients and chemicals from ski run and road maintenance, liquid waste treatment and accidental spills.

Water quality must meet provincial water quality criteria (i.e. the latest edition of MELP's *Approved and Working Criteria for Water Quality*, or the CCME *Water Quality Guidelines*, whichever is most current. - 1995). These criteria identify safe levels of contaminants for the protection of a given water use. In aquatic environments such as Jumbo and Toby Creeks, water quality is deemed to include the physical, chemical and biological quality of water, sediment and biota.

Review of Application/Evaluation

Runoff, Erosion and Sedimentation from Disturbed Surfaces

MELP has advised the project committee of concerns with respect to both the short-term and long-term impacts on fish-bearing streams associated with runoff (spring melt and seasonal storm events), erosion and sedimentation from disturbed surfaces such as roads, trails and construction sites, as well from developments such as the planned resort village and satellite complexes. Access road upgrading, for example, creates a significant risk of with water quality degradation. Page 14 of *Appendix P*, Section 3.2, correctly identifies "...storm water discharges related to sedimentation and erosion..." as a MELP (PPRPBC Environment and Lands) concern. This issue will need to be addressed in the project report.

The seasonal erosion of disturbed areas, and the consequent sedimentation of surface waters, can have has a significant impact on the quantity and quality of fish habitat in a stream environment. Given the level of ground disturbance expected during the construction phase, and later, during the routine operation of roads and trails, the potential for sedimentation of receiving waters, notably in association with annual spring runoff and seasonal storm events, is significant. In addition, problems associated with the collection and discharge of contaminated runoff via infrastructure storm drains, including mitigation programs in the form of stormwater treatment, also need to be addressed.

The project committee's present understanding is that the proponent does not intend to use explosives for glacier grooming, and that use of salt (e.g. for summer skiing) would be, at most, limited. However, if either

procedure is intended, water quality could be affected. MoH has raised with the project committee a possible human health concern with respect to downstream water users and license holders if excessive salt is used. In MELP's view, moderate use of salt would not be expected to affect downstream water quality, although there may be potential for some impact on soils and plant communities located immediately beside and beneath glaciers. In cases where salt use is intended during skiing operations, MELP (BC Environment and Lands) will require advance notice of the salting sites and the salt quantities to be used, and the proponent will require specific prior approval from MELP (BC Environment and Lands). Operational monitoring of effects will also be necessary where salt is used.

In a letter dated January 22, 1998, the proponent clearly stated that neither a golf course nor an equestrian facility are any longer a part of the project proposal. He stated further that there will be no use of salt or fertiliser for purposes of ski run maintenance or glacier grooming, and no blasting on glaciers or snowmaking on ski runs at the resort. On this basis, the relevant December 13, 1996 draft specifications referring to these facilities and activities and related issues have been removed from the finalised project report specifications, since they are not applicable to this proposal.

Collection and Analysis of Baseline Information

The proponent will need to present a synthesis of the water quality samples which have been collected by consultants Norecol, Dames & Moore. MELP had reviewed a suggested environmental work plan in 1992, and this is essentially repeated in the application (*Volume 5, Appendix P, Fisheries, Water Quality, Hydrology and Waste Disposal Environmental Work Programs*, May 1993), with little in the way of new information. The proponent still needs to act upon some advice for further investigations which MELP has provided to it in the past.

Section 3.4.1 of Appendix P (*Water Quality Sampling*) presents an outline of the sampling to be done, but does not discuss the sampling data, or the water quality impacts which might be expected from the project. Photocopies of the analytical reports are presented in appendices. To complete the baseline study, some analysis of this information is needed. MELP (Pollution Prevention and Pesticide Management) staff did provide initial comments on these data in 1993, noting the significance of the data, and suggesting additional work. It is not clear from the application whether or not this work has been undertaken.

The benthic invertebrate data for Jumbo Creek (Appendix B of the May 1993 Norecol, Dames & Moore report, which forms Appendix P of the application) represent new information which is considered sufficient for baseline data purposes. However, there is a need to interpret these data to contribute to the assessment of the potential impacts of the project on the health of aquatic systems.

Water quality baseline information gathered to date is considered adequate to characterise base flow conditions in Jumbo Creek. Should the project receive approval at the conclusion of the EA process, additional sampling will be required prior to construction to characterise sediment production during spring freshet. This information will function as necessary baseline data to help evaluate the effects of the development on sediment production.

In addition, if the project is approved, then as part of the baseline water quality analysis, a sediment metals sample must be collected to confirm the low level of mineralization in the basin, as suggested by water chemistry data. Fine sediments for at least two sites along Jumbo Creek should be tested for total metals (passing a 150 µm sieve).

Project Report Specifications – D.1(D): Runoff, Erosion and Sedimentation from Disturbed Surfaces

1. In the project report, the proponent must summarise baseline water quality conditions and existing stream ecology, and discuss, in general, how these will be protected from point-source and non-point-source contamination, or from any stream channel degradation which may occur at each phase of development, from the beginning of construction to operations at full build-out.

2. In the project report, the proponent must commit to conducting and submitting to MELP the following additional baseline water quality analyses, should the project be granted a project approval certificate under the *EA Act*, and before any site development/construction activity is undertaken:

- additional sampling in Jumbo Creek to characterise sediment production during spring freshet (April 1 to June 30), in order to establish existing sediment levels and to contribute to planning for the control of sediment production from all phases of the development; and
- additional sampling in Jumbo Creek to confirm the low level of mineralisation in the basin, as suggested by the water chemistry data. (Note - Fine bottom sediments for at least two sites along Jumbo Creek should be tested for total metals (passing a 150-µm sieve)).

RESPONSE – D.1(D)

1. Baseline water quality conditions and existing stream ecology has been reported by Norecol Dames, & Moore and by Enkon Environmental Ltd. Discussions of baseline water quality and benthic invertebrate communities may be found in Appendix 3-A Fisheries Resources. This appendix generally addresses protection of water quality from non-point and point source discharges, while details of water quality protection measures are provided in Appendix 3-C Environmental Management Plans. Protection is explained in the Master Plan, both in the Infrastructure Section and in the plan itself (MP 5.5.2.3). The plan is such that runoff, erosion and sedimentation effects will be contained and mitigated in the development area, outside any riparian areas, before any significant impact can reach and damage the existing stream ecology, both during the development stages and at build out. The same considerations are being applied

to any road work for the access road.

Water Quality and Stream Ecology

Baseline water quality and stream ecology are summarized in Section D.3(A) Fisheries Resources. Additional details are provided in Appendix 3-G Fisheries Resources.

Point-Source Contamination

The only point source discharges from the resort development will be stormwater outfalls, which are addressed as part of stormwater/non-point source management. Sanitary sewage will receive tertiary treatment prior to discharge to ground. Thus, there will be no point source discharge of sanitary wastewater. The potential for non-point source discharge of wastewater via a groundwater connection to Jumbo Creek will be assessed in greater detail as part of the Environmental Impact Study required for an operational certificate, but conceptually the fact that there will be full dispersion in the ground upstream of the road drainage system indicates that in addition to the system that will be planned and tested for full in ground discharge there will be a further safety net represented by the area of the road drainage. In addition, following the results of the above noted study, discharge location(s) will be reviewed again to ensure that there is no impact on Jumbo Creek.

Non-Point Source Contamination

The entire project design as proposed contributes to NPS contamination prevention, from garbage collection system to LWMP. The Master Plan concept explains that the drainage, sewage, fuel storage, garbage storage and in general all project systems are planned to maintain the natural environment so that the potential for indirect effects on Jumbo Creek via groundwater seepage is minimized. Protection of water quality from non-point contamination is discussed in Project Specification D.1(B) #7 above and discussed in detail in Appendix 3-C Environmental Management Plans. In general, JGR will develop and implement the following plans to protect water quality:

- Erosion and Sediment Control Plan
- Stormwater Management Plan
- Spill Contingency Plan, which includes Spill Prevention and Spill Response Plans

The subject of prevention of NPS potential contamination is discussed in Appendices 3-C and 3-N.

The baseline monitoring of Jumbo Creek will be used to confirm the effectiveness of the containment facilities provided and to identify any deficiencies and rectification measures necessary.

The subject of prevention of NPS potential contamination is particularly dealt with in Appendix 3-N.

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2. The Proponent is prepared to make the required commitment to conduct and submit to the appropriate Ministry the required water sampling before any site development/construction

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activity, and this commitment may be included in the Master Development Agreement between the Proponent and the Province. The monitoring will be completed and the results submitted to MWLAP before any site development/construction activity is undertaken. The additional baseline monitoring will include the following:

- additional sampling in Jumbo Creek to characterize sediment production during spring freshet (April 1 to June 30); and
- additional sampling in Jumbo Creek to confirm the low level of mineralization in the basin, as suggested by the water chemistry data.

The sampling during freshet will be conducted at two sites on Jumbo Creek: one within the CRA and one immediately downstream of the CRA. These sites were sampled during the 1992-93 baseline monitoring program.

Sampling to confirm the low level of mineralization will entail collecting bottom sediments from depositional areas. The two sampling sites will be located as close to the water column sampling sites as possible. The sediment fraction that passes through a 150 mm sieve will be tested for total metals.

D.1(E) Air Quality Issues

EA Issues Profile

Topic

Air quality implications of resort development.

Issues

- Identification of all sources of waste discharge to air at resort.
- Need for air quality assessment of resort's potential effects on local airshed in Jumbo Creek valley.
- Air quality management measures to maintain local air quality.

Relevant Project Components

- All on-site facilities.
- Off-site physical infrastructure in Toby/Jumbo Creek drainages.

Lead Agency

Ministry of Environment, Lands and Parks (MELP) - Pollution Prevention and Remediation Program.

Comments also Received From

Ministry of Health (MoH).

Relevant Public Comments on Application and Draft Specifications

- Air pollution within Columbia Valley will become intolerable as result of the resort. (12a)
- Burning of fossil fuels for jets, resort operation and road transportation will have detrimental effect on environment. Will proponent address contribution to greenhouse gas emissions? Global warming concerns need to be addressed.
- Government should enforce PM10 levels.
- Re. draft spec #1- should totally ban wood-burning stoves and fire places at resort.

Relevant Proponent Comments on Draft Specifications and Specifications Feedback

- Re. draft section D.1(G) - draft specs. 1# and #2 are unfair, impractical – are not required for other resorts (e.g., Panorama). Can provide some general measures, not detailed design. Do not understand need for hi-vol monitoring.
- Draft specs. do not reflect government policy; there is no generally proven and acceptable method employed to achieve such measurements; and there are no standards of what air quality levels are acceptable.
- Draft specs misleading – Jumbo valley has excellent airflow.
- Re. draft specs, section D.1(E), spec. #4 – can provide air quality management methods, not details. Wood burning fireplaces only in common areas of hotels, few residential units.

Related Issues and Relevant Specifications

- Re. land use and related land use planning issues, see section A.7.
- Re. other waste disposal issues, see other parts of section D.1.

Additional EA Reporting Requirements?

Yes – see below; had been section D.1(G) in draft specs; draft spec. D.1(G) #2, requiring field air quality monitoring, eliminated.

EA Review Focus

MELP does not anticipate significant off-site transport of air pollutants from the project. Any impacts are expected to occur only at the resort, which is located in a steep valley. The emissions that which might be expected to affect PM10 levels include wood burning (heating, clean-up fires), internal combustion engine exhaust and natural gas combustion (heating), none of which require permits under the *Waste Management Act*.

Review of Application/Evaluation

General Review Focus

MELP (PPRPBC Environment and Lands) has advised the project committee that the primary air quality focus with respect to this project should be directed towards the immediate environs of the resort and its residents. The project is located in a steep valley, and air pollutants will accumulate under valley inversions. The application does not address air quality. While it is understood that the primary energy source is intended to be electricity supplied via transmission line, the application did not address lodge and residential unit space heating. If wood stoves or fireplaces are permitted in the buildings or houses, this activity could have a significant impact on local air quality.

At present, MELP is not especially concerned that the ski village would contribute significantly to deteriorating air quality in the Columbia valley. MELP operates a PM10 monitor in Invermere, which has been recording the lowest levels of particulates found in any of the communities monitored in the East Kootenay region, although levels are elevated over rural sites. Most of the smoke detected in Invermere originates in the community itself.

Generally, rural air quality throughout the Rocky Mountain Trench is excellent, with the occasional bad episode, either localised due to open burning, or valley-wide, due to huge sources like forest fires.

Relevance of Ambient Air Quality and Objectives

MELP (PPRPBC Environment and Lands) has set a province-wide Level B ambient air quality objective for PM10 of 50 mg/m³. PM10 is a measurement of inhalable particulate matter in air. Level B defines the “maximum acceptable” concentration of an air quality parameter. In this case, in view of the relatively pristine nature of the air quality within the Jumbo Creek valley, and given that a sizeable population (8,000 or more) may be present at the resort on any given day, MELP recommends that, for the vicinity of the ski resort, consideration should be given by the proponent to a Level A (“maximum desirable”) PM10 objective (this is currently set province-wide at 25 mg/m³). This may prove to be important since, where conditions are conducive to temperature inversions, and particularly where wood-burning stoves are to be used, high

concentrations of particulate matter may occur in the atmosphere. Problems of this nature have been documented at certain ski resorts in the USA, and have been described in:

- Cannon, J.A. 1984. *Air Quality Effects of Residential Wood Combustion*. J. Air Poll. Cont. Assoc. 34:9, 859-897.
- Cooper, J.A. 1980. *Environmental Impact of Residential Wood Combustion Emissions and Its Implications*. J. Air Poll. Cont. Assoc. 30:8, 855-861.

Other reasons for recommending Level A objectives include the following:

- experience of MELP (PPRPBC Environment and Lands) in the East Kootenay region that the more narrow and confined the valley, the poorer the dispersion of emitted pollutants, particularly during winter cold spells when valley inversions can persist for weeks;
- excursions of high PM10 levels work counter to one of the goals of a ski resort, namely to attract people to clean mountain surroundings; and
- recent medical findings that PM10 or fine combustion source particulate (smoke) may significantly impact human health at lower levels than previously thought (see Vedal, P. June 1995. *Health Effects of Inhalable Particles: Implications for British Columbia*. MELP, Air Resources Branch).

In addition, pre-development baseline measurements of air quality are recommended, using a PM10 hi-vol monitor installed at the proposed village site. The proponent is advised to consult with MELP's Air Resources Branch in Victoria to discuss this matter. If wood burning for space heating is a part of the project plan and the project is approved, it is recommended that PM10 monitoring be instituted prior to project construction to determine ambient impacts.

Project Report Specifications – D.1(E)

1. The proponent, in its project report, must demonstrate how local air quality in the Jumbo Creek valley will be protected. Air quality management must be addressed, including conceptual plans to maintain low PM10 levels. Air emissions sources associated with this proposal, and any potential for these emissions (in combination with air emissions from other nearby sources) to lead to air quality conditions which are out of compliance with ambient air quality objectives set by MELP, must be discussed and assessed in the project report.

RESPONSE – D.1(E)

1. The Project Specifications are in error when they state that “a sizeable population (8,000 or more) may be present at the resort on any given day”. The Master Plan concept explains the actual overnight and day visitors may average at **one quarter of the alleged size**. Even the larger 1995 Master Plan would not be expected or planned to generate such “sizeable population”, perhaps half of it at 4,000 people per day on a busy day. In any event the Proponent intends to fully satisfy provincial policies regarding air quality, by controlling the number and type of wood burning appliances and reviewing each year the air quality in the Jumbo Valley and reporting it to the appropriate Ministry.

However, heating will be by propane or electric energy, and there is no plan nor expectation to utilize wood burning appliances for heating. Wood burning will be only in fireplaces which will be installed in a limited number of locations for aesthetic comfort, and except for wood burning appliances, there is no significant source of emissions at the resort or near the resort that can be identified as a potential concern.

Air Quality Management

Appendix 3-C Environmental Management Plans outline a detailed Air Quality Management Plan in Section 10.0. The following provides a point form summary of this plan and the commitments that will be made by Jumbo Glacier Resort.

Heavy Construction Vehicles and Equipment

JGR will ensure that the contractor will implement the following mitigation measures to minimize release of air pollutants from construction-related heavy-duty vehicle and equipment:

- On unpaved roads traffic speeds shall be limited to 20 km/h.
- Equipment producing excessive exhaust pollution, as determined by the Project Manager, shall be repaired or replaced at the Contractor's cost.
- All on-road dump trucks used on the Project shall be model year 1994 or newer.
- All dump trucks will be subject to visual inspection by the Project Manager. Vehicles shall have better than 10% opacity (i.e. 10% or lower). The Project Manager will remove any vehicles deemed to have excessive emissions from the Work Site.
- All off-road dump trucks shall be equipped with a catalyzed particulate trap fitted on the exhaust system. At no time shall any off-road truck be operated without a fully operational catalyzed particulate trap, maintained as recommended by the manufacturer. Catalyzed particulate traps shall remove a minimum of 85% of particulate matter and shall oxidize 90% of unburned hydrocarbons from equipment emissions.
- All off-road dump trucks shall utilize ultra-low sulphur diesel fuel. At a minimum, the fuel must match the catalytic particulate trap manufacturer's and vehicle manufacturer's requirements. Fuel shall have sulphur content less than 50 ppm.

Emissions from Worker Commuter Trips

To decrease emissions of air contaminants resulting from worker commuter trips during

construction, the contractor will:

- Educate workers on air quality issues related to vehicle exhaust;
- Encourage carpooling;
- Explore the use of low-pollution shuttle buses to transport workers to and (if necessary) around the project site during construction.

Open Burning Plan

To minimize potential air quality impacts from open burning, the contractor will implement the following:

- Determine the wind direction and speed for the day of the open burn. The burn may be rescheduled if the wind direction allows smoke to impact environmentally sensitive areas, such as upland nesting habitats.
- To the extent possible, conduct open burning in the spring and early summer. Daytime heating and general windflows help smoke to rise above ridgetops and into the free air winds where it is diluted and dispersed.
- Conduct open burning when the ventilation index³ on the day of the burn is good and the ventilation index on the following day is good or fair.
- Prohibit or restrict open burns at times and places where stagnant weather conditions result in poor smoke dispersion.
- Minimize the amount of dirt in the material being burned to reduce smoldering.
- Prohibit the burning of oils, rubber, tires, pesticide containers, and any other material creating unreasonable amounts of smoke or air pollutants.
- Extinguish open burns completely to ensure that smoldering of material does not persist.
- Notify the RDEK Fire Commissioner' Office about when and where the open burn will occur.
- Closely monitor the open burn to assess smoke dispersal and direction.
- For major burns, conduct a test burn to determine if smoke dispersal will be adequate.
- For major burns, a Burn Plan will be prepared for approval that includes:
 - location, duration and inclusive dates for the planned burn;
 - location of all sensitive features that may be impacted by smoke;
 - weather forecasts and how they will be used to prevent smoke impacts;
 - how weather changes will be monitored and what will be done to reduce or mitigate smoke impacts if unfavorable weather should occur after ignition;
 - coordination with air quality authorities;
 - how public will be informed prior to, during and after burning; and

³ Ventilation Index outlines whether wind and weather conditions are favourable for burning and is prepared using Environment Canada data and approved by a manager or a forest official.

- what will be done to enhance active fire phase and reduce smoldering phase.

Fugitive Dust Control Plan

To minimize potential impacts from fugitive dust, the contractor will implement a Fugitive Dust Control Plan. Elements of this plan will include:

- Use only environmentally acceptable dust suppressants or water as necessary to control dust on access roads, laydown, work and disposal areas. Use water in preference to chemical dust suppressants whenever practical.
- Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary and permanent roads.
- Water any temporary storage soil piles to reduce the potential for fugitive dust.
- Avoid potential dust-generating activities during periods when wind direction may carry dust into environmentally sensitive areas (e.g., riparian zones or nesting areas).
- Implement onsite cement and concrete batching in enclosed areas, with suitable water dowsing and wind shielding.
- Conduct a visual inspection of the site perimeter to check for dust deposition on vegetation, cars and other objects. Take remedial action if necessary.
- Replant vegetation in disturbed areas as quickly as possible.

Wood-Burning Appliances

Any Wood-burning appliances installed at Jumbo Glacier Resort are a potential source of common air contaminants such as particulates and greenhouse gases including CO₂, CH₄ and N₂O. To minimize potential air quality impacts from these emissions, Jumbo Glacier Resort will ensure that all installed wood burning devices will adhere to BC's *Waste Management Act Solid Fuel Burning Domestic Appliance Regulation* that specifies emission, labelling, testing and record keeping requirements for new solid fuel burning devices. This includes stoves, pellet stoves, fireplace inserts and factory built fireplaces that have air-fuel ratios of less than 35 to 1 and minimum burn rates of less than 5 kg/hr but does not include cook stoves, central heating systems, masonry heaters or site-built fireplaces. The regulation also contains specifications for residential pellet fuels.

Jumbo Glacier Resort will employ Best Available Control Technology measures such as:

- Use of new technology wood stoves;
- Ensuring that the stove/fireplace is of proper size for its location and use.
- Ensuring that the stove/fireplace is properly installed and regularly inspected.
- Improvements in wood burning performance (e.g., control of wood moisture content, weatherization of residences);
- Ensuring good draft and proper chimney size (liner).
- Installing a sealed, double-wall flue pipe from the stove to the chimney.
- Use of internal baffles, catalytic converters, and adequate air supply to promote the burning of vaporized unused fuels.

Jumbo Glacier Resort will also explore a public education program to make resort residents and visitors to the resort aware of the potential air quality impacts of improperly operated wood-burning appliances. Among some of the more education points that will be included in this program are:

- Avoid smouldering fires by using proper burning techniques.
- Avoid smouldering, overnight burns.
- Avoid the burning of trash or garbage in a wood-burning stove as these emit toxic fumes when burned.
- Avoid the burning of coal in a wood-burning appliance as coal emits oxides of nitrogen and sulfur along with carbon monoxide.
- In fireplaces, make small hot fires because with these types of fires combustion is more complete and pollution is less.
- Avoid the use of lighter fluids (these are not regulatory, but BACM) or other flammable liquids to start fires.
- Start fires with strips of newspaper and kindling placed loosely on top. As the wood begins to burn, add larger pieces until the fire is stable. Too much fuel will cause the fire to smolder and smoke.
- Remove ashes frequently, leaving a light "bed" to catch the coals. Too many ashes obstruct the flow of oxygen and smother the fire. (Use a metal bucket to remove the hot ashes and store them until cooled).

In addition, Jumbo Glacier Resort will investigate the use of a voluntary and/or mandatory program for curtailment of wood burning during periods of stagnant meteorological conditions. Voluntary curtailment programs have been demonstrated to be effective in reducing peak period PM₁₀ emissions by 16-50% in a variety of instances. Mandatory curtailment programs have reported peak period PM₁₀ reduction rates as high as 90% when combined with a public awareness program and stringent enforcement.

Emissions from Worker, Resident and Visitor Vehicles

To reduce emissions of common air contaminants and greenhouse gases from exhaust emissions from worker, resident and visitor vehicles, Jumbo Glacier Resort will:

- Design the resort to promote the use of walkways and bike paths within the resort and create a pedestrian area for most of the resort;
- Require overnight visitors to leave their cars parked during their stay;
- Promote the use of busses as modes of transportation to and from the resort; and
- Use low-pollution electric shuttle buses to transport visitors around the resort area like at resorts in the Alps, such as Zermatt, Switzerland.

Greenhouse Gas Emissions

To minimize greenhouse gas (GHG) emissions, JGR will implement the following:

- Commit to exploring the feasibility of registering with the Voluntary Challenge and Registration

Program (VCR). The VCR is a non-profit partnership between Industry and governments across Canada, which provides the means for promoting, assessing and recognizing the effectiveness of the voluntary approach in addressing climate change;

- Commit, where applicable, to applying Best Available Technology Environmentally Acceptable (BATEA) methods to reduce greenhouse gas emissions from wood-burning appliances (e.g., by installing low emission wood-burning appliances or natural gas fireplaces in residences);
- Construct energy efficient buildings at the resort to reduce heat loss and decrease heating/energy requirements; and
- Commit to preparing a Greenhouse Gas Action plan that details action items and to implement measures to reduce greenhouse gases at the resort.

Potential Impacts

Emissions from Construction Equipment and Workers Vehicles

At the time of preparation of this report, detailed construction schedules and knowledge of the type, number and duration of heavy equipment operations, which are necessary to accurately quantify construction-related emissions, are unknown. However, any air quality impacts caused by construction equipment emissions would be short-term, occurring only when construction activities are taking place, and would have a local impact on air quality.

Open Burning of Wood and Wood Debris

Land clearing for construction of the resort will result in the removal of timber, vegetation and organic debris from the landscape. Potential impacts to air quality from the disposal of wood, wood residue or debris that is cleared would only occur during disposal by burning. However, disposal by burning would likely to be warranted only in situations where a very high number of trees are cleared in an area with difficult access for removal. This is not expected to be the case at Jumbo Glacier Resort.

Fugitive Dust

Emissions of fugitive dust during construction can be associated with drilling and blasting, land clearing, excavation, earth moving, vehicle movements, material storage and handling. The extent of these impacts would depend on the existing air quality, the size of the affected area and the level of construction and demolition activities associated.

Energy Use

The preferred energy source at JGR is hydroelectric power. As this energy source does not entail burning of fossil fuels, GHG emissions are not expected.

Wood Burning Appliances

Wood burning devices will be installed in the single-family residences at the resort. They will be used primarily for aesthetic effects and secondarily as supplemental heating sources. The combustion of wood in these devices produces atmospheric emissions of CACs and GHGs including CO₂, CH₄ and N₂O. The CACs of most concern are PM₁₀ and CO (Houck and Tieggs 1998). Emissions from wood burning devices may lead to increased localised concentrations of

these contaminants in the airshed.

Emissions of air pollutants were calculated for wood-burning appliances using the following accepted formula:

$$E_{q,p} = [A \times OP] \times EF \times [1 - (CE_p/100)] \quad \text{Equation 1}$$

where:

$E_{q,p}$ = quantity emission rate of pollutant p during the operating period

A = activity rate for the source during period

OP = operating period (per hour or day or month or year)

EF = emission factor (emission of pollutant p per unit of activity rate)

CE = emission control equipment efficiency for pollutant p, %.

Using this equation, estimated resort emissions of PM₁₀ and CO from similar sources in the Kootenay Region amount to only 0.08% and 0.07%, respectively. GHG estimated emissions, when converted to CO₂ equivalents (CO₂E), amount to insignificant percentages of emissions from similar sources in urbanized areas such as the Lower Fraser Valley, for example.

Visitor Traffic

Exhaust emissions from the vehicles commuting to the Jumbo Glacier Resort also will generate air contaminants. Using Equation 1 above, the CAC emissions from vehicle traffic amount to less than 5% of similar sources in the Kootenay Region. GHG emissions estimates, when converted to CO₂ equivalents (CO₂E), amount to only 0.22% of emissions from similar sources in the Lower Fraser Valley (LFV).

Project Greenhouse Gas Emissions

GHG emissions from wood-burning appliances at the resort will only account for 0.32% of corresponding emissions from similar categories in the LFV. Similarly, GHG emissions from visitor vehicles will account for an extremely small proportion of emissions from similar categories in the LFV at 0.22%. Therefore, it appears that activities related to the Jumbo Glacier Resort will cause very little incremental emission of GHGs.

D.2 Water Management

Section D.2 addresses the following topics of interest and concern to the project committee with respect to water management:

- water supply (including regulatory requirements) - section D.2(A);
- hydrology - section D.2(B); and
- floodplain development control - section D.2(C).

D.2(A) Water Supply

EA Issues Profile

Topic

Water supply for resort facilities.

Issues

- Resort's projected water demand.
- Adequacy of sources of water supply.
- Water treatment and possible water recycling options.

Relevant Project Components

All on-site project facilities which will require supply of water.

Lead Agency

Ministry of Environment, Lands and Parks (MELP) - Land and Water Management.

Comments also Received From

- Regional District of East Kootenay (RDEK).
- Columbia Lake Indian Band (CLIB).
- Ktunaxa/Kinbasket Tribal Council (KKTC).
- Ministry of Health (MoH).

Relevant Public Comments on Application and Draft Specifications

- During summer, resort will consume entire yearly water supply. What will be resort's winter water source? (11a)
- There has been gradual but serious reduction in water flows in Dutch, Toby and Forster Creeks since early this century. (11b)
- Not practicable to consider melting snow and truck transportation of water from Invermere as two potential sources of potable water. (11c)
- Sourcing of 20 litres per second is not feasible.

- Re. draft spec. #4 – should identify water sources for all project phases, and with seasonally adjusted rates.
- Re. draft spec. #8 – why is addressing snowmaking a conditional spec?

Relevant Public Advisory Committee Comments on Draft Specifications

- Re. draft spec. #1 - add that available independent Bull trout studies should be reviewed by federal/provincial fisheries officials.

Relevant Proponent Comments on Draft Specifications and Specifications Feedback

- Water will be taken from groundwater wells, not from Jumbo Creek or any other drainages, and will be returned via ground infiltration or ground irrigation as treated wastewater effluent comparable in quality to that of creek.
- There is no possibility of using surface water sources – wells will be dug as deep as necessary to access groundwater.
- Intent of 1991 Jumbo Creek flow analysis misunderstood. Estimates were done, but do not need justifying or further work, since only groundwater will be used.
- Issue of water has been addressed by Fernand Beaulac in open letter, which received no response.
- Re. draft specs. #1 and #2 – imply water shortage which is not case elsewhere in Purcells. Should not have to drill wells now to prove up water sources. Will explain 20l/s rate. Will need reservoir for fire flow purposes. How many years of study?
- Re. draft specs. #3-#7 – these dispute reports which have been inaccurately read, and focus on surface water as though it would be main water source. There is no intent to use surface water, so these specs are unnecessary.
- Re. draft spec. #8 - proponent has stated categorically that no snowmaking is needed, warranted or desired for resort operations at this elevation- was never proposed.
- Re. draft spec. #9 – water recycling may be considered, but it is unreasonable to set binding spec. on issue. Performance criteria are controlled during detailed permitting. Project need not be fully designed at this stage. Primary goal is to find enough groundwater.

Related Issues and Relevant Specifications

- Re. land use and related land use planning issues, see section A.7.

- Re. related fisheries issues, see section D.3(A)

Additional EA Reporting Requirements?

Yes – see below; draft specs revised to reflect proponent focus on groundwater sources, intent not to make use of surface water withdrawals.

EA Review Focus

MELP is seeking assurance that the proponent will have sufficient water to meet demand at the resort at full build-out, and without fish habitat losses or significant impact on fish populations or any downstream water users.

MoH is interested in the possibility that the resort will incorporate a water recycling scheme.

Preview of Application/Evaluation

Provincial Context

The province owns the water in British Columbia and has the proprietary right to ensure its protection and sustainable use. While all water (including groundwater) is vested in the Crown in right of the province, the use of groundwater does not presently require a water licence.

Water Sources

In the original application, the proponent stated that the water supply for the project will be a combination of groundwater and surface water. MELP's Land and Water Management Program is not aware of any written statement by the proponent that withdraws the possibility of use of surface water. However, the proponent stated at a meeting on February 24, 1998, as noted in the meeting minutes, that water supplies will be obtained exclusively from groundwater sources. The proponent commented that, no matter how deep the necessary groundwater wells would have to be excavated, no surface water will be used. On the basis of this statement, MELP has recommended to the project committee removal of the specifications which require demonstration of surface water availability and assessment of the potential impacts on streamflows, fish habitat and fish populations of surface water withdrawals. The proponent has been asked to provide a reliable estimation of the volume of water the project will require, to accurately analyse how much groundwater is available to meet the demand, and to determine whether the groundwater withdrawals will have an impact on surface flows. The proponent has not been asked to drill wells in order to verify groundwater volumes, but to clearly demonstrate the methodology used (and reliability) of its groundwater estimates.

The proponent is proposing to obtain water primarily from groundwater

sources, and possibly also from surface stream flows. Although raised as an issue in public submissions, the project committee does not believe that the use of melted snow and/or trucked water has been suggested by the proponent as possible water sources for any aspect of the proposed development's total water needs, and is reviewing the project on the basis that this is not the case. Neither option is mentioned in the proponent's application. MoH has advised the project committee that variable quality may well be a drawback to use of melting snow as a water source.

The potential water requirements of the project and its associated infrastructure needed to be reliably estimated. High-elevation streams such as Jumbo Creek are prone to moderate spring and summer flows, with significantly reduced flows during the winter months when snow melt sources are absent. Subsequently, over-wintering fish populations must either move out of the system to more suitable habitat downstream, or must find deeper pools within the channel if they are to survive.

Groundwater withdrawals may have a significant effect on surface flows. Thus, it is recommended that more effort be devoted to researching this critical element of the proposal. High-elevation streams such as Jumbo Creek are prone to moderate spring and summer flows, with significantly reduced flows during the winter months when snow melt sources are absent. Consequently, over-wintering fish populations must either move out of the system to more suitable habitat downstream, or must find deeper pools within the channel if they are to survive. The diversion of approximately 20 l/s of water for the resort's water supply during this critical period will could have a significant impact on resident and over-wintering juvenile fish populations (e.g. on the availability of over-wintering habitat in Jumbo Creek and Toby Creek immediately downstream of its Jumbo Creek confluence). If groundwater is to be used for the project, it is recommended that more effort be devoted to researching this critical element of the proposal, since groundwater withdrawals can have a significant effect on surface flows.

Water Rights

Existing water licences are addressed in section 3.2.2.3, *Volume 2*, of the application, and a reserve on Toby Creek in favour of the Town of Invermere, for waterworks purposes, was mentioned. The proponent was correct in stating that the existing water licences on this system would not be act as a constraint to on the development, inasmuch as there is ample unrecorded water for which the Regional Water Manager could consider additional licensing. In any case, as noted, licences are not required for groundwater use.

However, the statement that the "*...Town of Invermere holds the reserve...*" on Toby Creek for waterworks purposes is not correct. Order in council #911 BC Reg. 149/80 "*...reserves the unrecorded waters of Toby Creek and its tributaries, in the Golden Water District, in order to make provision for water supply for waterworks purposes....The water reserved*

may, notwithstanding the reservation, be acquired for the purpose for which it is reserved, or may be acquired for other purposes under water licences subject to the reservation..."

This is interpreted by MELP (Land and Water Management) to mean that the existing licenses, and any future licences issued for purposes other than waterworks, would be subject to the "grand-parented" priority date of a waterworks licence. In this case, regulation of water withdrawals would not be a consideration. The proposed Jumbo Glacier project could have the earlier priority date, and therefore, could have first opportunity to withdraw water, especially due to the fact that location of the proposal is in the upper reaches of the drainage.

The proponent has no strict obligation to contact the District of Invermere regarding the reserve. However, the proponent may wish to do so voluntarily, since *Water Regulation* Part (2), section (3)(2)(d), gives the Comptroller of Water Rights or the Regional Water Manager, when considering an application for a water licence, the right to give notice to: any other person, agency or Minister of the Crown whose input the Comptroller or Regional Water Manager considers advisable.

Quality of Water Supply and Water Recycling

MoH has pointed out to the project committee that the proponent has not provided any details in its application on how water quality will be assured in the long term, or of any possible recycling of water to supplement and broaden the resort's water supply options.

MoH notes that, depending on what is proposed, health concerns could be raised by the recycling of waste water for water supply purposes. It is unusual for water which has been used in showers or wash basins, for example, to be recycled within the same building, because of the risk of contamination. Normally, such water is directed to a sewage lagoon or septic tank or sewer. However Nevertheless, MoH is would be agreeable in principle to the use of recycled "grey" water in urinals and toilets, subject to/based on certain stipulations. which are noted in the specifications outlined below. Moreover, the technical requirements which would have to be met are straightforward, so that MoH considers the possibility of water recycle to be a permitting matter, and is not seeking any further reporting on this option through the EA process. Detailed design plans must be approved before the construction of any water works. At the outset of the detailed design stage, the proponent is encouraged to contact Mr. Ove Hals (tel. (250) 354-6716) to discuss engineering concerns and site-specific constraints.

For the proponent's information, the *Safe Drinking Water Regulation* (BC Reg. 230/92) under the *Health Act* governs the operation of waterworks systems, and, in the East Kootenay region, is administered by the Regional Health Board. If the proponent intends to recycle water, permitting conditions will probably include:

- install a filtration system adequate to prevent the passage of cysts;
- install a post-filtration treatment system;
- regularly monitor treated water and drinking water (daily monitoring may be required); and
- guard against cross-connection of potable and recycled water by employing at least one person with cross-connection training, and ensuring that such a qualified person inspects all installations, alterations or other maintenance of the water supply system prior to use.

Thus, if grey water is to be recycled, MoH will expect a person who has completed a recognised course in cross-connection control and maintenance to be on staff by the time the resort begins operations. This should not be an onerous requirement. The individual could be a regular member of the resort's maintenance staff who, in addition to other qualifications, has appropriate cross-connection training (the latter is available at various institutions).

Post-EA Permitting Requirements

The proponent will require certain licences, permits and other statutory approvals to proceed with development if the project is approved under the *EA Act*.

While not specifically stated in its application, it is assumed that the proponent will build and operate the waterworks system as a privately-owned system. If this is in fact the case, the *Water Utility Act* would apply, since that Act defines a Water Utility as:

“...a person, including the lessee, trustee, receiver or liquidator of that person, who owns or operates in the province equipment or facilities for the diverting, developing, pumping, impounding, distributing, or furnishing of water to or for five or more persons, or to a corporation, for compensation; but does not include: a municipality in respect of services furnished by the municipality within its own boundaries, a person who furnishes services to only himself, his employees or tenants, where the commodities are not resold to or used by others, GVRD, an improvement district or water users' community constituted under the *Water Act*, a Regional District constituted under the *Municipal Act* in respect of the service of the supply of water a) in bulk to a member municipality participating in that service b) to consumers in a municipality participating in that service...”

If a water utility is to be formed, irrespective of source of supply (i.e. whether groundwater or surface water), a Certificate of Public Convenience and Necessity (CPCN) must be applied for and obtained. Well performance and aquifer performance must be adequately assessed

Part D: Environmental, Resource Management and Technical Issues

for groundwater extraction purposes, and a more detailed hydrology study by a professional hydrologist may be required. The MELP Regional Water Manager for the Kootenay region, located in Nelson, should be consulted for more information.

Project Report Specifications – D.2(A):

Projected Water Use and Its Impacts

1. In the project report, the proponent must assess potential impacts on streamflows, fish habitat and fish populations of all proposed groundwater withdrawals associated with the project.
2. The proponent states in *Volume 2*, section 3.2.2, of its application that it expects water to be provided by means of wells, with an ultimate extraction rate of 20 l/s being necessary. In respect of this estimate, the proponent must:
 - document the basis on which this rate was determined; and
 - provide estimates of water volume requirements for each individual purpose within each phase (i.e. lodge, hotels, village, residences, storage, fire protection, construction camps, etc.).

Groundwater Source Estimates

3. In section 3.2.2.1, *Volume 2*, of the application, the proponent states that the availability of groundwater ca. 1 km upstream of the proposed village has indicated that production wells with individual yields ranging from 0.33 l/s to 6.6 l/s may be feasible. Total groundwater flows are estimated to be in the range of 7.5 l/s to 22.5 l/s. The proponent must document how these rates were determined.
4. Section 3.2.2.4, *Volume 2*, of the application reports the proponent's intent that a drilling exploration program for groundwater will be undertaken prior to construction of Phase II of the project, and that this will more accurately determine the quantity of water available. While the drilling of wells is not required for EA review purposes, an accurate analysis of available groundwater to ensure and demonstrate that there is a long-term sustainable supply for all project phases must be addressed in the project report. The groundwater assessment must describe and quantify the relationship (degree of connectivity) between groundwater and instream flows in Jumbo Creek, and assess the impacts of groundwater withdrawals on this exchange.

Conditional Project Report Specifications – D.2(A)

5. While the project committee recognises that the proponent has now declared its firm intent to acquire all of the project's water supply needs from groundwater sources, should it not be possible to demonstrate an adequate supply of groundwater to meet all of the project's needs, the proponent must investigate and report on alternative water supply options, and must assess the environmental effects of these options in the project report.

Water Treatment

6. The proponent must provide an overview of the main elements of any required

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drinking water treatment facilities. (Note - MoH will work with MELP to evaluate these specific proposals.)

RESPONSE – D.2(A)

1. The Master Plan explains in Volume 5, Section 5.3, the planned water supply engineering. Golder Associates has explained normal procedures for monitoring ground water withdrawals at Section 5.3.5.1 of Volume 5 of the Master Plan so that no impact on streamflows, fish habitat and fish populations is caused. The preference for groundwater extraction is due also to the simplicity of the process relative to environmental stewardship. The Proponent's engineers, Golder Associates and McElhanney Consultants, are confident that the wells in the Jumbo Creek drainage would reach aquifers that would not have impact on surface water, and have recently demonstrated the same procedures at Kicking Horse Mountain Resort. Jumbo Valley, a U shaped valley with a long history of sedimentary deposits, is geologically more favourable for successful well drilling than the West Bench near Golden, where Kicking Horse Mountain Resort is located.

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2. The KPA Engineering office in Vancouver that provided the initial reports for the project has moved to Victoria and their work has been taken over by Golder Associates and McElhanney Consultants. The extraction rates discussed in the current Master Plan are considered reasonable by Golder Associates and by McElhanney Consultants, and provide the necessary confidence for the feasibility of the project for the investors to proceed. Once there is a degree of assurance that the political will exists for the project to go ahead and it is justifiable to request further investment, the well drilling program will demonstrate the availability of the necessary water from underground aquifers, or the project will go back to the drawing boards. The Proponent and its project team are confident that the engineers' advice is the only sound basis on which to proceed and that it will be proven correct as it has been in the other projects once a well drilling program is started.

Yearly water demand has been calculated based on the projected demand. The resort will be focused on year round skiing on natural snow and sightseeing. Therefore, it will not require water for golf courses or snow-making as do many other resorts. The calculated demand is conservative because it is expected that up-to-date water conservation measures will be implemented (see Master Plan Volume 5, Section 5.3.7). The amount of water required for the project was calculated using estimates of overnight and day visitors at the resort and assuming that the resort will operate 335 days per year, even if the real season dictated by market considerations is expected to be considerably shorter, with a main market season of approximately 150 days in winter and 60 days in summer. The total amount of water to be drawn yearly at full build out was calculated to be about 183,000 m³ per year. See Master Plan Volume 5, Section 5.3 and Section 5.3.4 for water demand calculations.

Additional hydrology information is outlined in the reports from Golder Associates (Appendix 3-I) and in the Liquid Waste Management Plan (Appendix 3-N).

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3. Section 3.2.2.1, Volume 2, of the 1995 Master Plan states:

“3.2.2.1 Groundwater Availability

A review of the availability of groundwater approximately 1 km upstream of the proposed resort base site, has indicated that production wells with individual yields ranging from 0.33 l/s to 6.6 l/s may be feasible. These wells could require drilling to depths of between 20 m (65.6 ft) to 100 m (328 ft). It is further estimated that the total groundwater flow which could be extracted from one or more wells at this location on a continuous basis would be in the range of 7.5 l/s to 22.5 l/s.”

The above noted rates were determined by assumptions from a preliminary hydrogeological review by KPA Engineering and are considered reasonable by the current engineers, based on comparable geological considerations.

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4. Section 3.2.2.4, Volume 2, of the 1995 Master Plan indicated that following the development of Glacier Lodge at the base of Glacier Dome the developer would be expected to start the infrastructure for the resort with the drilling of the necessary wells. As the Glacier Lodge phase has been eliminated in current planning, as explained in the current updated Master Plan, the distinction is no longer necessary. The Proponent confirms that the necessary wells will be drilled to supply the necessary water for the infrastructure before the project can proceed. A permission to subdivide by the Approving Officer would not be granted without a proven and adequate water supply. While we concur the drilling of wells should not be required for the EA Act review, our engineers are at a loss regarding how much more accurately they can guess the size and location of available aquifers without drilling wells. It appears that the Project Specifications require in this case a level of speculation that is not normal engineering practice and that would be purely academic, as the only determination is by well exploration and the only risk is the investors' risk, who would see their investment jeopardized if the estimates provided by their engineers were to be wrong. In any event, the Proponent reiterates its commitment to drill wells proving to the authority having jurisdiction the adequacy of the water supply. Golder Associates has submitted an additional report containing an analysis of available groundwater to ensure and demonstrate that there is long term sustainable supply to all project phases prior to drilling wells. The groundwater assessment describes and quantifies the relationship between groundwater and instream flows in Jumbo Creek, and assesses the impacts of groundwater withdrawals on this exchange (see Appendix 3-1).

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5. Section 3.2.2.2 of the 1995 Master Plan discusses surface water availability in detail and explains that water would be available by surface water or by a combination of groundwater and surface water if the Proponent chose to do so. On page 129 it states that following on site measurements taken by a KPA Engineering subcontractor on March 27, 1991, 10 year low flows of 50l/s and of 80l/s for the upper and lower intake proposed sites respectively were estimated. The Proponent and its engineers are fully satisfied that surface water extraction is an engineering

feasible option in the desired quantities for the proposed project. The Proponent's engineers advise that it is not necessary to investigate the environmental effects of the option of surface water extraction as it is not an option that will be necessary and it is not an option that has been chosen.

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6. The main elements will include:

Distribution System

Water will be pumped from the wells to one or more ground-level reservoirs above the resort in suitable locations hidden among the trees. Water from the reservoir will supply the entire resort base by gravity. Due to the differences in elevation across the site, the service area will be divided into pressure zones, which will be fed by gravity through pressure reducing valve stations.

The water distribution system will be designed to deliver water in adequate quantities and at adequate pressures for both domestic use and fire flows. Fire flow requirements will be based on the most recent publication by the Fire Underwriter's Survey. The waterworks system will be designed with input from the Fire Commissioner's Office, the East Kootenay Regional District, the District of Invermere Fire Department, and from other existing mountain resort communities.

The watermain network will generally follow the proposed roadways. Sufficient watermain looping will be provided for better flow/pressure balancing and elimination of stagnant water problems. Due to the difference in ground elevation of the various parts of the development, the distribution system may operate in at least two different pressure zones.

Storage Facilities

The resort's water distribution system will be designed to provide for peak flow requirements, such as instantaneous and daily/ hourly domestic flow variations, irrigation, fire suppression, etc. This will be accomplished by incorporating a potable water storage reservoir within the water distribution system. The reservoir volume will include fire storage, balancing or equalizing storage, and an emergency storage. The minimum reservoir volumes are recommended by Fire Underwriters Survey (F.U.S.). Automatic sprinkler systems will be employed for all building types, except for the single-family chalets, to substantially reduce the fire flow demand. The highest fire flow demand on completion for the proposed development is estimated at 150 L/s.

In addition, the required reservoir storage volume is based on the estimated average daily water demand at buildout. This volume has been estimated at 544 m³/d.

One or more reservoirs will be located above the resort base site, at an approximate elevation of 1800 m. A separate reservoir at an approximate elevation of 1920 m may serve the single family dwellings and heliport development area west of the creek. These locations will provide gravity service for the entire resort development.

Isolated Water Supply Facilities

The Teahouse located on the top of Glacier Dome may be supplied by separately with water from a 25 m³ reservoir installed in the restaurant. The potable water demand for Teahouse/Restaurant

will range from 10 m³/day to 20 m³/day in Phase 1, depending on the number of visitors. For the first few years, demand is expected to be around 10 m³/day, increasing to 20 m³/day within five years. Initially, potable water may be hauled from the potable water system in the resort base area to the Teahouse/Restaurant water reservoir by snow cat or similar service. Eventually, this means of potable water transport will be replaced with a pumped system.

Water Treatment

It is anticipated that the new wells will have a water quality that meets the Canadian Drinking Water Guidelines for all parameters. Therefore, minimal, if any, treatment will be required. Depending on the storage system, the drinking water may need to be disinfected (chlorinated) for health purposes prior to consumption. Treatment may be necessary only to prevent adverse effects of storing water. Following detailed design the engineering design team in consultation with the appropriate Ministry will advise on the level of treatment, if any, that may be necessary.

D.2(B) Hydrology

D.2(B) EA Issues Profile

Topic

Management of peak streamflows and runoff at resort.

Issues

- Mapping of existing drainage systems at resort and along access road.
- Any plans to stabilise stream channels (e.g. at stream crossings).
- Fishery implications of any stream modifications through channelling, armouring or relocation.

Relevant Project Components

All on-site and off-site project components with Toby/Jumbo Creek drainage which will contribute to runoff into streams or which may entail stream channel modification.

Lead Agency

Ministry of Environment, Lands and Parks (MELP) - Land and Water Management.

Comments also Received From

Ktunaxa/Kinbasket Tribal Council (KKTC).

Relevant Proponent Comments on Draft Specifications and Specifications Feedback

- Not proposing to move stream channels. Only stream crossing at km-6 will be altered. No fisheries issue, since no stream channel modification.
- Re. draft spec. #1 – there will be no change in drainage patterns or stream locations.
- Re. draft specs. #2-#4 - show failure to understand proposal. Draft specs. #2 and #3 should only require statement of design concept and intent. Draft spec. #4 does not apply, since riparian areas will be left intact, and there will be no creek armoring.

Related Issues and Relevant Specifications

- Re. related fisheries impacts, see sections D.3(A) and H.1.
- Re. access road upgrading, see section E.6(C).

Additional EA Reporting Requirements

Yes – see below.

EA Review Focus

MELP wishes to determine whether or not the proponent has adequately planned for management of peak streamflow and run-off at the resort and along the access road, so as to avoid erosion, stream sedimentation and impacts on fish and fish habitat.

Review of Application/Evaluation

Peak flows are of greatest interest in determining maintenance of the hydraulic regime. Paving, roofs, roads, ski runs, etc., may generate abnormally high runoffs and peak flows, and are capable of altering the timing of the runoff, which may lead to increased erosion and downstream sedimentation.

There was recognition on pages 139, 141 and 143 of the application (*Volume 2*) that there are concerns with possible debris flows and floods, especially in the valley floor where the village is to be located, but also along the access road. Positioning of buildings and services will need to take into account these hazards. Debris flows and flood hazards require consideration at several stream crossings along the access road, and may require entrapment works, debris catchment basins and special culvert or bridge designs.

Project Report Specifications – D.2(B)

1. Given that localised peak flows may increase significantly as a result of the influence of runoff from project facilities (either at the resort or along the access road), existing drainage patterns must be mapped for channel stability and capacity. Stormwater discharge points must be determined and downstream channel characteristics understood. Runoff control must be addressed in the project report.

Conditional Project Report Specifications – D.2(B)

2. Recognising that, if possible, the proponent intends to design the project to minimise or entirely avoid such works, if any channelising, armouring or relocating of stream channels is necessary within the development area, or in respect of access road upgrading, conceptual plans for the necessary works must be presented in the project report. (Note - If the project is approved at the conclusion of the EA process, engineered designs for such work must be submitted to MELP (Water Management) for review and approval prior to any work being undertaken.)

3. If any stream crossings will require upgrading to withstand debris flows, etc., they must be identified (e.g. at km 6). Conceptual plans must be presented in the project report. (Note - If the project is approved at the conclusion of the EA process, engineered designs must be submitted to MELP (Water Management) for review and approval prior to any work.)

4. In the event that any stream channelling, armouring or relocation is required, the project report must document fish habitat modifications or losses, and proposed habitat mitigation or compensation measures, under specifications D.3(A)#2 and H.1#4.

RESPONSE – D.2(B)

1. Golder Associates, McElhanney Consultants and Enkon Environmental have provided expert advice regarding runoff control and this is reported particularly in the LWMP, Appendix 3-N, and in the Environmental Management Plans, Appendix 3-C. The subject is discussed and reported on in relation with a number of project issues. Drawings showing the existing drainage system and the conceptual planning of the stormwater discharge points for the resort and the road are included in the LWMP (Appendix 3-N). The relevant drawings are numbered S1, S1.2, D1, RD1, RD2, RD3, RD4, and RD5. These drawings are reproduced in 11x17 format in the LWMP for ease of distribution. Full scale drawings are included in Volume 8: Map Volume of the Master Plan.

We must note that the review of Application/Evaluation reported above shows an incorrect reading of pages 139, 141 and 143 of Volume 2 of the 1995 Master Plan, as if there was some concern of debris flow and floods exposure “especially in the valley floor where the village is to be located.” This is incorrect and is possibly due to lack of attention to the slope and the geology of the valley, as well as the proposed location of the resort. At page 144 of Volume 2, subsection 3.6.4 of section 3.6, Geotechnical Review, of the same 1995 Master Plan it is written, “The proposed resort village site avoids areas of geotechnical hazard”. Page 139 indicates that

geomorphic processes and alpine soil processes have been mapped; the resort location has been selected precisely because it is not in the hazardous areas. This is further clarified by the discussion in the referenced pages 141 and 143. **The map at figure 3.5.5.(a) clearly indicates that the resort location is not in the hazardous areas of the Jumbo Creek valley.** Competent geotechnical advice has confirmed, on each site reconnaissance, that the resort site is **not** exposed to avalanches, debris flow or flooding, of which there is no historical trace or traceable potential danger based on geotechnical and hydrological studies.

200 year floodplain mapping and debris flow hazards and areas are discussed in the current Master Plan. The Master Plan explains the runoff control measures, in Volume 5: Infrastructure, Sections 5.5, 5.5.1 and 5.5.2. The above noted considerations about drainage patterns and channel stability and capacity are normal civil engineering requirements without which professional engineers would not design a project and which the Proponent's engineers will take into account, but it is not clear to what specific project facilities and to what size of peak flows the Project Specifications refer to. By way of comparison we should note that the Kicking Horse Mountain Resort project encountered serious drainage challenges due to the existing drainage patterns of the mountainside draining into the West Bench near Golden and that the project engineers had no problem mapping and designing appropriate solutions. As noted above, a conceptual Stormwater Management Plan has been developed to control runoff volume, which will prevent impacts to channel stability and configuration. The Stormwater Management Plan is presented in Appendix 3-C Environmental Management Plans.

2. As previously stated, the design shows that channelising, armouring or relocating of stream channels will not be necessary, as all riparian areas have been mapped and maintained in their integrity. Stream crossings have been eliminated in the final choice of road alignments for the improved route to the resort from the Mineral King Mine and from Panorama and the improved road will respect the riparian areas. If in the further detailed design any such occurrence were to appear, appropriate design measures would be submitted to the relevant Ministry as required for their approval prior to commencing any work.

3. The concern expressed in the Project Specifications about stream crossings is noted, but the project proposal is to maintain the present bridges initially and then to follow a road alignment according to the Route Study (See Appendix 5-A of Volume 5 of the Master Plan), which will eliminate all bridges in the Jumbo Creek drainage.

4. There is no plan that would appear to require stream channeling, armouring or relocation, but the concern expressed is noted and would be responded to in the unlikely event that a planning revision would require any of them.

D.2(C) FloodPlain Development Control

EA Issues Profile

Topic

Facilities located in floodplains.

Issue

Mapping of 200-year floodplains of any streams which may be affected by floodplain development.

Relevant Project Components

All on-site and off-site project components within Toby/Jumbo Creek drainage which are to be located within floodplains.

Lead Agency

Ministry of Environment, Lands and Parks (MELP) – Land and Water Management.

Relevant Proponent Comments on Draft Specifications and Specifications Feedback

- Opponents claim that Jumbo Creek will be drained or contaminated, but project is designed to protect riparian areas (e.g. using well-known engineering techniques which avoid these areas during construction).
- Re. draft spec. #1 – can provide information for locations where habitation, roads, structures, etc. are proposed.

Related Issues and Relevant Specifications

- Re. related fisheries impacts, see sections D.3(A) and H.1.
- Re. access road upgrading, see section E.6(C).

Additional EA Reporting Requirements?

Yes – see below.

EA Review Focus

To avoid potential future problems associated with building on floodplains, MELP

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is seeking a clear delineation of the floodplains of all streams that could be affected or could affect a development.

Review of Application/Evaluation

As noted in section D.2(B), there was recognition on pages 139, 141 and 143 of the application (*Volume 2*) that there are concerns with possible debris flows and floods, especially in the valley floor where the village is to be located, but also along the access road. Positioning of buildings and services will need to take into account these hazards. Debris flows and flood hazards require consideration at several stream crossings along the access road, and may require entrainment works, debris catchment basins and special culvert or bridge designs.

The floodplains of all streams which will be, or which may be, affected by the project, should be identified and mapped. Upon alienation of the subject Crown land, a referral will be made to the Land and Water Management Branch with respect to establishing covenants on the affected lands. The proponent is advised that establishment of such covenants requires a very detailed level of supporting information.

Project Report Specifications – D.2(C)

1. The once-in-200-year floodplains of all streams which could be affected by, or could affect, the project must be identified and mapped at a scale of 1:20,000.

RESPONSE – D.2(C)

1. As noted before, the references to pages 139, 141 and 143 of the 1995 Master Plan are incorrect as these pages and the map that they include prove the contrary of the inference of concern for the project site attributed by the Project Specifications. This is confirmed at page 144 where it is stated unequivocally that the project site has been selected because it “avoids areas of geotechnical hazards” as an easy site reconnaissance would show. In fact, as a partial evidence of a site not too exposed to the above mentioned hazards, a collapsed shack (which was standing when the project studies began) of the sawmill is still visible in the riparian area where it was located probably seventy five years ago, or more. Debris flows and floods are possible in the valley areas subject to slides and avalanches, which have been mapped (the avalanche map is on figure 3.5.5 (a), following page 141 of the 1995 Master Plan and has been reproduced in the current Master Plan as Appendix 2-B of Volume 2: The Site). Golder Associates has explained that a potential flow of debris in the valley floor towards the sawmill site that is proposed for the resort location is not physically possible due to the very low slope and U shape of the valley floor, particularly in the three to four kilometers upstream of the resort site.

Pre-existing floodplain mapping for the Jumbo Creek drainage is not available. The once-in-200 year flood plain of the streams which could be affected by, or could affect, the project has been identified by McElhanney and mapped at 1:20,000. Because of the required scale, in the pre-design context of the Project Specifications the flood plain identified in the drawing covers a larger area than would be indicated by more accurate drawings at a scale showing greater details. Conservative approximations make the once-in-200 year flood plain cover less than half of the

extent of the riparian areas mapped for Jumbo Creek in the proximity of the resort site. A map showing floodplain areas based on a 200 year return is attached as Appendix 2-C to Volume 2 of the Master Plan. The subject of flooding and of floodplains is also discussed in the Master Plan, Volume 2, Section 2.6.2.5.

Calculations done by McElhanney for the Jumbo Creek drainage in the proximity of the resort site, as indicated in the above noted Master Plan section, indicated a surface width of 14.5 meters for the 100 year return instantaneous discharge and of less than 16,5 meters width for the 200 year return. This will be more than contained by the more than 60 meters wide riparian area (based on a 15 meter setback on each side of the stream according to B.C. Environment guidelines) which has been mapped for the project and which will be more accurately mapped again once detailed surveys are completed. A drawing of the maximum anticipated 200 year flood plain in the proximity of the resort site is included as above noted.

The East Kootenay Regional District 's Bylaw No. 1034, Floodplain Management Bylaw requires a Floodplain Setback of 15 meters from the natural boundary of a lake marsh or pond, if flood plain mapping is not available, and a construction level 1.5 meters above the natural boundary of a water course, which is in accordance with McElhanney's estimates.

D.3 Fish and Wildlife Resources

MELP has advised the project committee that useful baseline information is presented in the proponent's application with respect to fish and wildlife resources in the vicinity of the development. For the project report, the format in which much of this information has been presented needs to be redesigned, with defined sections on the assessments of fish and wildlife impacts assessment integrated into the main body of the text. Specific sections should be presented on the assessments of key species which occur in the Jumbo Creek valley (i.e. moose, mountain goat, deer, elk, large carnivores other than grizzly bears, and fur-bearers).

Based on the technical information provided in this document, there is a particular need to address the potential impacts of project development (both immediate and longer-term) on wildlife populations in the Jumbo Creek drainage, due to the loss of habitat, the harassment and displacement of wildlife, and direct human/recreationist conflicts.

To permit evaluation of potential conflicts or impacts of the project's development components on wildlife resources, maps are required which There is no map in this application which indicates the planned location of facilities, including roads, trails, ski runs, lifts and or utility corridors in relationship to habitat features such as riparian areas, avalanche tracks, etc. in the project report. sufficient detailed to permit evaluation of potential conflicts or impact of the physical aspects of this development on wildlife resources. Knowledge of the planned location of these facilities in relationship to habitat features such as riparian areas, avalanche tracks, etc. will be required in the project report, to form the basis for a detailed and reliable assessment of potential impacts on fish and wildlife habitat. Habitat and infrastructure maps should all be presented at a scale of 1:20,000, to facilitate comparison and impact assessment.

The key fish and wildlife issues identified in the review of the application are as follows:

- potential impacts on water quality and fisheries resources in Jumbo and Toby Creeks - section D.3(A);
- potential impacts on wildlife habitat and populations in the Jumbo Creek valley and environs

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- section D.3(B);
- potential impacts on grizzly bear habitat and populations in the Jumbo Creek valley and environs - section D.3(C);
- implications of project development for birdlife - section D.3(D);
- implications of project development for threatened and endangered wildlife - section D.3(E);
- wildlife impacts of utility and access corridors - section D.3(F);
- potential human conflicts with wildlife, including grizzly bears, black bears, ungulates and fur bearers - section D.3(G); and
- potential impacts on alpine vegetation - section D.3(H).

D.3(A) Fisheries Resources

EA Issues Profile

Topic

Implications of project development for fisheries resources.

Issues

- Need for detailed assessments of fishery and fish habitat impacts.
- Avoidance/mitigation of fish habitat losses.
- Standards of fish inventory survey work.
- Proposals to manage and mitigate, and if necessary, compensate for, fishery impacts.

Relevant Project Components

All on-site and off-site project components within Toby/Jumbo Creek drainage.

Lead Agency

Ministry of Environment, Lands and Parks (MELP) – BC Environment and Lands.

Comments also Received From

- Fisheries and Oceans Canada (DFO)
- Columbia Lake Indian Band (CLIB)
- Ktunaxa/Kinbasket Tribal Council (KKTC)

- Ministry of Health (MoH)

Relevant Public Comments on Application and Draft Specifications

- Both liquid waste (anticipated at 1.2 million litres/day) and solid waste would have serious impact on local fish populations. (6h)
- What impact would access road and/or resort development have on fish of Toby and Jumbo creeks? (13a)
- Project will have negative effect on this area's fish. (13e)
- Jumbo/Toby drainage supports a population of Westslope Cutthroat trout, and habitat for Bull trout (which is blue-listed). Project will cause significant loss of fish in area. Cold streams are spawning grounds for Bull trout, which is endangered. Need independent review with federal involvement.
- Re. draft spec. #1 – add Horsethief drainage to fish evaluations for all species.

Relevant Proponent Comments on Draft Specifications and Specifications Feedback

- Understood in 1993 that fisheries data were adequate. Some analysis needs upgrading, but as written, draft specs require repeating studies.
- Preamble to draft section D.3(A) refers to inadequate mapping, but very detailed mapping is provided. What is the problem with the maps?
- Re. draft specs. #1-#4 – are unreasonable, given current evidence that Jumbo Creek has minimal fish habitat values and minimal fish, especially in upper reaches.
- Re. draft spec. #1 – studies completed from below Toby Creek in 1992, except tributaries. Also, have committed to riparian setbacks. No fish in upper reaches, so why look at tributaries? Did do late-summer low-flow survey, plus spring and summer work. Did not do groundwater upwelling work, given absence of fish. Can provide critical and sensitive habitat features, and locations of barriers – information collected, not yet summarised.
- Re. draft spec. #2 - MELP specifically agreed with Enkon Environmental that repeat fish surveys not necessary. Why survey Cutthroat trout in late June to confirm no fish?
- Re. draft spec. #3 – Will comply with federal *Fisheries Act* and 'no net loss' policy. Can't say if any fish habitat encroachments until bridge and crossing locations confirmed.
- Re. draft spec. #4 – Followed MELP's standards at the time, not current RIC standards.

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- Re. draft specs. #5 and #6 – proponent has extensively described plans for tertiary sewage treatment.

Relevant Issues and Relevant Specifications

- Re. land use and related land use planning issues, see section A.7.
- Re related solid waste disposal issues, see section D.1.A.
- Re related liquid waste disposal issues, see section D.1.B.
- Re. commercial and non-commercial fish-related recreation, see section E.5.F.
- Re. fish and wildlife resource management, see section E.7.K.
- Re. traditional First Nations use of fishery resources, see section G.1.
- Re. federal fishery and fish habitat issues, see section H.1.
- Re. possible federal cumulative fisheries effects assessment requirements, see section H.2.

Additional EA Reporting Requirements?

Yes – see below; draft specs revised to reflect that most field data are collected, but not yet assessed and reported; may need winter Bull trout survey.

EA Review Focus

MELP wishes to be in a position to assess potential project effects on fish habitat and populations, both during construction and during the life of the project, and to evaluate the proposed fisheries mitigation and monitoring programs.

MELP's primary concern is potential impacts on Cutthroat trout and Bull trout. Bull trout are blue-listed, and are a species of special management concern for the region. Tributary streams are crucial for the maintenance of stream ecosystems and fish populations. While, inventories show Cutthroat trout at the Jumbo Creek site, Bull trout have not been observed in Jumbo Creek to date. However, Bull trout have been documented in Toby Creek and some of its tributaries. There does not appear to be an obstruction to fish passage between Jumbo Creek and Toby Creek. Based on the other Bull trout populations in the Kootenays, portions of Jumbo Creek may be utilized by Bull trout during some stage of their life cycle.

DFO is concerned about any premature conclusion that Jumbo Creek has minimal fish habitat and minimal fish, especially in the upper portion. It cites, for example, a report entitled *Fisheries Survey of Dutch, Toby and Horsethief Creeks*, prepared for the Mica Compensation Program, Fisheries Technical

Committee, BC Hydro & MELP, March 1993. That report documents the occurrence of Bull trout throughout Toby Creek, as well as in Jumbo Creek. It is important that the species present are accurately identified and described, in particular in light of the concerns for regional populations of Bull trout, such as that found in the area of the proposed project. Bull trout are a species of concern in BC and are extremely sensitive to habitat disturbance, thus habitat protection is a key component of conservation. It needs to be established that this project will not affect critical habitat parameters, such as stream water temperatures and flows, channel stability and in-stream cover (e.g. related to road access).

Fish Management Jurisdiction

If there is to be any fish habitat loss, the draft regional memorandum of understanding with DFO will have effect (stream habitat alterations or fish habitat loss fall under DFO's "No Net Loss" Policy). All permitting and mitigation plans will then have to be approved by DFO. For more details of the fish management responsibilities of MELP and DFO, and their co-operative review arrangements, , see background to federal fisheries issues, below (section H.1 – *Impacts on Fisheries and Fish Habitat*).

Review of Application/Evaluation

Baseline Fish Surveys and Fish Impact Assessment

The application includes information from two fisheries surveys conducted for only one annual cycle (during September 1992 and in May 1993). The findings reported in the application do not address all of the objectives outlined in the a November 1992 background fisheries report in *Volume 5* of the application (see *Appendix P, Environmental Studies for the Proposed Jumbo Glacier Resort Development*, the November 1992 report by Norecol, Dames & Moore, entitled *Late Summer Fisheries and Wildlife Reviews*, section 2.0, *Fisheries* located in *Appendix P, Environmental Studies for the Proposed Jumbo Glacier Resort Development*).. Similarly, the findings reported in the application do not address all of the objectives outlined in the December 1993 Norecol, Dames and Moore report *Jumbo Valley Resort Development - Aquatic Resources*, also found in *Appendix P*.

The late date (September 23 to 27, 1992) during which the initial fisheries survey was conducted may not have allowed for the identification of spawning areas for spring spawners such as Cutthroat trout. However, Table 3 from the November 1992 report on the survey conducted on September 23 and 27, 1992 does identify identifies spawning/rearing habitat for spring spawners such as Cutthroat trout in the upper reaches of Jumbo Creek. As in most other high-elevation streams in the East Kootenay region, Cutthroat trout will often move out of spring and summer spawning and rearing areas in mid-to-late September, seeking reaches which will provide more suitable over-wintering habitat. MELP notes that the entries for *Fish Utilization*Utilisation in columns B and D in Table 3 of the November 1992 report should read "migration", not "mitigation".

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The proponent's follow-up (May 1993) sampling program may have been conducted too early to observe spring spawning Cutthroat trout, which often spawn later in colder, high-elevation streams such as Jumbo Creek.

Although the application notes habitat characteristics which are conducive to spawning, these sensitive habitat features must be clearly identified so that they can be avoided during the planning and construction phases of this project. Avoidance is one obvious means of mitigating potential impacts.

In the past, MELP (Fisheries Branch) has raised various points with respect to the fish studies proposed along Jumbo Creek (e.g. during a September 14, 1993 meeting with the proponent). These points will need to be addressed in the project report prior to any project construction if the project is certified at the conclusion of the EA process. They include the need to conduct stream fish surveys on the smaller tributaries of Jumbo Creek, and also the need to identify (through winter surveys) possible groundwater upwelling areas which may be conducive to over-wintering for Bull trout or Cutthroat trout. As indicated in the application (see *Appendix P* of the application, section 2.4.9, *Fish Sampling*, in from of the subsequent (May 1993) Norecol, Dames & Moore report, *Fisheries, Water Quality, Hydrology and Waste Disposal - Environmental Work Programs*, also found in Appendix P of the application), spring sampling must be conducted at all sites for the purpose of identifying fall spawning, over-wintering and spring spawning use by all species listed.

The proponent should be aware that all roads and stream crossings must be constructed to the standards outlined in the provincial *Forest Practices Code*, and the *Stream Crossing Guidebook for Fish Streams*, and in accordance with the federal fish habitat protection policy, to ensure minimal impact on fish habitat and fish movement.

Certain detailed site-specific fisheries, water quantity and water quality issues will have to be resolved to the satisfaction of MELP (BC Environment and Lands - Cranbrook) prior to permitting at the final design stage, if the project is certified at the conclusion of the EA process. Among these may be the potential impacts of development in local site-specific situations with respect to altered flow regimes, stream-side cover, floodplain management and wet meadow ecosystems. Again, the relevant provisions of the *Forest Practices Code* and the federal fish habitat protection policy will be applicable in considering detailed design issues.

DFO notes that the proponent's fish species survey requires updating to reflect current scientific identification practices for regional fish population, and any new information identified with respect to this. Specifically, the information provided for Dolly Varden char and Yellowstone Cutthroat trout are actually applicable to Bull trout and Westslope Cutthroat trout respectively.

Project Report Specifications – D.3(A)

Fisheries Assessment

1. In the project report, the following are required:

- reporting which demonstrates the achievement of the study objectives cited in the reports entitled Late Summer Fisheries and Wildlife Reviews – Proposed Jumbo Glacier Resort Development, November 1992 and Jumbo Valley Resort Development - Aquatic Resources, December 1993, and reorganisation and mapping of existing information to allow for easy geographical identification of reaches, reach characteristics and sampling sites;
- identification, description and mapping of critical and sensitive fish habitat features, including fall and spring spawning areas and overwintering sites;
- identification and mapping of all potential permanent and temporary barriers to fish passage between the upper and lower reaches of Jumbo Creek, noting where identified barriers are complete or partial, and where natural or as a result of human activities; and
- identification, description and mapping of sensitive Bull trout habitat features, including overwintering sites, upwelling areas and potential spawning habitat, should Jumbo Creek prove accessible to Bull trout under the previous bullet.

2. In accordance with the Fisheries and Oceans Canada (DFO) *Policy for the Management of Fish Habitat* (1986 - the 'no net loss' policy) and the *Habitat and Conservation Protection Guidelines* (2nd edition, 1998), the proponent is required to present information detailing measures to avoid, minimise or mitigate all potential effects on fish and fish habitat.

Conditional Project Report Specification – D.3(A)

3. If, taking account of all proposed impact management measures, residual impacts on fish and fish habitat are expected to occur, either during project construction or operation, the proponent, in the project report, must provide conceptual compensation plans which are demonstrated to be technically and economically feasible, for consideration by DFO and MELP.

RESPONSE – D.3(A)

1. The main objectives of the late summer fisheries component of the 1992 report were as follows:

- describe the stream habitat in the system using the DFO/MOELP aquatic inventory methods;
- conduct sampling of juvenile and adult fish populations utilizing non- destructive methods;
- conduct testing and sampling of water quality parameters in upper Jumbo Creek;
- conduct sampling of benthic invertebrates in upper Jumbo Creek;
- measure stream cross-sectional areas and flows at several stations; and

- identify important and sensitive fish habitat such as spawning grounds, rearing areas and overwintering habitat.

The objectives of the 1993 aquatic studies in Jumbo Creek were to supplement the 1992 data and to:

- describe stream habitat using the standard DFO/MOELP stream inventory methods;
- conduct spring season sampling of juvenile and adult fish populations using non-destructive methods;
- conduct sampling of benthic invertebrate communities;
- identify sensitive habitats and high use areas, particularly spawning, rearing and overwintering areas;
- predict the effects of the proposed resort development on fish and fish habitat in Jumbo Creek; and
- recommend impact avoidance and/or mitigation measures to minimize any potentially adverse effects of the proposed development on aquatic resources in Jumbo Creek.

Field studies to describe hydrology, water quality, aquatic habitat and fish populations were conducted by Norecol, Dames and Moore (Norecol) in Jumbo Creek on September 1992, February, April and May 1993. The data collected during these baseline studies were sufficiently comprehensive to address the Ministries' concerns. Appendix 3-G Fisheries Resources provides a full report, which includes the required mapping and demonstrates that the foregoing study objectives were achieved. In addition, ENKON Environmental Limited used the Norecol information to identify project impacts and provide mitigation measures to reduce project impacts to the fish resources of Jumbo Creek. The following text presents a summary of Norecol's and ENKON's results.

Stream Flows

The September 26, 1992 flow measurements showed discharge rates at the upper, mid and lower stations of 0.57, 1.73 and 3.28 m³/sec respectively. The May 20-23, 1993 stream flow measurements in Jumbo Creek showed discharge rates at Stations 1, 2 and 3 of 1.1, 3.5 and 5.4 m³/s, respectively. These rates are comparable to the fall 1992 data and represent moderate flow conditions. High flows in Jumbo Creek would likely be 2 or 3 times these values based on field observations of flood signs in the stream channel.

Water Quality

The results of the 1992 and 1993 water quality analyses Jumbo and Toby Creeks have clear, somewhat alkaline water with generally low levels of metals and nutrients (nitrogen and phosphorus compounds). All water quality parameters except iron were well within the British Columbia guidelines for the protection of aquatic life.

Benthic Invertebrates

The results of the 1992 and 1993 benthic invertebrate data show high proportions of the sensitive Ephemeroptera, Plecoptera and Trichoptera. The benthic invertebrate community in Jumbo Creek is typical for an unstressed stream in north temperate latitudes.

Fish Habitat

The biophysical habitat surveys were conducted in a similar manner to those of Carswell (1979), who completed standardized DFO/MOE stream survey forms to characterize the biophysical habitat features of Jumbo Creek. The results of the surveys are similar, except that Norecol identified four distinct stream reaches in Jumbo Creek, mainly defined by gradient, whereas Carswell (1979) identified three reaches. Based on gradient and habitat characteristics, the four reaches delineated by Norecol included:

- Reach D-including the lower, relatively steep section from the mouth of Jumbo Creek to about km 5 above the second bridge and just below the third bridge;
- Reach C-from km 5 to about km 10+, a reach of relatively gradual slope with more pools and meanders;
- Reach B-the central, relatively steep section from just above km 10 to about km 16 just above Leona Creek and the fourth bridge up the creek; and
- Reach A-the upper, relatively low-gradient section above km 16 to the toe of the upper valley wall. This reach includes the proposed resort base area.

A fifth reach could also be designated for the headwaters of Jumbo Creek in the very steep section at the head of the valley below the glaciers.

Norecol also noted a 1.5 metre waterfall (formed by a large boulder and log debris) located at the uppermost end of Reach B is likely a partial fish migration barrier. Reach B immediately below the waterfall, is also an impedence to upstream fish migration as it is relatively steep with rapids and small falls over large boulders. The more braided and low-gradient Reaches A and C contain better fish habitat and more diverse flow/substrate conditions. These reaches have smaller substrate sizes, more riffle areas suitable for fish spawning and more pools with large organic debris.

Fish Populations

Carswell (1979) conducted an inventory of Toby Creek mainstem and tributaries including Jumbo, Delphine and Coppercrown Creeks from May 25-June 12 and from August 8-18, 1978. Carswell (1979) found cutthroat trout as far upstream as the washed out bridge in middle/upper Jumbo Creek, but did not observe or capture Dolly Varden char (i.e. bull trout) in upper, middle or lower Jumbo Creek. However, Carswell did comment that Dolly Varden char (bull trout) presence is thought likely throughout Jumbo Creek.

Aquatic Resources (1993) conducted fisheries surveys of Dutch, Toby and Horsethief Creeks and tributaries from August 12-September 29, 1992 as part of the Mica Compensation Program. Aquatic Resources (1993) found bull trout throughout Toby Creek, mountain whitefish in lower Toby Creek and rainbow trout in Neave Creek a tributary to lower Toby Creek. Kokanee salmon were also observed spawning in lower Toby Creek. Cutthroat trout were only found in middle to lower Jumbo Creek within the Toby Creek system, while bull trout were only found at the confluence of Jumbo/Toby Creek. The electrofishing and trapping efforts produced very few fish in Jumbo Creek, all of one species (cutthroat trout) and all in the lower reaches. No fish were caught or seen in Jumbo Creek upstream of about km 10 as marked on the access road.

During Norecol's September 1992 and May 1993 fisheries study, few fish were caught or

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observed. Several cutthroat trout (*Oncorhynchus clarki lewisi*) were caught/observed in Reach C and D of lower Jumbo Creek during September 1992, while several more cutthroat trout were captured/observed in the lower section of Reach B near Leona Creek and in Reaches C and D in lower Jumbo Creek. The upstream limit of fish presence in Jumbo Creek was found by Carswell to be just below the bridge near the upper end of Reach B. The farthest upstream sighting of a fish by Norecol was also in the upper part of Reach B at Leona Creek a west- side tributary. No fish were caught by Carswell (1979), Norecol (1992 and 1993) or Aquatic Resources (1993) above the waterfall at the division point between Reach A and B.

It is of interest to note that during Aquatic Resources study from early August to late September 1992 with the exception of the confluence of Jumbo/Toby Creek, bull trout were not captured or observed in any tributary stream of the Toby (upper, middle or lower Jumbo, Neave and Delphine Creeks) or Horsethief (Andreen, Bruce, Law, Grottos tributaries, Gopher, McDonald, Stockdale or Farnham Creeks) Creek systems. Based on the three fisheries research projects conducted in Jumbo Creek, there is no evidence to suggest bull trout utilize Jumbo Creek.

Based on sampling conducted by Norecol (1992 and 1993), Carswell (1979) and Aquatic Resources (1993) few fish were found in Jumbo Creek, suggesting that there are one or more limiting factors to fish production in Jumbo Creek. The most likely factors are

- Limited habitat in winter, perhaps a few deep (1 m+) pools;
- “Flashy” flows from glacial meltwater creating instability in the benthic community and limiting fish rearing areas;
- High suspended sediments (glacial flour) in spring flood flows reducing primary; and secondary production;
- Low phosphorus levels limiting algal growth (primary production); and
- Limited access to Jumbo Creek due to steep gradients and fast flows in reaches B and D.

Potential Impacts and Mitigation Measures

To minimize or eliminate potential impacts to fish habitat, ENKON has recommended a number of different “*Streamside Protection and Enhancement Area*” zone widths for the mountain and resort base development including:

- The *Fish Protection Act-Streamside Protection Regulations* (January 2001) is applicable to the resort base residential and commercial development areas only. A 30m “*Streamside Protection and Enhancement Areas*” from Jumbo Creek mainstem and tributaries is recommended for the resort base development; and
- The Forest Practise Code “*Riparian Management Area Guidebook*” (1995) was specifically designed to apply to harvesting, silviculture and road construction practises in working forests. Therefore, ENKON classified the streams within the mountain development areas and applied the FPC guidebook recommendations for “*Riparian Management Zones*” to the aligning and construction of ski lifts and ski runs within the mountain plan areas of the resort development. “*Riparian Management Zones*” widths range from 20-30m from tributaries of Jumbo Creek associated with the development of ski runs and ski lift lines.
- The FPC Stream Crossing Guidebook was also applied to the upgrading of the access road.

Resort Base Development

Potential impacts to fish habitat from residential and commercial development have been minimized during the planning process and adherence to the recommended 30m “*Streamside Protection and Enhancement Areas*” as outlined in the *Fish Protection Act-Streamside Protection Regulations* (January 2001). As a result, there are no direct instream or riparian fish habitat impacts associated with the resort base development. Since there are no fish habitat impacts associated with the resort base development, no further mitigation measures are proposed.

However, JGR is committed to the following guiding principles and best management practices during the final design and construction of the resort development areas:

- Principle #1: Impervious Area Reduction - Although general guidelines for density designations (i.e. bed units and the number of ski lifts and runs) have been planned, development will be sensitive to impacts to stream-flow hydrology and will strive to minimize Total Impervious Area (TIA). Wherever possible, source control, interception, infiltration and diversion will be utilised to reduce impervious areas.
- Principle #2: Maintenance of Water Quality - Water quality control facilities will be designed with bio-filtration systems to treat stormwater prior to discharging into Jumbo Creek.
- Principle #3: Post Development Stormwater Discharge – Post development stormwater discharge rates will be controlled through the use of retention or detention of stormwater runoff.
- Principle #4: Post Development Stormwater Volume – Post development stormwater volumes will be controlled by containing and dispersing the runoff volume from a 2 Year return, 2 hour duration design storm.
- Principle #5: Base Flow Augmentation - Base flows will be maintained in Jumbo Creek between rainstorms through a combination of techniques.
- Principle #6: Protection of Leavestrips – Leavestrips will be maintained and/or enhanced adjacent to Jumbo Creek following the recommendations of the Streamside Protection Regulations or the Forest Practises Code.
- Principle #7: No Net Loss-Net Gain in Fish Habitat – The development will strive towards meeting no-net-loss: net gain in fish habitat through protection of fish bearing sections of Jumbo Creek and tributaries and associated riparian corridors.
- Principle #8: Integration of Site Vegetative Planting with Natural Areas – The development will integrate re-planted areas with adjacent riparian corridors and ecological features.
- Principle #9: Monitoring – A biological, physical habitat and continuous water volume and quality sampling program will be implemented pre and post-development.

Mountain Development

To minimize impacts to fish habitat, design and location of ski runs and ski lifts have followed the Forest Practice Code-Riparian Management Area Guidebook (1995) recommended riparian management zone widths as follows:

- Where ski lifts and runs are located parallel to streams, a 20-30 m wide riparian management zone width is proposed for S4, S5 and S6 streams.
- In addition to riparian management zones, the following environmental protection measures were taken into account by the Proponent during the planning and design of the ski runs/trails

and lifts:

- Ski trails/runs will cross perpendicular to streams where possible;
- Ski lift towers will span riparian corridors;
- No ski lifts or runs will cross fish bearing sections of any stream; and
- Many of the ski runs are located within existing heli-ski runs that have either been previously logged or are above the tree line.

To further minimize potential impacts from mountain development, ENKON also recommended a number of mitigation measures and “Best Management Practices” as per the recommendations in *‘Environmental Objectives, Best Management Practices and Requirements for Land Developments, Vancouver Island Region’* (MELP 2001) and the Forest Practice Code.

Access Road Upgrade

Currently, access to the proposed resort is provided by the Toby Creek road from Panorama Resort to the Mineral King Mine site, where access is further continued along the Jumbo Creek Forest Road. The existing road conditions vary throughout its length from what one could classify as a good, low volume road to an average gravel logging road in some sections. The operational speed of the existing road varies but would generally be classified as 50 kph with several sections where this speed is not achievable for safe operation due to limited vision and narrowness of the roadway. Currently there are numerous creek crossings along the road varying from steel girder bridges with timber decks (over Jumbo Creek mainstem) to steel pipe culverts for smaller tributary crossings.

The proposed resort development will create added traffic volumes along these roadways, and therefore some improvements will be required to provide a safe and functional facility for all users. The preferred road alignment and target design speed is 50 kph with the requirements of a subdivision road as defined in Section 14 of the Ministry of Transportation Highway Design Manual for Rural Local Undivided Roads (see McElhanney 2003). Although it is possible to use the existing bridges in the early stages of development, the bridges will not be necessary for the alignments chosen for road improvements and the ultimate road upgrade will see a route without creek crossings from Panorama to the resort..The only remaining bridge will be the one nearest to the sawmill site, which will be maintained for access to the west side of the drainage at the resort site. To minimize impacts to fish habitat, JGR will follow the design, installation and protection measures for stream crossing outlined in the “Forest Practice Code - Fish Stream Crossing Guidebook” (March 2002).

The preferred road alignment leads from Panorama to the resort at the sawmill site without bridges, but it proposes to include one bridge crossing (bridge N2-181) near the sawmill site for ease of access to the west side of the drainage from the new alignment. It will also include 26 Open Bottom Structures (OBS) and 10 Closed Bottom Structures (CBS). Based on the above structure types and information on fish bearing sections of Jumbo Creek and tributaries, ENKON recommends the following crossing structures:

- For fish bearing and non-fish bearing sections of Jumbo Creek mainstem, bridges will be used for all crossing structures.
- All road crossings of Jumbo Creek tributaries with <20% gradient (assumed to be fish bearing) will be designed as open bottom structures. There are 26 proposed open bottom crossings of

fish bearing tributaries.

- All road crossings of Jumbo Creek tributaries with >20% gradient (assumed to be non-fish bearing) will be designed on a site-specific basis and follow the recommendations of the Forest Practice Code (likely closed bottom structures). There are 10 proposed closed bottom crossings of non-fish bearing tributaries.
- Final design of all crossing structures will follow the Forest Practise Code and the Department of Fisheries and Oceans hierarchy of crossing types.

Since the proposed stream crossings follow the recommendations of the “Forest Practice Code - Fish Stream Crossing Guidebook” (March 2002) a Section 35(2) Authorization for the harmful alteration, disruption or destruction (HADD) of fish habitat should not be required from the Department of Fisheries and Oceans.

- *identification, description and mapping of critical and sensitive fish habitat features, including fall and spring spawning areas and overwintering sites;*

The biophysical habitat surveys were conducted in a similar manner to those of Carswell (1979), who completed standardized DFO/MOE stream survey forms to characterize the biophysical habitat features of Jumbo Creek. The results of the surveys are similar, except that Norecol identified four distinct stream reaches in Jumbo Creek, mainly defined by gradient, whereas Carswell (1979) identified three reaches. Aquatic Resources (1993) also identified four reaches within Jumbo Creek, although the reach breaks were at different locations than those of Norecol. Based on gradient and habitat characteristics, the four reaches delineated by Norecol included:

- Reach D-including the lower, relatively steep section from the mouth of Jumbo Creek to about km 5 above the second bridge and just below the third bridge;
- Reach C-from km 5 to about km 10+, a reach of relatively gradual slope with more pools and meanders;
- Reach B-the central, relatively steep section from just above km 10 to about km 16 just above Leona Creek and the fourth bridge up the creek; and
- Reach A-the upper, relatively low-gradient section above km 16 to the toe of the upper valley wall. This reach includes the proposed resort base area.

Reaches B and D are relatively steep and fast-flowing, while reaches A and C are of lower gradient and have more pools and gravel areas, as well as organic debris (logs, root wads). A fifth reach could also be designated for the headwaters of Jumbo Creek in the very steep section at the head of the valley below the glaciers.

The habitat surveys by Norecol (1992 and 1993) and Carswell (1979) suggest that Jumbo Creek, particularly in the sections within reaches A and C, has good-to- excellent fish habitat, at least in the ice-free seasons. However, few fish were found in the creek, either by Norecol in September 1992 and May 1993, or Carswell in August 1978, suggesting that there are one or more limiting factors to fish production in Jumbo Creek.

Aquatic Resources described the habitat within Jumbo Creek as relatively low gradient (1.5-1.6%) for the first 0.1 km from the Toby Creek confluence, with the gradient increasing to 8.7% further

upstream in Jumbo Creek (i.e. Reaches 2, 3 and 4).

Norecol also noted a 1.5 metre waterfall (formed by a large boulder and log debris) located at road km 17 at the uppermost end of Reach B is likely a fish migration barrier. Reach B immediately below the waterfall, from road km 17 to 10, is also an impedance to upstream fish migration as it is relatively steep with rapids and small falls over large boulders. The more braided and low-gradient Reaches A and C contain better fish habitat and more diverse flow/substrate conditions. These reaches have smaller substrate sizes, more riffle areas suitable for fish spawning and more pools with large organic debris.

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2. See Project Report Specification D.3(A) #1 above, Appendix 3-G Fisheries Resources, and the Route Study, attached as Appendix 5-A to Volume 5 of the Master Plan. The current choice of improved road alignments eliminates the need to upgrade any bridges. However, even according to earlier planning, since the proposed stream crossings followed the recommendations of the "Forest Practice Code - Fish Stream Crossing Guidebook" (March 2002) a Section 35(2) Authorization for the harmful alteration, disruption or destruction (HADD) of fish habitat was not expected to be required from the Department of Fisheries and Oceans.

- *identification and mapping of all potential permanent and temporary barriers to fish passage between the upper and lower reaches of Jumbo Creek, noting where identified barriers are complete or partial, and where natural or as a result of human activities; and*

Based on ENKON's 1992 and 1993 field surveys Westslope cutthroat trout inhabit Jumbo Creek mainstem up to approximately road km 17 (confluence with Leona Creek), where a 1.5 m high waterfall likely impedes upstream migration. In addition, the 7 kilometres of Jumbo Creek downstream of the waterfall is also an impedance to upstream fish migration as it is relatively steep with rapids and small falls over large boulders characterized by a series of cascades. In addition to Jumbo Creek mainstem, Westslope cutthroat trout are likely present in some of the larger tributaries in the low gradient sections (<20%) within the main valley floor.

The proposed road alignment provided by McElhanney Consulting Services Ltd. was draped over the classified streams to assess the number of crossings and type of crossing required. The Route Study Report (see Appendix 5-A of Volume 5 of the Master Plan) refers to various route options, however, for the purposes of this stream crossing assessment we refer to the preferred route alignment and not alternative route alignment options. This preferred alignment includes no bridge crossings for the main access to the resort site and one existing bridge (bridge N2-181) crossing accessing the west side of the drainage near the resort area, 26 Open Bottom Structures (OBS), and 10 Closed Bottom Structures (CBS).

Since the proposed stream crossings follow the recommendations of the "Forest Practice Code - Fish Stream Crossing Guidebook" (March 2002) a Section 35(2) Authorization for the harmful alteration, disruption or destruction (HADD) of fish habitat should not be required from the Department of Fisheries and Oceans for the following reasons:

- The "Forest Practice Code - Fish Stream Crossing Guidebook" (FPC-FSCG) (March 2002) states that Section 35(2) Authorizations are not required where there is no harm to fish habitat.

This was confirmed by H. Klassen of the Major Projects Review Unit of DFO during a meeting held on May 23, 2003. H. Klassen stated a follow-up e-mail on June 2, 2003 *“that pipe culverts in fish streams now require authorization under the fisheries act, and hence trigger CEAA. Further, the hierarchy or preferences in DFO’s Habitat Management Policy requires that open-bottom crossings be used to avoid harmful alteration, destruction or disruption of habitat”*. According to the Forest Practice Code-Fish Stream Crossing Guidebook, in general, an open bottom structure (OBS) does not require site-specific agency approval if the crossing is constructed within the timing window and if it spans the stream without:

- Disturbing the instream fish habitat;
- Encroaching on the stream channel width; or
- Causing excessive loss of riparian vegetation

Open bottom structures are proposed for all road crossings of fish bearing sections of Jumbo Creek mainstem and tributaries, as defined by Carswell (1979), Norecol (1992 and 1993) and Aquatic Resources (1993) or any stream <20% gradient.

- Although the FPC-FSCG states that in marginal fish habitat (applies to some fish bearing sections of tributaries to Jumbo Creek), where stream gradients are 6% or less and where the streambed is wide and deep enough to be excavated and the closed bottom structure (CBS) properly embedded, site-specific fisheries agency approval is not required provided that the installation is carried out within the timing window and design and installation are carried out according to Section 3.2 of the FPC Guidebook. Regardless of this option for closed bottom structures in some fish bearing sections of Jumbo Creek tributaries, closed bottom structures have not been proposed in any stream with less than 20% gradient.

“identification, description and mapping of sensitive Bull trout habitat features, including overwintering sites, upwelling areas and potential spawning habitat, should Jumbo Creek prove accessible to Bull trout under the previous bullet.”

During Aquatic Resources study from early August to late September 1992 with the exception of the confluence of Jumbo/Toby Creek, bull trout were not captured or observed in any tributary stream of the Toby (upper, middle or lower Jumbo, Neave and Delphine Creeks) or Horsethief (Andreen, Bruce, Law, Grottos tributaries, Gopher, McDonald, Stockdale or Farnham Creeks) Creek systems. Based on the three fisheries research projects conducted in Jumbo Creek, there is no evidence to suggest bull trout utilize Jumbo Creek.

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3. Potential impacts to fish habitat from residential and commercial development have been avoided during the planning process and adherence to the recommended 30m *“Streamside Protection and Enhancement Areas”* as outlined in the *Fish Protection Act-Streamside Protection Regulations* (January 2001). As a result, there are no anticipated residual impacts and no direct instream or riparian fish habitat impacts associated with the resort base development; therefore,

Part D: Environmental, Resource Management and Technical Issues

fish habitat compensation plans will not be required.

To avoid potential impacts to fish habitat, ENKON has recommended a number of different “*Streamside Protection and Enhancement Area*” zone widths for the mountain and resort base development including:

- The *Fish Protection Act-Streamside Protection Regulations* (January 2001) is applicable to the resort base residential and commercial development areas only. A 30m “*Streamside Protection and Enhancement Areas*” from Jumbo Creek mainstem and tributaries is recommended for the resort base development; and
- The Forest Practise Code “*Riparian Management Area Guidebook*” (1995) was specifically designed to apply to harvesting, silviculture and road construction practises in working forests. Therefore, ENKON classified the streams within the mountain development areas and applied the FPC guidebook recommendations for “*Riparian Management Zones*” to the aligning and construction of ski lifts and ski runs within the mountain plan areas of the resort development. “*Riparian Management Zones*” widths range from 20-30m from tributaries of Jumbo Creek associated with the development of ski runs and ski lift lines.
- The FPC Stream Crossing Guidebook was also applied to the upgrading of the access road.

Resort Base Development

While fish habitat compensation plans will not be required, JGR is committed to the following guiding principles and best management practices during the final design and construction of the resort development areas:

- Principle #1: Impervious Area Reduction - Although general guidelines for density designations (i.e. bed units and the number of ski lifts and runs) have been planned, development will be sensitive to impacts to stream-flow hydrology and will strive to minimize Total Impervious Area (TIA). Wherever possible, source control, interception, infiltration and diversion will be utilised to reduce impervious areas.
- Principle #2: Maintenance of Water Quality – Water quality control facilities will be designed with bio-filtration systems to treat stormwater prior to discharging into Jumbo Creek.
- Principle #3: Post Development Stormwater Discharge – Post development stormwater discharge rates will be controlled through the use of retention or detention of stormwater runoff.
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- Principle #7: No Net Loss-Net Gain in Fish Habitat – The development will strive towards meeting no-net-loss: net gain in fish habitat through protection of fish bearing sections of Jumbo Creek and tributaries and associated riparian corridors.
- Principle #8: Integration of Site Vegetative Planting with Natural Areas – The development will

integrate re-planted areas with adjacent riparian corridors and ecological features.

- Principle #9: Monitoring – A biological, physical habitat and continuous water volume and quality sampling program will be implemented pre and post-development.

Mountain Development

Design and location of ski runs and ski lifts have followed the Forest Practice Code-Riparian Management Area Guidebook (1995) recommended riparian management zone widths as follows:

- Where ski lifts and runs are located parallel to streams, a 20-30 m wide riparian management zone width is proposed for S4, S5 and S6 streams.
- In addition to riparian management zones, the following environmental protection measures were taken into account by the Proponent during the planning and design of the ski runs/trails and lifts:
 - Ski trails/runs will cross perpendicular to streams where possible;
 - Ski lift towers will span riparian corridors;
 - No ski lifts or runs will cross fish bearing sections of any stream; and
 - Many of the ski runs are located within existing heli-ski runs that have either been previously logged or are above the tree line.

D.3(B) Wildlife Resources

EA Issues Profile

Topic

Implications of project development for wildlife resources.

Issues

- Completion of baseline wildlife surveys and mapping necessary for adequate wildlife impact assessments.
- Detailed assessment of impacts on wildlife populations and habitats.
- Assessment of importance of Jumbo Pass as wildlife migration corridor, and implications of project for use of Pass.
- Proposals for impact mitigation and management.

Relevant Project Components

All on-site and off-site project components within Toby/Jumbo Creek drainage.

Lead Agency

Ministry of Environment, Lands and Parks (MELP) – BC Environment and Lands.

Comments also Received From

- Ktunaxa/Kinbasket Tribal Council (KKTC)
- Columbia Lake Indian Band (CLIB)
- District of Invermere
- Regional District of East Kootenay (RDEK)
- Parks Canada

Relevant Public Comments on Application and Draft Specifications

- Project is inconsistent with vision of retaining maximum biodiversity and connectivity for wildlife populations. (2c) Need regional connectivity plan before new potential barriers to wildlife movement are created. Project site is key east-west movement corridor. What is importance of Jumbo Pass for wildlife migrations?
- Project cannot meet criteria for SRMZ – i.e. provide (1) enhanced levels of management for wide-ranging carnivores, (2) connectivity and migratory routes for wildlife, and (3) buffer for Purcell Wilderness Conservancy (PWC). (2d)
- Wild backcountry is interconnected, and proposal extends into Farnham and Horsethief Creeks. Need environmental impact study of entire affected area, not just Jumbo Creek. (10b) Draft specs ignore cumulative effects on fauna and flora. Need study of entire Purcell Mountains ecosystem, including PWC, west side of Jumbo Pass, and Glacier and Tenise Creek drainages.
- Wildlife populations can be enhanced through habitat improvement, in conjunction with ongoing population survey. (13c,d)
- Project will have negative effect on area's wildlife and fish. Wildlife using Jumbo Pass need protection. (13e)
- Development will impact mountain goat kidding locations. (13g)
- Jumbo and Stockdale Passes are two of few passes used by wildlife to move across the Purcell divide. No other passes occur to north until Spillimacheen drainage. Project will obstruct critical wildlife corridor. (13i) Project will disrupt wilderness corridor between PWC and northern protected areas.
- Need wildlife inventory of Glacier and Hamill Creek drainages? (13j) Also Tenise Creek.

- Specs should require both regional and local impact studies. For key species, should assess effects on travel/dispersal, and long-term gene pools and population dynamics.
- Mitigation of wildlife impacts is not possible. What is level of acceptable impact?
- Species which will avoid the area include grizzly bear, black bear, mountain goat, caribou, wolverine and elk. Need to study problem.
- Draft specs imply process of negotiation between MELP and proponent to determine study requirements. MELP should simply direct study needs. Surprised by absence of specs for new wildlife studies.
- Mountain goats have not been adequately assessed - draft specs do not mention them.
- Draft specs deal insufficiently with small mammals and birds.
- How much deforestation is needed to accommodate resort? What will be impacts on wildlife habitats, slope stability and erosion, increased sedimentation and avalanche hazard?
- What will be impact on surrounding wildlife values from hikers, bikers, etc.?
- Need comparative wildlife studies with other resorts. Should study wildlife impacts of European resorts.

Relevant Public Advisory Committee Comments on Draft Specifications

- Re. draft spec. #2 - add mountain goat ranges (summer and winter) to first sentence.
- Re. draft spec. #5 – PAC agreed that scope of 1st bullet should include literature review. Extent of review was not agreed, and matter was referred to project committee.
- Re. draft spec. #5, 2nd last bullet - recommend project committee give detailed guidance to proponent on studying effect of wildfire suppression on wildlife in Jumbo valley and PWC.
- Re. draft spec. #5, final bullet - change 'significant' to 'potential impact' as the affected, as well as lost, habitat should be quantified.
- Re. draft spec. #11 - add "...to the effect that interviews with long-time users of the Jumbo Valley and adjoining valleys be conducted to determine their assessments of wildlife populations, habitats, etc..."
- Interviews should be done with hunters and trappers who have used Jumbo valley.

Part D: Environmental, Resource Management and Technical Issues

- Computer-based Geographic Information Systems (GIS) should be used for wildlife habitat assessment.
- There was suggestion (but without consensus) for additional spec for field study and cumulative effects analysis of 3-to-5-year duration on red- and blue-listed species, plus carnivores and ungulates (goats and elk).

Relevant Proponent Comments on Draft Specification and Specification Feedback

- No basis to claim that project will endanger or prevent wildlife use of Jumbo Pass. Project is designed to avoid Jumbo Pass (is located further north, and mostly on opposite side of drainage).
- Seven years of observations reveal occasional wildlife sightings, and no evidence of migration corridor, especially through Jumbo Pass. R.K.'s recent application to MELP cites lower wildlife significance of Jumbo valley.
- Earlier FOI request of MELP was intended to acquire MELP's data on wildlife migration routes in Jumbo Creek drainage. Apparently, MELP has no such information.
- Opponents' claim is not true that project will devastate region's ecosystems, as shown by experience at Panorama, which is more significant from biodiversity perspective. Project will have insignificant impacts, and could enhance Jumbo valley environment, which lost its pristine character earlier this century.
- Draft specs are repetitive and unreasonable, and do not acknowledge work already done, information in *Volumes 4 and 5* of application, and correspondence from Enkon Environmental.
- It would not be a significant effort to include caribou in rating scheme for Jumbo valley.
- Mortalities associated with poaching and hunting can be minimised by enforcing 'no hunting zones' and educating resort guests.
- Re. draft spec. #1 - Based on previous commitment from MELP in 1992/93, collection of wildlife baseline field data is complete, and review should be completed on basis of available data. Reviewers have overlooked some studies.
- Re. draft spec. #2 – have identified ungulate use areas, do not have mapping of rutting areas. Ungulates are moving in and out of the valley regularly.
- Re. draft spec. #5 – seems unnecessary to list this – just ask for standard EA practices.
- Re. draft spec. #6 – Jumbo Pass will not be impacted. Ungulates migrate up

and down Jumbo valley, do not migrate through it.

- Re. draft spec. #7 – all field studies complete, now need to do impact assessments.
- Re. draft spec. #8 – spec should be in section D.3(C), concerns grizzly bears.
- Re. draft spec. #10 – can do literature search for more controversial.

Related Issues and Relevant Specifications

- Re. land use and related land use planning issues, see section A.7.
- Re. related wildlife management issues, see other parts of section D.3.
- Re. commercial and non-commercial wildlife recreation, see section E.5(F).
- Re. fish and wildlife resource management, see section E.7(K)
- Re. traditional First Nations use of wildlife resources, see section G.1.
- Re. possible federal cumulative wildlife effects assessment requirements, see section H.2.

Additional EA Reporting Requirements?

Yes – see below; draft specs. Revised as follows: to reflect conclusion that pre-agreed aerial/ground wildlife data collection is adequate, but data need to be mapped/assessed; wildlife study area is expanded; 2 grizzly bear specs. Are transferred to section D.3(C); and need to conduct interviews with long-time users of area.

EA Review Focus

MELP wishes to be in a position to assess potential impacts of the project on wildlife populations and habitat at all stages of project development. No permits are issued pertaining to wildlife. Requests for detailed assessment of wildlife movement through the Jumbo Creek valley area are intended to permit some quantification of the extent of wildlife movement, and some assessment of the impacts of the proposed project on wildlife migration through the area. Variability in seasonal populations strongly suggests seasonal migration in and out of the Jumbo and Toby Creek drainages by a variety of wildlife.

Review of Application

Regional Context

MELP considers the Jumbo Creek drainage to be important for several species, including grizzly bears (see section CD.3(C), below). This

importance is referenced in MELP's *Regional Biodiversity Strategy*, which rates the ecosystem in the Jumbo Creek drainage as warranting high biodiversity emphasis in managing resources. In addition, the Jumbo Pass has been identified as being one of only two passes through the Purcell Mountains Range in the area to the north of the Purcell Wilderness Conservancy Provincial Park (PWC) which have terrain conducive to the east/west movement of wildlife and the maintenance of regional connectivity for wildlife populations.

For these reasons, the EA review of the resort's environmental effects is taking into account the need to maintain the biological diversity of the area, and the regional connectivity of wildlife populations.

The proponent has stated that there is no evidence of significant migration through this corridor, and this conclusion needs to be supported with technical analysis.

Presentation of Information

While considerable technical information is provided in the proponent's application, review and evaluation of this information have been difficult. The technical information is not well organised, and tends to be distributed throughout several volumes. Moreover, the main text of the application provides little in the way of integrated technical summary, and only a limited discussion of results, conclusions or recommendations beyond those offered in the individual background reports in the appendix volumes.

The proponent is commended for the comprehensive nature of the biophysical habitat baseline mapping. This mapping will provide invaluable baseline habitat information necessary for the evaluation of the project's potential impacts on wildlife habitats and populations. The biophysical information should be used as the base map for presenting all additional wildlife information.

In respect of the aerial and ground wildlife survey information contained in *Volume 5* of the Application, MELP agrees that the proponent has met the wildlife survey requirements identified in the terms of reference developed with the proponent in 1993. Theseat includes mountain goat survey information. Several letters from the public referred to a lack of information on goats in the area. However, the Ministry does not feel that there is a need for an additional surveys of goats. The initial survey results are consistent with what MELP biologists expected for goats in the area.

It is anticipated that the proponent will consider and refer to relevant experience at other ski resorts in documenting the required wildlife assessments, and will cite examples of differing degrees of success and failure in managing wildlife impacts at other resorts, with some explanation of the reasons for any observed variability.

Habitat Significance

One useful feature of the proponent's biophysical habitat mapping is the separation of the seasonal habitats of many of the identified species into spring, summer, fall and winter use. Although winter range is generally the most limiting and critical for the survival of most ungulate species, spring and fall ranges can be equally important, as can parturition and rutting areas. Furthermore, the availability of high quality spring and early summer forage on habitat units which exhibit early spring green-up (e.g. avalanche tracks and south-facing slopes) is essential as animals move off their winter ranges.

Spring and fall ranges are important for both black and grizzly bears. As bears come out of hibernation, they move down to lower forage areas in the forested valley bottoms, as noted in the application. However, they often move back up the valleys in mid-spring to feed on the high quality vegetation associated with early green-up on avalanche paths. Quality forage for bears in the fall is crucial if the animal is to store sufficient fat reserves for winter hibernation. These important fall ranges are often found on the mid-to-high-elevation south-facing slopes and lower segments of avalanche paths in drainages such as Jumbo Creek.

It has not been established that the Jumbo Creek valley functions as a "sanctuary" for any particular species. However, based on information currently available on the ecological requirements of grizzly bear, elk, black bear, mule deer and several other species which are known to frequent this valley (e.g. small furbearers), the potential for loss of habitat and disruption of migration patterns is a significant issue.

MELP notes that there is no clear evidence that either mountain caribou or mountain sheep occur within the Jumbo Creek valley or more generally within the area of influence of the project. The application indicates that there is little evidence of winter use of the alpine parts of the Jumbo Creek valley by mountain goats, although this is based on a very limited field survey.

Given the long-term nature of the Jumbo Glacier project, habitat enhancement will not likely be acceptable as compensation for unmitigatable impacts to wildlife resources. MELP would not support enhancement of adjacent wildlife habitats as mitigation or compensation for project impacts on wildlife. Wildlife enhancement generally refers to forest or vegetation manipulation to improve forage/cover habitat values. These are appropriate techniques to offset relatively short-term impacts of projects such as mines, until a permanent solution can be provided through reclamation. Reclamation is not an option in a project of this size and longevity.

Project Report Specifications – D.3(B)

Wildlife Surveys and Mapping

The proponent must complete the following survey and mapping tasks, and the mapping and survey findings must be presented in the project report:

1. Analysis of the results of aerial and ground wildlife surveys which were completed and included in *Volume 5, Appendix P* of the application, and of the biophysical habitat maps for the Jumbo Creek valley.
2. Biophysical habitat capability mapping for all ungulates at a scale of 1:50,000 for upper Glacier Creek and upper Horsethief Creek above its confluence with Farnham Creek, based on existing MELP habitat capability maps.
3. For the Jumbo Creek valley, mapping of special habitat features, specifically including winter ranges, game licks, parturition areas, rutting areas and migration routes for all major ungulate species, winter and summer ranges for mountain goats, and den sites for black bears. This information must be presented at a scale of 1:20,000, and in a format suitable for overlaying onto the biophysical habitat baseline maps.
4. For the upper Glacier and upper Horsethief Creek valleys, mapping of special habitat features, specifically including winter ranges and migration routes for all ungulate species. This information must be mapped at a scale of 1:50,000. The movements of wildlife back and forth between the Jumbo Creek valley and adjoining valleys must be given particular attention.
5. 1:20,000-scale overlay maps of the locations and layouts of all project development components, including the footprints of all accommodation facilities, the planned village, roads, trails, lifts and lift infrastructure, and the access road and power supply corridors. Where options are under consideration, the alternative locations must be mapped.

Wildlife Impact Assessment

6. Based on the baseline information which was documented in the application, and the additional information to be collected for the project report, the proponent must present in the project report an assessment of potential direct and indirect short-term (project construction) and long-term (project operation) impacts on wildlife habitats and populations, associated with both the project's on-site facilities and its off-site infrastructure components (including the upgrading and operation of the access road and the installation of a new transmission line).
7. The wildlife impact assessment required in specification #6 must identify (or prepare) and evaluate the following:
 - habitat losses (i.e. the quantified area and the significance of the habitat loss) attributable to the construction and operation of physical facilities associated with

each on-site and off-site resort component – this assessment must be supported by reference to relevant literature sources;

- the implications for wildlife populations of the various activities associated with the resort at all four seasons (e.g. winter skiing, summer skiing, hiking, biking, wildlife viewing, etc.);
- wildlife population impacts associated with access road traffic (e.g. road kills);
- wildlife population impacts associated with problem wildlife around the resort (e.g. destruction of problem bears, etc.);
- the possible increase in wildfire suppression in the interests of public safety at the resort, and the implications for long-term wildlife habitat management;
- the implications of the project for the maintenance of regional connectivity of key habitats; and
- detailed plans for avoiding or mitigating potential impacts on wildlife populations and wildlife habitat, including plans for monitoring the success of mitigation measures and a commitment to address ongoing problems, in consultation with MELP.

8. An assessment of the importance of the Jumbo Pass area as a wildlife migration corridor between the eastern and western Purcell Mountains, and the implications of the project for wildlife use of this corridor, must be presented in the project report.

9. As part of the wildlife assessment process, the proponent must conduct (and, in the project report, document) interviews with long-time users of the Jumbo Creek valley and adjoining valleys, so that assessments of wildlife populations, habitats, etc. benefit from the local knowledge of those familiar with the area. On request, MELP will identify some long-time users for the proponent, and other project committee members may also choose to do so.

RESPONSE – D.3(B)

1. ENKON analyzed previous aerial surveys for Mountain Goats conducted by Norecol Dames and Moore (Norecol). The observations are summarized in the table below.

Table 3.1: Summary of Mountain Goat Observations on Surveys Conducted by Norecol within the Study Area

Date	Observation or Sign	Comment
1992		
September	3 direct observation Tracks	-upper Commander Creek -ridges between The Cleaver and Black Diamond Mtn.
November	No direct observation Tracks	-upper Commander Creek
1993		
February	2 direct observation 10 direct observation	-south-facing bluff, N. side Jumbo -south-facing bluff, N. side lower Jumbo and W. side Toby Creek Valley
April	2 direct observation 10 direct observation	-south-facing bluff Jumbo -bluffs, W. side Toby Creek
May	None seen during aerial survey 2 observed, ground survey	-in snow at higher elevation in upper Jumbo Valley
Late May	Goats reported by hunters	-high on Black Diamond
June	2 observed, aerial & ground survey	-upper Jumbo Valley
July	Goats observed, aerial survey 12 observed, aerial survey	-far up Valley (Glacier Dome) -at a mineral lick at top of Horsethief Creek
August	Goats observed	-Jumbo Pass

A small number of Mountain Goats winter in Jumbo Valley. They were seen, during the November survey, using the upper regions of the east side (south-west aspect) of the Commander basin and the area above the treeline on the east side (west aspect) of the upper Jumbo basin (slope below Karnak Mountain). Most goats migrate out of the area, wintering on the ridge lying north of Jumbo Creek (and south of Delphine Creek) and west of Toby Creek above Delphine Creek. Goats also winter on the ridges of the upper Delphine Creek basin.

Available information suggests that in summer and early fall, goats occur along the north and

south sides of Jumbo Valley. Three goats were observed in the upper Commander Creek basin during the September 1992 survey, and goat trails were observed on the high ridges between The Cleaver and Black Diamond Mountain. Goats were not observed in the survey area during the November 1992 survey, though goat tracks were observed in the upper elevations of the Commander Creek basin. During the February, 1993 survey, two goats were observed on a south-facing rock bluff on the north side of Jumbo Valley, opposite Leona Creek. Ten goats were observed on the south-facing rocky bluffs and ridges on the north side of the lower Jumbo Valley and on the west side of the Toby Creek Valley. This area of bluffs and ridges extends from Monument Peak (east of Black Diamond Creek) over to Delphine Creek. Goat tracks were also observed in the upper Delphine Creek basin.

Mountain Goats appear to move out of the Jumbo Valley by November to winter ranges above Toby Creek (north side between Delphine and Jumbo Creeks). They remain there until May, and likely use the winter range for parturition, moving slowly into Jumbo Valley by June and being well dispersed by July. A small number (2 or 3) of Mountain Goats remained in Jumbo Valley and wintered there in 1993 (bluffs opposite Leona Creek). Rutting areas were not confirmed, but may include the upper Delphine Creek area, on the way to winter ranges above Toby Creek.

Mountain Goats appear to move extensively in and out of Jumbo Valley and adjacent areas, between summer ranges, rutting areas, winter range/parturition areas and back to summer ranges. The lick at the top end of Horsethief Creek may be a key element in the annual movement pattern of goats in the area. Movement corridors through Glacier Dome and Black Diamond seemed to be well used.

Mule Deer

ENKON analyzed previous aerial surveys conducted by Norecol. The observations regarding Mule Deer are summarized in the table below.

Table 3.2: Summary of Mule Deer Observations on Surveys Conducted by Norecol within the Study Area

Date	Mule Deer observation or Sign	Comment
1992		
September	Tracks and droppings Mule Deer observed	-lower elevations of valley -Toby Creek Valley

During the late May aerial survey and follow-up groundwork, no Mule Deer were observed in Jumbo Valley, although large numbers were observed in the Toby Creek valley, especially at Mineral King. By early June, Mule Deer had dispersed again into the Jumbo Valley, at least into the valley bottoms. By July, Mule Deer were well dispersed in Jumbo Valley, including up to the tree line. No Mule Deer fawns were observed. Parturition likely occurs in the valley bottom habitats. Rutting areas are outside the Jumbo Valley.

No direct observations of Mule Deer were made in Jumbo Valley during the September, November, February, or April surveys. Sign (tracks, droppings) was observed at the lower elevations of the valley during September 1992 ground surveys and Mule Deer were often

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observed in the Toby Creek Valley in September 1992. Mule Deer appear to move out of Jumbo Valley in the fall (by November) and move down to winter ranges in the Rocky Mountain Trench. No observations of Mule Deer or tracks in the snow were made during the November, February, and April surveys in Jumbo Valley. Large numbers of Mule Deer winter on the benches to the west of Invermere and were common there in April 1993 (based on roadside observations).

White-tailed Deer

ENKON analyzed previous aerial surveys conducted by Norecol. The observations of White-tailed Deer are summarized the following table:

Table 3.3: Summary of White-tailed Deer Observations on Surveys Conducted by Norecol within the Study Area

Date	Observation or Sign	Comment
1992		
November	No observations	-like Mule Deer, moves out of Valley to winter in Rocky Mountain Trench
1993		
May	Begin appearing	-near lower slide areas, Mineral King mine
June	1 observed, aerial survey	-relatively numerous along Jumbo floodplains through to fall
July	5 observed, aerial survey	-throughout Valley, utilizing floodplains and slide areas, no fawns observed in May or June

White-tailed Deer start to appear in the lower portion of the Jumbo Valley in late May when they utilize the lower slide areas for feeding and cover. Few were observed during aerial surveys (one on June 9 and five on July 23), although they are relatively numerous along Jumbo Creek floodplain habitats from early June through the fall (Norecol 1993).

White-tailed Deer were observed most of the way up the Jumbo Valley, utilizing floodplains and slide area habitats. As with Mule Deer, White-tailed Deer move out of the valley by late fall (November) to winter ranges in the Rocky Mountain Trench. They are common again in Toby Creek by late May (especially at Mineral King). No White-tailed Deer fawns were observed in Jumbo Valley during May or June surveys. They likely drop their fawns in the forested habitats along lower Jumbo Creek. Rutting areas are outside of Jumbo Valley.

Moose

ENKON analyzed previous aerial surveys conducted by Norecol. The observations of Moose are summarized in the following table:

Table 3.4: Summary of Moose Observations on Surveys Conducted by Norecol within the Study Area

Jumbo Glacier Resort/Project Report

Date	Observation or Sign	Comment
1992		
November	Aerial survey	cow and calf, lower slide, N.side of creek at 1300 m ¹
November	Aerial survey	cow and calf, lower slide, at 1340 m ¹
November	Aerial survey	cow and calf, N.side of Jumbo Valley, N of Leo Creek on S. aspect at 1580 m ²
November	Aerial survey	1 cow and 1 calf, lower slide area at upper end of Jumbo Creek, SW aspect at 1860 m ²
November	Tracks, feeding craters	N.side of upper Jumbo Valley at 2130 m
November 10	Tracks	Jumbo Valley above Leona Creek
November 11	Tracks	3 tracks seen East of resort centre
November 11	Tracks	Several days old, along Jumbo Creek in sedge-willow-birch flat
November 12	Tracks	Jumbo Valley road (7.7 and 8.1 km) crossing between a slide and bottomlands along Jumbo Creek
November 12	Tracks	Jumbo Valley road 12.5 km to 16.4 km
November 12	Tracks, browse	Lower section of logging road
1993		
February	Aerial survey	cow and calf, near road at 4.5 km SW of Panorama, 1190 m elevation ¹
	Aerial survey	bull, slide at NW corner of Lot 7151, 1370 m ¹
	Aerial survey	bull, slide at NW corner of Lot 7149, 1400 m ¹
	Aerial survey	adult, near Jumbo Valley road, Lot 15974, 1490 m ²
	Aerial survey	adult, near Jumbo Valley road, Lot 15975, 1490 m ²
	Aerial survey	bull, cow and calf, lower S. facing valley slope just west of Black Diamond Creek, 1520 m ²
	Aerial survey	bull, N. Jumbo Creek in valley bottom, 7 km, 1370 m ²
	Aerial survey	bull, crossing Jumbo Creek at 6.5 km bridge, 1370 m ²
February 16	Tracks, Ground survey	tracks, 3 Moose feeding in open, burn area;
April	No observation	none observed in upper Valley
May 26	2 observed	cow and calf, upper Jumbo Valley
May, June, July	Few observed during aerial survey	well dispersed in Valley

¹ Toby Creek from Panorama to Jumbo Creek ² Jumbo Creek Valley

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Information indicates that Moose utilize the upper Jumbo Valley area (above Leona Creek) from summer to late fall (November). By early winter (December) they move down to their winter ranges in the lower part of Jumbo Valley and into the Toby Creek valley bottom. During colder weather and new snow (e.g. in February) Moose had moved to well below Leona Creek, where the valley is widest and has the greatest availability of browse (willows, poplars) in the early seral stages following fire (i.e., 7.8 km to 2.8 km on Jumbo Valley road).

In early spring (late April), Moose actively occurred up to about Leo Creek. No sign of Moose was observed in the upper part of Jumbo Valley during the April survey. They were well dispersed by late May and few were observed during the May, June, or July aerial surveys. A young calf Moose was observed with a cow in upper Jumbo Valley on May 26, suggesting that the upper Jumbo Valley is used for parturition.

Rutting activity likely occurs throughout the Jumbo Valley, in the valley bottom and coniferous forests and successional stages on the lower valley slopes.

Anecdotal information suggests that hunting pressure on Moose in Jumbo Valley is heavy, and consequently, the Moose population may be depressed (Norecol 1993).

Elk

ENKON analyzed previous aerial surveys conducted by Norecol. The observations regarding Elk are summarized in the following table:

Table 3.5: Summary of Elk Observations on Surveys Conducted by Norecol within the Study Area

Date	Observation or Sign	Comment
1992		
August	J. Christensen*	-bands of +20 Elk have been observed in the alpine on N. side of Jumbo Valley, near Black Diamond
November	No observation	-move out of valley, to winter range in Rocky Mountain Trench
1993		
February	No observation	-
April	No observation	-
Late May	2 observed	-upper valley
Late July	Few, aerial survey	-calf Elk observed

* J. Christensen, pilot for Frontier Helicopters

Elk had moved out of the Jumbo Valley by the time of the November survey. Sparse Elk sign was still evident along Toby Creek; however, it appears that Elk generally move down to the main valley at Invermere, likely by late October.

Elk inhabit Jumbo Valley during summer and early fall. By November, Elk have moved out of the valley, likely moving down through Toby Creek to the Rocky Mountain Trench to winter. No evidence of wintering Elk was recorded in Jumbo Valley or the Toby Creek Valley during the November (1992) or February (1993) surveys and none were observed in Jumbo Valley during the April (1993) survey. Elk were observed again in Jumbo Valley in late May, including two Elk in the upper valley. This suggests that Elk move into the valley again by mid-May. Calf Elk were not observed in late May or early June and a few were observed during the late July aerial survey. Elk appeared to be well dispersed in small groups during the summer.

Parturition areas could not be confirmed but likely includes the remaining mature coniferous forests in the valley. Rutting areas were also not confirmed. Suitable rutting areas occur throughout the upper elevation basins and parkland habitats near tree line. There is no information on population size in Jumbo Valley, though bands of >20 Elk were reported in the alpine areas on the north side of Jumbo Valley near Black Diamond Mountain in August 1992 (J. Christensen, pilot for Frontier Helicopters).

Black Bears

Black bears were observed during the September 7, 1992; May 26, June 9 and July 23, 1993 aerial surveys. Ground observations were also made during late May, early June and late July to early August. Black bears frequented the slide area and lower valley forests. Fewer Black bears were observed than expected, likely due to their habit of staying in dense cover. They are likely abundant in the valley bottom and lower slope forests of Jumbo Valley.

It is possible that denning occurs in older stands where large trees have suitable denning cavities.

Suitable bear denning habitat (based on aspect, slope position, and surficial material) is located in the side drainages to the north of Jumbo Creek. The upper Jumbo Valley is rocky, with many unstable slide areas, and generally does not appear to provide suitable denning habitat for bears.

Grizzly Bears

Grizzly bears were sighted only twice during the aerial surveys: a sow and two year old cub on May 26, 1993 in a slide area on the north side of Jumbo Valley, between Commander and Leo Creeks; and a young, cinnamon/dark coloured adult on July 23, 1993 in early regeneration forest near the bottom of Commander Creek, on the north of Jumbo Valley.

Follow-up ground observations on June 9, 1993 produced another sighting of a young, dark silver-tipped adult Grizzly in the upper portion of Jumbo Valley. This bear was feeding in a meadow at the bottom of a large slide on the east side (west aspect) of the upper Jumbo Valley.

The log book kept at the Jumbo Pass cabin reports a "large" Grizzly spotted by hikers on the way up the Jumbo Pass trail on June 9, 1993, the same day as one of the aerial surveys. It is possible that this is the same bear observed on the ground further up Jumbo Valley on the evening of June 9.

A Grizzly was also reported in Jumbo Valley in late July by logging contractors, and was apparently a young cinnamon colored adult. A group of hikers interviewed at the Jumbo Pass cabin on August 1 reported that they had seen a young "brown" Grizzly at Mineral King during their drive in on the morning of July 31, 1993.

This brings the total number of sightings to seven Grizzlies - four individuals observed by the field biologists, and three by others. Of the latter, two could well have been the same bears observed earlier by the Norecol biologists.

The Jumbo Valley appears to be used by Grizzlies for feeding in the late spring-summer. One local resident (Mr. Nolan Rad from Invermere) suggests that breeding Grizzly bears during June use the upper Jumbo Valley.

One den site was observed from the air and was located at the upper elevation of the Commander Creek basin. No other den sites were found. Summer feeding sites (craters in meadows) were evident in several regions of the study area, notably west side of Jumbo Pass, upper Jumbo Creek, Commander Creek basin, and upper Leo Creek basin.

No tracks or other signs of bears were observed during the November 1992 survey, suggesting that bears had already entered their dens by the time of the survey. Grizzlies may still have been active in the region, as the weather had been mild and snow depth was light (generally less than 30-35 cm even at 2130 m (7000 ft) elevation).

Suitable bear denning habitat (based on aspect, slope position, and surficial materials) is located in the side drainages to the north of Jumbo Creek (e.g., the Commander basin and basin to the east.) The upper Jumbo Valley is rocky, with many unstable slide areas, and generally does not appear to provide suitable denning habitat for bears.

Large Carnivores

Carnivores are active in the upper Jumbo Valley: Coyote (or sign) was recorded, as was a possible Lynx track, identified by visiting skiers as a 'cat' track.

Cougars

Available information (Norecol 1992, 1993) suggests that cougars occur in Jumbo Valley, though none had been observed during fieldwork. Others have reported cougar tracks and one sighting in Jumbo Valley during 1992/93.

Wolves

Available information (Norecol 1992, 1993) suggests that Wolves occur in Jumbo Valley, though none have been observed during fieldwork. Discussions with a former trapper suggest that they may occasionally travel through Jumbo Valley in winter (pers. comm. Nolan Rad).

Coyotes

A lone Coyote was observed in Jumbo Valley during the February and April (1993) surveys and sign and tracks were observed during the November, February, and April surveys. In general, it is suspected that low numbers of coyotes use Jumbo Valley.

Lynx

In general, it is suspected that low numbers of Lynx may use Jumbo Valley.

Furbearers

ENKON analyzed previous aerial surveys conducted by Norecol. The observations related to furbearers are summarized in the following table:

Table 3.6: Summary of Furbearer Observations on Surveys Conducted by Norecol within the Study Area

Date	Observation or Sign	Comments
1992		
November	Tracks, ground survey	- tracks, possibly Wolverine
	Tracks, ground survey	-several furbearer tracks (Ermine), along road
	Tracks, ground survey	-Marten tracks, Leo Creek, km 15.9 and in forest at km 18 (resort centre)
	10 set of tracks, ground survey	-Ermine tracks, hillside eastside of valley
1993		
February	Furbearer tracks	-cross the road from Leona Creek (km 18) (Weasel and Marten)
April	Furbearer tracks	

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Furbearers including Wolverine, Marten, Weasel and Ermine are active in the upper Jumbo Valley. Furbearers (mainly Marten and Weasel) are most abundant between Leona Creek (at km 14) and km 18 (Norecol 1993).

Based on discussion with local trappers (including a former trapper in Jumbo Valley) and observations during November, February, and April surveys, Jumbo Valley supports Wolverine (small numbers due to large home range size), Marten and Ermine. The remaining stands of mature coniferous forest in particular provide good habitat for Marten, while the recently logged areas on the valley side and the early regeneration after logging provide good habitat for Ermine.

Inferring from ground/aerial surveys and available information, the study area does not support a visible Fisher population. Preferred habitat is found in SWB, SBS and BWBS biogeoclimatic zones with abundant coarse woody debris. Cannings *et al.* (1999) identified the south-eastern corner of the province as former Fisher range and as such we are providing management guidelines to protect potential populations and habitat.

Small Mammals

ENKON analyzed previous aerial surveys conducted by Norecol. The observations of small mammals are summarized in the following table:

Table 3.7: Summary of Small Mammal Observations on Surveys Conducted by Norecol within the Study Area

Date	Observation or Sign	Comments
1992		
November	Tracks, ground survey	-Squirrel-along road to resort centre -Squirrel-upper side of harvested, hillside east of valley in mature trees
	3 sets of tracks, ground survey	-Hare tracks along switch-backed, logging road on hillside
	Tracks, ground survey	-Porcupine-along Valley road (16.4 km and 16.7 km)
1993		
Feb/Apr	Tracks	-Red Squirrel

According to the Ministry of Forests, some of the small mammals that inhabit the Invermere TSA are Beaver, Muskrat, Squirrel, and Raccoon. According to field survey records, the area is home to Red Squirrel, Snowshoe Hare and Porcupine (Table 1-10). Due to their conservation status, an emphasis during research was placed on red-listed Least Chipmunk and blue-listed Red-tailed Chipmunk.

Habitat for Least Chipmunk is restricted to alpine and subalpine areas. They have not been

recorded in the immediate study area, but Nagorsen and Fraker (2002) recently collected specimens nearby in the Bruce Creek drainage and an area near Mount Brewer (Nagorsen *et al.* 2002). Thus, they could possibly occur in the upper Jumbo Valley below the glacier level. Fraker and Nagorsen concluded in their comprehensive study, that Red-tailed Chipmunk does not inhabit the Purcell Mountains.

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2. Habitat suitability (biophysical habitat capability) mapping has been completed at 1:50,000 scale, as required by the Project Specifications. The mapping is presented in 11x17 format (for ease of duplication and distribution) in Appendix 3-B Wildlife Resources. Full scale maps at 1:50,000 are included in the Map Volume (Volume 8) of the Master Plan.

The habitat capability mapping for ungulates is based on existing Ministry of Environment Lands and Parks (MELP) habitat capability maps, which were received from the Habitat Inventory & Analysis Section (Bryan Krueger, Geo-Spatial Analyst & Web Administrator). The original scale of these maps is 1:250,000, MELP habitat capability maps at 1:50,000 scale were not available for the project area. In addition, habitat capability for White-tailed Deer has not been mapped because it was not available from the government for the project area. White-tailed Deer habitat presumably would be similar to Mule Deer habitat, although White-tailed Deer would inhabit lower portions of the Jumbo Valley.

For grizzly bear the habitat capability mapping was developed based on 1:20,000 Terrain Ecosystem Mapping (TEM) for the study area provided by Slocan Forest Products Ltd. Habitat suitability ratings were applied to Ecosystem Units shown on the TEM maps. The Resource Inventory Committee's Wildlife Habitat Rating Standards (RIC 1999) were used to assess habitat for Grizzly Bear. Under this protocol the value of each habitat or ecosystem type for a species is quantified, and used to generate the suitability map. A six class rating scheme, as indicated in RIC (1999) was used: 1=High (75-100% of best in province); 2=Moderately High (50-75%); 3=Moderate (25-50%); 4=Low (5-25%); 5=Very Low (0.1-5%) and 6=Nil (0%). The rating scheme is based on the habitat's potential to support the wildlife species under optimum conditions relative to the best habitat available in the province.

Prior to developing ratings tables for wildlife species rated in this study, detailed life requisite models were outlined, which detail habitat attributes of importance to the species. These life requisite models are critical for the development of the ratings tables. Life requisite models were developed for ungulate species as well as for Grizzly Bear.

The following sections summarize the available habitat suitability information for ungulates Mountain Goat, Mule Deer, White-tailed Deer, Moose, and Elk.

Mountain Goats

Based on winter habitat suitability mapping for Mountain Goats, provided by the former Ministry of Environment, Lands and Parks (MELP) and Ministry project biologists, the most important areas for goats in the Jumbo Valley study area are on the high elevation slopes on the North side of Jumbo Creek, especially the area west of Monument Peak. Some moderately suitable habitats have been mapped in rocky terrain.

Habitat suitability mapping of winter and summer range provides a general overview of the area's

suitability to support Mountain Goats. Based on habitat, the south-facing, alpine areas north of Jumbo Creek may be of importance for parturition and rutting.

Mule Deer

Habitat suitability mapping for Mule Deer was completed for summer and winter. In winter, the most important habitats are found east of Leo Creek in the Valley bottom; however, for the most part, Mule Deer winter outside of the Jumbo Valley in the Rocky Mountain Trench (Norecol 1993). In early spring, early snowmelt areas at low elevations, particularly in riparian areas and on south-facing slopes, are of importance. North-facing, riparian areas are of lesser importance.

Based on habitat, the riparian area of Jumbo Creek may be of importance for parturition and rutting.

White-tailed Deer

Habitat suitability mapping for White-tailed Deer would be similar to that of Mule Deer, except that White-tailed Deer would select lower elevation habitats.

Moose

Based on Moose winter habitat suitability mapping provided by the former Ministry of Environment, Lands and Parks (MELP), and information collected by project biologists, the most important areas for Moose in the Jumbo Valley study area are on south-facing riparian areas north of Jumbo Creek. Moose in Jumbo Valley utilize areas on either side of Jumbo Creek. Areas outside of the Valley provide important winter habitat.

Habitat suitability mapping of winter and summer range provides a general overview of the area's suitability to support Moose. Based on habitat, the riparian zone of Jumbo Creek may be of importance for parturition and rutting

Elk

Based on winter habitat suitability mapping provided by the former Ministry of Environment, Lands and Parks (MELP) for Elk, and information collected during the project field work, the most important areas for Elk in the Jumbo Valley study area are on south-facing slopes north of Jumbo Creek. Elk utilize riparian areas on either side of Jumbo Creek, but tend to prefer sites east of Leo Creek. Areas outside of the Valley provide important winter habitat.

Based on habitat, the riparian zone of Jumbo Creek and lower elevation gentle slopes may be of importance for Elk parturition and rutting.

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3. Information on special habitat features in the Jumbo Creek Valley was compiled by Norecol Dames and Moore during their wildlife surveys from 1992 to 1993. This information was used to prepare 1:20,000 scale maps of migration routes, winter ranges, parturition areas and rutting areas for all ungulate species; Mountain Goat summer ranges; mineral licks and den sites for Black Bears. This information is presented with 11x17 maps in Appendix 3-B Wildlife Resources. Full scale maps are included in Volume 8 of the Master Plan. Detailed habitat mapping at

1:20,000 was also included in Volume 4 of the 1995 Master Plan which has been digitized and reproduced in the Project Report as Appendix 3-A.

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4. The information gathered to date was compiled by Norecol Dames and Moore during their wildlife surveys from 1992 to 1993. Appendix 3-B Wildlife Resources illustrates potential ungulate seasonal migration routes and includes mapping at 1:50,000 as required by the Project Specifications (see Master Plan Volume 8: Map Volume for full scale maps).

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5. The Master Plan and the Appendixes include scale overlay maps and drawings showing the locations and layouts of all project development components, including the footprints of all accommodation facilities, the planned resort, roads, trails, lifts and lift infrastructure, and the access road and power supply corridors. Master Plan, Volume 4: Project Components illustrates the locations and layouts of all project development components, including the footprints of all accommodation facilities, the planned resort base, roads, trails, lifts and lift infrastructure. The access road and power supply corridor, which is the access road alignment, is described in the Route Study (Appendix 5-A to Volume 5 of the Master Plan). In particular, the Master Plan, in Volume 4, Project Components, includes a series of Appendixes (4-B through 4-F) containing an inventory of maps and renderings of project components. These maps are included in 11 x 17 format for ease of distribution. Full scale maps are provided in Volume 8: Map Volume of the Master Plan. For convenience, the following table provides a quick reference:

Table 3.8: Project Development Component Mapping

Drawing Number:	Name:	Scale:
P0	Preliminary Conceptual Mountain Area Map	1:25,000
P0.1	Preliminary Conceptual Mountain Area Map	1:20,000
P0.2	1995 & 2003 CRA Comparison	1:20,000
P1	Resort Core Area – Aerial View – Existing	N.T.S.
P1.1	Preliminary Conceptual Resort Area Plan (Aerial view)	1:3,000
P2	Preliminary Conceptual Controlled Recreation Area Map	1:12,500
P2.1	Preliminary Conceptual Mountain Area Map of Summer Trails	1:12,500
P2.2	Preliminary Conceptual Mountain Area Map of Summer Lifts	1:12,500
PH-1	Preliminary Conceptual Resort Area Plan – Phase 1	1:3,000
PH-2	Preliminary Conceptual Resort Area Plan – Phase 2	1:3,000
PH-3	Preliminary Conceptual Resort Area Plan – Phase 3	1:3,000
P3	Preliminary Conceptual Resort Area Plan – Phasing	1:3,000
P4	Preliminary Conceptual Resort Area Plan	1:3,000

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P5	Extent of the Proposed Mineral No Staking Reserve	1:20,000
P6	Flood Plain Area Based on 200 Year Return	1:20,000
P7	Mineral Titles and Reserves	1:20,000
P8	Mineral Tenures Overview	1:40,000
S1	Preliminary Conceptual Storm Drainage Routing	1:3,000
S1.2	Preliminary Conceptual Stormwater Discharge Points	1:3,000
S2	Preliminary Conceptual Sanitary Sewer Routing	1:3,000
S3	Preliminary Conceptual Watermain Routing	1:3,000
S4	Preliminary Conceptual In-Ground Disposal of Treated Water	1:20,000
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6. The following Table lists potential sources of impacts to wildlife resources during resort construction and operation. The following sections describe potential impacts on various wildlife species (valued ecosystem components) and present mitigation measures for the impacts identified. The complete impact assessment is presented in Appendix 3-B Wildlife Resources.

Table 3.9: Summary of Potential Impacts from Resort Construction and Operation

Project Activity	Potential Environmental Effect
CONSTRUCTION	
Clearing and construction of ski lifts and runs	<ul style="list-style-type: none"> -Permanent loss/alteration of forest habitat, some fragmentation -Creation of high value growing season foraging areas for deer -New habitat for wildlife utilizing herb/shrubs -Displacement possible increase in competition in adjacent areas -Sensory disturbance -Increase in human-wildlife encounters
Resort road clearing and development	<ul style="list-style-type: none"> -Permanent loss/alteration of forest habitat, some fragmentation -Sensory disturbance -Disruption of natural drainage -Contamination through spills of oils/toxic substances
Helicopter use	<ul style="list-style-type: none"> -Sensory disturbance -Increased summer period stress
OPERATIONS	

Project Activity	Potential Environmental Effect
Resort base, buildings and other facilities	-Increased stress to some species due to potential free-running dogs (although the proponent plans to control and minimize the introduction of pets, which will not be permitted during construction, and will only be permitted in controlled conditions and for short stays for the tourist population) -Increase in human-wildlife encounters
Winter ski operations	-Sensory disturbance for sensitive wintering species
Avalanche control	-Sensory disturbance
Summer ski run maintenance	-Disturbance of species in that area
Use of surface water	-Surface flows will not be used
Stormwater run-off	-Contamination of streams and creeks -High water flows leading to bank scour and reduction of riparian habitat
Transmission lines	-Should positively impact many species by creating habitat. -Increased risk of electrocution to some raptors
Access and increased vehicle traffic	-Increased human activity, sensory disturbance, some fragmentation and displacement -Increased hunting pressure -Illegal garbage dumping -Increase in road kills -Should not affect high elevation species
Hikers	-Displacement and sensory disturbance of sensitive species -Localized degradation of habitat
Garbage	-Localized contamination of habitat for small species -Possible ingestion of some stray litter -Wildlife foraging in garbage cans/dumps; creation of nuisance animals (although the project will have strict controls and secure receiving areas to impede this)

Mountain Goats

Construction Phase

Ski Runs

Clearing and development of ski runs are expected to result in very limited sensory disturbance and displacement of resident goats. During the summer and fall, when clearing of ski runs is likely to occur, most Mountain Goats are in Alpine Tundra habitats of upper Jumbo Valley, specifically along the north and south sides of Jumbo Valley (Norecol 1993). Habitat alteration resulting from

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ski run development is not expected to affect goats, since goats do not utilize areas where habitat alteration is necessary (i.e., open alpine and subalpine habitats will not require any clearing or grading).

In the summer, herbaceous communities on ski runs may provide some new foraging areas for Mountain Goat. This potential benefit is expected to be very small and not significant since Mountain Goats summer in remote areas of Jumbo Valley.

Mitigation Measures

To reduce potential impacts on goats moving between winter and summer ranges, ski run and lift development activities in the areas of migrating goats will not be conducted in April, May or November.

Resort Base Facilities and Roads

Resort base facilities and road development at lower elevations, where Mountain Goats have historically not been found, is unlikely to lead to any notable sensory disturbance.

Helicopter Use

Helicopter use, if utilized, would be limited primarily to the summer construction period. During the operational period, helicopters would only be used in emergency and search-rescue situations. Aerial sightseeing tours will not be an associated recreational activity at the resort; thus impacts from aerial sightseeing tours are not anticipated.

Impacts to Mountain Goat from helicopter overflights during the construction period have the potential to be significant because goats will likely be present in the Valley during construction. However, the mitigation measures described in the following section will eliminate or minimize any disturbance to Mountain Goats.

Mitigation Measures

During construction, JGR will implement the following to minimize/eliminate impacts of helicopter use to Mountain Goats:

- Helicopter pilots will be required to follow established wildlife observation protocols and guidelines where possible within the limits of safety.
- Minimum heights above ground and distances from Mountain Goats will be observed.
- Pilots will also be made aware of areas of goat concentrations so that every effort can be made to avoid these areas.
- If helicopters are used for transportation and delivery of materials during the construction phase, careful scheduling and routing around the sensitive parturition and rutting periods and locales will be required.
- According to guidelines set out by the B.C. Environment Region 2 (1997) to ensure protection of over-wintering Mountain Goats, all activities (including helicopters) within 500 m of wintering range habitat are restricted from the period of May 1 to October 31 in a given year. JGR will determine the *absence* of Mountain Goats prior to operations and the aerial survey will be conducted to the satisfaction of Fish and Wildlife Management staff. If goats or tracks are

sited, the flight should be terminated immediately, and the relevant information forwarded to Fish and Wildlife staff.

JGR will also use the following enhanced plans from the former Ministry of Environment, Lands and Parks (MELP 2000) to mitigate impact of helicopter noise and its presence in the valley.

- Restrict helicopter activity during construction to a minimum, particularly beyond the bounds of the Jumbo Creek watershed;
- Prohibit helicopter access for the sole purpose of transporting guests to and from the resort once construction is completed (except for emergencies and any necessary maintenance);
- According to B.C. draft guidelines, a minimum 2000 m above ground level horizontal and vertical distance will be maintained, with a no fly/no land buffer around designated Mountain Goat habitat (Denton 2000);
- Avoid air traffic in identified kidding areas during the spring kidding season (May 1 to July 15) and direct traffic away from these areas;
- Avoid disturbance of identified critical winter ranges between December 01 and April 30, and direct activity away from these areas;
- Schedule helicopter flights between one hour after sunrise and one hour before sunset from mid April to mid October;
- Establish flight patterns of less than half a mile wide along travel routes and landing zones, except where flight safety precludes this;
- Travel routes should avoid all steep cliff faces and known areas of high use;
- Designate landing zones with adequate visual of topographic barriers;
- A qualified biologist should monitor the location and activity of goats within Jumbo Creek Valley; and
- If possible, allow only one access route to the developed area, by way of the primary road, and restrict flight access into other areas in Jumbo Creek Valley (except for emergencies).

Operational Phase

Avalanche Control

Avalanche control activities will not take place in the vicinity of wintering goats, thus avoiding significant impacts to Mountain Goats. Avalanche control activities will be infrequent and located a considerable distance to wintering goat populations.

Summer Ski Run Maintenance

Maintenance activities would take place during the summer when goats are in the summer ranges in the high elevation Alpine Tundra zone. Therefore, goats will not be in the area during run maintenance and any disturbance can be avoided.

Stormwater Run-off

Stormwater run-off associated with the resort will not occur in areas utilized by wintering or

summering Mountain Goats. Therefore, impacts are not anticipated.

Transmission Lines

Transmission lines will not be located in areas inhabited by Mountain Goats. Therefore, impacts are not anticipated.

Residual Impacts

With recommended mitigation measures, residual impacts from the resort are not expected to result in measurable changes to the local Mountain Goat populations.

Garbage

Garbage associated with the resort and residential areas will not affect Mountain Goats since resort development will occur outside known wintering areas. Increased garbage originating from hikers and mountain bikers is not expected to be an issue, since most users would typically pack-out what they pack-in, thereby keeping garbage in higher elevations to an absolute minimum. A policy of "Pack-in, Pack-out" will be rigidly enforced on all recreational trails as part of the Grizzly Bear Management Plan. As noted elsewhere the resort and its clientele are not expected to generate a significant increase of hikers, as the main opportunity will be skiing and snowboarding also in the summer, and hiking opportunities from upper Jumbo Valley, except for Jumbo Pass, will be minimal. (see also D.3 (G) and Appendix 3-C Environmental Management Plans).

Mule and White-tailed Deer

Construction Phase

Ski Runs

Clearing and construction of ski runs is expected to result in some sensory disturbance and displacement of Mule and White-tailed Deer during the summer and fall seasons when many deer move to higher elevations to forage on emerging herbaceous vegetation.

Creation of herb-dominated habitats adjacent to mature timber will provide excellent foraging habitats for deer in the early spring, summer and fall periods. Thus, although ski run development will result in short-term impacts (primarily sensory), the long-term benefits to deer are expected to be positive. Deer are adaptive to human development and if the limiting life requirements are preserved, populations are not expected to decline.

Mitigation Measures

Disturbance to Mule and White-tailed Deer will be minimized due to the following factors:

- Ski run development will be staged;
- Some of the proposed runs follow existing RK Heli-skiing trails;
- Run development will occur during the growing season; and
- The ski area is confined to a relatively small and partially existing ski trails.

Large tracks of untouched forested areas will provide important security and thermal cover for

deer during the growing season. Ski runs have been situated away from mountain streams, ensuring that valuable riparian habitats are not disrupted.

Resort Facilities and Roads

Some of the existing vegetation communities and deer habitat in the Jumbo Creek Valley will be lost as a result of the construction of buildings, access roads, foot and bike trails and parking lots.

Disturbances that may occur are the following:

- There may be a moderate degree of sensory disturbance, particularly for individuals migrating from low elevation wintering areas to high elevation summering areas. However, this should be minimized by staging development away from migrating deer.
- Clearing of land and its development will permanently remove site-specific summer habitats considered to be of high suitability for deer.
- The resort core and associated ski trails are expected to impact summer use areas causing displacement to adjacent habitats.
- The localized effect of the resort base facilities and road development on resident deer is expected to be of moderate significance locally. On a regional scale, the impact is anticipated to be insignificant due to the availability of high quality habitat in areas adjacent to the Jumbo Valley study area.

Benefits of the proposed resort development include clearing activities in areas surrounding the resort, which may result in additional summer forage for deer and other ungulates. Cleared areas (i.e. ski runs, service roads, hiking trail) may produce berries and forage plants for deer. The proposed resort is expected to increase summer habitat value to deer populations.

Mitigation Measures

The resort base area will not be developed in one year, but development will be staged over many years. Therefore, impacts related to sensory disturbance are expected to be localized with most mid-elevation areas free of significant disturbance. Staging of development on the site will also allow local deer populations to adjust to habitat changes.

To ensure that unacceptable deer mortality does not occur, JGR will ensure that staff and residents will not be permitted to carry firearms or hunt on the resort property during construction and operation. In addition, recreational use of all-terrain vehicles (ATVs), feeding, harassment or destruction of any wildlife by project personnel on the resort site will be prohibited.

ENKON recommends that management should make every effort to maintain the quality of deer habitat by maintaining forest cover to support foraging, security, thermal cover, and connectivity requirements. Mature forests should be the optimum distance to forage sites to provide deer with quick access to secure cover while feeding.

Helicopter Use

Helicopter use has the potential to disturb resident deer throughout their winter and growing

season habitat within the project area. However, helicopter flights would be restricted to the summer months of construction and the effects would be short-term and sporadic. Effects would be marginal at high elevations since deer do not utilize high elevation habitats. However, greater impacts could occur at lower elevations where helicopters may be used for transport during construction. If helicopter disturbance is regular, anticipated and a buffer of >500 m is maintained, deer may habituate to flights. However, if they do not, helicopter flights potentially would cause temporary displacement of deer to adjacent habitats.

Mitigation Measures

With helicopter overflight protocols established (see Appendix 3-C Environmental Management Plans and Appendix 3-B Wildlife Resources) and implemented by JGR, disturbance to summering deer will be confined to the construction period and kept to a minimal, tolerable level. In addition, JGR will ensure that helicopter traffic will be kept to a minimum, directed away from parturitions areas and scheduled to avoid rutting and parturition.

Operational Phase

Avalanche Control

Avalanche control activities at high elevations within the project area will be located a considerable distance from known wintering deer areas and are thus not expected to result in disturbance to deer.

Summer Ski Run Maintenance

Summer maintenance will be intermittent, requiring brushing and mowing of shrubby areas every two to four years in different areas each year. Therefore, sensory disturbance to deer summering in ski run areas is expected to be very localized and of short duration.

All-terrain vehicles (ATVs), which may be used as service vehicles throughout the immediate resort and ski runs, may cause sensory disturbance to unhabituated summering deer and displacement to adjacent habitat (Dorrance *et al.* 1975). Should deer habituate to the occasional intrusion by ATVs, the impact would be minor. Eckstein *et al.* (1979) detected no changes in White-tailed Deer movement or home range due to ATV use.

Stormwater Run-off

In high rainfall or snow or other events resulting in large discharges, uncontained stormwater runoff could lead to stream bank scour and minimal degradation of riparian habitats.

Mitigation Measures

JGR will implement an effective stormwater management plan (see Appendix 3-C Environmental Management Plans) that will minimize uncontained runoff.

Transmission Lines

Transmission lines will require forest clearing and maintenance of habitats at the herb or shrub stage. These vegetation communities will provide increased foraging opportunities for deer. If

forest clearing creates openings, especially on south-facing bluffs the openings may be used by deer as sunning areas. The overall effect of clearing for transmission lines creates new wintering habitat opportunities for deer.

Garbage

Garbage associated with the resort facilities and residential areas is not expected to significantly affect resident deer populations.

Mitigation Measures

With effective garbage management, a policy of pack-in/pack-out and enforcement the impact of garbage on deer will be minor. JGR will ensure that staff will be made aware of the wildlife risks associated with litter and will be instructed to pick up stray garbage and dispose of it appropriately.

Moose

Construction Phase

Ski Runs

Clearing and construction of ski runs is expected to result in some sensory disturbance and displacement of Moose during the summer and fall seasons when Moose tend to move to higher elevations to forage on emerging herbaceous vegetation. Since ski run development will occur during the growing season, impacts during the winter are not expected to occur. Although ski run development will result in short-term impacts (primarily sensory), the long-term benefits to Moose are expected to be positive, by way of an increase in foraging areas.

Mitigation Measures

Mitigation measures recommended in the previous section can be applied to Moose. In addition, to ensure that habitat fragmentation does not occur, JGR will follow the habitat management objectives for Moose from the KBLUP Implementation Strategy (*Kootenay Boundary Land Use Planning Implementation Strategy*).

It is the intention of JGR, in an effort to minimize disturbance to vegetation and wildlife, to locate all facilities along the corridor of the upgraded resort access road. Road and utility right-of-way will, whenever feasible, follow existing roads and trails. Any necessary deviation from the existing right-of-way will follow the route that is least disruptive to the natural environment (McElhanney 2003).

Resort Base Facilities and Road

Impacts and mitigation measures outlined for deer apply to Moose. In addition, ENKON recommends that effort should be made to restrict or minimize motorized vehicle access into high quality Moose ranges by establishing travel corridors in habitats of relatively lower quality. If travel corridors must be made through high quality ungulate summer ranges, restrictions should be in place (e.g., speed limit, day-time use only, on-trail only).

Helicopter Use

Impacts and mitigation measures for proposed for Mule and White-tailed deer apply to Moose.

Operational Phase

Avalanche Control

Avalanche control activities at high elevations within the project area will be a considerable distance from known wintering Moose areas and are thus not expected to result in disturbance to Moose.

Summer Ski Run Maintenance

Summer maintenance will be intermittent, occurring in different areas each year. Sensory disturbance to Moose summering in ski run areas is expected to be very localized and of short duration.

All-terrain vehicles (ATVs), used as resort and ski run service vehicles, may cause sensory disturbance to and displacement of (Dorrance *et al.* 1975) unhabituated summering Moose. Should they habituate to the occasional intrusion by ATVs, impact would be minor.

Stormwater Run-off

In high rainfall or snow or other events resulting in large discharges, uncontained stormwater runoff could lead to stream bank scour and minimal degradation of riparian habitats.

Mitigation Measures

JGR will implement an effective stormwater management plan (see Appendix 3-C Environmental Management Plans) that will minimize uncontained runoff.

Transmission Lines

The impact to Moose from transmission lines is anticipated to be similar to impacts to deer. The overall effect will be beneficial due to the creation of new foraging habitat.

Garbage

Garbage associated with the resort facilities and single family chalet areas is not expected to significantly affect resident Moose populations, although some ingestion of litter along frequented trails and roadways is a possibility. With effective garbage management, a policy of pack-in/pack-out and enforcement, the impact of garbage on Moose will be minor. Staff will be made aware of the wildlife risks associated with litter and will be instructed to pick up stray garbage and dispose of it appropriately.

Elk

Ski Runs

Clearing and construction of ski runs is expected to result in some sensory disturbance and displacement of Elk during the summer and fall seasons when they move to higher elevations. Moreover, some of the proposed runs follow existing RK Heli-skiing trails; thus, the disturbance will be limited. Since ski run development will occur during the growing season, impacts are not expected during the winter.

Although ski run development will result in short-term impacts (primarily sensory), the long-term benefits to Elk are expected to be positive, by way of an increase in foraging areas.

Mitigation Measures

Ski run development will likely be staged, ensuring that most areas of the mountain are relatively disturbance-free at any given time.

Large tracks of untouched forested areas will provide important security and thermal cover for Elk during the growing season. Ski runs have been situated away from mountain streams, ensuring that valuable riparian habitats are not disrupted.

Resort Base Facilities and Roads

Some of the existing vegetation communities and Elk habitat in the Jumbo Creek Valley will be lost as a result of the construction of buildings, access roads, recreational trails and parking lots. A moderate degree of sensory disturbance is expected to occur, particularly for individuals migrating from low elevation wintering areas to high elevation summering areas. The effect of resort facilities and road development on resident Elk is expected to affect less than 40 ha of land. The resort core and associated ski trails are expected to impact summer use areas causing possible displacement to adjacent habitats. The resort base area will not be developed in one year, but will be staged over many years. Therefore, impacts related to sensory disturbance are expected to be localized with most mid-elevation areas free of significant disturbance. Staging of development on the site will also allow Elk populations to adjust to habitat changes.

Benefits of the proposed resort development include positive clearing activities in areas surrounding the resort, which may result in additional summer forage.

Mitigation Measures

Mitigation measures proposed for Mule and White-tailed deer and Moose should adequately address potential impacts to Elk.

Helicopter Use

Impacts and mitigation measures from helicopter use to Mule and White-tailed deer apply to the local population of Elk (see Appendix 3-B Wildlife Resources).

Operational Phase

Avalanche Control

Avalanche control activities are anticipated for high elevations within the project area. They will be a considerable distance from known wintering Elk areas and are thus not expected to result in

disturbance.

Summer Ski Run Maintenance

Summer maintenance will be intermittent, occurring in different areas each year. Sensory disturbance to Elk summering in ski run areas is expected to be very localized and of short duration.

All-terrain vehicles (ATVs) used as service vehicles throughout the immediate resort and ski runs may cause sensory disturbance and displacement of un-habituated summering Elk (Dorrance *et al.* 1975). Should Elk habituate to the occasional intrusion by ATVs, impact would be minor.

Stormwater Run-off

In high rainfall or snow or other events resulting in large discharges, uncontained stormwater runoff could lead to stream bank scour and minimal degradation of riparian habitats. Overall potential losses of riparian habitats will not significantly impact overall Elk forage.

Mitigation Measures

JGR will implement an effective stormwater management plan (see Appendix 3-C Environmental Management Plans) that will minimize uncontained runoff.

Transmission Lines

The impact to Elk from transmission lines is anticipated to be similar to impacts to deer. The overall effect will be beneficial due to the creation of new foraging habitat.

Garbage

Garbage associated with the resort facilities and residential areas is not expected to significantly affect resident Elk populations, although some ingestion of litter along frequented trails and roadways is a possibility. The impact of garbage on Elk will be minor, with effective garbage management, a policy of pack-in/pack-out and enforcement. Staff will be made aware of the wildlife risks associated with litter and will be instructed to pick up stray garbage and dispose of it appropriately.

Black Bear

Construction Phase

Ski Runs

Clearing and construction of the ski runs is expected to result in some sensory disturbance of Black Bear during the summer and fall seasons when Black Bears forage at higher elevations on lush herbaceous growth and huckleberries. In the long term, development of herb and shrub dominated habitats on ski runs will provide excellent foraging habitats for Black Bear in early spring, summer and fall. The incremental increase in available high quality foraging habitats for bears is considered to be significant and may off-set habitat losses associated with the resort development.

Mitigation Measures

Most ski runs have been designed to maintain large areas of forested habitats between lifts. These forested areas will provide important security and resting cover for Black Bear during the growing season. In addition, ski runs have been situated to ensure that valuable riparian foraging habitats are not disrupted, and lifts have been designed to minimize impacts to riparian habitats.

Resort Facilities and Roads

Resort and road development at lower elevations will occur over a long period of time in areas utilized by Black Bear in all seasons. A moderate degree of sensory disturbance is expected to occur. Clearing and land development will permanently remove habitats, and lead to displacement into adjacent areas for animals currently utilizing these areas. The effect of resort and road development on local Black Bear populations is expected to be significant, although not likely to threaten the viability of regional populations.

Mitigation Measures

Since resort development will occur over several years, impacts related to sensory disturbance are expected to be localized leaving most mid-elevation areas relatively undisturbed. Habitat changes will also occur over many years, permitting local animals to adjust to these changes.

The JGR will also implement the following mitigation measures:

- Avoid riparian areas during construction; therefore these riparian corridors will be retained allowing altitudinal movements of Black Bear within the study area.
- Ensure that staff and residents will not be permitted to carry firearms or hunt on the property during construction or operation.
- Prohibit recreational use of all-terrain vehicles and feeding, harassment, or destruction of any wildlife by project personnel on or near the facilities.

Helicopter Use

Helicopter use has some potential to disturb Black Bears during the growing season. Effects are likely to be marginal since most flights would be conducted a considerable distance above ground and pilots would be adhering to strict wildlife-overflight guidelines. Minimum heights above ground and distance from Black Bears will be observed.

Operational Phase

Avalanche Controls

Avalanche control activities at high elevations within the project area are expected to be very infrequent and are unlikely to lead to disturbance of denning bears unless bears are located in close proximity to the cannon discharge areas.

Summer Ski Run Maintenance

Ski run maintenance is not likely to greatly affect foraging opportunities for bears in ski lift areas, since brushing treatments will likely be directed towards young conifers and deciduous trees (e.g., shrubs).

Mitigation Measures

JGR will brief workers involved in run maintenance about the potential for Black Bear encounters and given appropriate equipment to avert negative encounters (e.g., bear bells, bangers, pepper spray).

Stormwater Run-off

In high rainfall or snow or other events resulting in large discharges, uncontained stormwater runoff could lead to stream bank scour and minimal degradation of riparian habitats. Potential losses of riparian habitats are not likely to significantly impact foraging areas for Black Bear.

Mitigation Measures

JGR will implement an effective stormwater management plan (see Appendix 3-C Environmental Management Plans) that will minimize uncontained runoff.

Transmission Lines

Herb and shrub dominated communities maintained below transmission lines will result in increased foraging opportunities for Black Bear. The open, accessible habitats along transmission lines may also facilitate bear movement.

Garbage

Improper garbage disposal and management has the potential to cause highly significant negative impacts on resident Black Bears.

Mitigation Measures

A comprehensive Grizzly Bear Management Plan (see Appendix 3-C Environmental Management Plans) has been developed for the Jumbo Valley site. It contains measures that are applicable to Black Bears including garbage management recommendations. Essential components of the plan include:

- All outdoor trashcans and dumpsters will be of bear resistant design and all trashcans will have plastic removable liners to contain odours;
- Areas of concentrated visitors use will be maintained as litter-free as possible;
- Garbage pick-up will be carefully scheduled to prevent overflow of cans and to assure leaving as little garbage as possible overnight;
- All bear proof containers will be picked up as quickly as possible to minimize odours and spillage;

- Drive through inspections for garbage will be performed in residential areas;
- When loaded, trash collection vehicles will proceed directly to the appropriate transfer location. In the event that late-night pick ups are necessary, the loaded vehicle may be stored in a secure area;
- Mishandling of garbage by resort residents/visitors will be reported to resort officials. A repeat offence will result in a citation and may be grounds for loss of in-resort privileges;
- Planting of fruit trees, compost and other bear attractants will be avoided;
- A trained bear official employed by the resort will patrol all grounds and roads into and within the site during active hours to assure that food and garbage are stored properly and to talk to visitors about bears in the country;
- Facility personnel will identify and correct operational and maintenance deficiencies regularly on an on going basis;
- All commercial operators will be given food and garbage management guidelines for the area as part of their business license conditions;
- Garbage transfer or detainment areas will be fenced with bear resistant fencing or electric fencing;
- All enclosures for refuse will be cleaned and disinfected both inside and out at least once per year;
- No garbage is to be buried; and
- Odour control from sewage facilities will require a demanding management approach.

The relocation and lethal removal of 'problem' wildlife will be considered only when deemed appropriate and necessary by Jumbo Resort management and the local Conservation Officer. A program of managing wildlife-human conflicts will be based on similar successful programs in other mountain communities such as Banff, AB and Revelstoke, BC (FLCG 2003).

Large Carnivores

Construction and Operation Phase

Temporary impacts to large carnivores could occur during construction of proposed facilities, particularly in areas away from direct human influence. Carnivores may be displaced if construction phasing is not appropriately scheduled to maintain some areas free of disturbance.

Furbearers

Construction Phase

Ski Runs

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Wolverines are expected to occasionally venture into forests within the project area, and thus are susceptible to disturbance caused by clearing and construction activities associated with ski run development. However, since the possibility of an interaction is low, the significance of these particular project activities is low.

Shrub and herb dominated habitats that become established on ski runs will likely attract a higher abundance of resident small mammals and foraging deer. Although higher prey densities will likely be available to Wolverine, this positive effect is not considered to be significant since most Wolverines are expected to inhabit the alpine habitats.

The felling of hazardous trees along new trails would slightly increase the amount of coarse woody debris (CWD) available for CWD-dependent species (e.g., Fisher).

Overall effect of ski runs on furbearers is anticipated to be insignificant.

Mitigation Measures

To mitigate potential impacts, ENKON recommends that JGR implement the following:

- Retention of large areas of existing forest and woody debris between ski runs and protection of riparian habitats to ensure that Fisher, Wolverine and other furbearers continue to have security cover as they move altitudinally through the Jumbo Valley.
- Minimize activity around riparian zones and prohibit removal of coarse woody debris (when practical and safe).
- Brief workers and staff on the potential occurrence of Wolverine within the project area. Precautions to avoid interactions, particularly garbage management, will be critical.
- In the unlikely event that a Wolverine den is found within the commercial recreational area, all activities will cease in the vicinity of the den site until a management plan can be developed. Temporary closures of ski trails and other facilities are potential options until the den has been vacated.

The goal of the management plan will be to ensure that the health and integrity of all denning animals is maintained.

Resort and Roads

Wolverine is not a resident species of the study area, but some individuals may occasionally move through Jumbo Valley along riparian corridors. These habitats will generally not be impacted by resort development. Disturbance associated with resort development is expected to be of low significance or, in the case of Wolverine, no significance.

Mitigation Measures

Despite the low impact significance from resort and road development, JGR will implement the following to minimize potential impacts:

- Initiate a wildlife survey program to identify critical habitats by surveying potential denning areas, and will report all sightings and known use areas to the responsible

provincial biologist.

- Should areas of high Wolverine use be identified, facility development and high levels of human activity will be avoided at times of high use.
- Retain riparian and coarse-woody-debris areas, as much as possible, for the benefit of furbearers.
- When practical, an attempt will be made to enhance Fisher, Ermine and Wolverine habitat by maintaining wildlife trees and leaving behind remnants of coarse woody debris.

Helicopter Use

Wolverine (for example) is susceptible to disturbance from helicopter overflights. However, because they are rare migrants in the Jumbo Valley, the effect of overflights is anticipated to be of low significance. Impacts to other furbearers would be of lesser concern, as Wolverine is more sensitive to human disturbance than other furbearers and is a CDC blue-listed species.

Mitigation Measures

To minimize disturbance to furbearers, JGR will:

- Avoid helicopter over-flights.
- Prevent helicopter landings and snowmobile activity near any Wolverine den sites that might be identified in the future.

Operational Phase

Avalanche Control

Because avalanche control will likely be limited to a few days per winter, overall impacts of this project activity are considered to be Low.

Summer Ski Run Maintenance

Since Wolverines are expected to frequent alpine elevations during the summer months, there is a low possibility that Wolverines will interact with ski run maintenance crews and activities.

Stormwater Run-off

Stormwater run-off is not expected to impact furbearers. JGR will implement a comprehensive stormwater management plan to ensure that the potential for uncontrolled flows is minimized.

Transmission Lines

No impacts to furbearers are anticipated due to transmission lines.

Garbage

Wolverines are scavengers and will likely be attracted to exposed garbage. Habituated animals may be considered a threat and be destroyed.

Mitigation Measures

JGR will implement a public education program that will inform people how to minimize attractants such as garbage. Many of the recommendations listed for Black Bear also apply to furbearers.

Small Mammals

Construction Phase

Ski Runs

Construction of ski runs will result in permanent alteration of existing forested habitats. Many small mammals will potentially be impacted by forest removal. Local populations of some of the small mammals (e.g., squirrel) can be expected to contract, but the regional population should remain unchanged. Sensory disturbance associated with ski run construction will likely also impact small mammals in habitats adjacent to the ski runs. Small mammals could also be harmed by construction equipment.

Habitat for the red-listed Least Chipmunk is restricted to alpine to subalpine areas. This species has not been recorded in the study area and its range is restricted to specific locales within the Purcell range. Thus, due to its apparent absence from the project area, no impacts are expected.

In general, the creation of ski runs is expected to positively impact the local small mammal populations. Several small mammals are expected to thrive in herb and shrub-dominated habitats that will become established on the ski runs. Small mammals will in turn provide increased prey opportunities for predators such as Coyote.

Mitigation Measures

The management strategy for small mammals that will be implemented by JGR includes the following points:

- Retain slash piles, spaced at regular intervals, along the edge of ski runs to provide security and thermal cover for several species of small mammals;
- Maintain Coarse Woody Debris;
- Place logs and slash on the ski runs to provide cover for small mammals moving across these open areas; and
- Retain wide riparian corridors along creeks and other sensitive habitats to ensure that major movement opportunities exist on the site.

Resort Facilities and Roads

Resort and road upgrade/development will result in permanent loss of habitats utilized by many small mammals. Although local impacts to small mammals are anticipated to be of Moderate

significance, due to loss of habitat, the viability of sub-regional populations is not expected to be greatly disturbed. Sensory disturbance of small mammals residing in adjacent habitats is also expected to occur, but will likely be of Low significance.

Mitigation Measures

JGR will ensure retention of wide riparian corridors and Coarse Woody Debris to ensure that major movement opportunities and security habitat for small mammals will continue to exist on the project site.

Helicopter Use

Helicopter use is not expected to result in significant impacts to small mammals. Low overflights could stress small mammals that reside in the subalpine and alpine areas; however, these are very unlikely to occur given flight guidelines for Mountain Goats and other wildlife species.

Mitigation Measures

JGR will ensure that helicopter pilots adhere to overflight guidelines outlined for Mountain Goats and other wildlife species.

Operational Phase

Avalanche Control

Noise associated with avalanche control activities may result in some sensory disturbance to small mammal species. The potential stress on small mammals associated with firing of the cannons is likely of Low significance to resident small mammals.

Summer Ski Run Maintenance

Ski run maintenance activities will likely result in a temporary disturbance to small mammals that have colonized these areas. Impacts are expected to be infrequent, of short duration, and will likely not significantly impact small mammal populations.

Mitigation Measures

During ski run maintenance activities, JGR will direct crews to minimize disturbance to low-growing herbs and shrubs that are not the target of maintenance. These recently established herb-shrub communities will likely support populations of small mammals.

Stormwater Run-off

Stormwater run-off may also result in alteration of streamside or riparian vegetation. However, the potential scale of disturbance and importance of riparian vegetation to various small mammals is very difficult to determine. Some species that are common in riparian areas may be affected at a local level. Overall impacts are expected to be low to negligible with an effective stormwater management plan.

Transmission Lines

As with ski runs, small mammal populations are expected to thrive in shrub-dominated habitats below transmission lines. The overall effect on the size of some small mammal populations (e.g., Snowshoe hare, Red squirrel) may be positive.

Garbage

Garbage is not expected to be a significant problem for native small mammals. However, non-native species such as the Norway rat and house mouse may be inadvertently introduced to the area. The interaction between non-native and native species is not well understood, but it is possible that rats would prey on the young of some small mammal species (e.g., deer mouse).

Mitigation Measures

JGR will design garbage management systems to reduce problems with other scavengers will also reduce the possibility that exotic small mammals will invade developed areas of the project site.

Harlequin Duck

Despite the lack of evidence indicating their presence in the project area, JGR will take precautions to protect their habitat type. Mitigation measures for reducing impacts to fish utilizing these systems will also benefit Harlequin Duck.

Passerine and Passerine-like Birds

Construction Phase

Ski Runs

Clearing and construction of ski runs will result in permanent loss of habitats of importance to many bird species. However, impact on passerine and passerine-like habitat is being minimized and all species are expected to continue to breed in the area. Overall populations of forest-dwelling bird species may be reduced, but the viability of local populations is not likely to be compromised.

The increased amount of edge habitat may lead to increased nest predation and nest parasitism (Manolis *et al.* 2002, Flaspohler *et al.* 2001). In addition, birds inhabiting areas not directly impacted by ski run development will be subjected to a considerable level of sensory disturbance. Overall impacts of the project activity on passerine and passerine-like species are considered to be of moderate significance on a sub-regional scale, but of low significance following mitigation.

Development of shrub-dominated habitats on ski runs will attract a diversity of shrub-associated species (e.g., American robin, song sparrow). Populations of these and other species with similar habitat requirements are expected to increase within the project area. Other species dependent on dead trees for nesting cavities and foraging (e.g., woodpeckers) will likely take advantage of trees blown down along the edge of ski runs.

Mitigation Measures

ENKON recommends the following to mitigate potential impacts:

- Maintain as much avian habitat as possible with the retention of large forested blocks between ski runs to ensure that forest-associated birds will continue to nest on the property.
- Minimize fragmentation to help maintain interior forests for forest-associated birds. The position of shrub-dominated areas, and resulting extensive edge habitats, will likely result in a higher species diversity and density than currently exists.
- Abide by the *B.C. Wildlife Act*, clearing of natural habitats will not occur during the critical 01 April to 31 July breeding period for birds, where feasible.
- In cases, where project development scheduling conflicts with the breeding bird window are unavoidable, a recognized wildlife biologist will conduct a comprehensive and intensive nest survey of the subject area to ensure that no active nests will be disturbed by clearing. The nest survey protocol will follow the protocols of the Resources Information Standards Committee.

Resort Facilities and Roads

Although the impact of development on passerine and passerine-like birds is considered to be of moderate significance to local populations, on a regional basis, an extensive amount of similar habitat exists in adjacent areas. The viability of migratory bird populations in the area is expected to be maintained.

Mitigation Measures

ENKON recommends the following to mitigate potential impacts:

- Retain riparian corridors within all residential and commercial development areas. These riparian corridors, and other sensitive/unique songbird habitats, will have a buffer corridor established on either streamside.
- When possible, utilize methods that promote natural regeneration to maintain forest structure. Conversely, silvicultural techniques can be used to enhance requirement of specific migratory birds (e.g., retaining snags).
- Clearing of habitats will not occur during the critical 01 April to 31 July breeding period in order to avoid direct impacts, unless a nest survey and management plan is developed.

Helicopter Use

Helicopter use is not expected to have significant impacts on passerine and passerine-like birds.

Operation Phase

Avalanche Control

Avalanche control activities may result in sensory disturbance to high elevation birds occurring close to avalanche cannons. However, winter bird populations are generally very low and widely

distributed in high elevation areas. Thus, overall effects are expected to be negligible.

Summer Ski Run Maintenance

Disturbance of nesting birds during maintenance activities could occur, possibly leading to nest failure, particularly if the activities are conducted during the nesting period. However, since much of the vegetation maintenance occurs in the summer season, many of the ground-nesting birds would have finished nesting, and thus would not be impacted. Continued disturbance is expected to be limited since lift and trail maintenance would occur over a relatively short period each summer and would not occur on every trail every summer.

Stormwater Run-off

The overall potential loss of riparian habitat is expected to be small since JGR will implement an effective stormwater management plan.

Transmission Lines

The potential for bird collisions with transmission lines is expected to be low. Shrub-maintained habitats below transmission lines will provide suitable breeding and migratory habitats for a variety of species. These areas may be particularly important during the migratory period.

Garbage

Accessible garbage may attract Gray jay and Clark's Nutcracker. These species are generally considered to be of a minor nuisance. Stringent garbage management will greatly reduce the availability of garbage to scavengers.

Non-migratory Birds

Construction Phase

Ski Runs

Potential impacts to resident or breeding birds may affect their abundance, density, distribution and reproductive success. Construction of ski runs will cause sensory disturbance and habitat removal during the growing season. Removal of older forests, which provide foraging and roosting opportunities for owl species, may result in negative impacts to resident owls, particularly in the area of nest sites. Nesting areas for Golden Eagle are often in steep cliffs and talus areas, which would be unaffected because they are unsuitable for use as ski runs. Impacts to American Kestrel and other low elevation nesting raptors are less likely to occur because the Jumbo Valley and the surrounding area provide these species with sufficient nesting opportunities. An overall impact to raptors is considered to be of low significance.

In the long term, the development of shrub dominated habitats on ski runs will likely attract breeding populations of several species of songbirds and small mammals. The combination of higher densities of these prey species and preferred edge habitat may benefit some raptor species (e.g. Northern Goshawk).

Mitigation Measures

JGR will implement the following measures to mitigate potential impacts:

- Retention of riparian habitats along creeks will ensure that important breeding and foraging habitat for many raptor species is maintained and that corridor-linkages are maintained between core forested areas.
- If active raptor nests are found within the construction area during land development activities, all activity in the vicinity of the nest will be halted until a management plan is developed with the cooperation of regulatory agencies. The *Draft Guidelines for Mitigating Impacts of Commercial Backcountry Recreation on Wildlife in British Columbia* (MELP 2001) should be considered as a template. The guidelines for Bald Eagle nests from this document are appropriate for the nests of other raptors:
- Prevent facility development within 100 m of nest trees.
- Minimize human activities within 100 m of active nests between February and July.
- Maintain all existing habitat components within 100 m of nest trees.
- Train staff and provide information to guests on appropriate behaviour in the vicinity of raptors and their nesting habitat.
- An attempt will be made to retain all large old-growth trees or other trees that may be suitable for raptor nesting and perching. Perching opportunities are not expected to be limiting along the edges of ski runs.

Resort Facilities and Roads

Potential permanent construction impacts to raptors could include a decrease in the population and fragmentation of habitat. Permanent habitat alteration (e.g., conversion of forest to shrub, or clearing of habitat for structures) could lead to indirect mortality and alienation of habitat. There is the potential for raptor nesting within the area proposed for development. Permanent habitat loss is expected to impact raptors occurring in these areas. Those occupying adjacent habitats will be subjected to high levels of sensory disturbance during construction. Overall impacts may be of Moderate significance to local raptor populations.

Mitigation Measures

Direct losses will be prevented by strict adherence to the *Wildlife Act*, which prevents construction disturbance during the breeding bird season. Construction activity and the ensuing noise may also lead to nest abandonment, which can lead to low survivorship of young.

In addition, JGR will attempt to retain all large old-growth trees or other trees that may be suitable for raptor nesting and perching. JGR will limit construction activities to the period outside of the active raptor nesting period.

Additional measures are the same as those listed for mitigation of ski run construction impacts.

Helicopter Use

Part D: Environmental, Resource Management and Technical Issues

Helicopter use is not expected to result in significant levels of sensory disturbance to raptors.

Operational Phase

Avalanche Control

Most raptors will occur at lower elevations during the winter, thus will likely not be disturbed by avalanche control activities.

Summer Ski Run Maintenance

Removal of forage habitat (i.e., forest edges) preferred by hunting raptors is not expected to result in measurable changes in populations. Disturbance of nesting birds during maintenance activities could occur, possibly leading to nest failure, particularly if the activities are conducted during the nesting period.. Continued disturbance is expected to be limited since lift and trail maintenance would occur over a relatively short period each summer and would not occur on every trail every summer.

Stormwater Run-off

The overall potential loss of riparian habitat is expected to be small, as JGR will implement an effective stormwater management plan to control stormwater events. Thus, no effects on raptor habitat are anticipated.

Transmission Lines

The potential for raptor collisions with transmission lines is low and not considered to be significant.

Mitigation Measures

ENKON recommends that the occurrences of raptor electrocutions due to transmission lines should be monitored and an adaptive management plan devised if deemed necessary. *Suggested Practices for Raptor Protection on Power Lines* (RRF and EEI 1996) provides a detailed examination of mitigation techniques to protect raptors from powerline electrocutions.

Garbage

Impacts from garbage will not be a factor for resident raptors.

7. The wildlife impact assessment required in specification #6 must identify (or prepare) and evaluate the following:

- **habitat losses (i.e. the quantified area and the significance of the habitat loss) attributable to the construction and operation of physical facilities associated with each on-site and off-site resort component – this assessment must be supported by reference to relevant literature sources;**

Mountain Goats

Field studies suggest that in summer and early fall goats occur in Jumbo Valley. In winter, there are few, if any, goats in the valley. By this time, most have moved to their wintering grounds on the ridges near Monument Peak.

Most goats winter on the ridge lying north of Jumbo Creek (and south of Delphine Creek) and west of Toby Creek above Delphine Creek. Goats also winter on the ridges of the upper Delphine Creek basin. These areas are not likely to be impacted by the proposed development. RK Heli-Skiing has been in the area for some time. The existing populations of Mountain Goats have become habituated to the presence of helicopters; therefore impacts will likely be negligible. Overlaying the proposed resort facilities on goat winter habitat indicates there could be potential conflicts. According to the overlay, a maximum of 280 ha of High rated winter habitat on the project site will be impacted by ski run development, or ~20 % of the entire 1340 ha development. However, Mountain Goats do not appear to winter in these areas due to deep snow conditions and there is an adequate supply of quality habitat in neighbouring watersheds of Toby and Glacier Creeks. In fact, 280 ha represent less than 1% of the habitat in Jumbo, Toby and Glacier Creek watersheds, which is winter, rated as High or Moderately High for Mountain Goats. Thus, there are adjacent areas of high quality for Mountain Goats.

Summer goat ranges are found along the north and south sides of Jumbo Valley, specifically in the upper Commander Creek basin and on the ridges between The Cleaver and Black Diamond Mountain. Goats were also observed at Jumbo Pass and at a mineral lick at the top of Horsethief Creek. An overlay of the proposed resort facility plan on potential Mountain Goat summer habitat has similar results to that of the winter overlay. A total of 317 ha could be affected by resort development if Mountain Goats are summering in areas earmarked for glacier skiing and hiking. This area represents 1.6 % of available quality summer habitat in the valleys of Jumbo, Toby and Glacier Creek.

Mule Deer

An overlay of the proposed project on Mule Deer winter habitat that is rated as High or Moderately High indicates that high quality Mule Deer (and White-tailed Deer) winter habitat should not be affected by project development.

Ski run and lift development could affect approximately 476 ha of High or Moderately High rated Mule Deer summer habitat. This area represents less than 25 % of the available higher quality rated habitat on the site and less than 1 % of the available high quality habitat in the Jumbo, Toby and Glacier Creek Valley network. Outside of the Jumbo Valley, resident deer will likely find alternative habitat, which satisfactorily meets their life requirements.

Moose

An overlay of the proposed project on mapped winter range indicates that the majority of Moose winter range will not be affected by project development. An estimated 317 ha of Moderate rated habitat could be affected, but High or Moderately High Moose winter habitat will not be affected.

An estimated 317 ha (i.e., 34 % of 932 ha) of High rated summer habitat could be affected by the residential, road/parking infrastructure and ski run components of the resort development. Outside of the resort development area, within the Jumbo, Toby and Glacier Creek valleys there are over 27 000 ha of High and Moderately High rated habitat available.

Figures 18a and 18b are overlays of the proposed resort facilities on Moose winter and summer habitat suitability interpretations, respectively.

Elk

An overlay of the proposed project on Elk winter habitat indicates that high quality Elk winter habitat should not be affected by project development. In fact, according to the overlay calculation of habitat loss, only habitats rated as Very low or Nil are affected by resort development.

Ski run and lift development could affect approximately 280 ha of High rated Elk summer habitat. This area represents approximately 30 % of the available High rated habitat on the site and 1 % of the available high quality habitat in the Jumbo, Toby and Glacier Creek Valley network. Outside of the Jumbo Valley, if some resident Elk are displaced they will likely find alternative habitat, which will meet their life requirements.

Black Bear

The proposed project may conflict with middle elevation winter denning habitat for Black Bear. Goodrich and Berger (1994), Linnell *et al.* (2000) note that the tendency for high overlaps between bear denning sites and potential winter recreation areas results in a high potential for den abandonment due to human disturbance. They recommend that bear denning areas receive protection from human disturbance during the winter. Fewer habitat conflicts are anticipated for the lower and high elevations.

Much of the area within the ski run areas will remain as high quality foraging habitat after revegetation (if necessary). Conflict areas are less of a concern in summer and fall when bears are widely distributed in the Valley and have a wide range of foraging opportunities available to them.

Large Carnivores

Potential impacts and mitigation measures applying to predators such as Coyote, Cougar, Bobcat and Wolf are similar to that which was discussed for Black Bear. Recommendations for Grizzly Bear management will ensure that impacts associated with garbage are minimized and public education will assist in reducing conflicts with humans. Specific mitigation measures are provided below.

Furbearers

Impact to furbearers may result from a loss of habitat and sensory disturbance. However mitigation measures will be implemented to minimize the impact from resort construction and operation.

Small Mammals

Construction of ski runs will result in permanent alteration of existing forested habitats. Many small mammals will potentially be impacted by forest removal. Local populations of some of the small mammals (e.g., squirrel) can be expected to contract, but the regional population should remain unchanged.

Resort and road upgrade/development will result in permanent loss of habitats utilized by many small mammals. Although local impacts to small mammals are anticipated to be of Moderate significance, due to loss of habitat, the viability of sub-regional populations is not expected to be greatly disturbed.

- ***the implications for wildlife populations of the various activities associated with the resort at all four seasons (e.g. winter skiing, summer skiing, hiking, biking, wildlife viewing, etc.);***

Mountain Goats

Resort and Facilities

Resort facilities, once operational, are expected to have insignificant impacts on wintering or summering populations of Mountain Goats due to the large distances from known wintering and summering ranges.

Winter Ski Operations

During field work, a small number of winter-resident Mountain Goats were observed in Jumbo Valley. Most goats winter on the ridges on either side of Delphine Creek, north of the former Mineral King mine, and also on the ridges of the upper Delphine Creek basin. These areas are outside of the commercial recreation area. RK Heli-skiing has been in the area for some time, thus the existing population of Mountain Goats may have become somewhat habituated to the presence of skiers. Some sensory disturbance pressure may be exerted upon the few Mountain Goats that remain in the upper Jumbo Valley, but taken within the context of the regional population the impact would be minimal.

Mitigation Measures

Areas used by wintering goats, where disturbance may occur, will have numerous signs warning skiers of the resort boundary and hazardous conditions beyond the posted sign. Skiers will avoid these areas due to the hazardous conditions, thereby reducing the potential for sensory disturbance to goats.

Hikers

Impact from hikers on the Glacier Dome hiking trail is not expected to displace Mountain Goats.

Mitigation Measures

Mountain Goat access to the mineral lick identified at the top of Horsethief Creek will be protected from human access. Trail restrictions will be implemented to protect the known mineral lick site, and any that might be identified in the future.

Mule and White-tailed Deer

Resort and Facilities

Once the resort and resort facilities are operational, few additional impacts are anticipated.

Part D: Environmental, Resource Management and Technical Issues

Human activity around the resort will result in some sensory disturbance and interaction with visitors, but resident deer will likely become habituated to human activity (Nolte, Undated; Vogel, 1983; Canfield, 1984). There is potential sensory disturbance to dogs, however (Miller *et al.* 2001). Deer could pose a public safety problem if they habitually forage in the resort and begin to display aggressive behavior.

Mitigation Measures

ENKON recommends that deer presence in the resort must be minimized by deterring deer from foraging in the resort. Therefore, ENKON recommends that JGR considers selecting the most unpalatable vegetative species (e.g., timber milk-vetch, wineberry, barberry) to deer for planting in the resort.

To prevent pets from harassing wildlife, ENKON recommends that resort management should consider a policy that requires residents and guests to keep dogs on a leash.

Winter Ski Operations

Winter ski operations are not likely to result in significant impacts to wintering deer, since most deer will be in the lower elevations of the Rocky Mountain Trench. A few deer may experience winter sensory disturbance from snowmobiles used for resort maintenance and transportation. Assuming only moderate use of snowmobiles during the winter season, it is expected to be of minor significance to the small population of deer that may remain near the resort base during the winter.

Hikers

Hikers utilizing mountain slopes within the project boundaries may result in sensory disturbance to summering deer. Impacts would be non-significant, however, as hikers will be limited to a single trail to Glacier Dome. Off-trail use, if any, of the valley would likely occur during the influential parturition periods. During these times the deer could be displaced from the higher elevation feeding and potential calving areas. Displacement is expected to be temporary or partial and would not alter the population's status. Off-trail use at the resort will be strongly discouraged, however, and resort visitors are not expected to participate in off-trail hiking.

Mitigation Measures

ENKON recommends that the following management techniques that reduce human disturbances on deer summer range be implemented:

- Prevent development of summer recreation trails and facilities in high quality foraging habitat along the base of the valley, and where possible, immediately surrounding the resort. Consider restrictions on existing roads or trails to minimize disruption of these important areas.
- Establish a designated route, away from parturition areas, to make human use of summer range as predictable as possible and maintain these routes without alteration. If alteration and trail deviation must occur, it must be as gradual as possible to allow ungulate habituation and prevent unacceptable displacement.

- Reclaim unnecessary roads and trails that fragment high quality foraging habitat and re-establish native vegetation and maintain minimum access.
- Minimize administrative use and access to trails/roads on summer ranges along the south facing slopes of the valley.

Moose

Resort and Facilities

As a result of built up encroachment on winter ungulate habitat, there will be more human and ungulate interactions. Moose are not expected to be impacted directly by human presence at this time since they are likely out of the valley, only a very small moose population remains at the valley's base during the winter.

Mitigation Measures

JGR will actively participate in a program to increase public's awareness and understanding of human-wildlife interactions and will implement ways to avoid or minimize human-Moose conflicts. Strategies to increase resident and visitor awareness and understanding would include the following:

- Providing technical assistance, educational opportunities, and practical options to the public to address wildlife conflicts;
- Fostering cooperative efforts with local, provincial and federal agencies, along with relevant private organizations, to help resolve and prevent human-wildlife conflicts;
- Working with local communities and municipalities to develop resort and community plans to address wildlife conflicts; and
- Identifying specific conflicts where additional staffing may be required.

ENKON recommends that JGR plant most unpalatable vegetative species (e.g., timber milk-vetch) to Moose in an effort to keep Moose away from the resort.

Winter Ski Operations

Impacts from winter activities at the resort should be insignificant because, according to field studies, most individuals have moved out of the area to their winter range. As an estimate, 95% of the resident Moose population should move to elevations below 1000 m (e.g., in Toby Creek valley) (Serrouya and D'Eon 2002). For the few Moose that remain in the Valley near Mineral Creek Mine there may be some sensory disturbance from human presence and limited use of snowmobiles.

Hikers Hikers utilizing mountain slopes within the project boundaries may result in sensory disturbance to summering Moose. Impacts would be non-significant, however, as hikers will be limited to a single trail to Glacier Dome. Off-trail use of the valley would increase sensory disturbance and could result in localized habitat degradation (e.g., trail braiding) of low significance. Off-trail use will be strongly discouraged and resort visitors are not expected to

participate in off-trail hiking.

Mitigation Measures

Mitigation strategies applied to summer deer habitat will help minimize impacts from hiking.

Elk

Resort and Facilities

Once the resort and resort facilities are operational, few additional impacts are anticipated. Human activity around the resort will result in some sensory disturbance and interaction with visitors, but resident Elk will likely become habituated to activity, either moving to adjacent unoccupied areas or utilizing built-up areas nocturnally (Schultz and Bailey 1978). Since the current project design allows for primarily winter recreational use, Elk are not expected to be impacted directly by human presence during the winter season since most winter outside of the valley. They will likely re-inhabit the existing ski slopes and base areas during the summer seasons.

Mitigation Measures

Mitigation measures outlined above for deer also apply to Elk.

Winter Ski Operations

Impacts on Elk from winter activities at the resort will be insignificant because Elk migrate out of Jumbo Valley by late fall. From available information, they move through Toby Creek to their wintering range in the Rocky Mountain Trench.

Hikers

Hikers utilizing mountain slopes within the project boundaries may result in sensory disturbance to summering Elk. Impacts would be non-significant, however, as hikers will be limited to a single trail to Glacier Dome. Off-trail use of the valley would increase sensory disturbance and could result in localized habitat degradation (e.g., trail braiding) of low significance. Off-trail use will be strongly discouraged and resort visitors are not expected to participate in off-trail hiking.

Mitigation Measures

Management techniques that reduce impact from backcountry recreation on Elk summer range include those recommended for Mule and White-tailed Deer.

Black Bear

Resort and Facilities

The experience of other resorts (e.g., Whistler-Blackcomb) suggests that viable Black Bear populations can still exist in close proximity to developed areas, provided that measures to reduce human-bear conflicts are in place. Ongoing sensory disturbance resulting from human activity will likely reduce habitat effectiveness in the immediate area of developed areas. Impacts associated with garbage disposal and resulting, so-called, 'problem' bears are described in more detail under

the section titled 'Garbage'.

Mitigation Measures

Similar to what has been undertaken in the communities of Revelstoke and Whistler, JGR will facilitate the formation of a Black Bear task force or bear management committee that will further develop a comprehensive bear management plan for the proposed development. The primary goal of the plan will be to minimize the number of human-bear conflicts and the number of bears that may need to be destroyed. Essential components of the plan will include:

- Public education to inform residents of proper waste disposal methods and to encourage greater human tolerance of bear presence;
- Installation of bear-proof garbage containers;
- Enforcement of proper waste management practices for both residential and commercial areas and;
- Identification and preservation of critical foraging and denning areas, movement corridors and security/thermal cover.

JGR will also implement the following:

- A bear awareness program, where project staff employed during the active bear season will be given special training.
- A public education program will be implemented to inform summer recreationalists about special precautions to avoid undesirable encounters.
- A pack-in/pack-out policy
- Maintenance of a bear sighting log will help resort staff identify areas where the probability of a bear-human interaction is expected to be unacceptably high.
- Temporary or possibly permanent trail closures may be implemented to minimize human access to such areas.
- A policy that prohibits feeding bears, with contravention subject to fines or legal action, as was enforced in the Resort Municipality of Whistler (Globe and Mail, September 12, 2002, A12).

Winter Ski Operations

There is a possibility that bears selecting denning areas adjacent to ski runs would be subject to sensory disturbance caused by skiers and lift equipment during the winter months. With mitigation impacts from winter ski operations are not expected to have significant impacts to hibernating bears.

Mitigation Measures

Human disturbance and potential for a human-bear encounter will be minimized by having ski

runs situated away from any identified den site.

JGR will develop a management plan for all active bear dens located within the project area to minimize sensory disturbance to hibernating bears, and to avoid potentially harmful human-bear encounters. In cases where active dens have been located within the development area, JGR will consider closing ski runs and other winter use areas to minimize impacts.

Hikers

Hikers utilizing mountain slopes within the project boundaries may result in sensory disturbance to Black Bear and an increase in the possibility of human-bear encounters. Impacts would be non-significant, however, as hikers will be limited to a single trail to Glacier Dome. In areas of high summer recreational use, Black Bears may initially avoid habitats in close proximity to heavily traveled trails. However, like many species, Black Bears will likely become somewhat habituated to regular and predictable human use. Off-trail recreational use of the area would result in a possible increase in disturbance, and will therefore be strongly discouraged.

Mitigation Measures

The availability of human food and garbage on recreational trails is considered a potential cause of bear management problems and public safety. The following measures should be implemented to reduce the impact to Black Bears from hikers and mountain bikers.

- Staff should routinely monitor trail areas and identify any areas with insufficient bear-proof garbage collection bins. These deficiencies will be remedied immediately by resort operations.
- A policy of "Pack in-Pack out" will be strictly enforced on all recreational trails.
- Overnight camping along trails will not be permitted.
- Bear warning signs will be posted at all entry points to trails.

Large Carnivores

Sensory disturbance associated with the resort development is likely to have the greatest impact on carnivores, which will in turn likely avoid developed areas. Coyote is known to thrive in human-dominated settings and is not expected to be impacted to the same extent as Cougar. Bobcat and Wolf are likely very rare on the site; therefore impacts are expected to be very low. Some disruption of predator movements across the site is anticipated, although placement of large culverts on all drainages will facilitate movement. With mitigation measures proposed, impacts of these effects are expected to be of low significance.

Bear management will address many of the issues associated with other carnivores (e.g., wildlife-human encounters, road kill, garbage etc.). In addition, JGR will:

- Brief workers and staff on the potential occurrence of the various predator species on the project property.
- Identify areas where the potential animal-human conflicts may exist.

- If carnivore den sites are located during resort development, all activities will cease in the vicinity of the den site until a management plan can be developed.
- Not permit resort staff and workers to carry firearms or hunt within the project area.
- The goal of the management plan will be to ensure that the health and integrity of all denning animals is maintained.

Furbearers

Resort and Facilities

Potential interactions between resort facilities and Wolverine are anticipated to be non-existent or limited to sensory disturbance of animals that occasionally make altitudinal movements on the site. The possibility of Wolverines being attracted to available garbage within the resort could have greater impacts. Impact to other furbearers is anticipated to be of low significance.

Mitigation Measures

Wolverines share similar life history traits to other scavengers like Black Bears. Thus, mitigation for Black Bear will also apply to Wolverine.

Winter Ski Operations

Winter ski operations have the greatest potential to impact Wolverine populations. However, because Wolverine do not regularly inhabit the Jumbo Valley, impacts resulting from winter ski operation are not anticipated to be significant.

Mitigation Measures

If a Wolverine den site is located in the vicinity of ski operations, all activity will cease in the area of the den until a management plan can be developed. Temporary closures of ski trails and other facilities are potential options until the den has been vacated.

The management plan may include setting a buffer zone of 2000 m around known denning habitats from January to May (Krebs and Lewis 2000).

Hikers

The presence of hikers in areas preferred by Wolverine (if present) would likely disturb, possibly temporarily displacing them to adjacent areas. Although the numbers of recreationalists utilizing alpine areas is not expected to increase dramatically from current conditions, particularly since hikers at the resort will be limited to a single trail to Glacier Dome, any impact is still expected to be short-term and sporadic.

Mitigation Measures

The overall public education program developed and implemented by JGR for summer outdoor recreationalists will include information on Wolverine. Emphasis will be placed on informing people how to respond if an encounter occurs, and of the important of the pack-in/pack-out

garbage policy. Many of the Black Bear recommendations apply to furbearer management.

Small Mammals

Resorts and Facilities

Once the resort has been developed, further negative impacts to small mammals are expected to be relatively low, with the exception of predation by domestic cats. Cats are active hunters known to kill millions of small mammals and birds in North America each year. Disruption of movement corridors is another potential problem, particularly for juvenile individuals being displaced from natal areas.

A potential positive effect of resort and road construction is the creation of retaining walls, rocky road edges and other road dominated habitats that are attractive to some species as living and security habitat. The overall positive effect on local small mammal populations is expected to be of low significance.

Mitigation Measures

ENKON recommends that JGR consider the development and implementation of an education to protect populations of small mammals through training of staff and education of residents and guests. The education program should encourage or require residents to join the "Cats Indoor" campaign, which advocates keeping domestic cats indoors to prevent them from needlessly hunting small mammals and songbirds.

If Least Chipmunk is recorded in the study area, ENKON recommends that JGR develop a management plan that incorporates stricter regulations regarding domestic pets on the resort property.

Winter Ski Operations

Small mammals residing above ground (i.e., on snow) during the winter (e.g., Douglas squirrel) will be susceptible to some sensory disturbance associated with skiers and grooming equipment. Mammals such as shrews, voles, and deer mice that live under the snow are less likely to be disturbed by winter activities. Overall impact of winter ski operations on small mammals is considered to be of low significance.

Hikers

Hikers utilizing mountain slopes within the project boundaries could disturb feeding, breeding and travel activities of cliff/talus-dwelling animals such as pikas and marmots. However, the impact is unlikely to greatly impact small mammals.

Passerine and Passerine-like Birds

Resorts and Facilities

Impacts to forest-dependent species from operation of the resort and facilities are expected to be low. Window strikes are expected to be an ongoing mortality factor for birds in the area. Domestic cats are expected to result in some mortality for vulnerable bird species. Vehicle collisions are

expected to be a less serious source of mortality.

New habitat niches will be created for more urban-associated bird species. In addition, residential feeders will create new foraging opportunities.

Winter Ski Operations

Winter ski operations are expected to have insignificant impacts on the few resident birds that remain at high elevations during the summer. Some human-habituated species such as Gray Jay and Clark's Nutcracker may benefit from human food sources during the winter.

Hikers

Impacts from hikers on most forest dwelling songbirds are expected to be insignificant, although some ground nesting birds may be vulnerable to off-trail use. Off-trail use leading to habitat loss is expected to be of very low significance for alpine areas.

Migratory Birds

Resort and Facilities

Once resort facilities are in place, further impacts to raptors on the site are expected to be relatively low. There is some potential for mortality due to window strikes and vehicle collisions. Presence of bird feeders and higher small bird populations may benefit diurnal species, which prey on small songbirds.

Winter Ski Operations

Resident raptors are expected to move to lower elevations during the winter and are unlikely to interact with winter ski operations at higher elevations.

Hikers

Hikers are expected to cause some sensory disturbance to raptors since the Glacier Dome trail extends into the higher elevations, though the level of disturbance is not expected to be unacceptable. Ground nesting, non-migratory birds, such as Blue grouse, may be vulnerable to off-trail use. The greatest potential impacts will likely occur in subalpine and alpine areas where many of the breeding birds are ground-dwelling nesters. Off-trail use will be strongly discouraged and off-trail use leading to habitat loss is expected to be of low significance for alpine areas.

Mitigation Measures

JGR will train staff and provide information to guests on appropriate behaviour in the vicinity of raptors and their nesting habitat.

wildlife population impacts associated with access road traffic (e.g. road kills);

Mountain Goats

Access to the resort will be from an upgraded Forest Service Road, which will be at lower elevations of the proposed resort in areas where Mountain Goats do not occur. Therefore,

impacts on goats due to access and vehicle traffic are not anticipated.

Mule and White-tailed Deer

Regular use of access corridors by ski resort visitors or residents will increase disturbance of resident deer. However, the resort access road will be upgraded from an existing Forest Service Road (FSR). Some areas may require realignment, but for the most part the access corridor is already in existence. Deer have likely habituated to the existing FSR. The potential for deer-vehicle collisions will also increase due to increased traffic flows. Impact from winter traffic would most likely occur along the entrance to Jumbo Creek watershed at Toby Creek. This has been identified as a gathering area for wintering deer on their migration to the Rocky Mountain Trench. This area is only a staging area for deer during their winter migration, thus the impact would be local and short-term.

Winter maintenance of roadway, often creates steep cut-banks and graded snow berms along the road edge, these obstacles can create physical barriers for deer that are attempting to escape predation. Predators such as Coyotes use the graded roads on winter nights as easy travel corridors. Thus a localized effect might be increased predation rates on deer.

A consequential effect from the increased access to the Jumbo Valley area could be an increase in hunting and poaching. However, the harvest pressure exerted can be minimized by implementing harvesting guidelines and enforcement of regulations.

Mitigation Measures

JGR will implement the following measures and recommendations to minimize impact from access development and vehicle traffic:

- Locate all facilities along the corridor of the upgraded resort access road. Road and utility right-of-way will, whenever feasible, follow existing roads and trails. Any necessary deviation from the existing right-of-way will follow the route that is least disruptive to the natural environment (McElhanney 2003).
- ENKON recommends that JGR management initiate a policy regarding wildlife-vehicle collisions (WVC). In the event of a WVC, the carcass must be removed immediately.
- Vehicle speeds (i.e., maximum of 50 kph) will be enforced to avoid unnecessary collisions with deer. Signs, enforcement, road design (e.g., speed bumps) and fencing are options being considered to limit vehicle speeds (Gunther *et al.* 2002).
- In years of deep snow, snow berms created by ploughing will be broken at regular intervals so that animals can easily escape from the roadway into adjacent secure habitat. ENKON recommends that fencing should not be constructed for Phase 1 or Phase 2. Upon the initiation of Phase 3, the need for fencing should be re-evaluated.
- ENKON recommends that JGR should act proactively to avoid WVC by hydroseeding roadsides with unpalatable herbaceous species and avoiding the use of salt on resort roadways.
- ENKON recommends that JGR should also consider utilizing a mixture of sand-salt

and a form of ungulate repellency. Some repellent compounds that have been used successfully in the past are Wolfin®, Deer Away Big Game Repellent® and lithium chloride (LiCl) (Brown *et al.* 2000).

- With regard to wildlife harvesting and poaching, JGR will ensure that hunting regulations are enforced to maintain hunting at an acceptable level.
- JGR will restrict all motorized vehicles to designated routes and enforce restrictions (e.g., hunting season), with cooperation from the public by way of the provincial “Observe, Record & Report Program.”

To reduce the impact of resort access roads on deer (and other ungulate) populations, ENKON recommends the following technical points:

- Reduce the density of roads within the Jumbo Creek valley, logging roads not being utilized as part of the resort access road used should be de-activated and re-vegetated with native species.
- Any temporary roads required for resort construction should be built in a manner to facilitate their eventual closure and re-vegetation (with native species).
- Maintain existing drainage patterns along roads and prevent the introduction of drainage that promotes roadside vegetative growth.
- Store any top soil removed from road construction and re-use the topsoil to re-vegetate areas along roadsides. Re-vegetation of roadside areas should not include plants that will attract foraging ungulates.
- Where feasible, allow >100 m between important feeding/security habitat and any new roads in order to provide quick cover.
- Do not create new roads or re-vegetate existing roads so that blind corners would occur between motorists and wildlife.
- Road side reflectors, such as the *Strieter-Lite*® system, should be erected along the access road as they reflect light and create a virtual barrier (i.e., a visual fence) to wildlife.
- Consideration should be given to the *Wildlife Protection System* being developed by InTransTech in cooperation with the Insurance Corporation of British Columbia and other partners (Kinley *et al.* 2003). The advantage of this system is that it operates to prevent WVC 24-hours a day and is triggered by animal presence. The disadvantage is that it may be prohibitively expensive.

If fencing is required during Phase 3 of the resort development, overpass/underpasses should be constructed to promote wildlife movements across roads. The crossing structures should be located at strategic locations with the following characteristics (based on Jackson and Griffin 2002):

- Low road densities

- Low human population
- Possess good terrain ruggedness
- Have an association with a major drainage and
- Be in proximity to high quality food and shelter habitat
- Avoid road construction/maintenance (where possible) during key ungulate periods (spring-early/summer).

Moose

Impacts and Mitigation Measures outlined above for deer are similar for Moose.

Elk

Impact from access development and vehicle traffic on deer and Moose populations also apply to resident Elk.

Mitigation Measures

ENKON recommends the following measures to alter visitor behavioural changes to minimize wildlife pressures from the presence of increased traffic.

- A wildlife awareness program should be initiated at the resort entrance. It would operated and function much like entrance booths to National Parks. The cost of running the program could be included in the lift ticket price.
- Wildlife Warning Signs should be placed at the entrance to the access road, at strategic locations along the access road (i.e. high-risk areas), and within the resort base area.
- As part of a recommended education program for residents and resort personnel a committee or persons should be allocated to monitor highway traffic and regulate any interactions of tourists/visitors with wildlife. In conjunction with “no stopping” signs on roadways, this educational program should help prevent traffic jams that result from wildlife viewing.

Black Bear

Human use of the up-graded/new access corridor will potentially increase disturbance of local Black Bears. The potential for bear-vehicle collisions will likely increase, but collisions are not expected to be a significant source of bear mortality within the project area provided that appropriate mitigation measures are put into place. Hunting and poaching may also increase due to increased access to the area; however, with appropriate enforcement this can be avoided.

Mitigation Measures

ENKON recommends that the following mitigation measures should be considered by JGR during

the upgrading and/or realigning of the access road into the proposed resort development:

- The use of existing Forest Service Road(s) will be maximized and the construction of new roads will be minimized to avoid impacting undisturbed bear habitat. The width of road clearing for potential future upgrades will be minimized to avoid impacting moderate to high value feeding and security habitat.
- High quality security habitat adjacent to roads will be maintained and/or restored, when practical.
- New temporary roads that are constructed to access ski runs for clearing and lift placement will be designed to facilitate eventual decommissioning. Temporary roads will be re-vegetated with native vegetation or left for natural conifer regeneration. Where possible, this should occur after one season of use.
- Clearing widths, low cuts and fills of new roads will be minimized.
- Existing drainage patterns along roads will be maintained.
- Top soil removal from road construction will be stored and re-used during revegetation of roadsides. During revegetation, the use of plants that will attract bears will be avoided.
- Roads will be created to avoid blind corners and the potential for sudden encounters between motorists and bears.
- Where practical, road construction or maintenance will be avoided during key bear periods (i.e., spring-early summer and late fall).

It is unlikely that traffic volumes from the proposed resort development will significantly disrupt bear movements, particularly since the speed limit along the access road will be significantly less than the posted limits of major highways (e.g., Trans-Canada Highway), where wildlife-vehicle collisions are of mounting concern.

In order to reduce the risk of bear-vehicle collisions, ENKON recommends that JGR should consider implementation of the following:

- Establish within the resort base area a “Bear Information Centre”, which would operate through the active bear season (April-November) and inform and remind visitors and residents of the potential dangers of bears and the potential for bear encounters while at the resort.
- Initiate a bear monitoring program to identify areas of high risk for bear encounters. Access to such areas can be restricted to reduce or avoid human-bear interaction. This program could involve the cooperation of government agencies and public interest groups.
- Design the resort access road for low speed limits (e.g., 50-60 kph); this limit must be strictly enforced by resort staff and the local RCMP.

- Place Wildlife Warning Signs at the entrance to the access road and at strategic locations along the road where the frequency of bear crossings may be higher than normal.
- Remove wildlife carcasses within 100 m of roadways to areas away from visitor activity to avoid the possibility of vehicle-wildlife collisions due to bears (and other carnivores) feeding on carcasses.
- If fencing is required during future resort phases, construct overpasses and underpasses to promote bear (and wildlife) movement across roads.
- An educational program for residents and resort staff. As part of this program, a committee or persons should be allocated to monitor highway traffic and regulate any interaction of visitors and residents with bears.
- Resort staff will manage traffic to ensure that traffic snarls do not form due to bear watching motorists. This will involve a combination of traffic controls, answering questions and ensuring that the public does not approach or behave inappropriately around bears (and other wildlife).

Furbearers

Improved access at low elevations of the subject property will increase the number of vehicles and people, resulting in potentially higher disturbance to resident furbearers. Wolverine will likely avoid high density or high activity areas. The overall impact to furbearers is considered to be low, especially because Wolverine occurs on the property only as a migrant.

Mitigation Measures

JGR will implement the following to ensure that impacts to all furbearers from increased access and traffic volume is minimized:

- Road maintenance will include rapid disposal of carrion to avoid collateral kill of Wolverine (and other carnivores).
- Hunting and trapping restrictions will be in place on the project property and resort management will help to ensure enforcement of harvesting regulations.

Small Mammals

Improved and widened roads on the subject property will create barriers to small mammal movement between habitats on either side of roads. Natural migration movements and dispersal patterns may be disrupted. Small mammals are also particularly susceptible to road kill. Overall impacts to small mammals are considered to be of Moderate significance without mitigation, and of Low significance after mitigation strategies are put in place.

Mitigation Measures

As part of the master plan for the resort, ENKON recommends that road culverts with natural ground substrates (i.e., bottomless) be used whenever feasible. These culverts should be wide

enough to ensure that small mammals utilize them to facilitate movement between habitats dissected by roads and trails.

Passerine and Passerine-like Birds

Mortality caused by vehicle collisions is likely to be of low significance to local migratory bird populations.

Migratory Birds

The potential for vehicle collisions with raptors is considered to be Low.

- ***wildlife population impacts associated with problem wildlife around the resort (e.g. destruction of problem bears, etc.);***

See Project Report Specification D.3(B) #6, with particular reference to impacts and mitigation associated with garbage.

- ***the possible increase in wildfire suppression in the interests of public safety at the resort, and the implications for long-term wildlife habitat management;***

Resort management will cooperate with the Ministry of Forests to develop an appropriate policy toward wildfire suppression. This will likely involve prescribed understory burns and a limited amount of forest harvesting in order to mimic natural disturbance events.

- ***the implications of the project for the maintenance of regional connectivity of key habitats; and***

Jumbo Pass

The Kootenay Boundary Land Use Plan KBLUP identified an east-west connectivity corridor between lower Dutch Creek through the Purcell Wilderness Conservancy and between Kootenay and Duncan Lakes via lower Hamill Creek. Jumbo Creek and Upper Glacier Creek (including Jumbo Pass) were included along the northern boundary of the corridor; however, these two areas form a north-south peninsula and do not contribute significantly to east-west connectivity. Jumbo Pass is also a popular hiking destination, with a hut recently rebuilt and expanded.

The only north-south connectivity corridors identified on Ministry maps are located along the Columbia River to the east or through a variety of interconnected east-west corridors west of Kootenay and Duncan Lakes. A series of glaciers to the north and south of Glacier Creek, to the north of Jumbo Creek and Howser Creek, and east of Duncan River limit north-south connectivity through the west-central Purcell Mountains.

The design of the project has concentrated the proposed development area north and upstream of the Jumbo Pass corridor. Except for the improvements to the existing road, the current design has avoided increasing impacts to the Jumbo Pass corridor, and the proposed Controlled Recreation Area has been modified to be entirely removed from the Jumbo Pass corridor.

Resort construction and operation will not affect the main connectivity corridor through the Purcell Wilderness and west across Kootenay and Duncan Lakes. There could be some disruption of

connectivity along upper Jumbo Creek, but with strict guidelines in place and appropriate mitigation measures the impacts can be minimized and kept to an acceptable level. Although the KBLUP did not make specific recommendations for the Jumbo Creek watershed, the general mitigation measures it provides are applicable to the Jumbo Glacier Resort project.

Maintaining Connectivity

Under the Kootenay Boundary Land Use Plan: Implementation Strategy, the intent behind the regional connectivity guidelines is 1) to maintain opportunities at the regional level for genetic exchange between populations and for gradual shifts in the distribution of whole ecosystems in the face of catastrophic events and 2) to use the system of regional connectivity corridors to enhance management of rare habitats, red/blue listed and other regionally significant species, and ecosystems that are under-represented in the protected areas.

The operational principles to facilitate the maintenance of regional connectivity, as outlined in the KBLUP, will be adhered to during the construction and operation of Jumbo Resort. The interim principles as they relate to the proposed project are as follows:

- To meet habitat requirements, mixed plant species management (especially native species) will be promoted;
- Effort will be made to retain natural attributes in areas adjacent to the resort development;
- Old-growth stand attributes within connectivity corridors will be maintained when practical;
- A coordinated, planned approach will be used to minimize linear barriers and accommodate movement;
- Maintaining connectivity corridors will be a priority item during planning, regulation and/or rehabilitation, and may involve road deactivation.

detailed plans for avoiding or mitigating potential impacts on wildlife populations and wildlife habitat, including plans for monitoring the success of mitigation measures and a commitment to address ongoing problems, in consultation with MWLAP.

Wildlife Mitigation Plans

Mitigation measures for each potential impact (e.g., access road, garbage) that will be implemented by JGR are outlined in Project Specifications D.3(B) #6 and #7 above. In addition, a detailed Grizzly Bear Management Plan (Appendix 3-D) has also been prepared outlining specific mitigation measures for potential construction and operational impacts. An overview can be found in Appendix 3-C Environmental Management Plans.

Monitoring Plans

Wildlife and vegetation field inventory and documentation studies will be conducted during all phases of construction and during the operational phase of the resort. Field studies will be conducted on a regular basis during each season, with a special emphasis being placed on

locating the following sites: ungulate mineral licks; Grizzly and Black Bear dens; large carnivore den sites (e.g., Wolverine); and raptor nest sites. Data will be collected and compared to existing data.

Construction monitoring will be conducted on a regular basis. A wildlife biologist will be present at regular intervals during the construction phases to ensure that the mitigation strategies outlined in this document are followed.

Adaptive Management

To evaluate the success of the mitigation/compensation measures it is recommended that an adaptive management approach combined with an effective monitoring program be implemented after project certification. The monitoring program should have feedback mechanisms that will allow the results of the monitoring to influence the implementation of any further mitigation measures. Adaptive management requires that identified problems are addressed, particularly when actual or potential conflicts persist in particular areas and/or times.

The monitoring should be undertaken before construction of the project begins, during initial construction of the project (i.e. prior to commercial-scale resort operations), and during commercial-scale operations. The monitoring program would consist of regular data gathering on wildlife occurrence, any significant wildlife-human conflicts, human recreational uses in the area, and other factors of interest to wildlife management that may be identified. During the operations phase, the education program also should be reviewed and analysed annually before the start of a new season comparing records of data.

Performance Indicators

Methods to achieve the management plan outlined in this report will be implemented and evaluated each year to identify their effectiveness and the effectiveness of all mitigation measures implemented relating to the human activities in and around the resort facilities. This will involve establishing several criteria to evaluate the performance and effectiveness of the management plan. The following performance indicators were identified in the Grizzly Bear Management Plan (Appendix 3-D) and are included here as important measurement tools in the management of other wildlife species surrounding the proposed resort development. Each will be assessed annually qualitatively and quantitatively for implementation effectiveness. The performance indicators are:

- Number of property damage incidents due to wildlife;
- Number of threat encounters;
- Number of no contact charge encounters (base and back country);
- Number of annual wildlife relocations/translocations at the resort assessed as necessary by a conservation officer;
- Number of animals destroyed in and around the Jumbo Creek Drainage;
- Total known mortality in and out of the Jumbo Creek watershed. Sources should be separated into human and natural causes;

- Total number of observations reported in the Jumbo Creek Drainage;
- Total annual resort visitations; and
- Total human injuries and/or deaths caused by ungulates (e.g., Moose and Elk) in the Jumbo Creek drainage versus outside.

All identified characteristics should be divided into front and backcountry occurrences for annual analysis of the program success. Annual analysis, because of observer bias, will be based on multi year trends to evaluate wildlife-human conflicts. The program is to be implemented immediately upon Phase 1 construction.

Finally, if the management program objectives are not being met at an acceptable level according to the Wildlife Management committee, contingency measures will have to be implemented by the provincial government including but not limited to the following:

- Increased enforcement (patrol frequency);
- Area design and delivery of the wildlife-human conflict awareness and education programs;
- Additional spot closures to human access;
- Hunter harvest restrictions and closures as recommended by affiliated agencies in the Purcell Mountain Range or by MSRM; and
- On-going monitoring and research in the Jumbo Creek Drainage involving the monitoring of ungulate security habitats and how effective this habitat is relative to the impacts of the proposed development and human presence in the Jumbo and surrounding valleys.

Finally, JGR will commit to addressing ongoing problems, if present, with MWLAP.

8. An assessment of the importance of the Jumbo Pass area as a wildlife migration corridor between the eastern and western Purcell Mountains, and the implications of the project for wildlife use of this corridor, must be presented in the project report.

This has been reported previously under Project Report Specification D.3(B) #7 bullet: the implications of the project for the maintenance of regional connectivity of key habitats.

The Kootenay Boundary Land Use Plan KBLUP identified an east-west connectivity corridor between lower Dutch Creek through the Purcell Wilderness Conservancy and between Kootenay and Duncan Lakes via lower Hamill Creek (see Figure 20 in Appendix 3-B Wildlife Resources). Jumbo Creek and Upper Glacier Creek (including Jumbo Pass) were included along the northern boundary of the corridor; however, these two areas form a north-south peninsula and do not contribute significantly to east-west connectivity (Figure 20). Jumbo Pass is also a popular hiking destination, with a hut recently rebuilt and expanded.

The only north-south connectivity corridors identified on Ministry maps are located along the Columbia River to the east or through a variety of interconnected east-west corridors west of

Kootenay and Duncan Lakes. A series of glaciers to the north and south of Glacier Creek, to the north of Jumbo Creek and Howser Creek, and east of Duncan River limit north-south connectivity through the west-central Purcell Mountains.

The design of the project has concentrated the proposed development area north and upstream of the Jumbo Pass corridor. Except for the improvements to the existing road, the current design has avoided increasing impacts to the Jumbo Pass corridor, and the proposed Controlled Recreation Area has been modified to be entirely removed from the Jumbo Pass corridor.

Resort construction and operation will not affect the main connectivity corridor through the Purcell Wilderness and west across Kootenay and Duncan Lakes. There could be some disruption of connectivity along upper Jumbo Creek, but with strict guidelines in place and appropriate mitigation measures the impacts can be minimized and kept to an acceptable level. Although the KBLUP did not make specific recommendations for the Jumbo Creek watershed, the general mitigation measures it provides are applicable to the Jumbo Glacier Resort project. These mitigation measures are discussed in Project Report Specification D.3(B) #7 bullet.

The East West connectivity value of the Jumbo Pass has been overemphasized relative to the impact of current human use and to the availability of better wildlife connectors through the Purcell Conservancy, particularly the Earl Grey Pass / Hamill - Toby Creek. This and the other connections through the drainages to the south of the Jumbo and Glacier Creek drainages are clearly favored by the unspoiled wilderness of the Conservancy, where motorized traffic is not permitted and human intrusion is less frequent. North South connectivity exists also West of the Jumbo Creek drainage, extending from Glacier Creek to the Kootenay and Duncan Lakes.

9. As part of the wildlife assessment process, the proponent must conduct (and, in the project report, document) interviews with long-time users of the Jumbo Creek valley and adjoining valleys, so that assessments of wildlife populations, habitats, etc. benefit from the local knowledge of those familiar with the area. On request, MELP will identify some long-time users for the proponent, and other project committee members may also choose to do so.

Telephone discussions were held with the following staff members of several provincial government agencies in order to obtain wildlife information for the study area.

- Dennis Demarchi, Habitat Classification Specialist, Wildlife Branch-Ministry of Environment, Lands and Parks (1991)
- Doug Martin, Habitat Protection Biologist-Ministry of Environment, Lands and Parks (1991)
- Cy McConnell, Resource Officer (Inventory), Derm Gorsuch, Resource Officer (Engineering) and Russ Hendry, Resource Officer (Planning)-Ministry of Forests (1991)
- Sue Crowley, Environmental Stewardship Branch-Ministry of Water, Land and Air Protection (2003)
- Dave Phelps, Land Management Biologist (1991)

- Ray Demarchi, Regional Wildlife Biologist (1991)

Additional telephone discussions were held with Roger Madsen (heli-skiing guide), to obtain general information on the study area, and with several biologists familiar with Grizzly Bear ecology and behaviour (Keith Simpson - private consultant, Bruce McLellan - Wildlife Habitat Ecologist, Ministry of Forests, Revelstoke).

A personal interview was held with Nolan Rad, a long time resident of Invermere. Mr. Rad has extensive knowledge of the Jumbo and Toby Creek Valley dating back to the late 1940s. He has been a trapper in the Jumbo Valley and has hunted the area for many years. Detailed notes were made during the interview. Additional meetings and interviews were held with a local ranger over a period of several years.

D.3(C) Grizzly Bears

EA Issues Profile

Topic

Implications of project for grizzly bear resources

Issues

- Need to survey experience in BC and adjacent jurisdictions with respect to typical grizzly bear responses to land use activities.
- Detailed assessment of direct and indirect impacts (both on-site and off-site) of project on grizzly bear populations and habitats.
- Assessment of on-site and off-site cumulative effects of project on grizzly bear resources.
- Measures for impact mitigation and management, and for operational monitoring to evaluate effectiveness of these measures.

Relevant Project Components

All on-site and off-site project components within Toby/Jumbo Creek drainage.

Lead Agency

Ministry of Environment, Lands and Parks (MELP) – BC Environment and Lands

Comments also Received From

- Ktunaxa/Kinbasket Tribal Council (KKTC).
- Parks Canada.
- District of Invermere.
- Regional District of East Kootenay (RDEK).

Relevant Public Comments on Application and Draft Specifications

- Need wildlife inventory of Glacier and Hamill Creek drainages? (13j) Also Tenise Creek.
- Whatever affects grizzlies in Jumbo valley will have serious effects on bears throughout Purcell ecosystem. (13k) Have impact concerns on both sides of Purcell Divide. Need 2-to-3-year grizzly bear study for reliable results. Should consider entire Purcell system.
- Even if grizzly bears are forced out of valley, more habitat for wildlife would be created. There would be less pressure from logging/mining companies on adjacent areas. (13l)
- Jumbo valley is main breeding ground for grizzly bears. If resort development proceeds, present habitat effectiveness of area will be lost. (13m)
- MELP considers Jumbo Creek valley important for grizzly bears – see Regional Biodiversity Strategy.
- How can government reconcile *British Columbia Grizzly Bear Conservation Strategy* with allowing resort that will compromise prime grizzly habitat. (13o) Need to assess project in light of priorities in strategy. Disagree principles can't be applied on site-specific basis.
- Need field studies (e.g. using radio collars). Cannot rely on habitat suitability mapping, which gives incomplete picture (e.g. will not identify denning and mating sites, or whether or not Jumbo Pass is a bottleneck or funnel for migrations).
- Studies should assess habitat use and conflicting usage, habitat loss, food sources, bear movement, denning sites, mortality, and current population and status.
- Should consult existing studies – East and West Slopes Grizzly Bear Projects, Bow Valley Study, and Alberta Natural Resources Conservation Board hearings on Three Sisters Project.
- Question validity of US Forest Service Cumulative Effects Model. Re. draft specs #1-#12 – all assumptions for model should be reported in project

report.

- Re. draft spec. #8 – should not be done at proponent's discretion.

Relevant Public Advisory Committee Comments on Draft Specifications

- Re. draft spec. #1 - remove word 'reasonable'.
- Re. draft spec. #2 – should break down studies into (1) impacts on grizzly populations, (2) human interaction, (3) impacts of ski hill development on grizzly populations, (4) habitat effectiveness, (5) core area analysis, and (6) linkage zone protection.
- Re. draft spec. #3 - detailed field assessment should include analysis of habitat capability, habitat use, movements and habitat effectiveness factors. Also, in more distant parts of study area, there could be some variation in map scale of study - left to discretion of those doing mapping.
- Re. draft spec. #5 - add Howser Creek. Also, add field assessment under habitat capability in 2nd line.
- Re. draft spec. #6 - add Howser and Stockdale Creeks.
- Re. draft specs. #7, #8 and #9 - there was suggestion, but without consensus, to switch from Cumulative Effects 'Model' to 'Analysis', which would examine population viability, thresholds and impact of increased or reduced logging over time on grizzlies.
- Re. draft spec. #10 - wording should read "...the analysis involving mitigation should be expanded to require a full review of theory and practice, how and why, based on grizzly bear ecology and human behaviour, and where in the past these measures have worked..."
- Re. draft spec. #11 - wording should read "...to provide a strategy to monitor the direct and indirect effects of the project's operations which will be sufficient to detect and assess changes (if any) in habitat use..."
- Re. draft spec. #12 - add "...To utilise existing knowledge through interviews with people who have talked to the people who have studied and worked with bears in the Jumbo Creek area..."
- There was suggestion, but without consensus, to refer specs for grizzly bear study to the Grizzly Bear Scientific Advisory Committee.
- There was suggestion, but without consensus, to add spec to carry out 3-to-5-year study of grizzly bears in region.
- Grizzly bear field work is needed to complement assessments using habitat suitability maps.

Relevant Proponent Comments on Draft Specifications and Specifications Feedback

- Opponents' claims that grizzly bears are endangered, and should be protected, contradict other opponents who maintain Jumbo area is prized hunting ground. 1995 MELP pamphlet indicated area is one of two areas in BC where grizzly population is not endangered.
- Reports on Lake Louise and Whistler areas indicate that presence of ski areas has increased grizzly bear population. In Jumbo valley, where hunting would have to be restricted if resort proceeds, bear numbers would be enhanced. Whistler bear population has increased, despite poor garbage handling and fact that Whistler is 10 times larger than proposed resort.
- Ongoing monitoring of Jumbo valley indicates wildlife and bear sightings are less than usual for similar valleys, and less than in Toby Creek. There has been long period of sawmill activity, and neither proponent nor local heli-ski operator have sighted significant bear presence.
- Agree that some recommended studies may be valid for the ongoing assessment of mitigation strategies and management of grizzly bears.
- Subject to clear understanding of scope of work between proponent's wildlife consultant and MELP, draft specs are not unreasonable. Need to reaffirm that review will be based on currently available data.
- Conducting biophysical habitat mapping at 1:20,000 scale is not necessary for evaluating impacts to grizzly bear habitat within Jumbo valley.
- It is not proponent's responsibility to collect research and inventory data for Grizzly Bear Scientific Advisory Committee.
- Draft specs wrongly imply that MELP has useful information. Earlier FOI request of MELP was to acquire MELP's data on wildlife migration routes in Jumbo Creek drainage. Apparently, MELP has no such information.
- Grizzly bears could co-exist with Jumbo project over long term.

Related Issues and Relevant Specifications

- Re. land use and related land use planning issues, see section A.7.
- Re. related wildlife management issues, see other parts of section D.3.
- Re. commercial and non-commercial wildlife recreation, see section E.5(F)
- Re. fish and wildlife resource management, see section E.7(K)
- Re. traditional First Nations use of wildlife resources, see section G.1.

Part D: Environmental, Resource Management and Technical Issues

- Re. possible federal cumulative wildlife assessment requirements, see section H.2.

Additional EA Reporting Requirements?

Yes – see below; key additions to draft specs include: need to conduct genetic testing of hair samples to establish bear numbers and distribution; expanded literature review; and need to conduct interviews with long-time users of area.

Evaluation

Background

The proponent's application documented visual reconnaissance data collected by helicopter and on foot, as well as information gathered from local residents and an analysis of hunting statistics. In addition, attributes of biophysical habitat classes were rated for grizzly bears on the basis of cover, food availability, migratory route potential and denning potential. Key habitat types for grizzly bears were assumed to be avalanche slide areas, moist lower slope brush sites, sedge meadows in wet areas along streams, and alpine meadows.

It has been acknowledged by the proponent that this information does not constitute an assessment of the potential impacts of the project on grizzly bears. The assessment of potential impacts will be undertaken as part of the preparation of the project report.

Various members of the project committee, as well as the public and the public advisory committee, have raised issues with respect to grizzly bear impacts the most appropriate means of identifying and assessing potential adverse effects of the project on grizzly bears(see above listing). MELP is the ministry responsible for the management of grizzly bears, under the authority of both the *Wildlife Act* (in the immediate area of the project) and the *Park Act* (in the nearby Purcell Wilderness Conservancy Provincial Park [PWC]). Accordingly, MELP has taken the lead in preparing draft specifications in final form for consideration endorsement by the project committee. Following minor revisions, the project committee has approved them for release. In 1996, MELP first hired consultant Ben van Drimmelen to provide advice to MELP and the project committee on grizzly bear assessments. He has also assisted MELP and the committee to evaluate the feedback received on the December 13, 1996 draft specifications, and his report in this regard is attached to this appendix – see report *Grizzly Bear Project Report Specifications for the Jumbo Glacier Alpine Resort Impact Assessment – Analysis of Comments and Recommended Final Specifications* (dated November 10, 1997).

Preparation of the final specifications has taken into consideration, and has greatly benefited from, comments on the draft specifications made by

the public, the public advisory committee and the proponent, as well as those members of the project committee with technical expertise in the assessment of potential impacts on grizzly bears - Parks Canada, KKTC and MoF. The objective of these draft specifications is to ensure that a thorough understanding of the potential impacts of the proposed development on grizzly bears is obtained, and that any viable options to prevent or mitigate any adverse effects are identified and analysed.

Concerns with respect to the potential impacts on grizzly bears were identified by MELP from the outset of its participation in the review of this proposal under the Commercial Alpine Ski Policy (CASP) process in 1991. Over the ensuing years, MELP has provided direction on grizzly bear assessment requirements to the proponent on several occasions. Two significant changes in the government's regulatory regime have affected the clarity of this direction - the coming into force of the *Environmental Assessment Act (EA Act)* in June 1995, and the *British Columbia Grizzly Bear Conservation Strategy*, which was also announced in the summer of 1995.

MELP's approach to grizzly bear management was significantly revised between 1991 and 1995. A status review showed that grizzly bear ecosystems had been greatly impacted in the past, to the point where grizzly bears have been extirpated from a quarter of their historical range, and where two-thirds of the remaining grizzly bear habitat is vulnerable to loss. Both grizzly bear populations and habitat were continuing to decrease.

In response, the *British Columbia Grizzly Bear Conservation Strategy* was finalised in 1995. While this addressed the need for a provincial grizzly bear policy, the general objectives of the strategy are difficult to apply on a site-specific basis to developments such as the Jumbo Glacier project. Consequently, the following specifications, while reflecting the increased provincial recognition of the importance of grizzly bears evidenced through the strategy, at the same time are designed to allow the type of impact assessment contemplated by the *EA Act*. Clarifying the policy context for the review of this project under the *EA Act* in light of the *British Columbia Grizzly Bear Conservation Strategy* has been in large measure responsible for MELP's delay in forwarding draft specifications to the project committee for its consideration.

Regional Context

As noted in section D.3(B), above, MELP considers the Jumbo Creek drainage to be important for grizzly bears, and this is identified in MELP's *Regional Biodiversity Strategy*. Extensive logging and fires, the belt of wetter subzone variants, and numerous avalanche chutes have resulted in extensive shrub-lands of important all-season bear food - huckleberries, bulbs, sedge meadows, cow parsnip, etc. This area is also located in the vicinity of regional-scale north-south and east-west wildlife movement corridors, and immediately north of the PWC, a large protected

area.

Assessment Principles and Definitions

For the purposes of EA review, there are four five basic phases of work required to complete the environmental assessment of the impacts of the proposed Jumbo Glacier project on grizzly bears and grizzly bear habitat. The work required in each of these phases must be based on habitat capability (potential bear numbers), not actual grizzly bear numbers. The intent is that this work is to build on material already submitted in the proponent's application. The four five phases are:

- identification of grizzly bears and grizzly bear habitats (presence, absence, limiting factors), both existing and potential;
- collection of hair samples from grizzly bears for one season for purposes of genetic analysis;
- identification of probable impacts (direct, indirect and cumulative) of the project on those resources;
- identification of measures to prevent impacts and minimise those which cannot be prevented; and
- monitoring the impacts, their prevention and mitigation, with modification as necessary, if plans are not effective to achieve the expected results.

For the purposes of these draft specifications, the following general definitions are used.

Direct impacts are those which are directly attributable to the construction and operation of the resort, the access road and other off-site utilities and infrastructure. Direct impacts will normally be localised, matching or slightly exceeding the "footprint" of the project, and may include:

- habitat either lost or abandoned, due to construction; and
- habitat abandonment due to disturbance of grizzly bears by the activities of guests of the resort, or by other associated resort-based activities.

Indirect impacts are those which are indirectly attributable to the construction and operation of the resort and the attendant creation of improved access for people in the area. Indirect impacts may occur in a larger buffer zone well beyond the area of the project itself, such as in the immediately adjacent watersheds of Toby, Horsethief, Glacier, Hamill, Carney and Dutch Creeks. Examples of indirect impacts would include:

- garbage disposal, and its effect in attracting grizzly bears;

- increased grizzly bear mortality due to such factors as vehicle collisions, poaching and destruction of "problem" bears, and possibly also disturbance during denning; and
- abandonment of portions of habitat due to habitat division ("fragmentation"), whether caused by through disturbance by resort visitors and local and other residents who access the area, using roads upgraded by the proponent, or by the loss of cover along utility and access corridors.

Cumulative impacts are the direct and indirect effects of the project, combined and measured as incremental additions to the effects of other existing and imminent land uses within the expected range of grizzly bears which use habitats affected by the proposal. This requires assessment of historic activities and predictions about past, existing and imminent activities in what, for large carnivores such as grizzly bears, would be a large area.

Cumulative Effects Assessment Model

In the last five years, a sophisticated approach has been developed for assessing the direct, indirect and cumulative effects of development on grizzly bears. This approach involves a model developed and used by the US Forest Service to manage the remnant grizzly bear populations in the United States. It is intended that this model be used as the basis for completing the grizzly bear assessment for the project.

The model, in essence, applies a grizzly bear value to habitat units, varied by season of expected bear use. Then, the model superimposes human use/disturbance factors, as collected from a standard GIS computerised mapping technique. Various land uses and activities can be assessed, both in space and through time.

Ultimately, Geographic Information Systems (GIS) maps are produced which show the study area, colour-coded for overall grizzly habitat suitability (by season) at different stages of human land uses in the past and present, with or without the proposed project.

Although models are only as reliable as the underlying assumptions, it is considered that this proposed direct/indirect/cumulative impact assessment process would result in a detailed and objective analysis. It would also allow the assumptions to be reviewed and varied by both the proponent and the project committee to test the sensitivity of the conclusions.

Population Monitoring through Genetic Testing

Use of the cumulative effects model is intended to form the primary framework for the assessment. However, MELP, after evaluating feedback on this issue from KKTC and Parks Canada, the public advisory

committee and the public, has recommended to the project committee that some grizzly bear field observations be required to provide a better understanding of grizzly bear habitat use and numbers. Thus, specification D.3(B) #12 requires the proponent to collect hair samples from grizzly bears within the area of expected direct and indirect impacts of the Jumbo resort for one field season for the purposes of genetic analysis. DNA analysis is to be performed on the samples, and interpretation of those samples and the findings are to be reported in the project report.

The purpose of collecting this information is to obtain an indication of the numbers of grizzly bears in the area which would be potentially impacted by the proposed project. The data will improve the reliability of the impact assessment, better inform the project decision, and establish a baseline for ongoing monitoring to detect changes in grizzly bear numbers and distribution over time, if the project proceeds. The work is to be conducted in accordance with provincial Resource Inventory Committee (RIC) standards for determining relative abundance of grizzly bears, as set out in *Inventory Methods for Bears* (draft).

Based on the advice of grizzly bear experts, the findings of other similar studies in BC, and information from the RIC manual, the outside parameters for the field season during which the grizzly bear hair samples are to be collected is June 1st to July 31st in the Jumbo Glacier project area. The reliability of the census is directly related to the 'catchability' of the bears. Catchability declines with greater food availability (i.e. as more foods become available in a wider range of habitats). Such surveys need to begin in spring, after all the bears have emerged from their dens, when natural foods are scarce, and bears are more likely to approach baited hair capture sites. In the interior of the province, surveys are best done prior to the berry season in mid-to-late July, depending on the location and the year. In view of the early spring this year, it is the opinion of grizzly bear experts that the 1998 field season should start on or close to June 1st. Up to 5 trapping sessions are recommended, 1 week to 10 days apart. To monitor and assess population trends over time, inventory surveys should be conducted under comparable conditions each year.

For more details, see also November 10, 1997 report by consultant Ben van Drimmelen.

Project Report Specifications – D.3(C)

Scope of Review

1. The overall scope of the grizzly bear assessment must be based on the eventual construction and operation of the resort at full 'build-out' (i.e. with approximately 7,000 bed units), and on assuming the maximum potential impact on grizzly bears.

Data Collection and Analysis

Specifically, for inclusion of results in the project report, the proponent must:

2. Carry out a review of existing research studies undertaken in BC and adjacent jurisdictions, including the northwestern US States, with respect to grizzly bears and their response to land use activities. In carrying out this review, particular attention must be paid to identifying and documenting studies which have addressed: (1) impacts on grizzly bear populations; (2) human interaction studies; (3) impacts of ski hill developments on grizzly bear populations; (4) studies of habitat use; (5) core area analysis; and (6) linkage zone protection.

3. Conduct and report on interviews with long-time users of the Jumbo Creek valley and adjoining valleys, as required more generally for wildlife assessments by specification D.3(B)#9, so that the assessment process may benefit from local knowledge of wildlife values. These interviews are to include questions regarding grizzly bear use of these areas. Any pertinent information gathered through this exercise must be reported in the grizzly bear section of the project report. On request, MELP will identify some long-time users for the proponent, and other project committee members may also choose to do so.

4. Apply the research literature review and interview results to existing 1:20,000-scale habitat capability information to provide a detailed analysis of the direct effects of the project within the Jumbo Creek valley, including (but not limited to) habitat lost to construction and habitat abandonment due to grizzly bear disturbance by resort clients and their vehicles (any projected helicopter traffic included). Where habitat mapping of a scale of at least 1:20,000 is unavailable, the proponent should utilise the most detailed scale which is available (e.g. 1:50,000-scale mapping).

5. Make use of the research literature review and interview results and the existing 1:20,000-scale habitat capability information to undertake a detailed analysis of the indirect on-site effects of the project within the Jumbo Creek watershed, including disturbance during denning and abandonment of portions of habitat in response to habitat division ('fragmentation'), the latter associated with:

either disturbance by local and other residents who access the area using roads upgraded by the proponent;

or the loss of cover along utility and access corridors.

6. Make use of the research literature review and interview results and the existing 1:20,000-scale habitat capability information to undertake a detailed analysis of the indirect off-site effects of the project within the watersheds of Jumbo, Toby, Horsethief, Glacier, Hamill, Carney, Howser and Dutch Creeks. Indirect effects include, but are not limited to, garbage disposal attraction of grizzly bears and increased grizzly bear mortality as a result of poaching, vehicle collisions and the destruction of 'problem' bears. Where 1:20,000-scale habitat mapping is unavailable, the proponent should utilise the most detailed scale which is available (e.g. 1:50,000-scale mapping).

7. Collect and compile data on grizzly bear habitat capability within the Purcell Mountain block south of the Spillimacheen and Duncan Rivers or, if computer mapping information is not imminently available for the land north of Jumbo Creek, at least in the area bounded by Horsethief, Howser and Stockdale Creeks, the Kootenay River, the highway between Cranbrook and Creston, and Kootenay Lake.

Cumulative Effects Assessment

8. Compile these data in a form suitable for direct input into a cumulative effects assessment model (based on the US Forest Service's model, as modified by written agreement between MELP and the proponent). Data are to be compiled in digitised computer mapping files which are compatible with MELP's standard GIS platform (TRIM-based, NAD 83 shifted, ARC Info compatible). Data are expected to include grizzly bear habitat capability, current forest cover category and human disturbance factors such as roads, trails, communities, railways, etc.

9. At the proponent's exclusive discretion, assess the cumulative impacts of the project using the cumulative effects model, as modified by agreement between MELP and the proponent. If the proponent declines to assess cumulative impacts, it must provide suitably compiled computer map data as described above to MELP to allow MELP instead to assess cumulative impacts for the project committee, using the cumulative effects model.

10. Provide information to a panel of grizzly bear specialists, selected by MELP, with respect to the assumptions which were used, or which, in its view, should be used, in the cumulative effects model, regarding quantification of grizzly bear habitat values. This must include advice with respect to appropriate seasons, habitat coefficients, edge coefficients, protein coefficients, activity groups, mortality coefficients and other essential information required for the model's operation.

11. Carry out a review of existing literature from BC and adjacent jurisdictions, including the northwestern US States, to identify, describe and assess the effectiveness of mitigative strategies and techniques applicable to land use impacts on grizzly bears and their habitats and, with the benefit of this review, propose measures to be applied by the proponent to prevent or mitigate the identified adverse direct, indirect and cumulative effects of the project.

Population Monitoring through Genetic Testing

12. Monitor and report on the potential direct and indirect effects of the project to predict, detect and assess changes (if any) in grizzly bear numbers and distribution. The monitoring program is to include:

- field collection of hair samples of grizzly bears within the area of expected direct and indirect impacts for one field season (approximately June 1 through July 31) prior to the completion of the project report, genetic analysis of the hair samples to identify individual bears, interpretation of the hair

analysis data to assist in the prediction of potential direct and indirect impacts of the project on grizzly bears, and to establish a baseline for future monitoring, and reporting of the findings in the project report; and

- if the project is approved under the *EA Act*, continued field collection of hair samples from grizzly bears within the area of direct and indirect impacts during final project planning and construction (and thereafter for 10 years, or until such earlier time as MELP determines that it is no longer required), genetic analysis of the hair samples, interpretation of the hair analysis data to detect and assess changes (if any) in grizzly bear numbers and distribution in response to project construction and operation, and reporting of the findings to MELP.

Impact Management

13. Provide plans to evaluate and monitor the effectiveness of mitigation actions and measures, including plans to allow modification of such measures and actions to increase their effectiveness.

RESPONSE – D.3(C)

1. The overall scope of the grizzly bear assessment has been based on the eventual construction and operation of the resort **at full 'build-out'**. Build out is proposed to occur for an approved Master Plan including 5502 beds for tourist accommodation and 750 beds for employee accommodation. The maximum potential impact on grizzly bears is the assumption of the assessment and of the revised Master Plan.

2. A review of existing research studies undertaken in BC and adjacent jurisdictions with respect to grizzly bears and their response to land use activities identified the following major impacts from these activities. Appendix 3-C Environmental Management Plans and Appendix 3-D Grizzly Bear Management Plan provide a more detailed analysis of these activities and their impacts on grizzly bears.

Habitat Impacts Studies

Austin (2000) notes that the Jumbo Creek drainage contains highly suitable Grizzly Bear habitat, but he also notes that the effectiveness has been reduced by the existing level of human disturbance associated with hiking trails, forestry activity and the valley road and backcountry hut.

A report by Clayton Apps (2003) confirms Austin's assertion that the valley has been impacted by external, anthropogenic influences. In Apps's cumulative effects assessment (CEA) for the project (see Appendix 3-E), the Jumbo watershed is the third least effective watershed in the Central Purcell Mountains. Presumably, this is due to the impacts listed by Austin (2000). Apps estimated that within the CEA area, the proposed project is projected to decrease grizzly bear habitat effectiveness by 1.5%, resulting in an overall habitat effectiveness value of 75%, which is well within the habitat effectiveness threshold of 70%-80% suggested by Herrero and Herrero (1996). From Apps (2003), habitat effectiveness is defined as "the realized ability of a species to inhabit and persist within a landscape after accounting for human influence factors." From Apps's preliminary CEA results, the most valuable Grizzly Bear habitat, according to habitat effectiveness are the Fry, Carney, Hamill, Stockdale and Howser watersheds. The former watersheds all

possess habitat effectiveness values greater than 80%.

The access road to the Jumbo resort has the potential to impact Grizzly Bear populations. Chruszcz *et al.* (2003) studied roads in Banff National Park. Their findings suggested that Grizzly Bears use areas close to roads more than expected, particularly low volume roads. The authors found that habituated bears were closer to roads than wary bears, as one would expect. Males were closer to low volume roads than females but crossed roads less than females during the berry season. When bears crossed roads, crossing tended to occur at sites with higher habitat rankings, and generally from lower to higher habitat rankings at low volume roads. Chruszcz *et al.* note that Grizzly Bears learn to use habitat adjacent to roads because traffic is relatively constant and predictable and has no negative stimulus associated with it; therefore, they learn to accept the intrusion (Herrero 1985, McLellan and Shackleton 1989). They also recommend the maintenance of high-quality Grizzly Bear habitat adjacent to roads and recommend that wildlife managers address the effects of traffic volume on the road-crossing decisions of Grizzly Bears. They concluded that the Trans-Canada Highway, which dissects Banff National Park, acts as a partial barrier (or filter), and that it is unlikely that isolation effects will occur in the Banff Grizzly Bear population.

Similar to Chruszcz *et al.*'s results Gibeau *et al.* (2002) found that females remained farther away from paved roads than males. However, the authors found that this tendency was present regardless of habitat quality and the time of day. Males were closer to paved roads when within or adjacent to high quality habitat and during the period of least human activity. Bears were also found closer to trails during periods of human inactivity when these trails were within high quality habitat. Gibeau *et al.* concluded that management agencies must maintain access to high quality habitat, especially for adult females, and create new opportunities to support the reproductive potential of the population.

Related to the effects of roads and development on Grizzly Bears, Mattson *et al.* (1987) set out to determine 1) if levels of Grizzly Bear habitat use, along roads and around developments were equal to what was expected based on habitat quality, 2) if productivity of occupied habitat was equal to that expected with non-selective use along roads and around developments, 3) whether there was any evidence of road and development avoidance by bears and, if so attempt to quantify this, and 4) if sex and age classes differed with habitat type. They used a zone of influence of 4 km along roads and 6 km around developments. Their data suggests that Grizzly Bears are avoiding a 3 km buffer along roads and during the fall they move to a buffer of 4 km. Gibeau and Heuer (1996) and Mattson *et al.* (1993) also document avoidance of human facilities. Some problems in Mattson *et al.* study that they identify are the inaccuracy of their aerial locations of Grizzly Bears and conducting their searches for radio-collared bears during the day, when many Grizzly Bears are nocturnally active, especially during the summer. They make conclusions regarding avoidance of roads and developments but they failed to meet their objective of quantifying the effect of the roads and development on the Grizzly Bear population.

Mace *et al.* (1996) found that Grizzly Bears in the Swan Mountain study area of Montana exhibited either a neutral or positive selection for buffers surrounding closed roads and roads receiving fewer than ten vehicles per day, but avoided buffers surrounding roads having more than ten vehicles per day. The authors also found that Grizzly Bear habitat selection tended to be strongest for elevation and cover type variables relative to total road density, indicating that although roads play an important role in habitat selection there are other natural factors which play more significant roles. Mace *et al.* suggest the following as a means to mitigate road presence and traffic volumes: minimize road density during the spring and traffic volume in

watersheds having highly preferred habitats such as those with avalanche chutes. Subsequently, based on local knowledge of habitat selection patterns, road density standards could then be relaxed somewhat in less suitable habitat, allowing increasing public use while minimizing threats to the local Grizzly Bear population.

The barrier created by roads is discussed by Alexander and Waters (2000). Their research in Banff National Park identifies predictors for Grizzly Bear movement based on aspect: Alexander and Waters found that Grizzly Bear movement tends to be from the south, southwest and west facing slopes. Flat slopes, areas of low topographic complexity and slopes lower than 5° were also effective predictors of animal movements. Mitigation measures for road impacts should attempt to facilitate normal wildlife movement most effectively. Should wildlife underpasses be considered as a means to maintain wildlife corridors, Clewenger and Waltho (2000) suggest that future underpasses be designed around topography, habitat quality, and location. These measures to maintain movement will not be successful if human activity is not managed.

Human Interaction Studies

The proposed JGR has the potential to conflict with middle to high elevation winter denning habitat for Grizzly Bear. Linnell *et al.* (2000) note that the tendency for high overlaps between bear denning sites and potential winter recreation areas results in a high potential for den abandonment due to human disturbance. They recommend that bear denning areas receive protection from human disturbance during the winter. Fewer habitat conflicts are anticipated for the lower elevations.

Several studies provide guidance for managing trails and campground to minimize the potential for human-Grizzly Bear conflicts. For example, based on the reaction of Grizzly Bears to human disturbance on trails, Chester (1980) recommends a minimum of 152-m set-back allowance between hiking trails and high quality Grizzly Bear habitat. Additionally, Creachbaum *et al.* (1998) outlined mitigation measures in their re-design of campgrounds in the Shoshone National Forest (Wyoming) that are applicable to trails.

Relevant aspects of Creachbaum *et al.*'s (1998) criteria for designing Grizzly Bear friendly campgrounds are: 1) use buffer zones, leave strips, trails and barriers (e.g., drift fencing) to help direct bear travel; 2) consolidate bear attractants in one area, and prevent access to Grizzly Bears; 3) avoid areas of high bear activity; 4) locate trails away from watercourses. Grizzly Bears use these as movement corridors and the noise from streams interferes with hearing thus increases the risk of surprise encounters; 5) locate trails away from established game trails; 6) limit the chance of surprise encounters by maximizing the sight distance on trails by removing vegetation; 7) ensure that palatable vegetation is not present on trails; 8) ensure that hiking groups are greater than two persons (Nadeau 1987) and that they remain on designated trails; and 9) make attractants unavailable to wildlife. In addition, Creachbaum *et al.* and other authors, suggest seasonal trail closures in habitat where Grizzly Bears are active. This is especially important during years of food scarcity.

Grizzly bears-human conflicts have been studied rather extensively in the Greater Yellowstone Ecosystem (GYE) (e.g., Gunther *et al.* 2002). Gunther *et al.* recorded 227 Grizzly Bear-human conflicts in the GYE in 2001. Anthropogenic food was the cause of conflict in 56% of the cases followed by livestock (26%), property damage in order to get food (12%), feeding in orchards (3%), injuring people (2%), and feeding at beehives (2%). There were 31 Grizzly Bear captures, 19 bear deaths due to humans and 16 bears were removed from the population. From these and

other studies of Grizzly Bear-human conflicts it becomes apparent that the major management problem lies in controlling the availability of human food (Herrero 1985). A source of Grizzly Bear mortality not addressed in Gunther *et al.*, but referred to in IGBC (1987) is the problem of non-sport mortalities caused by hunters, most (87%) of whom perceived the bear as an immediate or potential threat to their life or property.

Garbage

Schullery (1980) chronicled the history of the grizzly bear/garbage situation in Yellowstone National Park. Both black and grizzly bears were feeding at hotel dumps as early as the 1890's and nuisance bears had emerged by the early 1900's. The number of grizzly bears feeding at dumps rose drastically from 40 bears in 1920 to 260 bears in 1930. Grizzlies were often closely associated with garbage in many preserves, therefore leading to human/bear problems, and as a result "nuisance bears" or habituated bears (GBIT 1987). Craighead (1980) reported that 56-77% of the total grizzly bear population of Yellowstone Park congregated at the dumps. These nuisance bears become habituated to people and obtain non-natural foods, are "repeat-offenders" in relocation programs and express offensive aggressive behaviour towards humans, becoming a threat to human safety (MELP 1996). In 1932, the Research and Education Branch suggested that dumps were unhealthy for bears and were no longer necessary in Yellowstone National Park. The last of the Yellowstone Park dumps were closed in 1970.

Open-pit garbage dumps and poorly designed incinerators still enabled grizzly bears to obtain garbage in several Canadian National Parks throughout the 1960's. The landfills in Banff and Jasper National Parks were fenced in 1970 but habitual garbage bears still managed to obtain garbage by digging under, or breaking through the enclosures (Kaye, 1982). The Banff landfill was closed in 1980 and an electric fence was placed around the Jasper landfill in 1981 to discourage bear activity. Kootenay and Yoho National Parks have hauled all refuse to nearby communities since 1973 and 1974, respectively.

Beginning in 1980, all refuse from Denali National Park was hauled to the public landfill at Nenana, Alaska. Singer (1982) felt that closure of the park dump, bear-proofing of most garbage cans and increased visitor awareness were the primary factors in minimizing grizzly bear incidents in Denali Park.

Herrero (1970, 1976, 1978, 1982 and 1985) concluded that bears which habitually fed on human food and garbage often lost their natural wariness of people. Such food conditioned bears were more likely to show aggressive tendencies than non-food conditioned bears. Although there is some uncertainty as to the degree of habituation/conditioning related solely to feeding at remote garbage dumps, there is general agreement that acquisition of garbage or other human foods in campgrounds or developed areas can have serious consequences for humans and bears. Within North American National Parks, habituated food-conditioned grizzly bears accounted for approximately 2/3's of all bear-inflicted human injuries up to 1970. Ninety percent of these injuries occurred in developed campgrounds in Yellowstone National Park where grizzlies had a long history of feeding on human refuse. Since 1970, improperly stored food and garbage was the second most common circumstance following surprise encounters associated with grizzly bear inflicted injuries.

Garbage feeding bears are generally more often predisposed to control actions and resultant relocation or mortality. Every year about 950 black bears and 50 grizzly bears are destroyed in BC to protect the public (MELP 1996, CWS 1971). Between 1986 and 1996, the Conservation Officer

Service relocated 107 grizzly bears and 54 black bears and destroyed 15 grizzly bears and 266 black bears within or near the City of Revelstoke (Robinson 1997).

In Yellowstone National Park, the average size of grizzly bear litters before dump closure was 2.1 cubs whereas the average litter size after dump closure was 1.9 cubs. Knight and Eberhardt (1984 and 1985) reported that 70% of the females reproduced at age 5 prior to the dump closure while 60% of the females reproduced at age 6 after dump closure.

Knight et al. (1981) found that three adult males weighed less in 1980 after the Cook City dump closed. The mean weight of male bears five years and older was significantly less after dump closure. Russell et al. (1979) observed that the only grizzly bear in Jasper National Park that used a landfill was exceptionally large for its age. Their observations suggest that grizzly bears that used garbage to supplement their natural diet did attain greater weights than bears that did not supplement their diet with garbage.

Outdoor Recreation

Many studies have been conducted addressing impacts of recreational activities and related noise on grizzly bears due to urban presence (GBIT 1987, Gibeau 2000, Haroldson and Mattson 1985). Recreational areas are associated with prime grizzly bear habitat due to the human favoured panoramic views. Reactions of grizzly bears to human recreational use have primarily been documented as negative, resulting in bear displacements or human/bear conflicts (Gunther 1990, Schleyer et al. 1984, Hemmera 1999, GBIT 1987, Herrero 1997). Many of these studies conclude that human recreational use in alpine and sub alpine areas can displace grizzly bears during foraging seasons, but most of these displacements can be avoided with seasonal trail closures (GBIT 1987).

The consequences of superimposing high recreational activity on productive grizzly bear habitat include both direct mortality and reduced habitat effectiveness. There is considerable evidence that grizzly bears avoid human facilities especially when they are occupied and active (Mattson, 1993).

For example, Grizzly Bear den disturbance is often identified as a potential impact from recreational snowmobiling. Podruzny *et al.* (2002) noted that den disturbance can cause 1) an elevated expenditure of energy, 2) den abandonment, 3) loss of cubs, and 4) displacement from denning areas. The authors recommend that, for management purposes, agencies identify denning areas and estimate the overlap with snowmobiling areas. The parameters used by Podruzny *et al.* to model Grizzly Bear denning habitat were: slope, elevation, forest cover and solar radiation; solar radiation acts as a proxy for topographical aspects. In the GYE, the authors concluded that the availability of denning sites was not a limiting factor. The model introduced by Podruzny *et al.* can be used by land managers to identify potential conflict areas and thus minimize potential impacts of winter recreation and other activities on denning bears. A second conclusion suggested by the data is that females do not locate their dens in areas different from the rest of the GYE Grizzly Bear population. Their data suggest that females with cubs are not any more or less susceptible to disturbance while in the den when compared to other segments of the population. This result is contrary to what many biologists have asserted in the past.

Haroldson *et al.* (2002) conducted a study similar to Podruzny *et al.* in that they analyzed the effects of snowmobiling on Grizzly Bear denning. The authors concluded that snowmobiling in the spring is dangerous because females with cubs are still confined to the area of the den.

Unlike the previous study, Haroldson *et al.* did state that females are more sensitive to disturbance; they also recorded female dens at elevations 100 m higher than the rest of the population. Similar to other den studies, they found that den entry depended on food availability and weather. Other important results of the study were: 1) researchers documented that security at the den site is important, especially at the time of entry, 2) less den abandonment was documented if the disturbance occurred late in the winter, relative to disturbances at the time of den entry, and 3) they found that there was a high risk of impact when females with cubs move to lower elevations after emergence because of the increased risk of human disturbance. Haroldson *et al.* concluded that agencies should combine their observations on den chronology with descriptions of suitable denning habitats for Grizzly Bear to limit disturbances to denning Grizzly Bears.

Access Roads

The most direct form of road-related mortality involve bears killed by vehicles (Knight *et al.*, 1981, 1988; Greer 1985; Palmiscano 1986; Burns 1986). However, most researchers have concluded that the effects of increased human access into bear habitat, particularly increased vulnerability to legal and illegal harvest, constitute the most critical impacts of road activity on grizzly bears (Nagy and Russell 1978; Ruediger and Mealy 1978; Smith 1978; Schallenberger 1980; Zager 1980; McLellan and Mace 1985). In Banff National Park, between 1971 and 1995 of the 118 grizzly bear mortalities, only 11 were not man-caused. Over 80% of the man-caused mortalities occurred within 500 m of a road while only 14% of these mortalities were due to highway or railway collisions. Most were management actions toward problem grizzly bears.

Mattson (1987) suggested that adult female grizzly bears use roadside habitat in order to avoid close contact with adult male grizzly bears that pose a mortality risk, especially to cubs. Conversely, Gibeau (2000) found that female grizzly bears avoided the Trans Canada Highway regardless of habitat quality or time of day, while males and especially subadult males were found closer to the Trans Canada Highway when within or adjacent to high quality habitat and during the human inactive period. However, regardless of the sex of grizzly bear using roadside habitats, between 1975-1990 habituated bears were killed 3.1 times more often than wary bears in the Greater Yellowstone Ecosystem (Mattson *et al.*, 1992). The authors concluded that road environments cause grizzly bears to make difficult choices with little opportunity to learn successful behaviours if they die in the process. Mattson *et al.* (1992) suggested that adult female grizzly bears that are thought to operate under considerable energetic duress in the Yellowstone area, might have higher mortality and lower productivity rates from avoidance of developments and roads.

While a number of different management strategies have been attempted to reduce mortality and impacts from road development, some mitigation measure may be detrimental to grizzly bear populations. For example, between 1983-1987 a 27-km section of the Trans Canada Highway in Banff National Park was upgraded from a 2-lane highway to a 4-lane divided highway. At the same time a 2.4 metre high woven-wire fence was installed on both sides of the highway to prevent vehicle-wildlife collisions (Gibeau and Heuer, 1996). Although highway overpasses/underpasses were constructed to allow wildlife movement across the highway, for the first 5-10 years since the installation of the highway fences in 1987, only two unconfirmed and one confirmed use of the wildlife underpasses by grizzly bears has been recorded (Gibeau and Heuer, 1996). The implications of fencing and associated mitigation could have profound effects on grizzly bear passage across the Bow River Valley and ultimately movement throughout the

Central Canadian Rocky Mountains (Gibeau and Heuer, 1996).

Aircraft

Aircraft such as helicopters and small planes have not been documented very intensely (GBIT 1987). Grizzly bears are very affected by aircraft but have been known to habituate to their presence (Harding and Nagy 1980).

In Yellowstone National Park, Graham (1978) and Peacock (1978) observed grizzly bears, which fled into timber as research tracking planes approached. Conversely, Schleyer (1980) found that research planes did not disturb grizzly bears. Campbell (1985) observed that 54.5% of the grizzly bears seen from small planes showed no response while only 29% showed a severe response. McLellan and Mace (1985) found that 15-20 grizzly bears observed from the air showed no reaction to the aircraft, while the remaining five bears ran to cover.

Impacts of Ski Hill Development

A study of Grizzly Bears, habitat and humans was conducted in Banff National Park (Jalkotzy *et al.* 1999). This particular study was different for other bear studies conducted in the Bow Valley because one aspect of the study investigated the impact within the Lake Louise Bear Management Unit (BMU), which includes the Skiing Louise ski resort. Jalkotzy *et al.* found that cleared ski runs on the Skiing Louise lease were strongly selected habitats during the spring. Early green-up of forbs on the lower slopes of the ski runs attracted bears in the spring. Spring is one of the most critical seasons for post-hibernating Grizzly Bears and sows with newly born cubs, thus the valuable spring ski run habitat could be very important to survivorship. Jalkotzy *et al.* found that, although selection for ski run habitat weakened in the summer, attraction to these artificial openings in the summer continued as green-up progressed up the slope. Berry production, tends to be greater along the ecotone between the predominately closed forest surrounding the ski run and the open runs than in closed forest itself, thus these ski run interfaces provide foraging opportunities in the late summer.

The researchers also recorded core home range for radio-collared Grizzly Bears which included a wide variety of human infrastructure, including the Skiing Louise lease. Movement for the radio-collared bears in this study was regularly recorded across secondary highways (i.e., Icefield Parkway and Bow Valley Parkway) in the area. Two of the Grizzly Bears in the study crossed a road on the lease at least several times per day, both during the day and at night. This road, although not open to public traffic, was used frequently by Skiing Louise staff and others with permission (Jalkotzy *et al.* 1999).

The hiking trails on the Skiing Louise leased land were also investigated by the research team. According to Jalkotzy's research, Grizzly Bear selection of home range did not appear to avoid areas with hiking trails. Shallenberger and Jonkel (1980) found that Grizzly Bears in the Rocky Mountain East Front tend to use habitat closer to low and moderately used trails than to trails receiving high or extremely high use. Their behaviour relative to human developments is likely the result of their ability to tolerate humans as a means of accessing food or finding security from dominant bears. They became habituated in close proximity to humans and human development on the ski hill.

Several thousand hikers per month use the Lake Louise BMU during the summer. Use of hiking trails during the spring was rated as low (<100 users per month), and in the summer and fall

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virtually all human disturbances were rated as high (>100 per month). As a mitigation strategy, Jalkotzy *et al.* proposed capping the summer use of areas of the Lake Louise BMU and a neighbouring BMU would probably achieve the habitat effectiveness target set out by the management plan, which for the Lake Louise BMU is >60% habitat effectiveness (Jalkotzy *et al.* 1999). They also suggest that mitigation strategies could also incorporate the decommissioning of trails, picnic areas campgrounds, backcountry huts, etc.

Researchers Hadden and Jonkel (1983, cited in IGBC 1987) noted that, for a proposed ski resort in northern Montana, the most impact from the resort would result from habitat alteration and increased potential for human activity in the non-ski seasons. The same conclusion was drawn by Reid *et al.* as they evaluated the effects of a proposed Clark Fork snowmobile corridor on Grizzly Bears (cited in IGBC 1987). They felt that the most serious consequence of the development were off-season uses. The stress caused by two-wheel vehicular traffic was of greatest concern, especially in the late fall and early spring. Base on these evaluations, it would appear that careful management of and limitation on non-winter recreational activities is critical for the maintenance of Grizzly Bear spring-fall habitat.

Habitat Use Studies

In the spring, adult females are associated with low to mid elevation habitats, and in summer and fall, females were positively associated with mid to high elevations. These were the findings of a study by Mace *et al.* (1999). They found that logistic regression coefficients for the spring were negative for all road and human activity variables. Summer and fall coefficients were also negative for road, human activity and trail variables. The statistical results imply, based on their available data, that there was avoidance of roads and human activity from spring to fall, with additional trail avoidance in the summer. Due to the strong indication of seasonal variations in habitat use, Mace *et al.* recommend that habitat management agencies implement reductions in road densities in seasonal habitat and implement methods to maintain habitat function on private lands.

A more comprehensive review of habitat use studies is included in the *Grizzly Bear Management Plan* (Appendix 3-D).

Linkage Zone Studies

The Interagency Grizzly Bear Committee (IGBC) is the committee of American and Canadian agencies working cooperatively to implement the Grizzly Bear Recovery Plan (USFWS 1993, Ruediger 2001)) and conserve and recover the Grizzly Bear in North America. The IGBC is involved in a wide range of activities to accomplish this goal including limiting human-caused mortality, habitat management, management of bears that come into conflict with human activities, education efforts with users of Grizzly habitat, and outreach and cooperation with private land owners in Grizzly habitat.

Habitat fragmentation is one of the issues complicating the conservation of grizzly bears and many other species of wildlife. Habitat fragmentation is the process of separating populations of animals and their habitats into smaller and smaller units. The main factor causing habitat fragmentation is human disturbance. Linkages of wildlife populations across areas of human development must be maintained, in order to have secure Grizzly Bear populations.

To address the issue of habitat fragmentation, the IGBC supports the identification of areas within

and between the major Grizzly Bear ecosystems where wildlife can live or move between existing large blocks of relatively secure habitat. These areas are called linkage zones. Linkage zones occur primarily between large blocks of public lands. Cooperation and coordination between public land managers, wildlife agencies, private landowners, and transportation agencies is required to maintain linkage zones. The IGBC supports this cooperation and coordination.

The IGBC is developing a Linkage Zone Report with the objective of identifying the areas where linkage for carnivores is still possible between ecosystems. The organization is producing GIS maps of linkage zones in each major mountain valley where human development and transportation structures influence carnivores in the Northern Rocky Mountains (Servheen *et al.* 2003).

One project relates to linkage zone prediction (LZP). It depends on GIS to model and graphically display the opportunities for wildlife movement between areas; these areas would have highest potential for linkage between habitat units for various carnivores. The LZP model was developed to quantify, in an iterative fashion, the extent to which human development has limited potential for movement between blocks of public lands in the Northern Rockies. The main assumption is that human activities are the primary determinant of wildlife distribution in developed areas. The model uses 4 digital layers in the GIS model to predict potential linkage zones.

- Road density;
- Human developed sites and the influence zone around them;
- Presence or lack of vegetative hiding cover; and
- Presence of riparian zones.

Clevenger *et al.* (2002) developed empirical and expert models (for Black Bear) for determining the location of mitigation passages for wildlife. These can be used as tools for resource and transportation planners when baseline information is lacking and when time constraints do not allow for data collection before construction. The authors found that wildlife crossings tend to occur at drainages, and mortalities generally occur less than 200 m from the nearest drainage.

Core Area Analysis Studies

Core area, also known as *refugia* is an area where special environmental circumstances have enabled a species or community of species to survive after decline or extinction in surrounding areas. For the purpose of this report, Grizzly Bear refugia can be defined as “habitats or environmental factors that provide spatial and temporal resistance and/or resilience to terrestrial communities impacted by natural and anthropogenic disturbances”

According to a historical study conducted by Mattson and Merrill (2002), Grizzly Bear populations require protected areas of about 4,000 km² and 50,000 km² in size to have a 50% and 90% chance, respectively, of survival. According to the authors, extensive restrictions on human access and armaments or widespread modifications of human behaviour are required. Extensive core areas would also exist where there are < 0.5 humans per km². Greater topographical relief would be an asset in core areas, but only where key food sources are dispersed and away from human activity. An encouraging aspect of the study by Mattson and Merrill was their discovery that management effort to maintain core areas of Grizzly Bear habitat are succeeding. Their model predicted, based on data from 1920-1970 (circa 1990), that there would have been no chance of sustaining core Grizzly Bear habitat in 2000, but their model failed to account for a

decrease in Grizzly Bear mortality as a result of positive changes in human behaviour since 1970. These core areas are more extensive now due to human changes that were initiated after 1970.

Mace and Waller (1998) recommend that wildlife managers develop a conservation strategy to promote bear population stability or growth by improving female survivorship while minimizing bear conflicts on private lands. To accomplish these two objectives governments must 1) protect core areas on public lands of superior habitat through access management; 2) must require Black Bear hunters to complete a bear identification course because hunters often misidentify Black Bears for Grizzly Bears (IGBC 1987); 3) reduce the negative impact from anthropogenic food on private lands and 4) continue to monitor Grizzly Bear populations and habitat.

The cumulative effects assessment by Gibeau (1995) of the Banff, Yoho and Kootenay National Park system suggests habitat alienation in core Grizzly Bear refugia. He also notes that most of the mountainous national parks are not inherently prime Grizzly Bear habitat due to the presence of rock and ice throughout much of the parks.

Protected core areas should include the entire range of all females in the reserve to ensure the protection of a reserve population (Wielgus 2002). Wielgus recommends placing a no-hunting buffer around the core refugia. The buffer should be the equivalent of half the mean estimated home range diameter or radius of an adult male in the prospective core area within a biogeoclimatic zone. According to the author, this will protect all females and most or all males that have up to half of their home range outside the benchmark Grizzly Bear Management Unit (GBMU). The buffer zone should also reduce or eliminate the possibility of anthropogenic-induced infanticide on off-spring of protected females residing completely within the benchmark GBMU. Wielgus would base the size of core reserves and the associated buffer zone on estimated population specific density and mean male home range size.

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3. Interviews of long-time users of the Jumbo Creek valley were conducted in order to better inform the Proponent's consultants about local users' perceptions of wildlife values and grizzly bears. While much of the information gathered was anecdotal, some information gathered on sightings proved helpful. For example, interviews by Norecol biologists of local hikers at the Jumbo Pass cabin, and of logging contractors in the Jumbo Creek valley on grizzly bear sightings helped verify information gathered through aerial surveys (see Appendix 3-B, Section 1.4.6).

A personal interview was held with Nolan Rad, a long time resident of Invermere. Mr. Rad has extensive knowledge of the Jumbo and Toby Creek Valley dating back to the late 1940s. He has been a trapper in the Jumbo Valley and has hunted the area for many years. Detailed notes were made during the interview. Among other information provided, Mr. Rad suggested that during June breeding Grizzly Bears use the upper Jumbo Valley.

Telephone discussions were also held with Roger Madson (heli-ski operator and guide), to obtain general information on the study area, and with several biologists familiar with Grizzly Bear ecology and behaviour (Keith Simpson – private consultant, Bruce McLellan - Wildlife Habitat Ecologist, Ministry of Forests, Revelstoke). In addition, hikers, loggers and the log book at the Jumbo Pass cabin provided information on Grizzly Bear sightings. This information reported in Appendix 3-B. Meetings and interviews were also held with a local ranger.

Telephone discussions were also held with the following staff members of several provincial

government agencies in order to obtain wildlife information for the study area.

- Dennis Demarchi, Habitat Classification Specialist, Wildlife Branch-Ministry of Environment, Lands and Parks (1991)
- Doug Martin, Habitat Protection Biologist-Ministry of Environment, Lands and Parks (1991)
- Cy McConnell, Resource Officer (Inventory), Derm Gorsuch, Resource Officer (Engineering) and Russ Hendry, Resource Officer (Planning)-Ministry of Forests (1991)
- Sue Crowley, Environmental Stewardship Branch-Ministry of Water, Land and Air Protection (2003)
- Dave Phelps, Land Management Biologist (1991)
- Ray Demarchi, Regional Wildlife Biologist (1991)

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4. Biophysical Habitat mapping for the Jumbo Creek drainage at 1:20,000 prepared by Norecol was included in Volume 4 of the 1995 Master Plan and has been utilized. It has been digitized and included in Appendix 3-A. Mapping for the other drainages has been utilized at the available scale. Direct effects of the project and habitat loss have also been identified at the available scales. Potential impacts and proposed mitigation measures to reduce impacts are described in detail in Appendix 3-B Wildlife Resources and 3-D, Grizzly Bear Management Plan and in Appendix 3-C, Environmental Management Plans.

Grizzly Bear habitat capability mapping for the project area was developed from Terrain Ecosystem Mapping provided by Slocan Forest Products Ltd. The Grizzly Bear habitat capability map is presented at in 1:50,000 scale in Master Plan Volume 8: Map Volume and in 11x17 format in Appendix 3-B Wildlife Resources. Habitat capability refers to a landscape's potential to support a species under ideal conditions, while habitat suitability is the landscape's current capacity given existing vegetative conditions. A third measure of habitat quality is the habitat effectiveness of a landscape, which is the realized ability of a species (e.g., Grizzly Bear) to inhabit and persist with an area after accounting for human influences. As part of Apps (2003) cumulative effects assessment model, the habitat effectiveness for each of the aforementioned drainages was calculated. The habitat effectiveness values are more useful than habitat capability information because they take into account the actual state of the local environment, not only the theoretical state that is modeled by habitat capability models.

The Commercial Recreation Area is 5960 hectares with 451 hectares (7.6%) representing high-rated, 1819 hectares (30.5%) representing moderate-rated and 3635 hectares (61%) representing low-nil-rated Grizzly Bear habitat.

An overlay of the proposed Jumbo Glacier Resort (JGR) development on capability mapping for Grizzly Bear is presented at in 1:50,000 scale in Volume 8 of the Master Plan and in 11x17 format in Appendix 3-B Wildlife Resources. This figure indicates that potential impacts are associated with ski run development and the resort base. The proposed resort base, in its present design,

would use 93 hectares of moderate-rated Grizzly Bear habitat. Grizzly Bear denning habitat should not be affected by the resort base and its construction because Grizzly Bears would presumably select areas of higher elevation and steeper slopes, but the resort base may impact the spring-fall feeding habitats of Grizzly Bears. However, according to the cumulative effects assessment model (Apps 2003), neighbouring watersheds have considerably higher habitat effectiveness in comparison to the Jumbo watershed; thus there is suitable spring-fall habitat located outside of the Jumbo valley.

The project overlay also indicates that 907 hectares will be used for the proposed ski runs, based on a buffer of 30 m. Of these 907 hectares, 84 hectares (9.3%) are rated as high Grizzly Bear habitat, 332 hectares (36.6%) are moderate-rated and 491 hectares (54.1%) are rated as low habitat quality or of no habitat value for Grizzly Bears. Some of the proposed ski runs are located on glacial terrain (286 hectares, or 31.5%), which precludes Grizzly Bear presence. Much of the potential Grizzly Bear habitat on the ski runs will be relatively disturbance free during the spring to fall seasons, with the exception of maintenance on some runs during some summers. A small portion of the winter ski runs is proposed for a single recreational trail that would follow existing ski runs.

Construction Phase: Impacts and Mitigation

Ski Runs

Impacts:

As mentioned above, approximately 907 hectares will be designated as ski runs, of this area 9.3%, 36.6 %, and 54.1% is rated, respectively as high, moderate, and low/nil capability Grizzly Bear habitat. Portions of the ski runs are proposed on glacial terrain which is of no value as Grizzly Bear habitat. The clearing necessary for the ski runs will be minimized due to the use of existing runs created by RK Heli-skiing.

Grizzly Bears were not observed during the Norecol, Dames and Moore surveys in the high elevations of the project area; when Grizzly Bears were observed it was generally along Jumbo Creek. Norecol, Dames and Moore did record summer feeding sites in several regions of the study area, notably the west side of Jumbo Pass, upper Jumbo Creek, Commander Creek basin and upper Leo Creek basin. No Grizzly Bear hair samples were captured by AXYS (Strom *et al.* 1999) in the high elevations of the Jumbo Valley. Inferring from this data, Grizzly Bears may be infrequent residents in the higher elevation area earmarked for ski run clearing. In addition, there will be very little clearing (if any) at high elevations as the ski runs will take advantage of open areas and runs already created for heli-skiing. However, since habitats at the higher elevations of Jumbo Valley do have the potential to support Grizzly Bears, impacts from ski run construction may disturb individuals if they are present during the clear and construction period.

Clearing and construction of the ski runs is expected to result in some sensory disturbance of Grizzly Bear during the summer and fall seasons when Grizzly Bears forage at higher elevations on lush herbaceous growth and berry patches. Ski run development will likely be staged, ensuring that most areas of the mountain are relatively disturbance-free at any given time.

In the long term, development of herb and shrub dominated habitats on ski runs will provide excellent foraging habitats for Grizzly Bear in early spring, summer and fall. The incremental increase in available high quality foraging habitats for bears is considered to be significant and

may off-set habitat losses associated with the resort development.

Potential impacts from ski run construction should be limited by the fact that Grizzly Bears do not appear to use the Jumbo drainage extensively during the summer months. According to the results from the population survey done by AXYS Environmental Consulting Ltd. (Strom *et al.* 1999), Grizzly Bear habitat use, within their study area, was focused in the Toby, Hamill and Glacier drainages, which are all outside the development area.

Mitigation Measures

Most ski runs have been designed to maintain large areas of forested habitats between lifts, and have been designed to minimize the area of clearing necessary for construction. These forested areas will provide important security and foraging habitat for Grizzly Bear during the growing season. In addition, ski runs have been situated and designed to ensure that valuable riparian foraging habitats are not disrupted.

A significant portion of the ski runs are proposed on glacial terrain. Such terrain is of little habitat potential for Grizzly Bears; thus there will be no foreseeable impacts to Grizzly Bears as a result of the glacier ski runs.

Resort Base and Roads

Impacts

The proposed resort base is designed to occupy approximately 93 hectares of moderately rated Grizzly Bear habitat. During construction, any Grizzly Bears that may occupy the area would likely be in the high elevation areas, which would minimize any potential disturbance.

Resort base and road development at lower elevations will occur over a long period of time in areas utilized by Grizzly Bear. A moderate degree of sensory disturbance is expected to occur. Clearing and land development will permanently remove habitats, and lead to displacement into adjacent areas for animals currently utilizing these areas. The effect of resort and road development on Grizzly Bears may disturb individuals that forage or migrate through the area, but based on studies of Banff National Park (Chruszcz *et al.* 2003), it is not likely to threaten the viability of the regional population. These researchers also found that Grizzly Bears utilized habitats close to low-volume roads much more than expected, thus they may still utilize the highly productive habitats along the JGR access road.

Mitigation Measures

Since resort development will occur over several years, impacts related to sensory disturbance are expected to be localized leaving most mid to high elevation areas relatively undisturbed. Habitat changes will also occur over many years, permitting local animals to adjust to these changes.

Riparian areas are being protected with riparian buffer set-back allowances. Hence, these riparian corridors will retain important foraging areas and security habitat, allowing altitudinal movements of Grizzly Bear within the study area. Grizzly Bear use of the Jumbo Creek drainage is estimated to be less significant than other drainages in the region (Apps 2003, Strom *et al.* 1999); thus the impact of the access road on the Grizzly Bear population will be lessened because of their

tendency to use other more suitable drainages. According to the findings of Strom *et al.* (1999) the majority of the regional Grizzly Bear population is found in the Toby, Glacier and Hamill Creek drainage basins.

To ensure that unacceptable mortality of Grizzly Bear does not occur, staff and residents will not be permitted to carry firearms or hunt on the property during construction or operation. In addition, recreational use of all-terrain vehicles and feeding, harassment, or destruction of any wildlife by project personnel on or near the facilities will be prohibited.

The construction of the resort base and access road will result in the loss of moderately rated Grizzly Bear habitat; however, with adjacent drainages intact habitat existing in neighbouring drainages there may be a spatial and temporal shift in habitats for the regional Grizzly Bear population. By applying on-site and off-site mitigation measures, the proponent is committed to achieving no-net-impacts on the regional Grizzly Bear population.

Helicopter Use

Helicopter use has some potential to disturb Grizzly Bears during the growing season. Effects are likely to be marginal since most flights would be conducted a considerable distance above ground and pilots would be adhering to strict wildlife-overflight guidelines. Minimum heights above ground and distance from Grizzly Bears will be observed (refer to the *Grizzly Bear Management Plan*, ENKON 2000 in Appendix 3-D). JGR would attempt to schedule and plan all construction overflights in such a way as to minimize or eliminate impacts to Grizzly Bears (e.g., planning flights in areas where there are no foraging Grizzly Bears).

The Proponent does not intend to offer summer or winter helicopter sight-seeing or heli-skiing as part of the proposed project.

Operation Phase: Impacts and Mitigation

Resort Base and Facilities

Impacts

The experiences of Banff National Park (Chruszcz *et al.*, 2003) and Yellowstone National Park (Mattson and Merrill 2002) suggest that viable Grizzly Bear populations can still exist in close proximity to developed areas, provided that measures to reduce human-bear conflicts are in place. Ongoing sensory disturbance resulting from human activity will likely reduce habitat effectiveness in the immediate area of developed areas. Impacts associated with garbage disposal and resulting, so-called, 'problem' bears are described in more detail under the section on garbage management, with mitigation measures addressed in the *Grizzly Bear Management Plan* (Appendix 3-D).

According to Apps (2003) more effective habitat exists in the neighbouring drainages of Fry, Carney, Hamill, Stockdale and Howser, all of which have Grizzly Bear habitat effectiveness values of more than 80 percent. As well, based on the population survey results, the Hamill and Toby watersheds appear to be important habitats relative to the Jumbo Creek drainage (Strom *et al.* 1999). Thus, based on these two reports and the field work completed by Norecol Dames and Moore, the impacts resulting from the resort base will be lessened by the apparent lack of a resident Grizzly Bear population and the presence of more suitable habitat in nearby watersheds.

Mitigation Measures

Measures to address habitat effectiveness should focus on the neighbouring drainages. Some potential mitigation measures are to: decrease road densities through road closures, reduce the number of bear conflicts, address infanticide, manage human access to neighbouring drainages and provide quality foraging and den habitat. Mitigation strategies will be formulated by MWLAP and the proponent and assessed for effectiveness and likelihood of implementation.

Winter Ski Operations

Impacts

For winter den sites, Grizzly Bear tend to select denning sites based on slope angle where the den is dug, the snow-holding ability of the site and drainage of the soil (Vroom *et al.* 1976). Podruzny *et al.* (2002) also used elevation, forest cover and the solar radiation index as parameters for predicting Grizzly Bear den sites.

Based on habitat and terrain, Grizzly Bears may den in the alpine and sub alpine (Demarchi and Johnson 2000) areas of the Jumbo Valley, more specifically, Commander Basin and the basin east and north of Jumbo Creek have suitable denning terrain.

From Norecol Dames and Moore field studies (1992-1993), one Grizzly Bear den site was observed from the air and was located at the upper elevation of the Commander Creek Basin. Effort should be made to confirm whether this den is still active or whether it has been abandoned. If it is still active a no-disturbance buffer zone should be designated around the den.

There is a possibility that bears selecting denning areas adjacent to ski runs would be subject to sensory disturbance caused by skiers and lift equipment during the winter months. Mitigation measures will ensure monitoring of potential denning areas and implement protect measures for any known den sites from such disturbance. With mitigation, impacts from winter ski operations are not expected to have significant impacts to hibernating bears.

Mitigation Measures

Human disturbance and potential for den disturbance should be minimized by having ski runs situated away from any identified den site. If active dens are located within the development area, closure of ski runs and other winter use areas could be a consideration to minimize impacts.

A management plan should be developed for any active bear dens located within the project area to minimize sensory disturbance to hibernating bears, and to avoid potentially harmful human-bear encounters. A set-back buffer should be established near dens identified as active. This buffer should be based on scientific literature and the advice of expert bear biologists and will be established with the cooperation and guidance of MWLAP.

An innovative measure that was introduced at the Kicking Horse Mountain Resort and could be considered at JGR is the creation of a Grizzly Bear refuge for orphaned cubs. The Kicking Horse refuge was created after the Grouse Mountain Refuge for Endangered Wildlife began to search for a suitable home for two orphaned Grizzly Bear cubs. Kicking Horse Mountain Resort offered land and operational support for the creation of the unique bear refuge. Such an establishment at

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JGR would be focused on caring for orphaned cubs with the objective of reintroducing them into the wild; it would also serve as a valuable resource to educate the public about Grizzly Bear biology and their plight.

Avalanche Control

Avalanche control activities at high elevations within the project area are expected to be very infrequent and are unlikely to lead to disturbance of denning bears unless bears are located in close proximity to the cannon discharge areas. Cannons should not be discharged near any bear dens that may be identified; alternative avalanche control measures would be implemented near denning bears (e.g., snow packing).

Summer Ski Run Maintenance

Impacts

Maintenance of ski runs will be necessary on a sporadic basis and in limited areas once the ski resort is operational. Bears foraging in ski run areas during the growing season may be subject to very localized and temporary sensory disturbance. The potential for human-bear encounters is enhanced in areas where shrub growth obscures workers and foraging or resting bears. Ski run maintenance is not likely to greatly affect foraging opportunities for bears in ski lift areas, since brushing treatments will likely be directed towards young conifers and deciduous trees, not the low-growing shrubs and herbs that are the preferred forage species for Grizzly Bears.

Mitigation Measures

Workers involved in run maintenance activities should be briefed about the potential for Grizzly Bear encounters and given appropriate equipment and instruction to avert negative encounters (e.g., bear bells, bangers, pepper spray). The bear spatial and temporal distribution should be closely monitored to avoid maintaining ski run areas while bears are actively foraging.

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5. Habitat mapping at 1:20,000 has been utilized to undertake the detailed analysis and to review the impacts generated by the revised Master Plan included as the primary Appendix to this report. Potential impacts and proposed mitigation measures to reduce impacts are described in detail in Appendix 3-B Wildlife Resources and 3-D, Grizzly Bear Management Plan and in Appendix 3-C, Environmental Management Plans. Indirect on site effects of the project within the Jumbo Creek watershed have been assessed and have generated the reduction of the CRA to the upper part of the drainage only and to the glacier areas of Jumbo, Commander and Farnham. Disturbance during denning and abandonment of portions of habitat in response to habitat division ('fragmentation') have been considered in the planning revisions and in the review of actual projections.

In particular:

- Disturbance by local and other residents who access the area using roads upgraded by the Proponent are discussed in the revised Master Plan and the disturbance is minimized by the design approach, that leads primarily to use the road to access the lifts to the mountain tops for skiing and for access to the viewpoint, and by avoiding to provide any trails except the one leading to the top of Glacier Dome (Master Plan, Volume 4, Project Components, Section

4.5.10). Updated road use calculations, reduced road design speed and use of the most appropriate existing alignments show that the risk of fragmentation has been minimized (McElhanney 2003 Route Study Appendix 5-A of Volume 5: Infrastructure of the Master Plan).

- The loss of cover along utility and access corridors has been mitigated by keeping the electrical line, i.e. the utility corridor, in the road right of way and by keeping the improved road along the existing alignments.

Grizzly Bear Denning

Indirect effects of the project on Grizzly bear denning are not likely to arise from existence of use of roads and utility access corridors. Grizzly bears den at high elevations well away from these corridors. Protection of den sites is addressed in response #4 and in Appendices 3-B Wildlife Resources and 3-D Grizzly Bear Management Plan. The following sections discuss other potential effects of roads and utility access corridors and mitigation for these effects.

Transmission Lines

In other areas of British Columbia, the herb and shrub communities below transmission lines provide foraging areas for Grizzly Bear throughout the growing season. Since transmission lines will be developed along the access road where Grizzly Bears have been observed, their benefit may be quite significant. The open, accessible habitats along transmission lines may also facilitate bear movement. Security cover will be retained adjacent to transmission line and road corridors.

Access Development and Vehicle Traffic

Impacts

In areas with well-established Grizzly Bear populations, improved vehicle access greatly reduces the suitability of remaining habitats, and may increase the potential for Grizzly Bear mortality through poaching and vehicle collisions. Grizzly Bear foraging along roadsides may be subject to minor harassment by resort visitors. The potential for bear-vehicle collisions could increase somewhat, but collisions are not expected to be a significant source of bear mortality within the project area, especially when compared with the much larger and heavily impacted Banff National Park where only one Grizzly Bear was killed by a vehicle collision from 1985-1995 (Gibeau and Heuer 1996). In addition, in Apps (2003) his cumulative effects assessment (CEA) model forecasted an increase in Grizzly Bear mortality of 2.6% (i.e., < 5%) through the CEA area, but this did not account for the effect of mitigation measures. Therefore, the mortality risk index could be significantly lower than the estimated value of 2.6%, provided that appropriate mitigation measures are put into place. Hunting and poaching may also increase due to increased access to the area; however, with appropriate enforcement this can be avoided.

Mitigation Measures

Jonkel (1982) suggest that new roads have the greatest impact on grizzly bears because bears eventually avoid the surrounding area and a block of habitat is lost. The following mitigation measures should be considered during the upgrading and/or re-aligning of the access road into the proposed resort development:

- Maximise the use of the existing Forest Service Road alignments and minimise the

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construction of new roads to avoid impacting undisturbed grizzly bear habitat. Minimise the width of road clearing for upgrades during later phases of development and avoid impacting moderate-high value feeding/security habitat;

- Road densities that are a broad index of the ecological effects of roads in a landscape should be limited to a threshold density of <0.6 km per km². Presently, road densities within the Jumbo Creek Valley are an average 1.2 km per km² (Horejsi, 2000) with 35% of the area >0.62 km per km². Therefore, in order to reduce the density of roads within the Jumbo Creek valley, logging roads previously used for accessing timber supplies and landing areas should be de-activated and re-vegetated. Unused sections of the existing access road that have been re-aligned across Jumbo Creek are prime candidates for closure and restoration. Techniques for closure/de-activation should include placement of physical barriers (i.e. rocks, wood debris, downfall, etc.) gates, signage, scarification, water barring, re-vegetation of exposed soils, removal of culverts, etc.;
- Maintain and/or restore high quality security habitat adjacent to roads especially if associated with forage/feeding areas. Maintenance/restoration of these areas is important for adult female and sub-adult grizzly bears because these bears are more likely to interact with humans resulting in greater chances of mortality;
- Any new, temporary roads to be constructed to access ski runs for clearing and lift placement should be done so as to facilitate their eventual closure/obliteration and actively re-vegetated with indigenous vegetation or left for natural conifer regeneration. Closure and re-vegetation should occur within one season after use;
- Minimise clearing widths, low cuts and fills of new roads and maximise diversity in a horizontal and vertical alignment through indigenous re-vegetation;
- Maintain existing drainage patterns along roads and prevent the introduction of drainage that promotes roadside vegetative growth. As mentioned earlier, snow removal, road dust and modified drainage patterns along roads in Denali National Park caused roadside vegetation to green-up before other areas. Hastened green-up of some roadside forage species attracted grizzly bears to roads in late spring (Tracy 1977, cited in McLellan 1990).
- Refrain from the creation of >0.6 m paved road shoulders;
- Store any top soil removed from road construction and re-use the topsoil to re-vegetate areas along roadsides. Re-vegetation of roadside areas should discourage the use of plants that will attract grizzly bears;
- Where possible, allow >100 m between important grizzly bear feeding/security habitat and any new roads in order to provide cover. Create/leave buffer strips especially in areas with steep slopes, rugged terrain and/or open habitats;
- Do not create new roads or re-vegetate existing roads so that blind corners and surprise encounters would occur between motorists and bears;
- Avoid road construction/maintenance (where possible) during key grizzly bear periods (spring-early summer and late fall);
- Austin (2000) recommended that the access road be fenced to reduce the potential for grizzly bears to be struck and killed by vehicles. Gibeau and Heuer (1996) stated that from 1985 to 1995 only one grizzly bear was killed on the Trans Canada Highway.

While we recognise the increased risk of bear mortality associated with vehicle/bear collisions,

habitat fragmentation within the Purcell Mountains was also identified as a potential impact from the resort development by Austin (2000). Austin (2000) concluded that human development and activity associated with the proposed resort development would extend approximately two-thirds of the distance between the Rocky Mountain Trench and Kootenay Lake. Therefore, fencing carries an inherent trade-off between reducing the risk of bear mortality from vehicle collisions and restricting bear movements through the Central Purcell Mountains.

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6. The detailed analysis of the indirect off-site effects of the project within the watersheds of Jumbo, Toby, Horsethief, Glacier, Hamill, Carney, Howser and Dutch Creeks has been included in the cumulative effect assessment in Appendix 3-E. Habitat mapping at 1:20,000 is only available for the Jumbo Creek drainage and the analysis for the nearby drainages has utilized mapping at 1:50,000. The indirect affects related with garbage, poaching, vehicle collision and the destruction of 'problem bears' are discussed in Appendixes 3-B, 3-C and 3-D and are at the root of some of the planning considerations, such as the particular care explained in the Master Plan provisions to ensure that there will be no exposure of garbage and of its smell.

The creation of the resort is not expected to result in extensive offsite activities in the Jumbo Valley and adjacent valleys because the resort will focus on skiing in both winter and summer. The resort will not offer golfing, horseback riding, mountain biking or other offsite activities. Summer activities other than skiing will be restricted to the provision of one hiking trail within the resort boundaries. This trail will not connect directly with other backcountry trails such as the Jumbo Pass Recreation Trail. In addition, as specified in the Grizzly Bear Management Plan (Appendix 3-D), the JGR resort operators will implement measures to discourage off trail use and access to the backcountry via the resort trail and/or gondolas. The educational component of the Grizzly Bear Management Plan, which will focus on human-Grizzly Bear interactions and garbage management, also should help to minimize any potential for offsite disposal of garbage and creation of "problem bears."

Despite these restrictions, the creation of a paved access road likely will result in some increase in overall human use of the project area. The JGR access road will not facilitate access into the other drainages, and use of these areas is not expected to increase. The increased accessibility to the Jumbo and Toby Creek watersheds is not expected to result in offsite increases in Grizzly Bear poaching, nor is it expected to increase the chance of vehicle collisions. The number of illegally hunted Grizzly Bears (and other wildlife species) will likely diminish due to the increase in the risk of poachers being caught by the general public.

Offsite and onsite vehicle collisions with Grizzly Bears are not expected to increase because there will be only one access road to the resort development; speed limits will be strictly enforced; mitigation measures will be in place (Appendix 3-D), and traffic volumes will be low (see Route Study, Appendix 5-A to Volume 5 of the Master Plan). In addition, the highest traffic volumes would be during the winter months when Grizzly Bears are denning in the higher elevations.

These offsite effects are addressed in the Cumulative Impact Assessment (Appendix 3-E). As mitigation for offsite effects, closing of motorized access to all pre-existing roads within the Jumbo, Toby and Glacier Creek watersheds (as well as roads in other drainages) has been proposed. These closures would reduce the potential for poaching and other sources of Grizzly Bear mortality and disturbance, resulting in no net impacts.

Impacts related to hiking and garbage primarily within the Jumbo Glacier Resort are discussed below.

Hikers

Impacts

The increased number of hikers utilizing Jumbo Valley within the project boundaries could result in an increased likelihood of a Grizzly Bear encounter. However, the proposed JGR does not intend to offer summer hiking as a primary resort activity as there is only one recreational hiking trail incorporated into the design. The Proponent intends offer summer glacier skiing as the primary summer activity; thus hiking will be kept to a minimum as most residents and visitors will take advantage of the unique summer skiing opportunity.

In areas of high summer recreational use, Grizzly Bears may initially avoid habitats in close proximity to heavily traveled trails. However, like many species, Grizzly Bears will likely become somewhat habituated to regular and predictable human use. Off-trail recreational use of the area would result in a possible increase in disturbance. Management should consider restricting trail access into areas that are frequented by Grizzly Bears.

Mitigation Measures

The availability of human food and garbage on recreational trails is a potential cause of bear management problems and public safety. The following measures should be implemented to reduce the impact to Grizzly Bears from hikers.

- Recreational trails should be placed away from moderate-high quality Grizzly Bear feeding and security habitats and located in areas with natural barriers (e.g., rock outcroppings, vertical slopes) to nearby drainages.
- Recreational trails should be vegetated with species non-palatable to Grizzly Bears and vegetation should be maintained to ensure a clear line-of-sight at all points along the trail.
- Trails will be clearly marked/fenced to avoid off-trail use by hikers. Signs will be posted to warn hikers of the potential danger of Grizzly Bear encounters off-trail. Off-trail use will be prohibited due to the risk to hiker and Grizzly Bear.
- Bear Warning signs will be provided at the entrance to trails and at trailheads identifying Grizzly Bear habitat and recommending appropriate human conduct (e.g., creation of noise, staying on trails, proper food and garbage handling).
- Hikers with Packs will be prevented from using the lifts/gondolas to prevent hikers from gaining access into nearby drainages.
- Buffer zones, leave strips, trails and barriers should help direct bears away from and around recreational trails. Creachbaum *et al.* (1998) suggest 100 m buffers for campgrounds.
- Trails with a documented increase in grizzly bear use (i.e. spring or fall feeding periods) should be temporarily closed. Resort staff will regularly patrol trails during visitor use to identify problem areas.
- JGR should consider limiting the daily number of hiking parties on the trails, and the hours that the trail is open (e.g., daylight hours).

- JGR should consider setting a requirement for hiking guides for all hiking parties.
- All hiking parties should be a minimum of four (4) persons, in fact the larger the hiking party the better (Nadeau 1989). Hikers should maintain the speed of the slowest hiker.
- Pets will not be allowed on to trails due to the increase risk of disturbance.
- Bear-proof garbage containers will be placed at strategic resting places on the recreational trails.
- A policy of “Pack in-Pack out” will be strictly enforced on all recreational trails and all food should be stored in air-tight containers.
- Overnight camping along trails will not be permitted.
- Bear warning and educational signs will be posted at all entry points to trails and at various intervals along the trails.
- Bear information and materials, such as pepper spray, bear bangers and bear bells, should be made available in the resort.
- Motorized vehicles (all terrain vehicles) will not be allowed on trails
- If grizzly bear tolerance levels have been exceeded, use of backcountry areas should be restricted through the use of permit systems or the re-evaluation of commercial uses (subject to MWLAP).

The following points should be considered if a permit system is required:

- JGR should require all hikers to attend a bear familiarization course perhaps in conjunction with the permit application. The course would teach hikers how to avoid surprise Grizzly Bear encounters; and
- If hiking permits were issued they should require the hikers to check-in before beginning the hike and check-out after returning from the hike.

A more comprehensive discussion on impacts and mitigation strategies for impacts to Grizzly Bears as a result of recreational trails is included in Appendix 3-D Grizzly Bear Management Plan.

Garbage

Impacts

Like Black Bears, Grizzly Bears are attracted to improperly contained garbage and, if not managed with sufficient precautions, this has the potential to cause negative impacts on resident Grizzly Bears. Black Bears and Grizzly Bears are natural scavengers and will be attracted to areas where refuse or garbage is readily available. Once a bear becomes accustomed to foraging on non-natural food sources and loses its fear of humans, it will quickly become a ‘nuisance’ or ‘problem’ (Herrero 1985) and may be considered a risk. Habituation of Grizzly Bears is not necessarily negative; conflict only arises when hungry bears begin to associate humans with food (Creachbaum 1998). Therefore, JGR should be aware of the increase risk of Grizzly Bear-human encounters during times of Grizzly Bear food scarcity. During such times, less dominant bears can be displaced from habitats and they may come into contact with humans.

Mitigation Measures

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A comprehensive *Grizzly Bear Management Plan* (ENKON 2002) has been developed for the Jumbo Valley site and has been included in this report as Appendix 3-D. The plan endeavors to 1) Reduce or eliminate bear deaths and relocations as a result of them being attracted into urban areas by garbage, fruit, compost, and other human-generated attractants; and 2) Increase the public understanding of the negative implications to bears and humans when bears forage in urban areas.

Essential components of the plan include the following points.

- All outdoor trashcans and dumpsters will be of a bear resistant design and all trashcans will have plastic removable liners to contain odours as much as possible. Plastic can liners will be changed at every pickup to eliminate any odour. Maintenance personnel will ensure that the bear-proof garbage cans are available where needed;
- Areas of concentrated visitor use will be maintained as litter-free as possible within the limits of available staff and budgets;
- All bear proof containers will be picked up as quickly as possible, on a daily basis, if necessary, to minimise the build up of any odours or spillage;
- When loaded, trash collection vehicles will proceed directly to the appropriate transfer station, and the trash may be stored on the collection vehicle inside a closed utility building or in bins within a secured, enclosed utility building;
- All food wastes, including cooking grease, from resort restaurants will be stored indoors until they can be taken to the waste transfer station by the individual restaurants or by the resort management's collection service;
- Resort residents will be required to take all garbage and recycling to a waste transfer stations within the resort. All overnight visitors will be required to keep refuse in enclosed predator-proof areas before dropping it off at the resort transfer station. The resort will not provide curbside collection of garbage or recycling.
- Drive-through inspections for garbage will be performed in the residential areas on a regular basis;
- Mishandling of garbage by resort residents/recreational visitors will be reported to resort officials. Repetition of mishandling garbage or any case of deliberate feeding of bears will result in a citation and may be grounds for loss of in- resort privileges;
- Planting of fruit trees, maintenance of compost piles and other bear attractants will be prohibited;
- A trained bear official employed by the resort will patrol all grounds and roads into and within the site during active hours to assure that food and garbage are stored properly and to talk with visitors about bears in the country;
- Resort management will consider partial funding for a local Conservation Officer;
- Resort staff will be required to complete bear awareness training as a requirement for employment;
- Facility personnel will identify and correct operational and maintenance deficiencies regularly on an on going basis. Inspections will be conducted all year round and comply with regional standards;
- All commercial operators will be given food and garbage management guidelines for the area

as part of their business license conditions;

- Garbage transfer or detainment areas will be in enclosed, odourless buildings;
- All enclosures for refuse will be cleaned and disinfected (steam cleaned) both inside and out at least once per year, and
- If garbage is to be burned on-site all combustible garbage will be burned in enclosed incinerators. No garbage is to be buried, including empty cans or other food containers.

The relocation and lethal removal of 'problem' wildlife will be considered only when deemed appropriate and necessary by the local Conservation Officer and Jumbo Resort management. A program of managing wildlife-human conflicts will be based on similar successful programs in other mountain communities such as Banff, AB and Revelstoke, BC (FLCG 2003). The JGR will commit to achieving and maintaining Bear Smart community status (ENKON 2002).

Literature Review

Since the early 1960's, comprehensive grizzly bear management plans have been prepared to address grizzly bear-human conflicts in the National Parks throughout the Pacific Northwest.

In 1960, the National Parks Service implemented a bear management program in Yellowstone National Park designed to reduce the number of bear-caused human injuries and property damages occurring within Yellowstone National Park and to re-establish bears in a natural state (Gunther, 1994). During the 1960's, the National Parks of Canada were also developing and implementing bear management programs (Canadian Wildlife Service, 1971). Similar to the US plans, the early National Parks programs were focused on bear-human conflicts and reporting of bear movements.

In 1970, a new more intensive bear management program (Leopold et al., 1969) was initiated in Yellowstone National Park with the objective of restoring the grizzly and black bear populations to subsistence on natural forage and reducing bear-caused injuries to humans (Cole 1976, Meagher and Phillips 1983).

In 1983, the park implemented a modified grizzly bear management program with greater emphasis on habitat protection in backcountry areas. This plan restricted recreational use in areas with seasonal concentrations of grizzly bears.

Since 1983, bear-caused human injuries declined to an average of one per year. During the first years of these programs, most bear-human conflicts involved food-conditioned bears that aggressively sought human foods. In more recent years, management problems have involved habituated (but not food-conditioned) bears seeking natural foods within developed areas along roadsides.

In 1998, a bear-human conflict management plan was prepared by Parks Canada and was a synthesis of five bear management plans including Banff, Jasper, Yoho, Kootenay and Waterton National Parks. The plan concentrated on mitigation measures such as bear monitoring systems, bear-human conflict management, facility management, public information/education and training of park personnel.

In summary, grizzly bear management plans/programs have evolved over the years to reduce the cause of bear-human conflicts through such mitigation measures as backcountry access

restrictions, food and garbage management, public information/education, training of park personnel and monitoring systems.

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7. Clayton Apps (2002) has developed Grizzly Bear habitat suitability mapping for the Central Purcell Mountains including the Carney, Dutch/Brewer, Duncan, Fry, Hamill, Horsethief, Howser, Glacier, Jumbo, Kootenay, Stockdale, Toby and Windermere watersheds. This mapping is provided as part of the Cumulative Impact Assessment (Appendix 3-E).

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8. Grizzly Bear habitat capability and habitat effectiveness data for the Central Purcell Mountains were compiled in GIS format (Idrisi® version 14, Clark Labs 2003) for input to the cumulative impact model. Other data compiled and used in this model included the Controlled Recreation Area boundary, roads, recreation activity features (outfitter camps, trail heads, hut/shelters, a lodge, helicopter landing and fuel caches and weather/communication stations), foot trails, a gas distribution system, buildings, mine sites, existing urban and recreation areas (Invermere and the Panorama Resort) and traffic volume projections on the Toby Creek and Jumbo Creek roads. A complete description of the data sets and their use is provided in Appendix 3-E Cumulative Impact Assessment.

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9. Clayton Apps (2003) prepared the Cumulative Impact Assessment, which is included as Appendix 3-E to this report. The assessment included both a minimum impact scenario and a maximum impact scenario. The assumptions common to both scenarios were as follows:

- Human use of the area is as represented by the data sets described in response #8 above.
- The Toby/Jumbo access road to the JGR will be of “high” use-intensity during summer months upon full build-out of the development.
- Other than the main JGR access road, no increased motorized or non-motorized human use of roads will occur anywhere within the analysis area as a result of the JGR development.
- Summer recreational use within the analysis area is constrained to road and trail features.

Assumptions for the minimum impact scenario were as follows:

- Human activity resulting from the development will not emanate beyond the CRA and the access road leading directly to it.
- Hiking parties originating from the JGR will be constrained to the CRA.
- There will be no “spin-off” development or increased recreational demand in the analysis area resulting from the Jumbo Glacier Resort. This includes guided hiking, trail riding, and other non-motorized or motorized recreational activities.
- High-intensity human activity within the CRA will be restricted to the infrastructural features (e.g., roads, trails, buildings) represented by the data provided.
- Summer helicopter access to the CRA will be rare and for emergency only, and will not influence grizzly bears.

- There will be no increase in helicopter-assisted summer recreation in the analysis area due to the JGR development.

Assumptions of the maximum impact scenario were:

- No new hiking trails will be constructed outside of the CRA, and decommissioned roads will receive only low-intensity non-motorized use.
- All trail systems that are directly accessible from the paved JGR access road will increase from low to high intensity non-motorized use to the point beyond which overnight stay outside of an existing public or commercial shelter would be expected. This includes: (1) all mapped trails within the Jumbo drainage, (2) trails within the north and south forks of the upper Glacier Creek drainage, and (3) the main fork of Toby Creek within the Purcell Wilderness Conservancy, and (4) the Coppercrown and Delphine subdrainages of Toby Creek. The Farnham subdrainage and the trail to Lake of the Hanging Glacier within the Horsethief drainage will not be easily accessed from the CRA and will remain at low intensity use.
- There will be no increased use of non-mapped guide-outfitter trails (e.g., trail riding).
- The effect of any “spin-off” development within the analysis area will be only to shift the intensity of non-motorized use of the above-listed hiking trails from low to high.
- Grizzly bears will be influenced within a 5 km zone surrounding the specific localized resort area as defined by “residential” features associated with the JGR development. However, this influence will be blocked by major ridgelines (i.e., the zone extends for 5 km or until a ridgeline is hit). Within this zone, the effect of human influence will equate to that of high intensity non-motorized use with no attractants or firearms. This assumption is supported by Mattson et al. (1998).
- A helicopter landing site will be situated and used within the CRA, but will not service helicopter-assisted summer recreation (e.g., hiking) within the analysis area.
- There will be no increase in helicopter-assisted summer recreation in the analysis area due to the JGR development.

The computer model used for the cumulative impact assessment predicts relatively small reductions in habitat effectiveness and increases in mortality risk within the cumulative effects assessment area. The range of reduction in habitat effectiveness based on minimum and maximum impact scenarios is 1.7% to 3.1%, while the range of increase in mortality risk for these scenarios is 2.6% to 3.8%.

As mitigation for offsite effects, Apps (2003) proposes closing of motorized access to all pre-existing roads within the Jumbo, Toby and Glacier Creek watersheds, as well as roads in the Howser, Horsethief and Brewer/Dutch drainages. According to the cumulative effects model, these closures would increase habitat effectiveness and reduce mortality risk, resulting in no net impacts to Grizzly Bear.

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10. Enkon has been in touch with several Grizzly Bear specialists through the study period. Over the last two years, the Proponent’s consultants have met regularly with Matt Austin, Large Carnivore Specialist with the Ministry of Water, Land and Air Protection, to discuss the cumulative impact assessment. At a meeting held December 3, 2003, Mr. Austin was recognized as the “panel of Grizzly Bear specialists” referred to in the Project Report Specifications. The primary

purpose of the December 3, 2003 meeting was to present the assumptions and results of the Cumulative Impact Assessment. At the request of Mr. Austin, the cumulative impact assessment model was rerun using a more conservative set of assumptions. The final Cumulative Impact Assessment report resulting from this meeting is provided as Appendix 3-E.

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11. Following a review of existing literature as noted above at bullet #6 and elsewhere, and a review of all aspects of the proposed project, mitigative strategies and techniques (applicable to land use impacts on grizzly bears and their habitats and measures to be applied by the Proponent to prevent and mitigate adverse direct, indirect and cumulative effects of the project) have been proposed:

Bear Management Plan

The following is a brief description of the major components of the Bear Management Program proposed by JGR to mitigate effects of the project within the resort boundaries. Details of this plan and specific mitigation measures are discussed in Appendix 3-D Grizzly Bear Management Plan and Appendix 3-C Environmental Management Plans.

Garbage Management

JGR will adopt its' own "Bear Aware Program" to reduce bear/human conflicts associated with non-natural food attractants. The program will have the following objectives:

- Reduce or eliminate bear deaths and relocations as a result of their being attracted into urban areas by garbage, fruit, compost, and other human-generated attractants. Ultimately the reduction/elimination of bear deaths would ensure that births exceed deaths;
- Increase the public understanding of the negative implications to bears and humans when bears forage in urban areas; and
- Build public support for the objectives of these programs (Robinson 1998).

The Bear Aware Program includes specific mitigation measures for the following project components:

- Resort Base Area
- Roadside Corridors
- Recreational Trails

Outdoor Recreational Management

The following mitigation measures will be implemented by JGR and are intended to reduce/eliminate bear/human conflicts and associated bear mortality from recreational trail hiking:

- Trail development will avoid moderate-high value feeding and security habitat. These habitats are generally associated with the lower elevations adjacent to Jumbo Creek and a number of south and north-facing avalanche tracks within the lower portion of the valley;
- Trail development will be restricted in the upper alpine areas and located in areas with natural barriers (rock outcroppings, vertical slopes, etc.) to nearby drainage's. Many studies conclude

that human recreational use in alpine and sub alpine areas can displace grizzly bears during foraging seasons, but most of these displacements can be avoided with seasonal trail closures (GBIT 1987);

- The hiking trail will be clearly marked/fenced to avoid off-trail use by hikers. Signs will be posted to warn hikers of the potential danger of grizzly bear encounters off-trail. Off-trail use by hikers will be discouraged;
- “Bear Warning” signs will be provided at the entrance to trails and at trailheads identifying grizzly bear habitat and recommending appropriate human conduct (creation of noise, staying on trails, proper food and garbage handling, etc.);
- “Hikers with Packs” will be prevented from using the lifts/gondolas to prevent hikers from gaining access into nearby drainages;
- Recreational hikers will be encouraged to travel in groups of four or more as most grizzly bears avoid large and noisier groups (USFS, 1985);
- Trails with a documented increase in grizzly bear use (i.e. spring or fall feeding periods) will be temporarily closed. Resort staff will regularly patrol trails during visitor use to identify problem areas;
- Pets will not be allowed on to hiking trail;
- Hikers will not be allowed on trails between one hour before sunset and one hour after sunrise;
- Motorised vehicles (all terrain vehicles) and mountain bikes will not be allowed on trails; and
- If grizzly bear tolerance levels have been exceeded, the backcountry areas will be restricted through the use of permit systems or the re-evaluation of commercial uses (subject to WLAP).

Access Road Management

ENKON recommends that JGR consider the following mitigation measures during the upgrading and/or re-aligning of the access road into the proposed resort development:

- Maximise the use of the existing Forest Service Road alignments and minimise the construction of new roads to avoid impacting undisturbed grizzly bear habitat. Minimise the width of road clearing for upgrades during later phases of development and avoid impacting moderate-high value feeding/security habitat;
- Road densities that are a broad index of the ecological effects of roads in a landscape should be limited to a threshold density of $<0.6 \text{ km per km}^2$. ;
- Maintain and/or restore high quality security habitat adjacent to roads especially if associated with forage/feeding areas;
- Any new, temporary roads to be constructed to access ski runs for clearing and lift placement should be done so as to facilitate their eventual closure/obliteration and actively re-vegetated with indigenous vegetation or left for natural conifer regeneration;
- Minimise clearing widths, low cuts and fills of new roads and maximise diversity in a horizontal and vertical alignment through indigenous re-vegetation;
- Maintain existing drainage patterns along roads and prevent the introduction of drainage that promotes roadside vegetative growth;

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- Refrain from the creation of >0.6 m paved road shoulders;
- Store any top soil removed from road construction and re-use the topsoil to re-vegetate areas along roadsides;
- Where possible, allow >100m between important grizzly bear feeding/security habitat and any new roads in order to provide cover. Create/leave buffer strips especially in areas with steep slopes, rugged terrain and/or open habitats;
- Do not create new roads or re-vegetate existing roads so that blind corners and surprise encounters would occur between motorists and bears;
- Avoid road construction/maintenance (where possible) during key grizzly bear periods (spring-early summer and late fall);
- In order to reduce the risk of vehicle/bear collisions during Phase 1 and 2, ENKON recommends the following:
 - a) A “Bear Aware Information Booth” should be established at the entrance to the resort access road at the confluence of Toby and Jumbo Creeks to inform resort visitors of the dangers of bears and the potential for vehicle/bear collisions. A “Bear Information Centre” should also be established within the resort base area to inform and remind visitors of the potential dangers of bears and the potential for bear encounters while at the resort.
 - b) As a component of the grizzly bear monitoring program, grizzly bear/human conflict areas along the resort access road should be patrolled/monitored to identify high risk areas which would then be incorporated into the information pamphlet hand-outs;
 - c) Wildlife Warning Signs should be placed at the entrance to the access road, at strategic locations along the access road (i.e. high-risk areas for bear crossings), and within the resort base area.
 - d) Road side reflectors should be erected that reflect light and create a barrier image such as the “Streiter-Lite Wildlife Warning Reflector”.
 - e) The access road should be designed for low speed limits (50-60 km/hr.) and the speed limits should be enforced by resort staff in combination with the RCMP; and
 - f) If fencing is required during Phase 3 of the resort development, overpass/underpasses should be constructed to promote grizzly bear movements across roads.
- As part of a recommended education program for residents and resort personnel a committee or persons (as part of interpretative and regulating staff) should be allocated to monitor highway traffic and regulate any interactions of tourists/visitors with grizzly bears. The following are mitigation plans to help reduce bear mortality as a result of human/bear

interactions, and “bear-jams” resulting from visitors stopping to view and interact with bears along roadsides and trails⁴:

Helicopter Access Management

The proposed development is anticipated to create noise and problems with aircraft use, primarily during the construction phases of the development, causing bear displacement problems. The following plans may be used to mitigate impact of aircraft noise and its presence in the valley:

- Restrict helicopter activity during construction to a minimum, and particularly beyond the bounds of the Jumbo Creek watershed;
- If possible, prohibit helicopter access for the sole purpose of transporting guests to/from the resort once construction is completed (except for emergencies and any necessary maintenance);
- Minimise air traffic during the denning period, particularly during the den entry period (October-mid-November) and emergence (April-May);
- Schedule helicopter flights between one hour after sunrise and one hour before sunset from mid April to mid October;
- Maintain minimum helicopter altitudes of 300 m;
- Establish flight patterns of less than half a mile wide along travel routes and landing zones, except where flight safety precludes this;
- Designate landing zones with adequate visual of topographic barriers; and
- If possible, allow only one access to the developed area; by use of the primary road and restrict flight access into areas elsewhere within the Jumbo Creek Valley except for emergencies.

Education Program

In order for the recommendations of the “Bear Management Plan” to be successful, the public and resort staff within and surrounding the Jumbo Resort Project must be committed to making it work. Education, awareness and involvement of the general public and staff of the resort are critical to the future success of the program.

The goals of the education program include:

- Reduce or eliminate bear-human conflicts through understanding of bear ecology, becoming bear aware (safety) and reducing the potential for bear–human interaction, and responsible disposal, transfer and storage of human-generated waste;
- Increase public understanding of the negative implications to bears and humans when bears forage in areas of urban centres; and

⁴ However, it should be noted that the potential for bear jams is extremely low to non-existent based on the relatively small number of grizzly bears observed within Jumbo Valley by the Proponent, their consultants and Strom et al (1999) over the past ten years.

- Build public and visitor support for the program.

Problem Bear Management Action Plan

All bear management actions including aversive conditioning, trapping, immobilisation, relocation or destruction of bears will not be implemented without the knowledge and approval of the Bear Management Committee.

The Ministry of Environment, Lands and Parks will be responsible for performing all direct actions such as aversive conditioning, trapping, relocation/translocation and destruction unless there is immediate threat to life or property. In these exceptional cases, properly trained resort employees through agreement with WLAP may carry out these emergency actions.

Any extraordinary costs associated with responding to bear/human conflicts (i.e. use of helicopters for translocation of bears) will be the responsibility of JGR.

Decisions regarding area closures, aversive conditioning, hazing, capture, relocation/translocation and destruction of bears will be made through the Grizzly Bear Management Committee. Decisions and emergency response action protocols regarding bear attacks will be pre-determined with input and prior approval from the Grizzly Bear Management Committee

Details of the Problem Bear Action Plan are discussed in Appendix 3-C Environmental Management Plans.

Mitigation of Cumulative Effects

The cumulative effects model (Appendix 3-E Cumulative Impact Assessment) has been used to identify mitigation measures that could increase (regain) habitat effectiveness and reduce Grizzly Bear mortality risk. Mitigation options include closure of all motorized human access in the Jumbo Creek watershed except the resort access road plus closure of all motorized access within the Glacier and Howser watersheds. The cumulative effects model predicts that implementing these closures would result in no net impact to the Grizzly Bear population within the cumulative effects study area.

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12. Population Monitoring through Genetic Testing:

Grizzly bears are part of the Purcells ecosystem and are also sensitive to effects of human activities and development. In order to help estimate the significance of effects of the proposed development on grizzly bears in the Purcells, an estimate of the size and seasonal distribution of the grizzly bear population was required. Information on the size and distribution of grizzly bears in the northern Purcell Mountains was also intended for use in the comprehensive environmental impact assessment and cumulative effects assessment of the proposed Jumbo Resort development.

AXYS Environmental Consulting Ltd. was retained to conduct surveys and estimate the abundance and seasonal distribution of grizzly bears in the Central Purcell study area, which encompasses the proposed development (see Appendix 3-F). The Central Purcell study area is defined by the heights of land of the headwaters of Stockdale Creek, Horsethief Creek, Jumbo

Creek, Toby Creek, Glacier Creek and Hamill Creek. The approach used to generate the population estimate was based on collection of hair samples, analysis of DNA obtained from hair samples, and genetic identification of individual bears.

Primary results of the survey include the following:

- the unbounded population estimate for the Central Purcell study area and surrounding area was 45 grizzly bears with a 95 percent confidence interval of 37 – 68 grizzly bears;
- 33 individual bears were identified from the hair samples including 18 females, 10 males, and 5 of unknown sex. Approximately ½ of the bears were recaptured at least once;
- grizzly bears were sampled throughout the study area; distribution of hair captures was non-uniform with least success obtained in the lower and middle Horsethief valley in the northeastern quadrant of the study area;
- female captures were relatively evenly distributed in those drainages where grizzly bear presence was confirmed. Of the 18 female grizzly bears found in the Central Purcell study area, five were captured in the Glacier Creek watershed, three in Stockdale Creek, three in lower Toby Creek including Mineral and Coppercrown creeks, three in upper and south Toby Creek drainages, two in the Jumbo Creek watershed, and one female grizzly bear in each of Farnum and Hamill Creek watersheds. The two female grizzly bears captured in the Jumbo valley confirm that a minimum of two female grizzly bears use habitats in the valley;.
- the majority of male grizzly bears were sampled from within the southern one third of the study area, specifically in Hamill, Upper Toby, South Toby, Mineral and Coppercrown creeks.
- the study area is not closed to grizzly bear movements, suggesting that bears were leaving or entering the study area during the sampling period; and
- many of the bears in adjacent watersheds in the study area are related to each other.

The data provided by this survey shows that there is a currently viable resident population of grizzly bears occupying the Central Purcell study area. History and extrapolation from other research efforts in the region suggest that there will be impacts associated with the development, but further assessment will be required to attempt to quantify and estimate the significance of those impacts.

If the project is approved under the *EA Act*, JGR commits to continued field collection of hair samples from grizzly bears within the area of direct and indirect impacts during final project planning and construction (and thereafter for 10 years, or until such earlier time as MELP determines that it is no longer required), genetic analysis of the hair samples, interpretation of the hair analysis data to detect and assess changes (if any) in grizzly bear numbers and distribution in response to project construction and operation, and reporting of the findings to MELP.

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13. Impact Management - Monitoring

The Grizzly Bear Management Plan is outlined above and reported in Appendix 3-D. To evaluate the success of the mitigation/compensation measures it is recommended that an adaptive management approach through an effective monitoring program be implemented after project certification. The monitoring program should have feedback mechanisms that will allow the results of the monitoring to influence the implementation of any further mitigation measures.

Part D: Environmental, Resource Management and Technical Issues

Adaptive management requires that identified problems are addressed, particularly when actual or potential conflicts persist in particular areas and/or times, including the issue of people moving from the resort directly out of the valley into adjacent drainage's. In addition, it is recognised that there may be some residual impact on habitat effectiveness and at least a slightly increased mortality risk to bears from the presence of the resort that cannot be completely mitigated. These residual impacts may need to be compensated by habitat enhancement or restrictions of human activities outside of the drainage.

Grizzly Bear Populations and Distribution

Under Section D. 3(C) Grizzly Bears of the "Project Report, "Population Monitoring Through Genetic Testing" is required to monitor and report on the potential direct and indirect effects of the project to predict, detect and assess change (if any) in grizzly bear numbers and distribution. The monitoring program is to include:

- Field collection of hair samples of grizzly bears within the area of expected direct and indirect impacts for one field season (approximately June 1-July 31) prior to the completion of the project report, genetic analysis of the hair samples to identify individual bears, interpretation of the hair analysis data to assist in the prediction of potential direct and indirect impacts of the project on grizzly bears and to establish a baseline for future monitoring and reporting of the findings of the project report. During 1998, the Proponent and the Environmental Assessment Office jointly funded a grizzly bear population survey utilising hair samples/genetic analysis. The intent of the survey was to gather additional information on grizzly bears within and adjacent to the proposed Jumbo Glacier Resort Development. The results of this population survey were reported to WLAP by Axys (1999) and satisfy the requirements of point #1 above.
- Once the project is approved under the EA Act, continued field collection of hair samples from grizzly bears within the area of direct and indirect impacts during final project planning and construction (and thereafter for 10 years, or until such earlier time as WLAP determines that it is no longer required) is required. The hair samples should undergo genetic analysis, and the genetic analysis should be interpreted to detect and assess changes (if any) in grizzly bear numbers and distribution in response to project construction and operation. The results should be reported to WLAP.

The Proponent acknowledges the requirements Point #2 above and upon receiving the project approval certificate and depending on the timing of project advancement, is committed to further monitoring of the grizzly bear populations in the Central Purcell study area.

Human Recreational Use

If a project approval certificate is granted to the Proponent for the development of the Project under the Environmental Assessment Act, it is also recommended that the Proponent/WLAP monitor the unsupervised public recreational use (including use by resort construction and operations employees, resort visitors and resort residents) and other use of roads which link to Highway #95 at Invermere. The purpose of this monitoring will be to establish the baseline level of use of roads during the period when grizzly bears are active and after construction of the project has commenced, to establish what proportion of observed use of these roads is attributable to resort construction and operations employees, resort visitors and resort residents.

Performance Indicators

Methods to achieve the management plan outlined above will be implemented, and evaluated each year to identify their effectiveness and that of all management implementations relating to the human activities in and around the resort facilities. This will involve the monitoring of several criteria to indicate the performance of the management plan and its effectiveness to the protection of human/bear problems. The following criteria have been identified as important indicators of performance in the bear management plan surrounding the proposed resort development activities, and each will be assessed annually qualitatively and quantitatively for implementation effectiveness:

- Number of garbage storage units;
- Number of property damage incidents;
- Number of threat encounters;
- Number of no contact charge encounters (base and back country);
- Number of annual bear relocations/translocations necessary by WLAP, in and around the facilities;
- Number of bears destroyed in and around the Jumbo Creek Drainage;
- Total known mortality in and out of the Jumbo Creek watershed. This should be separated into human and natural causes;
- Total number of bear observations reported in the Jumbo Creek Drainage;
- Total annual resort visitations;
- Total bear occurrences;
- Total human injuries, deaths caused by grizzly bears in and out of the Jumbo Creek drainage vs. outside; and
- The education program should be reviewed and analysed annually before the start of a new season comparing records of data.

Finally, if the grizzly bear management program objectives are not being met, on an acceptable level to the Grizzly Bear Management committee, contingency measures will have to be implemented by the provincial government including but not limited to the following:

- Increased enforcement (patrol frequency);
- Area design and delivery of the bear/human conflict awareness and education programs;
- Additional spot closures to human access;
- Hunter harvest restrictions and closures as recommended by affiliated agencies in the Purcell Mountain Range or by WLAP; and
- Perform on-going monitoring and research in the Jumbo Creek Drainage involving the monitoring of grizzly bear security habitats and how effective this habitat is relative to the impacts of the proposed development and human presence in the Jumbo and surrounding valleys.

D.3(D) Birds

EA Issues Profile

Topic

Implications of project development for birdlife.

Issues

- Use of area in vicinity of project site by migratory and resident birds.
- Need for impact assessment and mitigation avoidance proposals.

Relevant Project Components

All on-site and off-site project components within Toby/Jumbo Creek drainage.

Lead Agency

Canadian Wildlife Service (CWS) – for migratory birds.

Ministry of Environment, Lands and Parks (MELP) – BC Environment and Lands – for resident birds.

Relevant Public Comments on Application and Draft Specifications

- Columbia River wetlands, which both Jumbo and Toby Creeks flow directly into, have been nominated as World Heritage Site for wetlands, and are an important flyway for many species of migratory birds. (13b)
- Impacts on birds are understated in draft specs – deserve careful consideration.

Relevant Public Advisory Committee Comments on Draft Specifications

- Re. draft spec. #1 – should mention white-tailed ptarmigan, a primary species in area, because of its different habitat requirements (ground-dwelling).
- In draft specs, section D.3(D) omits mention of 'listing' of various birds – EA process should address Golden Eagle, Harlequin Duck, Northern Pygmy-Owl, White-tailed Ptarmigan and Northern Goshawk.

Relevant Proponent Comments on Draft Specifications and Specifications Feedback

- Draft specs do not take account of reviews already conducted. Not aware of any study of birds required at other ski resorts, or of any bird/resort conflicts.

Related Issues and Relevant Specifications

- Re. related wildlife management issues, see other parts of section D.3.
- Specifically re. threatened or endangered wildlife, see section D.3(E).
- Re. possible federal cumulative bird effects assessment requirements, see section H.2

Additional EA Reporting Requirements?

Yes – see below; draft specs. Expanded to require assessment of non-migratory birds also.

Review of Application

The proponent included some very preliminary bird information in *Appendix P (Appendix D)* of its application. *Appendix D* contains a list of bird species which could occur in the project area. The September 1992 to July 1993 Wildlife Surveys by Norecol, Dames, and Moore focus almost entirely on large mammals, with the exception of raptors, and do not present any data on migratory birds. The proposed *Detailed Wildlife Study Programs for the Proposed Jumbo Valley Development - Addendum* has the same emphasis, and states that “...*Specific surveys to document raptor nesting or use by migrants are not planned...*” (page 14). A field survey of birds in the project area is required.

Evaluation

CWS Assessment of Area

The project appears to be located primarily in the Engelmann Spruce-Subalpine Fir biogeoclimatic zone. According to the publication: *Ecosystems of British Columbia* (Meidinger and Pojar, 1991), common migratory and non-migratory bird species resident in this zone can include: Harlequin Duck, Golden Eagle, Northern Goshawk, Northern Hawk Owl, Northern Pygmy- Owl, Barred Woodpecker, Three-toed Woodpecker, Rufous Hummingbird, Steller’s Jay, Clark’s Nutcracker, Bohemian Waxwing, American Dipper, Varied Thrush, American Robin, Red Crossbill, White-winged Crossbill, Pine Siskin, Hammond’s Flycatcher, Pine Grosbeak, Western Tanager, Cassin’s Finch, Golden-crowned Kinglet, Mountain Chickadee, Red-breasted Nuthatch, Winter Wren, Yellow-rumped Warbler, Wilson’s Warbler, Golden-crowned Sparrow, Fox Sparrow, and Dark Eyed Junco.

None of these species is designated as threatened or vulnerable (i.e. they may be yellow-listed, but not either red-listed or blue-listed). Some of these species, though some of them may be of management interest (i.e. .may be designated in the higher of the two yellow-listed categories, and thus placed on a ‘watch’ list). SHowever, some subspecies of some

species such as the Steller's Jay and Pine Grosbeak may be "red-listed" or "blue-listed" in other parts of the province (e.g. the Queen Charlotte Islands subspecies of Steller's Jay and the Gulf Islands/Vancouver Island subspecies of Pine Grosbeak). . Similarly, only the Vancouver Island subspecies of both the Northern Pygmy-Owl and the White-tailed Ptarmigan are blue-listed, while only the Queen Charlotte Islands subspecies of the Northern Goshawk is red-listed. Two subspecies of Peregrine Falcon are listed differently - , one (*anatum*) is red-listed in BC and COSEWIC Endangered, while the one other (*pealei*) is blue-listed in BC. MELP's Conservation Data Centre (CDC) currently has no record of the occurrence of either subspecies in the vicinity of the project. Some Peregrines could potentially occur in areas of rocky cliffs or talus. Harlequin Duck is yellow-listed, but is subject to a special 'watch' The proponent should check further with MELP's Conservation Data Centre (CDC) with respect to the extent to which to ensure that the project area does may or may not overlap with the range of any of these sensitive or endangered subspecies.

The highest elevations of the project area appear to fall within the Alpine Tundra (AT) biogeoclimatic zone. According to *Ecosystems of British Columbia*, common resident bird species in the AT zone above the Engelmann Spruce-Subalpine Fir zone can include: Golden Eagle, White-tailed Ptarmigan, Water Pipit, Horned Lark, and Rosy Finch. NNone of these species is threatened or vulnerable in the project area, although the *Strigata* subspecies of Horned Lark is red-listed in British Columbia. The proponent should check with the CDC to ensure that the range of any of these subspecies does not overlap with the project area.

Migratory Birds

The project area is class 7 habitat for waterfowl according to Canada Land Inventory mapping for waterfowl capability. The topography of the area is too steep for most waterfowl. However, the project area may very well provide habitat for Harlequin Duck. Harlequin Ducks need fast-flowing streams which contain abundant insect larvae. The proponent's assessments should ascertain whether any such streams might be affected by the project, and if so, whether any Harlequin Ducks actually nest in the project area.

Resident Birds

In the project report, the proponent should document the likely occurrence and associated habitat for all indigenous bird species which are likely to frequent areas that could be disturbed through project development and operation. This should also include a field assessment of all planned development areas to identify special habitat features such as nest sites and cavity nesting wildlife trees which could be destroyed or disturbed by construction.

Project Report Specifications – D.3(D)

1. The proponent must conduct a thorough survey of the project area to determine the use of the area by migratory birds. The survey must be detailed enough to allow an accurate estimate of presence/absence, relative abundance and habitat use. Results of the survey must be used to mitigate impacts on migratory birds by appropriate modifications to the resort design.
2. The proponent must conduct a thorough survey of the project area to determine the use of the area by non-migratory birds, with special emphasis placed on identification of nesting sites and feeding areas which could be physically disrupted or impacted by resort development and operation.

RESPONSE – D.3(D)

1. Field studies were carried out by Norecol Dames Moore and are the basis of their reports for the 1995 Master Plan documents and for the current report. Additional information including impact mitigation is in Appendix 3–B: Wildlife Resources. There are 32 migratory bird species that occur in the biogeoclimatic zones, Engelmann Spruce-Subalpine Fir (ESSF) and Alpine Tundra (AT) biogeoclimatic zone, of the study area. The following table indicates migratory bird species that have been recorded in the Jumbo watershed during field studies and information outlining the probability of occurrence for other species.

Table 3.10: Passerine and Passerine-like birds that Occur in ESSF and AT Biogeoclimatic Zones

Common name	Scientific name	Common name	Scientific name
American Dipper ^K	<i>Cinclus mexicanus</i>	Red Crossbill	<i>Loxia curvirostra</i>
American Robin ^K	<i>Turdus migratorius</i>	Red-breasted Nuthatch	<i>Sitta canadensis</i>
American Tree Sparrow ^U	<i>Spizella arborea</i>	Red-necked Phalarope	<i>Phalaropus lobatus</i>
Black-backed Woodpecker	<i>Picoides arcticus</i>	Rosy Finch	<i>Leucosticte arctoa</i>
Bohemian Waxwing	<i>Bombycilla garrulus</i>	Rufous Hummingbird	<i>Selasphorus rufus</i>
Cassin's Finch	<i>Carpodacus cassinii</i>	Say's Phoebe	<i>Sayornis saya</i>
Clark's Nutcracker ^K	<i>Nucifraga columbiana</i>	Smith's Longspur ^U	<i>Calcarius pictus</i>
Dark-eyed Junco ^K	<i>Junco hyemalis</i>	Steller's Jay ^K	<i>Cyanocitta stelleri</i>
Fox Sparrow	<i>Passerellailiaca</i>	Three-toed Woodpecker	<i>Picoides tridactylus</i>
Hammond's Flycatcher	<i>Empidonax hammondi</i>	Townsend's Solitaire	<i>Myadestes townsendi</i>
Harlequin Duck	<i>Histrionicus histrionicus</i>	Varied Thrush ^K	<i>Ixoreus naevius</i>
Horned Lark	<i>Eremophila alpestris</i>	Water Pipit	<i>Anthus spinoletta</i>
Least Sandpiper	<i>Calidris minutilla</i>	Western Tanager ^K	<i>Piranga</i>

Part D: Environmental, Resource Management and Technical Issues

			<i>ludoviciana</i>
Mountain Chickadee	<i>Parus gambeli</i>	White-winged Crossbill	<i>Loxia leucoptera</i>
Pine Grosbeak	<i>Pinicola enucleator</i>	Wilson's Warbler	<i>Wilsonia pusilla</i>
Pine Siskin	<i>Carduelis pinus</i>	Yellow-rumped Warbler ^K	<i>Dendroica coronata</i>

U=Unlikely, K=known

According to the Canada Land Inventory mapping for waterfowl suitability, the project area is class 7 habitat for waterfowl. This classification means that the site has no capacity for arable culture or permanent pasture (CLI 1998), two traits that are often required to be suitable waterfowl habitat. The steep topography of the area makes it unsuitable for most waterfowl, with the possible exception of Harlequin Duck. Given that the area has a history of logging and on-going recreational use, the probability of Harlequin Duck's occurring is low. Throughout the wildlife surveys, this species was not observed. Additionally, Canadian Wildlife Service and the Conservation Data Centre have not recorded Harlequin Duck in the area.

There were 12 species of neotropical birds observed during the Jumbo Glacier Resort field studies. The most likely species to occur in the study area are those associated with coniferous forests, alpine meadows, riparian areas and alpine-subalpine areas.

The Proponent has made a commitment to conduct additional field studies for migratory birds. These studies are planned for the end of spring/early summer 2004 and the results will be submitted and included as part of the assessment. The Terms of Reference for Migratory and Non-Migratory Bird Surveys are included in Appendix 3-U.

Table 3.11: Summary of Passerine and Passerine-like Bird Observations on Surveys Conducted by Norecol within the Study Area

Common name	Scientific name	Common name	Scientific name
American Dipper	<i>Cinclus mexicanus</i>	Mountain Bluebird	<i>Salialia currucoides</i>
American Robin	<i>Turdus migratorius</i>	Pileated Woodpecker	<i>Dryocopus pileatus</i>
Chipping Sparrow	<i>Spizella passerina</i>	Steller's Jay ^K	<i>Cyanocitta stelleri</i>
Clark's Nutcracker ^K	<i>Nucifraga columbiana</i>	Varied Thrush	<i>Ixoreus naevius</i>
Dark-eyed Junco	<i>Junco hyemalis</i>	Western Tanager	<i>Piranga ludoviciana</i>
Gray Jay	<i>Perisoreus canadensis</i>	Yellow Warbler	<i>Dendroica petechia</i>

2. Common non-migratory bird species resident within the Engelmann Spruce-Subalpine Fir and Alpine Tundra biogeoclimatic zone are summarized in the following table based on information from *Ecosystems of British Columbia*. The table indicates species that have been recorded in the Jumbo watershed during field studies carried out by Norecol, Dames & Moore and information outlining the probability of occurrence for other species

Table 3.12: Non-migratory Birds that Occur in ESSF and AT Biogeoclimatic Zones

Common name	Scientific name	Common name	Scientific name
Anatum Peregrine Falcon	<i>Falco peregrinus</i> ^P	Northern Hawk Owl	<i>Surnia ulula</i> ^P
Barred Owl	<i>Strix varia</i> ^K	Northern Pygmy Owl	<i>Glaucidium gnoma</i> ^K
Blue Grouse	<i>Dendragapus obscurus</i> ^E	Rock Ptarmigan	<i>Logopus mutus</i> ^U
Common Crow	<i>Corvus brachyrhynchos</i> ^K	Ruffed Grouse	<i>Bonasa umbellus</i> ^K
Common Raven	<i>Corvus corax</i> ^K	Sharp-shinned Hawk	<i>Accipiter striatus</i> ^E
Golden Eagle	<i>Aquila chrysaetos</i> ^K	Spotted Owl	<i>Strix occidentalis</i> ^U
Great Gray Owl	<i>Strix nebulosa</i> ^K	Spruce Grouse	<i>Dendragapus canadensis</i> ^E
Gyrfalcon	<i>Falco rusticolus</i> ^U	White-tailed Ptarmigan	<i>Lagopus leucurus</i> ^K
Northern Goshawk	<i>Accipiter gentilis</i> ^K	Willow Ptarmigan	<i>Lagopus lagopus</i> ^U

Falconiformes observed in Jumbo Valley to date include Golden Eagle, Osprey, Red-tailed Hawk, Rough-legged Hawk, Goshawk, and American kestrel. In addition, an historic record exists for the presence of Peregrine Falcon, but it was not seen during the course of the project field work. In addition to the species aforementioned it is also expected that the following species may be local residents or occasional migrants: Sharp-shinned Hawk, Cooper's Hawk, Red-tailed Hawk, Merlin and Bald Eagle.

Barred Owl, Great-horned Owl, and Northern Pygmy Owl are present within the project area, and it is expected that Great Gray, Long-eared and Northern Saw-whet Owls are also present in the vicinity. The rock bluffs and ledges at the upper elevations provide ideal nesting sites for several raptors, while the remaining mature coniferous stands and the open burned and/or logged valley slopes provide habitat for others.

Bald Eagle nest sites are generally located in riparian areas or next to large bodies of water. Due to the absence of large bodies of water, the Jumbo Valley should not be considered ideal nesting habitat. However, as noted in the preliminary wildlife surveys for the valley, Bald Eagle can be expected to occur in low numbers as migrant species.

Part D: Environmental, Resource Management and Technical Issues

Of the ground-dwelling birds, Ruffed Grouse and White-tailed Ptarmigan were the only species observed; however, Blue and Spruce Grouse may inhabit the area.

Table 3.13: Summary of Non-migratory Birds Observations on Surveys Conducted by Norecol within the Study Area

Common name	Scientific name	Common name	Scientific name
American kestrel	<i>Falco sparverius</i>	Northern Goshawk	<i>Accipiter gentilis</i>
Barred owl	<i>Strix varia</i>	Northern Pygmy owl	<i>Glaucidium gnoma</i>
Common crow	<i>Corvus brachyrhynchos</i>	Osprey	<i>Pandion haliaetus</i>
Common raven	<i>Corvus corax</i>	Ruffed Grouse	<i>Bonasa umbellus</i>
Golden Eagle	<i>Aquila chrysaetos</i>	White-tailed Ptarmigan	<i>Lagopus leucurus</i>
Great Horned Owl	<i>Bubo virginianus</i>		

Specific nesting and feeding sites were not observed during the wildlife surveys to date. However, migratory and non-migratory bird surveys are planned for the construction stage of the project. During this time critical bird habitat will be identified and construction and operational plans will be adjusted accordingly. Whenever possible, important habitat will be avoided, and when it cannot be avoided due to an intolerable increase in costs, efforts will be made by the project team to minimize impact or remediate by the creation of additional habitat in environmental reserves.

If raptor nests are found within the area earmarked for land clearing, the appropriate government agency will be consulted to discuss development options. See also Appendix 3-B Wildlife Resources.

It must be noted that the potential impact would be primarily limited to the approximately 104 hectares of the resort development surrounding the former sawmill site. The ski lift disruption would be primarily due to the presence of the lift towers supporting the cables. Ski run development is not planned to be significant because most of the runs, where the terrain is not open, have already been cut for the heli-skiers.

The Proponent has made a commitment to conduct additional field studies for non-migratory birds. These studies are planned for the end of spring/early summer 2004 and the results will be submitted and included as part of the assessment. The Terms of Reference for Migratory and Non-Migratory Bird Surveys are included in Appendix 3-U.

D.3(E) Threatened or Endangered Wildlife

EA Issues Profile

Topic

Implications of project development for threatened or endangered wildlife.

Issues

- Need to survey area around project site for threatened or endangered species.
- Need for impact management and long-term monitoring plans.

Relevant Project Components

All on-site and off-site project components within Toby/Jumbo Creek drainage.

Lead Agency

Ministry of Environment, Lands and Parks (MELP) – BC Environment and Lands

Comments also Received From

- Parks Canada.
- Ktunaxa/Kinbasket Tribal Council (KKTC).

Relevant Public Comments on Application and Draft Specifications

- No studies appear to have been done on potentially threatened species such as wolverine and marten. (13h)
- In draft specs, impacts on threatened and endangered species seem to be downplayed. Draft specs seem to imply losses are acceptable, if monitored.
- Should establish baseline data from field studies prior to project approval.

Relevant Public Advisory Committee Comments on Draft Specifications

- Re. draft spec. #1 - change wording of last sentence to "...Consultation...is required..."

Relevant Proponent Comments on Draft Specifications and Specifications Feedback

- Biophysical habitat report has already evaluated issue. Will take account of direct and indirect impacts, will consult CDC.
- Re. draft spec. #1 – aerial surveys and biophysical mapping complete. Birds and habitats were evaluated. Did provide red/blue species list of seen or anticipated birds.
- Re. draft spec. #2 – Unnecessary. Proponent has offered ongoing monitoring program – not acknowledged. Will be part of management plan to be finalised in master development agreement.

Related Issues and Relevant Specifications

- Re. related wildlife management issues, see other parts of section D.3.
- Re. traditional First Nations use of wildlife resources, see section G.1.

Additional EA Reporting Requirements?

Yes – see below; draft specs. clarified to ensure focus on habitat features potentially affected by individual development components.

Evaluation

Review of Application

Based on a review of the application further assessment is needed of threatened or endangered species of wildlife found within the proposed development area, and also in the surrounding zone of influence. The application includes a report by Norecol, Dames and Moore (included in *Appendix P in Volume 4*), which acknowledges that “...*the present study was not intended to provide full interpretation of wildlife utilisation based on biophysical habitat mapping; rather a preliminary assessment of habitat suitability was included...*” (page 2). Moreover, the same report acknowledges that the species lists developed “...*are considered preliminary only...further field work and habitat analysis would be necessary to establish actual occurrence in a particular habitat class...*” (page 13).

Collection of Inventory Information

The collection of data on threatened and endangered species in British Columbia is co-ordinated by the MELP’s Conservation Data Centre (CDC). The goal of the CDC is to provide a single access point for information on the rare elements of biodiversity in the province. The CDC can provide a *Tracking List for Vertebrate Animals, Vascular Plants and*

Plant Communities, which identifies species and subspecies currently ranked as requiring special management attention. Some species which may exist within the proposed development area have been identified in *Appendix D to Appendix P*, found in of *Volume 4* of the application.

Occurrence of Threatened or Endangered Species

The list which follows includes those species, as well as others which MELP believes could possibly occur in the area: Bald Eagle, American Peregrine Falcon (*anatum* subs.), Least Chipmunk (*selkirki* subs.), Red-tailed Chipmunk (*simulans* subs.), Wolverine (*luscus* subs.), Fisher, Woodland caribou (southern population) Grizzly Bear, Bull trout, White-tailed ptarmigan, goshawk , Northern pygmy owl and Harlequin Duck. The Kootenay region subspecies of White-tailed Ptarmigan and Goshawk are *not* listed.

Other species listed in the Norecol report (Western Screech Owl (*macfarlanei* subs.), Turkey Vulture, Prairie Falcon, and Lewis' Woodpecker) are considered unlikely to occur in the Jumbo Creek valley. Nevertheless, the proponent should look for evidence of their occurrence and should document any evidence found. Parks Canada has pointed out that Harlequin Duck is known to be declining in many areas, are vulnerable to low levels of disturbance, including noise, human presence and removal of stream-side vegetation cover, and, if present, could be affected by resort development.

Recognising that time-limited studies in advance of resort development may lead to an incomplete picture of the status of threatened or endangered species in the area, if the project is approved, some form of monitoring of the status of these species over the course of development may be established as a condition of any approval, in order to gauge the success of mitigation measures and ensure the maintenance of species. Details of such a condition would be developed at the time of any project approval.

Biodiversity Issues

With the drafting and implementation of the provincial *Forest Practices Code*, MELP places increased emphasis on the maintenance of biodiversity and the impacts of industrial and recreational activities on biodiversity values, including impacts on threatened and endangered species and species of special management concern. In consideration of the changes in its emphasis on threatened and endangered species, MELP feels that, in addition to the possible occurrence list requested in the original terms of reference draft specifications for this project, work will be required to identify habitat features for threatened or endangered species in areas which will be directly impacted by construction and operation of the resort facility, and propose mitigation plans to address impacts. Attention should be given to the resort site, resort buildings, tower locations and any ski runs located away from off of the glacier

areas.

Project Report Specifications – D.3(E)

1. In the proponent's wildlife evaluations for the project report, a greater focus should be placed on sensitive, threatened or endangered species than on ubiquitous common species. The proponent must include in the project report an assessment of the known or likely occurrence of the species mentioned in the background to this issue (see *Appendix A*, section D.3(E)), and any other threatened or endangered species cited on the CDC Tracking List within the zone of potential project-related impacts. Consultation with the CDC is required.

2. In the project report, the proponent must include a summary of an assessment of habitats for all species identified in specification #1 in areas which will be directly impacted through construction and operation of the resort facilities. The proponent must also present possible mitigation strategies to minimise or avoid these impacts.

3. In the project report, the proponent must include a commitment to develop a plan for ongoing field inventory and documentation of the occurrence of threatened or endangered species during all phases of construction and operation of the resort facilities. Specific emphasis must be placed on areas which will be physically disturbed by the construction of resort facilities or access. This plan must incorporate proposed plans to mitigate, manage or avoid impacts to such species, associated with either the short-term or long-term effects of resort development.

RESPONSE – D.3(E)

1. The following Table is an assessment of the potential for the study area to provide suitable habitat for red- and blue-listed species identified for the Invermere area, with an emphasis on those which are known to occur in the study area or, according to habitat and range maps, could potentially occur. The Jumbo Glacier Project committee identified another four species of local concern: Bald Eagle, American Peregrine Falcon, Red-tailed Chipmunk and Harlequin Duck. The potential for these species to inhabit the study area is based on a careful review of the field studies and accumulated literature documenting their habitat requirements and occurrence in the province.

Of the 23 red- or blue-listed wildlife species recorded by the Conservation Data Centre (CDC 2003) for the Invermere Forest District, approximately four species are expected or known to occur within the Jumbo Valley study area. Wolverine and Grizzly Bears have been recorded in the area, and Fisher and Least Chipmunk may inhabit the area, based on their habitat preference and range maps. A Rare Element Occurrence Report for a 100-km radius around the Jumbo Valley provided by CDC lists no wildlife⁵ and only a single blue-listed plant species (*Melica spectabilis* or

⁵ Although Grizzly Bear and Wolverine are known to occur in the area, the CDC lists only recorded observations, which they have received. Apparently no one has submitted a record of Grizzly Bear or Wolverine in or around the

purple oniongrass, which was reported in a slide area along Toby Creek).

The federal *Species at Risk Act* (SARA) lists 47 British Columbia species of herptiles, birds and mammals listed as endangered, threatened or special concern. Of these 47 species only Wolverine and Grizzly Bear occur within the Jumbo Creek watershed.

Table 3.14: List of Red- and Blue-Listed Mammals and Birds that May Occur in the Study Area

Scientific Name	English Name	BC Status	Occurrence in Study Area**
Mammals*			
<i>Gulo gulo luscus</i>	Wolverine, <i>luscus</i> subspecies	Blue	Known ³ - ESSF, AT
<i>Martes pennanti</i>	Fisher	Blue	Possible ⁴ - ESSF, AT
<i>Myotis septentrionalis</i>	Northern Long-eared Myotis	Blue	Unlikely – found in lower elevations, requires more research ⁴
<i>Rangifer tarandus pop. 1</i>	Mountain Caribou (southern population)	Red	Unlikely ¹ – ESSF, AT - Occurs in Purcell range ⁴
<i>Tamias minimus selkirki</i>	Least Chipmunk, <i>selkirki</i> subspecies	Red	Possible - ESSF, AT - found in Toby Creek watershed and Purcell Mtns ⁴
<i>Taxidea taxus</i>	Badger	Red	Unlikely ⁴ - found in BG, IDF, PP
<i>Ursus arctos</i>	Grizzly Bear	Blue	Known ^{2,3}
Birds*			
<i>Aeronautes saxatalis</i>	White-throated Swift	Blue	Unlikely ^{5,6} – BG, PP, IDF, ICH ⁴ – nest sites Invermere and Windermere ⁵
<i>Ardea herodias herodias</i>	Great Blue heron, <i>herodias</i> subspecies	Blue	Unlikely ⁶ – CDF, CWH, BG, PP, IDF, ICH, SBS, req. cottonwood ⁴
<i>Asio flammeus</i>	Short-eared Owl	Blue	Unlikely ⁶ - CDF, CWH, BG, PP, IDF, ICH, SBS, breeds in Okanagan
<i>Botaurus lentiginosus</i>	American Bittern	Blue	Unlikely ⁶ - CWH, BG, PP, IDF, ICH, SBPS, SBS, Okanagan Valley
<i>Buteo swainsoni</i>	Swainson's Hawk	Red	Unlikely ⁶ - BG, PP, IEF, SBS, Thompson-Okanagan hotspot
<i>Dolichonyx oryzivorus</i>	Bobolink	Blue	Unlikely ⁶ - BG, PP, IDF, ICH, SBS, prefers hayfields/riparian meadows
<i>Falco mexicanus</i>	Prairie Falcon	Blue	Unlikely ^{1,6} – BG, PP, IDF, AT-ESSF?
<i>Grus canadensis</i>	Sandhill Crane	Blue	Unlikely ⁶ – CWH, PP, IDF. SBPS,

Jumbo Valley to the CDC.

Part D: Environmental, Resource Management and Technical Issues

Scientific Name	English Name	BC Status	Occurrence in Study Area**
			SBS, SWBS, 1-2 pairs in EKT
<i>Melanerpes lewis</i>	Lewis's Woodpecker	Blue	Unlikely ^{1,6} – BG, PP, IDF, ICH
<i>Numenius americanus</i>	Long-billed Curlew	Blue	Unlikely ⁶ – BG, PP, IDF, grasses
<i>Otus flammeolus</i>	Flammulated Owl	Blue	Unlikely ⁶ - IDF, PP
<i>Tympanuchus phasianellus columbianus</i>	Sharp-tailed Grouse, <i>columbianus</i> subspecies	Blue	Unlikely ⁶ – IDF, PP, outside of range
Other species of concern identified in Final Report Specifications (EAO 1998)			
<i>Haliaeetus leucocephalus</i>	Bald Eagle	Yellow	Possible in low numbers or as migrants
<i>Falco peregrinus anatum</i>	American Peregrine Falcon (<i>anatum</i>)	Red	Unlikely ⁴ - CWH, BG, PP, IDF, SBS, No CDC record in area
<i>Tamias ruficaudus simulans</i>	Red-tailed Chipmunk (<i>simulans</i>)	Blue	Unlikely - Limited to Selkirk Mtn ⁴ – found <i>T.amoenus</i> <i>T. minimus</i> in Purcell Mtns. ⁴
<i>Histrionicus histrionicus</i>	Harlequin Duck	Yellow	Possible – not recorded by gov't or during wildlife surveys, human disturbance history

*As identified by the CDC Invermere Forest District Tracking List

** Refer to Appendix C for Biogeoclimatic Zone abbreviations

¹Jumbo Glacier Project Committee 1998

⁴Cannings *et al.* 1999

²Strom *et al.* 1999 2

⁵CDC Rare Elements Occurrence, East Kootenay Study Area

³Norecol Dames and Moore 1993

⁶Fraser, D.F. *et al.* 1999

2.

Wolverine

In Canada, COSEWIC (the Committee on the Status of Endangered Wildlife in Canada) has listed the eastern Wolverine as Endangered and the western Wolverine as Vulnerable. Similarly, the B.C. government has listed the species as blue, and considers it vulnerable. Based on discussions with local trappers (including a former trapper in Jumbo Valley) and observations during November, February and April surveys, Jumbo Valley supports small numbers of Wolverine. Suitable habitat is found in the upper areas of Jumbo Valley.

Fisher

Fisher (*Martes pennanti*) is blue-listed because populations are believed to have declined recently over much of their range. Inferring from ground/aerial surveys and available information, the study area does not support a visible Fisher population. Preferred habitat is found in Spruce-Willow-Birch (SWB), Sub-boreal Spruce (SBS) and Boreal White and Black Spruce (BWBS)

biogeoclimatic zones with abundant coarse woody debris.

Northern Long-eared Myotis

At present *Myotis septentrionalis* is blue-listed in British Columbia. Concerning the study location, Northern Long-eared bats would be at the outer edge of their range (Eder and Pattie 2001). They are also unlikely to inhabit high elevations, thus are unlikely to frequent the area of Jumbo Valley.

Caribou (southern populations)

Mountain Caribou subspecies was not observed in the Jumbo Valley during the project field studies. The absence of this species from the Jumbo Valley may be due to the lack of suitable habitat.

Least Chipmunk (selkirki subspecies)

According to the CDC, the Least Chipmunk is provincially listed as red, and the International Union for the Conservation of Nature recently listed it as Vulnerable. Least Chipmunks have not been recorded in the study area; their range is restricted to specific locales within the Purcell range (Nagorsen *et al.* 2000). However, they could possibly occur in the upper Jumbo Valley below the glacier level. Should the project receive government approvals, field surveys of the study area would continue to actively monitor for presence of this species.

Badger

Badgers have not been recorded in the study area, perhaps due to unsuitable habitat.

Grizzly Bear

Grizzly bears have been recorded during fieldwork conducted during the 1992-1993 season as well as during the data collection for Strom *et al.* (1999). A detailed discussion on habitat and management is discussed above (see Project Specification D.3 (C) and in detail in Appendix 3-C Environmental Management Plans.

Migratory Birds

None of the red- or blue-listed migratory bird species have been recorded in the study area. Due to the unsuitable habitat types, it is unlikely that they are inhabitants of the Jumbo watershed. However, during the monitoring and continued field surveys, field biologists will continue to look for and record observations of these and other bird species.

Bald Eagle

Haliaeetus leucocephalus is listed as yellow by the province, meaning that the population is considered secure. Most of the components required for nesting and wintering habitat for Bald Eagles are lacking in the study area. For an area to be considered suitable Bald Eagle habitat it must be near a large body of water or it must have a sufficient prey base to support nesting eagles. Thus, large numbers of eagles are not expected to nest in the area; however, they are expected to occasionally pass through the Valley.

American Peregrine Falcon (*anatum* subspecies)

The Peregrine Falcon (*Falco peregrinus anatum*), listed provincially as red and nationally. At present, the Peregrine Falcon does not nest in the Jumbo Valley, and it is unlikely to pass through the area.

Red-tailed Chipmunk

Red-tailed Chipmunk (*Tamias ruficaudus simulans*) is recognized as a species of concern within the Nelson Forest District, specifically for the area near Kootenay Lake. The CDC has given this subspecies blue listed status due to its restricted range. Although appropriate habitat is present, Red-tailed Chipmunk is an unlikely resident of Jumbo Valley; the *sumulans* subspecies is restricted to the Selkirk Mountains only *T. amoenus* and *T. minimus* have been recorded in the Purcell Range.

Harlequin Duck

Histrionicus histrionicus is yellow-listed by the province, meaning the population is considered secure, but due to a globally threatened population it is subject to a special watch. This species may occur in the Jumbo Valley during the breeding season, but the likelihood is lessened because Harlequin Ducks require habitat free from disturbances (Pandion 2002). Due to historic logging disturbance in the valley this species would likely not breed at this location. The Ministry of Sustainable Resource Management (and formerly MELP), the CDC and the Jumbo Glacier project team have, to date, no recorded observations of Harlequin Duck for the project area.

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3. The Proponent commits to conducting additional field surveys during the preconstruction/ construction phase of the project as indicated in the response to Project Report Specification D.3(D). In addition, the Proponent commits to an ongoing wildlife monitoring program during project operation. The Proponent has made a commitment to develop an Environmental Monitoring Centre in conjunction with a First Nations Interpretive Centre. The environmental monitor that will be in charge of the program will derive the terms of reference of his/her work from the project report and the Master Development Agreement between the Proponent and the Province. This work will include the above noted plan for an on going field inventory of threatened or endangered species. In this plan specific emphasis will be placed on areas which will be physically disturbed by the construction of resort facilities or access. The plan will incorporate proposed plans to mitigate, manage or avoid impacts to such species, associated with either the short-term or long-term effects of resort development. The plan will be in accordance with the observations included in Project Report Specification D.3(B) #7 above and Appendix 3-C Environmental Management Plans.

D.3(F) Wildlife Impacts of Utility and Access Corridors

EA Issues Profile

Topic

Wildlife implications of access road upgrading/use and transmission line development.

Issues

- Need to clarify requirements for access road upgrading (including any potential for avalanche control structures) and transmission line development.
- Proposed measures to mitigate wildlife impacts.
- Details of any intended helicopter use associated with resort, and proposed mitigation measures.

Relevant Project Components

All on-site and off-site project components within Toby/Jumbo Creek drainage.

Lead Agency

Ministry of Environment, Lands and Parks (MELP) – BC Environment and Lands

Comments also Received From

- Parks Canada.

Relevant Public Comments on Application and Draft Specifications

- Road infrastructure and traffic occasioned by resort will greatly increase chances of bears being shot by hunters and poachers. (7e)
- Road in Toby Creek and Jumbo Creek valleys was very heavily travelled in 1960s, but healthy wildlife population existed, despite the traffic. Why would traffic have any greater impact now? (7f)
- If location of electricity transmission corridor has yet to be defined, environmental impact study should be expanded to all surrounding drainages. (9b) Application refers to initial 25-kV electrical transmission line, to be upgraded to 69-kV line in later phases. Visual impact of electrical lines of this size may not be acceptable in Jumbo Creek drainage, so electrical lines may have to be routed up adjacent drainage. This could significantly affect ecology and wilderness character of chosen drainage. (9c)
- Jumbo Glacier project will add to problem of unwelcome helicopter activity in backcountry. (23d) Helicopter noise will be commonplace. It already intrudes into Bugaboos and Shangri-La (in connection with heli-hiking).

Part D: Environmental, Resource Management and Technical Issues

- Should document how much existing access corridor will have to be modified. Should minimise width of utility/access corridor.

Relevant Public Advisory Committee Comments on Draft Specifications

- Re. draft spec. #2 - add "...and in a cumulative effects context, with specific reference to the impact of 800-1,000 vehicles per day travelling to the resort..."
- Re. draft spec. #4 - add "...impacts on wildlife resources, hunting and recreation, in the area. There should be specific references to goats..."
- Add spec. requiring assessment in project report of impacts on wildlife habitats and populations, using impact studies along highways in National Parks and on access roads with similar traffic flows (e.g. Sunshine Village and Silver Star Resort).
- Add spec. requiring literature review, scope to be determined by project committee.

Relevant Proponent Comments on Draft Specifications and Specifications Feedback

- Draft specs unnecessary and unusual for project, show poor understanding of proposal. Preamble to specs reinforces misinformation about impacts of road and helicopters.
- Re. draft spec. #1 - Avalanche conditions in access corridor are normal for area, will not require unusual structures (as confirmed by MoTH staff during May 1997 site tour). Will look at direct, indirect and residual impacts of off-site facilities (road, trails, etc.).
- Re. draft spec. #2 – Will address issue, but looking at cumulative effects only on grizzly bears. Telephone and power lines will follow road, without incremental impact.
- Re. draft spec. #3 – Wildlife mortalities along access road can be minimised through low design speeds, avoiding re-routing of access road through critical habitat area or movement corridors, and, if necessary, with localised fencing, signage and reflectors.
- Re. draft spec. #4 - Use of helicopters is not part of proposal, which relies on road and lift access. Helicopter activity is undertaken by R.K. Heli-Ski, and it may choose to relocate its base to resort. R.K.'s activity in resort area itself would decrease. Other helicopter-based activity would require government approval, not proponent's. Not economically viable to bring clients to resort by helicopter

Related Issues and Relevant Specifications

- Re. related wildlife management issues, see other parts of section D.3.
- Re. noise issues, see section E.5(D).
- Re. commercial and non-commercial wildlife recreation, see section E.5(F).
- Re. local heli-ski operations, see section E.5(G).
- Re. access road upgrading (including avalanche control), see sections E.6(C) and (D).
- Re. transmission line development, see section E.6(F).
- Re. traditional First Nations use of wildlife resources, see section G.1.
- Re. possible federal cumulative wildlife effects assessment requirements, see section H.2.

Additional EA Reporting Requirements?

Yes – see below; draft specs. revised to incorporate literature review of wildlife/traffic conflicts.

EA Review Focus

MELP wishes to be in a position to evaluate wildlife population and habitat impacts of the development, and to assess proposed mitigation measures. Avalanche paths provide crucial spring, summer and late fall forage habitat for a variety of wildlife, including black bears, grizzly bears and ungulates. In addition to the loss of habitat associated with access construction across slide paths, use of adjacent habitat can be significantly curtailed due to increased human disturbance. In addition, helicopter traffic and its potential impacts on wildlife populations is of concern to MELP with all backcountry commercial ski and recreational projects.

Review of Application/Evaluation

Background

In the discussion of access requirements in the application, there is little mention of the impact of access development or utility corridors on fish and wildlife populations.

In particular, where development is located within fish or wildlife habitat, experience has shown that the construction and maintenance of access, and the attendant increased accessibility of the surrounding area for recreationists and the general public, typically lead to some of the more

significant fishery and wildlife impacts.

Access Road Upgrading

MoTH has advised the project committee that, based on projected traffic levels, the existing resource road along the Toby Creek and Jumbo Creek valleys will need to be upgraded to ensure safe, efficient public road access to the resort, and that this could possibly entail significant relocation of the existing resource road alignment in places. Since the proponent was not aware of any specific access road upgrading requirements at the time of filing of its application, the application does not address this issue. It is important that the fish and wildlife implications of road relocation and redesign options are assessed in some depth in the project report.

The construction phase is of key concern. This project will result in the construction of roads, utility corridors and lift towers on or adjacent to active avalanche paths. In addition to the disturbance associated with the construction of this infrastructure, the added disturbance of constructing any avalanche and debris protection structures must also be identified. This would also include maintenance roads and trails required for avalanche control, etc. In this regard, MELP understands that in MoTH's view, a satisfactory route alignment is possible which avoids almost all avalanche paths, and which may not require any structures. Added to the direct and permanent loss of productive habitat, increased public access through these habitat types may result in increased harassment of wildlife and reduced use of these sites by grizzly bears, as well as by elk, black bears and mule deer.

Increased Road Use

Improved access into the Jumbo Creek drainage and the substantial increase in traffic along this route from Invermere to the resort complex will likely increase the potential for collisions with wildlife which frequent the area. During periods of heavy snow fall, many wildlife species, such as moose and elk, will prefer the relatively snow-free movement made possible by ploughed access routes. As has been observed elsewhere along remote ploughed logging roads, wildlife may attempt to outrun or out-manoeuvre vehicles on the road surface, rather than move off into deep snow conditions.

In assessing this issue, the proponent should consult existing studies which examine wildlife/traffic conflicts. Parks Canada reports that it has collected considerable data on this issue. Significant mortality rates along the Trans-Canada Highway (TCH) through Banff, Yoho, Mount Revelstoke and Glacier National Parks, and along the Kootenay Parkway in Kootenay National Park, are of concern. In the case of the TCH, well-substantiated concerns about wildlife population declines (e.g. elk in Banff National Park) and blockage of movement (particularly for bears and other carnivores) have led to expensive measures such as fencing,

underpasses (poor success with carnivores) and, more recently, overpasses (assumed to be more effective for carnivores). Data from Kootenay National Park indicate that current levels of parkway elk mortality are considered contributory, together with habitat loss and other mortality, to the observed decline in the park elk populations. Parks Canada is able to identify reference studies for the proponent's use.

Other Access and Utility Corridor Uses

The impacts of transmission line development on fish and wildlife populations and/or habitat need to be addressed. In addition, if any significant helicopter traffic may be directly or indirectly is to be associated with this project at any season, the noise and disturbance impacts should be discussed. It is recognised that the wildlife in the vicinity of the project site already experiences this type of disturbance at certain seasons in connection with the local heli-ski operation. The proponent has indicated that construction of the lifts and day use lodge may be undertaken using helicopters, and it is anticipated that helicopters will play a role in search and rescue, and in aspects of maintenance and operation of the resort. The application raises the possibility that R.K. Heli-Ski might opt to base itself out of the resort, if developed. Whether or not this would lead to any change in the current levels of helicopter usage by R.K. Heli-Ski is unclear. Presumably there would be a reduction in its flying activity around those glaciers and ski runs which would be incorporated into the resort's skiable terrain (see also section E.5(G)).

Impact Management Issues

To minimise the impacts on fish and wildlife habitat, and to minimise site disturbance to vegetation communities during the construction and maintenance of power transmission lines, water lines, sewer lines and access roads, the project committee agrees with the proponent's intention of locating all all facilities, to the extent possible, should be located in a single corridor along the upgraded access road to the resort and lodge facilities.

The construction phase is of key concern. This project will result in the construction of roads, utility corridors and lift towers on or adjacent to active avalanche paths. In addition to the disturbance associated with the construction of this infrastructure, the added disturbance of constructing avalanche and debris protection structures must also be identified. This would also include maintenance roads and trails required for avalanche control etc. Added to the direct and permanent loss of productive habitat, increased public access through these habitat types may result in increased harassment of wildlife and reduced use of these sites by grizzly bears, as well as by elk, black bears and mule deer.

Improved access into the Jumbo Creek drainage and the substantial increase in traffic along this route from Invermere to the resort complex will likely increase the potential for collisions with wildlife which frequent

the area. During periods of heavy snow fall, many wildlife species, such as moose and elk, will prefer the relatively snow-free movement provided by ploughed access routes. As has been observed elsewhere along remote ploughed logging roads, wildlife may attempt to outrun or out-manoeuve vehicles on the road surface, rather than move off into deep snow conditions.

The impacts of access development on wildlife populations need to be addressed in a cumulative effects context, taking account of the implications of the project in improving access to an area to which the quality of current access is of comparatively lower standard. - see the provisions for cumulative effects analysis in sections D.3(B) and (C), above.

Conditional Project Report Specification – D.3(F)

1. Recognising that MoTH now considers it unlikely that there will be any need for avalanche and debris protection structures along the access corridor - see section E.6.D of these specifications - if any structures are deemed necessary, following completion of the route study required by specification E.6.C(b)#2, MELP requires information in the project report on their location and design, and on those areas which may be disturbed by construction and maintenance of these structures.

Project Report Specifications – D.3(F)

2. Mapping at a scale of 1:20,000 for all roads, and any avalanche or slide protection structures associated with them, must be presented in the project report. An assessment of the impacts of utility and access corridor construction and use on wildlife habitats and populations is required in the project report, both in respect of direct impacts, and in a cumulative effects context. The assessment must be conducted with specific reference to the impact of the projected volumes of traffic traveling to and from the resort at each development stage. The assessment must also include the impacts of altered wildlife use, such as use of ploughed road surfaces by moose and increased predator success associated with ploughed and compacted snow surfaces.

3. The assessment of the impacts of increased traffic along the access road on wildlife habitats and populations, required by specification #2, must include reference to the findings of wildlife/traffic impact studies along access roads with similar traffic flows, including those within National Parks. Mitigation measures proposed as a means of reducing wildlife disturbance and collisions with vehicles must be outlined in the project report.

4. Recognising the proponent's statements that the resort's management itself has no intention of offering helicopter-based activities at the resort, a description is required of any helicopter use at the resort during construction and operation, including seasonal use and possible flight paths. The project report must identify potential impacts from helicopter use directly and indirectly associated with the resort, and outline mitigative practices and operational methods which will minimise impacts on wildlife resources,

hunting and recreation in the area. The proponent's assessment must include specific reference to impacts on mountain goats.

RESPONSE – D.3(F)

1. There is no need for avalanche and debris protection structures along the road.
2. The Master Plan and the Route Study show clearly the mapping of all the roads at a scale of 1:10,000. The utility (only an overhead power line along the access road) and access corridors are limited to the use of existing corridors of existing highways and forestry and mining roads.

An assessment of the cumulative effect has been considered already in the previously noted study at D.3(C)#8 . Regarding the altered wildlife use, the power line will follow existing forestry roads and will be within the access road right of way. The evaluation and fear of potential impacts is conditioned by the misconception of the road as if it were a major highway. The road and traffic impact on wildlife and the concern of altered wildlife use are due to a misconception because the conditions are compared to the Trans Canada Highway and its slide protection structures. In fact, the Trans Canada Highway has a posted speed limit of 90km/hr and has a traffic count that can range in the neighbourhood of 8,000 vehicles per day, including a large number of semi-trailer trucks who regularly travel over the speed limit. Gibeau (2000) commented on the consequences of peak summer traffic volumes of 21,000 vehicles per day through the Bow Valley corridor. The summer use of the Jumbo Creek road has been calculated at an ADT of 432.5 vehicles per day (McElhanney 2003 – Appendix 5-A of the Master Plan) at build out. It is designed for 50km/hr and will have a posted speed limit of 50km/hr.

Regarding use of ploughed roads by wildlife, the road to the Mineral King Mine is already ploughed in winter. Although the traffic will increase, the experience at other winter resorts demonstrates that a road kill on a mountain resort road is very rare, and with a reasonable enforcement of the speed limit may be considered most unlikely. The Kootenay National Park road, with a posted speed limit of 90km/hr, a length of some 110 km, and a traffic flow in the range of 3,000 to 6,000 vehicles per day generates approximately 40 road kills in a year.

Based on the small spatial scale of the resort roadway and the secure forested habitat adjacent to the roadway, impacts on the JGR access road should be relatively minor. Seiler (2001) and Seiler and Eriksson (1997) note that small scale roadways and those in forested landscape do not have the same relative impacts as large scale motorways (e.g., Trans-Canada Highway). It would be reasonable to expect that at 'build out' with an annual average AADT of 943 cars per day (423 vehicles per day during summer), a 50km/hr road 36 kilometers long, can be utilized with a risk of, at a maximum, 0 to 4 road kills per year at build out. Traffic calculations for each phase have been done based on peak hourly traffic, and are shown on Table 1 – Traffic Volumes, at Page 3 – 5 of the above noted Route Study. Based on the proportional growth of the traffic projections and road kills, it would be reasonable to determine that in Phase 1 road kills per year should be between 0 and 1, in Phase 2 between 0 and 2, and at build out between 0 and 4.

The effects of roads on wildlife are further discussed in Project Specification D.3(B) #7 bullet and in Appendix 3-B Wildlife Resources and Appendix 3-D Grizzly Bear Management Plan.

It is the intention of the Proponent, in an effort to minimize disturbance to vegetation and wildlife, to locate all facilities along the corridor of the upgraded resort access road. Road and utility right-

of-way will, whenever feasible, follow existing roads and trails. Any necessary deviation from the existing right-of-way would follow the route that is least disruptive to the natural environment (McElhanney 2001).

Winter maintenance of roadways often creates steep cut-banks and graded snow berms along the road edge. These obstacles can create physical barriers for ungulates that are attempting to escape predation. Predators such as Coyotes use the graded roads on winter nights as easy travel corridors. Thus, a localized effect might be increased predation rates on deer. To mitigate this effect, in years of deep snow, the snow berms created by ploughing will be broken at regular intervals so that animals can easily escape from the roadway into adjacent secure habitat.

A consequential effect from the increased access to the Jumbo Valley area could be an increase in hunting and poaching. However, the harvest pressure exerted can be minimized by implementing harvesting guidelines and enforcing regulations

3. Point #2 above includes references to wildlife/traffic impact studies. It is necessary to reiterate, however, that the reference to “similar traffic flows” with respect to the National Parks is erroneous. Due to low traffic flows and low speeds in the access to Jumbo Valley, the Proponent is confident that through posted signs, web site campaigns, pamphlets and an invitation to exercise care and attention, wildlife road kills per year can be minimized.

Additional discussion of this point is presented in Appendix 3-D Grizzly Bear Management Plan, which also describes mitigation measures to minimize effects of the access road on Grizzly Bear. Additional mitigation measures are presented below.

Vehicle speeds (i.e., maximum of 50 kph) will be enforced to avoid unnecessary collisions with wildlife. Signs, enforcement, road design (e.g., speed bumps) and fencing are options being considered to limit vehicle speeds (Gunther *et al.* 2002). ENKON recommends that fencing should not be constructed for Phase 1 or Phase 2. Upon the initiation of Phase 3, the need for fencing should be re-evaluated. Consideration must be given to the trade-off between the fence’s acting as a barrier to wildlife movement and its being a preventative measure against vehicle caused wildlife mortality. Ideally if fences are erected they should be done so in combination with wildlife crossing structures, because an increase in wildlife-vehicle collisions (WVCs) is often detected at the fence-ends (Clevenger *et al.* 2001).

Management will act proactively to avoid WVC by hydroseeding roadsides with unpalatable herbaceous species and avoiding the use of salt on resort roadways. Management also will consider utilizing a mixture of sand-salt and a form of ungulate repellency. Some repellent compounds that have been use successfully in the past are Wolfin®, Deer Away Big Game Repellent® and lithium chloride (LiCl) (Brown *et al.* 2000).

4. During construction, helicopter use will be limited to assisting in the construction of the top lift stations and the installation of lift towers. This is a common method of operation recently used at Sunshine in Banff National Park without known impacts. Flight paths are decided by the pilots according to variable conditions, and while recommendations can be made, it is not possible for the Proponent to proscribe them in advance. The only other foreseeable helicopter use is for air ambulance, for avalanche monitoring and prevention after snow falls and by RK Heli-ski, which has been trying to establish a base in Jumbo Creek and has been offered an operating base as part of the resort plan. These are not uses that are controllable by the Proponent, and flight paths for these uses vary and are filed by the helicopter operators. There is no plan to use helicopters

for transportation. There has been helicopter use in the summer by CODA to allow Alpine Canada Alpin to ferry its athletes to Farnham Glacier in order to train there in the absence of a chairlift, as proposed by the Proponent in the 1995 Master Plan and in the current Master Plan. A chairlift would be a more sustainable and effective solution. See also Project Specification D.3(B) #6 above for an outline of possible mitigation measures with regards to helicopter use and Appendices 3-B and 3-C Wildlife Resources and Environmental Management Plans.

D.3(G) Potential Human Conflicts with Wildlife

EA Issues Profile

Topic

Problems with wildlife in vicinity of resort.

Issues

- Magnitude of potential human/wildlife conflict problems (notably attraction of bears to garbage).
- Management strategies to minimise potential for such conflicts.

Relevant Project Components

All on-site and off-site project components within Toby/Jumbo Creek drainage.

Lead Agency

Ministry of Environment, Lands and Parks (MELP) – BC Environment and Lands

Comments also Received From

Parks Canada.

Relevant Public Comments on Application and Draft Specifications

- Road infrastructure and associated traffic will greatly increase chances of bears being shot by hunters and poachers. (7e)
- Even if grizzlies are forced out of valley, more habitat for wildlife would be created, since there would be less pressure from logging and mining companies on other adjacent areas. (13l)
- Resort development will prompt major bear/human conflicts, resulting in injuries to humans and high grizzly mortality levels. (13n)

Relevant Public Advisory Committee Comments on Draft Specifications

- Additional spec. suggested (but without consensus) to review need for remote wilderness habitat for wildlife that is 80 to 100 km from settlement.

Relevant Proponent Comments on Draft Specifications and Specifications Feedback

- Re. draft spec. #1 - no precedent for this requirement, which anticipates extraordinary risk to wildlife which does not exist. Why does Panorama management not have to file such wildlife protection plans? Panorama resort is located in a more valuable wildlife area (e.g. for grizzly bears).
- Bear conflicts can be prevented by meticulous waste management practices, developing trails of proper design and limited extent, and visitor education.

Related Issues and Relevant Specifications

- Re. solid waste (garbage) disposal issues, see section D.1(A).
- Re. related wildlife management issues, see other parts of section D.3.
- Re. problem wildlife management, see section E.7(K).

Additional EA Reporting Requirements?

Yes – see below; draft specs. revised to add focus on local grazing tenure.

Review of Application

The potential for direct conflict between humans and wildlife species such as grizzly bears, black bears and cougars, is not considered in the application.

Evaluation

Human/Wildlife Conflict Problems

The project will bring increased human activity directly into contact with wildlife, including species which have a history of conflict with people, such as coyotes, bears, moose and cougars. When there is documented or perceived risk to public safety due to wildlife/human encounters, action is taken to remove or destroy the animal. Other Some species are highly susceptible to human disturbance during critical periods in their life cycle, such as moose and mountain goats.

With the exception of areas such as the Flathead River drainage in the southeast corner of the region, the upper portions of the St. Mary River north of Kimberly, including the Purcell Wilderness Conservancy Provincial Park, and the upper Kootenay River valley, there are relatively few areas in the East Kootenay region where major predator populations are more than 80 to 100 kilometres from human development. In many areas, communities and rural development have encroached directly into traditional habitats, resulting in an increasing number of incidents involving potential risk to human life and damage to private property. As

the number of suitable areas for problem animal relocation continues to decline, these conflicts more often than not result in the death of the problem animals.

Sustainability of the grizzly bear population in and near the Jumbo Creek drainage has been identified as a concern of MELP since this project was first proposed from the outset of project review. In addition to the anticipated loss of habitat, disruption of traditional home ranges and displacement of populations into adjacent ranges, the potential for additional reduction in local populations due to human/wildlife conflicts involving recreationists and resort users is considered a significant issue.

To illustrate a similar problem of human/grizzly conflicts elsewhere in the region, eighteen grizzly bears have been destroyed or removed from the communities of Elkford and Sparwood in the past two years alone. Neither community is new, which suggests that the problem is not one which will necessarily diminish quickly. The problem can also be documented around ski resorts, both in the region and elsewhere. Problem bears are being destroyed at Whistler, and MELP has been working with the operators of the Panorama resort in an effort to address chronic problems with wildlife associated with the lodge and adjacent residential community.

The proponent is referred to the report entitled: *Conservation of Grizzly Bears in British Columbia—Background Report*, May 1995 (see especially pages 43 and 44).

Research Studies in National Parks

Parks Canada notes that studies in several National Parks, including Mount Revelstoke and Glacier National Parks (the ongoing West Slopes Bear Study), Yoho National Park (Lake Ohara Study), and Banff National Park (BNP - ongoing East Slopes Bear Project), have demonstrated the negative impact of roads and facilities on bears and other carnivores. The Bow Valley Study (its results and recommendations are summarised in the report *Banff Bow Valley: At the Crossroads*, 1996) was an independent evaluation of the ecological integrity of this area. It concluded that the combination of transportation corridor development, access roads, townsites, tourism support facilities and high visitor use has seriously compromised BNP's ecological integrity. As a result, the task force recommended numerous (and in some cases) controversial measures to restore wildlife movement and habitat effectiveness.

Data from the National Parks and other studies have convincingly demonstrated low use by bears of roads and areas near facilities. Even in backcountry areas, reduced use extends from 400 to 2000 meters from occupied campsites and cabins. Thresholds of human use which result in displacement appear very low; hence the requirements, in some areas, for minimal vehicular use and targets of less than 100 persons per month.

Control action mortality, though much reduced following dump closures and sanitisation, still raises concerns with respect to population viability. Most of the mortality has been female, and associated with facilities. The conclusion from the Bow Valley study is that control action mortality must be further reduced if bears are to be sustained in Banff National Park. Recommendations now being implemented include:

- closing access roads to public use;
- disallowing commercial summer use at Lake Louise and Mount Norquay Ski areas;
- limiting trail use to less than 100 persons per month; and
- fencing townsites, resorts and campgrounds to prevent bear/human conflicts.

Project Report Specifications – D.3(G)

1. The issue of potential wildlife/human conflicts must be addressed in the project report. This discussion must consider the potential magnitude of the problem for all phases of construction and development, and must include a mitigation plan to minimise human/wildlife conflicts and losses of wildlife.

RESPONSE – D.3(G)

1. The issue of bear/human conflict is reviewed extensively in the Grizzly Bear Management Plan (Appendix 3D), which also provides guidelines for minimizing the potential for bear-human conflicts. The management plan addresses garbage management, outdoor recreation (trail) management and access road management. It also presents methods of dealing with any bear that does become a problem. Although developed specifically for Grizzly Bear, most parts of the management plan are applicable to Black Bear and other carnivores (e.g. Coyote, Wolverine).

See also Project Report Specifications D.3(B) #6 and #7 D.3(C) above and Appendix 3-C Environmental Management Plans.

Years of studies have been spent to develop a Master Plan that responds with a sustainable model to the issues of potential wildlife/human conflict. However, the work of the consultants' team encountered some difficulty due to an improper definition of the issues. In part this has been due to lack of knowledge of the Jumbo Creek drainage, which is not at the same level of wildlife visitation as other parts of the Kootenays, perhaps because of its history of human intrusion for mining, forestry operations and tourism (Jumbo Pass is a favourite hiking destination and the Jumbo Creek road is the access point for logging operations and a supply route for the fuel tanks of the heli-ski company as well as being a departure point for hunting trips. In earlier years a sawmill operated at the proposed resort site), and in part this has been due to the underlying objective of denying further access to the backcountry in general. The following considerations have been made part of the Master Plan to mitigate the potential problem:

- The access road utilizes existing highway, forestry and mining road corridors almost through

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its entire length.

- Working with the Ministry of Transportation and Highways, the design speed and the speed limit have been kept as low as possible. The Jumbo Creek road will be a 50km/hr road.
- The resort size has been kept small, both in total number of guests and in terms of footprint. The project is the most compact mountain resort proposed in B.C., covering approximately 100 hectares.
- The entire resort can be fenced, and it can be maintained as a ship in the wilderness. Pets will be discouraged and will only be permitted indoor or with a leash in designated areas inside the resort perimeter.
- The problem of garbage has been resolved with the program described in the Master Plan, which will prevent any attraction of wildlife by human waste
- There will be minimal tourist exposure outside the resort perimeter, because the tourists will either be on ski runs in areas with snow or looking at the vistas from the top of Glacier Dome and of Jumbo Mountain. There will be only one designated walking trail in the summer, going from the resort to the Glacier Dome base of the lift and from there to Glacier Dome, in an area less known for wildlife visitations, and keeping a narrow corridor following the route of the road for human intrusions.

The focus of human activity generated by the resort and its lifts is skiing on the glaciers and the experience and views from the mountain tops accessed by lift, but we have noted the argument that in the National Parks there is evidence of widespread hiking under little control by tourists who then become victims of accidents, which generates the impression that it will not be possible to control widespread hiking in all directions. These people may be tourists or employee residents of the park villages, and it is believed that this is an example that shows that with increasing tourist populations, with more employees of tourism facilities and improved access, the number of people accessing the backcountry will increase proportionally.

We believe the argument may be applicable to park areas but the comparison does not work well for the JGR project for the following reasons:

1. Banff, Jasper and adjacent parks cater to a vastly larger population of tourists and employees, with a much greater variety of people accessing the region. People who access the parks may be from Jasper, Banff or Canmore, or as far as Edmonton and Calgary, as well as the destination tourists. The Jumbo Creek drainage would be accessed primarily by the same population presently in the Columbia Valley or by destination resort tourists.
2. In the parks there is a greater number of day visitors and a large number of relatively easy access points that gradually lead into the side valleys and into scenic locations and special interest points. A large number of trails encourage visitors to go further into a number of natural attractions, and hiking is perhaps the most important activity in the parks, after skiing in winter.
3. Unlike in the parks, the access to Jumbo Creek is a dead end with steep mountain sides in a small drainage. The valley sides terminate with rocky cliffs and there are no trails leading to side valleys or mountain access. Climbing the steep inclines of the drainage is not common nor encouraged because the rock features formations of schists which are

dangerous for climbers. There is no convenient and relatively quick access to the mountains except by lift or by long and difficult routes known only to experts of the area and mountain guides. Except for the easy Jumbo Pass trail the valley is not a preferred hiker's destination now and there is no reason why this should change.

4. The only existing trail and easy mountain access is the Jumbo Pass trail, but this is also a trail that really terminates at the pass as its destination and best viewpoint. Going down to the other side leads to a logging road and to the Kootenay Lake and Duncan Lake drainages.
5. Jumbo Pass is currently and will continue to be the easiest trail because one can drive a car to the trail head only a few kilometers from the pass; there is no reason to believe that once the road is paved the hike will become a substantially stronger magnet for new valley residents or tourists, as an alternative to the lift access to the mountain tops at a very affordable cost. Except for the width, the road is practically as easy to drive now as it will be in the future and it is not clear that increased traffic will make it more attractive to the Columbia Valley's hiking population.
6. Jumbo Pass is also an attractive location, but it is not a different destination from thousands of beautiful B.C. destinations. It is separated from the view of the valley base and of the resort location a few kilometers to the north by a shoulder of the mountain, and by the trees during the hike, and despite the hut and some of the other hikers it will maintain a sense of solitude. However, it is unlikely to change substantially its appeal just because it will be possible to drive in greater comfort to it.
7. Not only the Jumbo Creek drainage is different from the National Parks because it does not have the abundance of trails and of access points to special scenic locations and experiences other than by its lifts, but also the only lifts accessing the mountains in the parks during summer, Sulphur Mountain, Lake Louise and Jasper Tram do not lead to any sporting activities and cannot compare to a lift to a large and spectacular mountain top where you can ski or snowboard for weeks.
8. The National Parks lifts and trails do not have a focus of an immediately available activity of tremendous appeal such as a fast access to skiable glaciers.
9. Despite the road improvement that may encourage more people to drive into Jumbo Creek there is no reason to believe that, except perhaps for some use of the Jumbo Pass trail, more people would want to drive up and then not use the fast and affordable means to reach the mountain tops, which are vastly more spectacular and allow to play in the snow.
10. It is wrong to believe that by necessity an improved road increases the number of hikers. It is impossible to make precise comparisons because one cannot find two mountain resorts that are the same, but there are bigger places like Courmayeur, on the Italian side of the Mont Blanc, where the introduction of a freeway has increased the number of lift riders but not that of hikers in any comparable proportion.
11. On the contrary, the population of the Windermere valley that is the major contributor of the hiking population in the area is relatively stable, and it is conceivable that a number of people that would have gone hiking without the resort and its lift access to the glaciers, would forego some of the hiking trips to access the glaciers and the skiing in the summer,

which will be an attractive and affordable alternative.

12. There is a change in the mood of generations, and it is apparent that where access to mountain tops is available by lifts, this acts as a deterrent from the greater effort to access mountain tops by climbing. This phenomenon is particularly noticeable among the new generations in the Alps, where the majority of people have not hiked many of the mountains where their parents went, and that are still without lift access, but have visited more mountain tops than their parents and have skied more locations by means of lifts.

D.3(H) Impacts on Alpine Vegetation

EA Issues Profile

Topic

Implications of ski runs and glacier management techniques for alpine vegetation communities.

Issues

- Impacts of ski runs and glacier use on alpine vegetation and soils, and downstream water quality.
- Impact mitigation measures.

Relevant Project Components

All high elevation on-site project components

Lead Agency

Ministry of Environment, Lands and Parks (MELP) – BC Environment and Lands

Relevant Public Comments on Application and Draft Specifications

- Snow compacted by 1000's of skiers will impact food sources of wildlife. (13f)

Relevant Public Advisory Committee Comments on Draft Specifications

- Re. draft spec. #1 – add potential impacts on yellow-, red- and blue-listed species.

Relevant Proponent Comments on Draft Specifications and Specifications Feedback

- Issue greatly exaggerated. Will place into more reasonable perspective.

- Re. draft spec. #1 – Is unfair. Other resorts (e.g. Panorama) are not required to address issue. Project is designed to contain, not to cause, tourist sprawl, and is not catering to backpackers. There is no evidence that year-round ski resort and sightseeing projects attract backpackers (e.g. compare with Whistler, Banff).
- Re. draft spec. #1 – Proposed runs are already skied without requiring ‘ski run construction’ or glacier modification. Ski run maintenance will be minimal compared to other resorts, with grooming of runs similar to that at Panorama.

Related Issues and Relevant Specifications

- Re. glacier grooming measures, see section C.2.
- Re. related wildlife management issues, see other parts of section D.3.

Additional EA Reporting Requirements?

Yes – see below.

EA Review Focus

MELP has raised the issue of potential impacts on alpine vegetation. The issue of the potential impacts of commercial backcountry developments on sensitive alpine vegetation communities is now being considered during interagency reviews of other backcountry proposals in the region. Increased human traffic can have significant impacts on some of the species and plant communities in alpine areas.

The Jumbo Glacier project is proposed as a four-season resort facility, which raises the prospect of potential non-skiing recreation in the alpine areas which will become accessible via the project’s lift system. Even though the proponent has not specifically identified alpine hiking as an aspect of the project, the area is expected to attract hikers, and hiking would be difficult to control, once, easy access to the alpine has been provided.

Review of Application/Evaluation

The application did not address the immediate and long-term impacts of the project on sub-alpine and alpine vegetative communities. In addition to direct disturbance of these communities associated with the construction of access roads, ski runs, and ski lifts, additional impacts may well be associated with increased spring, summer and fall recreational use of the area by hikers. (Note - Since the proponent has advised the project committee that it has abandoned withdrawn the proposal in its application to develop equestrian facilities at the resort, alpine disturbance associated with equestrian traffic is not of concern to the project committee at this time.)

Historically, environmental impacts associated with backpack hiking and horse

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traffic has been relatively minor in this area. This will likely change (even with horseback riding) if the number of pedestrian recreationists in the area increases and the accessibility of the higher-elevation trails and ridges is enhanced through the construction of a network of lifts and gondolas.

The construction and use of ski runs may have significant direct effects on vegetation and soil, and could lead to soil erosion and sedimentation of streams. Discussion with provincial, federal and US Parks staff would provide some comparative insight into this problem.

Project Report Specifications – D.3(H)

1. The impacts of ski run construction, operation and maintenance, and of increased backpacking and hiking on alpine vegetation and soils, must be assessed in the project report. A commentary on potential impact mitigation measures must be presented.

RESPONSE – D.3(H)

1. This project specification is somewhat misdirected because of a wrong understanding of the size and type of project. It may have been caused in part by the enthusiasm generated with the preparation of the Formal Proposal in 1991 and after the Interim Agreement in 1993, when a variety of consultants, experts and project enthusiasts increased the project proposal with activities that were not part of the original concept and distracted the public perception from the focus of the project, which is skiing and sightseeing from mountain tops reached by means of lift by tourists who are not involved in hiking and other alpine activities.

There is also a misunderstanding regarding ski runs. Most of the ski area to be accessed by the lifts is represented by snow covered glaciers and moraines, which require no construction or modification, except for snow grooming and compacting for safer and easier skiing. A good part of the area of ski runs that come into contact with the forest is in relatively sparse forest that has already been gladed by the heli-ski company, and through ski runs that have already been cut by the heli-ski company. There will be small areas where the lower ski runs will be connected or changed in the forested sections, but there is no plan or need to “construct” ski runs by clearing and recontouring the slope. Where it is not possible to align the routes around existing stands of trees, the trees will be flush-cut so that the roots will remain to stabilize the soil.

When the ski runs are in use they are abundantly covered with snow. Thus, there should be little or no impact on vegetation from compaction or grooming.

In the event that any areas of bare soil are present after run preparation or following snowmelt, the areas will be re-seeded with an appropriate seed mix. The seed mixture(s) will include species that are adapted to the climate and soil conditions of the region. Seeds will be obtained from local native sources wherever possible. If it becomes necessary to use non-local seed sources, only mixtures that are certified as weed-free will be used. A complete revegetation plan is presented in Appendix 3-C Environmental Management Plans.

Backpacking/hiking in the Jumbo Valley and adjacent areas is expected to be minor because the resort is designed to focus on summer skiing rather than other recreational activities. The resort will have only one constructed trail, which will lead to Glacier Dome and will not connect to the

Jumbo Pass Recreation Trail. Thus, it is unlikely that the resort will attract guests whose primary purpose is a wilderness backpacking/hiking experience. Furthermore, the Proponent plans to collaborate with local interests to discourage increased backcountry use by requiring any guest who may want to enjoy a wilderness hike to do so only if escorted by a qualified guide. The project is designed to give an opportunity to people from many origins, but particularly to urban dwellers to ski and see the mountains. It is not expected to have a significant clientele of hikers and backpackers. Please also refer to Project Report Specification D.3(G) and E.5(A).

Regarding access, whether the existing road is improved and paved or not is not expected to make a significant difference for the people who want to go backpacking into the wilderness. The improved road will not change the fact that the only available trail will remain the Jumbo Pass trail. The Jumbo Creek drainage will only have another trail leading from the resort to the top of Glacier Dome, and the trail destination will also be serviced by a gondola. The rest of the drainage does not lend itself to hiking destinations, as the sides of the mountains are impervious and lead to steep and dangerous mountain faces that are not recommended for climbing.

However, there is some potential for damage to alpine vegetation from construction and use of the trail to Glacier Dome. Therefore, trail construction guidelines have been provided and a Trail Management Plan has been prepared to avoid or mitigate potential impacts.

The trail route will be selected to maximize hiking over bare ground or plant species that are most resilient to disturbance. The trail will be constructed through habitat/vegetation types in the following order of preference (from most desirable to least desirable route) (Butler *et al.* 2003):

- Rocky Ground
- Bare Ground
- Graminoids (grasses, sedges & rushes)
- Herbs & Forbs (Plants with buds below the soil surface)
- Geophytes, i.e. yellow glacier-lily & queen's cup
- Plants with buds at the soil surface
- Hemicryptophytes, i.e. alpine pusseytoes & scarlet paintbrush
- Woody or Herbaceous Plants with buds above ground
- Chamaephytes, i.e. kinnikinick, pink mountain heather
- Woody Plants with buds a great distance above the ground
- Phanerophytes, i.e. dwarf blueberry, mountain huckleberry

The trail will avoid areas with permanently or frequently saturated soils, where the potential for erosion and damage to vegetation is highest.

The following management plan for hiking trails will be implemented:

- The trail will be clearly marked, including fencing in particularly sensitive areas, to deter off-trail use
- Signs will be posted to inform trail users of the sensitive nature of alpine ecosystems and potential for damage from off-trail activities.

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- Picking wildflowers will be prohibited.
- Any interpretative staff guiding visitors on trails will inform hikers of the potential damage caused by off trail activities and picking wildflowers.
- Visitor information centre staff members will hand out information on trail etiquette and the protection of alpine and other sensitive ecosystems. Trained staff will be available to answer visitor questions.
- Resort staff will regularly patrol the trail to look for signs of vegetation damage (trampling, corner-cutting, unauthorized new trails). Portions of the trail may be closed temporarily if the damage appears to be significant. In cases of severe damage, reseeding with an appropriate seed mixture may be necessary.
- Trail use may be restricted based on seasonal conditions. For example north facing slopes and other areas of late-lying snow should be avoided early in the season, or until these surfaces are less water saturated.
- If there is an ongoing issue with damage to sensitive plant communities, access to some backcountry areas may be restricted using a permit system.
- Resort staff will be required to set an appropriate example for guests by adhering to the trail use rules.

In addition, the following plans have been prepared to mitigate other potential vegetation impacts:

- Tree Protection Plan
- Sensitive Ecosystem Protection Plan
- Monitoring Plans to Measure Success of Revegetation

These plans are described in detail in Appendix 3-C Environmental Management Plans.

D.4 Forest Resources

The forest management topics which are addressed in section D.4 are:

- potential impacts of project development on harvestable timber - section D.4(A); and
- the implications of project development for the Forest Land Reserve - section D.4(B).

D.4(A) Harvestable Timber Impacts

EA Issues Profile

Topic

Implications of project development for harvestable timber volumes.

Issues

- Potential for increased visual management requirements in timber harvesting, both at project site and along Jumbo/Toby corridor.

- Potential (if any) for consequential incremental restrictions on logging activity.

Relevant Project Components

All on-site and off-site project components within Toby/Jumbo Creek drainage.

Lead Agency

Ministry of Forests (MoF)

Comments also Received From

Forest Land Commission (FLC)

Relevant Public Comments on Application and Draft Specifications

- Valley is not pristine, but trees will grow back, once logged. In meantime, other cut-blocks are being laid-out in area, which will continue to be harvested until re-growth of first cut is completed, at which time it will be cut again, unless a different economy has emerged that is not dependent on logging. (17o)
- Projects of this scale should be planned using MoF's Total Resource Planning system.

Relevant Public Advisory Committee Comments on Draft Specifications

- Re. draft spec. #1 - add to 2nd sentence "...Impacts of altered forest development costs, *including job gains and losses*, to achieve..."
- Re. draft spec. #1, add to last sentence "...affected area, *the loss of old growth*, and will..."

Relevant Proponent Comments on Draft Specifications and Specifications Feedback

- Draft specs are excessive. Panorama resort is not required to address issue.
- Proponent has no intention of restricting logging in nearby drainages.

Related Issues and Relevant Specifications

- Re. land use and related land use planning issues, see section A.7.
- Re. significance of Forest Land Reserve status of project site, see section D.4(B).
- Re. economic profile of regional project setting, see section E.1.

- Re. broader visual management issues, see section E.5(C).

Additional EA Reporting Requirements?

No – draft spec. eliminated, given clarification of provincial visual management regime.

Evaluation

The upper Jumbo Creek valley, which is directly affected by this proposal, includes approximately 1000 hectares (ha) of harvestable timber land base. This represents approximately 0.4% of the supply of timber within the local Timber Supply Area (or TSA).

There is approximately 175,000 m³ of mature wood which, in the short term, would sustain the licensee for about nine months.

Following timber harvesting in the early 1970s, and subsequent burning, silvicultural investments have been made in the 1980s to maintain a productive forest. Approximately \$300,000 was spent on spacing overstocked thickets, while about \$200,000 was spent on planting. The December 13, 1996 draft specifications had speculated on the possibility that these investments could be largely lost if strict visual management objectives (in the form of Visual Quality Objectives or VQOs) are to be set to accommodate a busy travel corridor (the upgraded access road), should the development proceed. However, provincial visual management policy has been clarified since the draft specifications were released, and draft specification D.4(A)#1 is now inconsistent with that policy. VQOs are not to be set for this area, and the access road corridor between the Panorama ski resort and upper Jumbo Creek will not be designated a visually sensitive corridor. Thus, the project committee has deleted any reporting requirements with respect to this issue. MoF considers that the specifications in section D.4.B are sufficient to address any economic impacts of project development on timber harvesting.

More specifically, there may be public pressure to increase Visual Quality Objectives (VQOs) for the corridor between the Panorama ski resort and upper Jumbo Creek, and perhaps also in the Farnham Creek valley. If VQOs were to be raised, the impacts on harvestable volumes are difficult to estimate accurately. However, MoF has crudely estimated approximately a similar level of impact on available timber volumes (i.e. another 0.4%).

MoF has not concerned itself at this stage of review with the administration of cutting approvals required for development, nor transitory considerations with respect to the construction associated with any road upgrading. MoF has advised the project committee that such issues are relatively minor and can be addressed satisfactorily at the permitting stage, if the project is approved at the conclusion of the EA process.

Project Report Specifications – D.4(A)

No further EA or permitting requirements specific to this issue (see above).

D.4(B) Forest Land Reserve (FLR)

EA Issues Profile

Topic

Significance of Forest Land Reserve (FLR) for project development.

Issues

- Purpose of FLR, and role of Forest Land Commission in review of required local government Official Community Plan and zoning bylaws.
- Need to determine current forest land quality, and forest management plans of forest tenureholders.
- Potential for direct and indirect reductions in harvestable timber volumes, associated with direct loss of land base and indirect influences such as enhanced visual management requirements and increased wildfire hazard.

Relevant Project Components

All on-site and off-site project components within Toby/Jumbo Creek drainage.

Lead Agency

Forest Land Commission (FLC)

Comments also Received From

- Ministry of Forests (MoF)
- Regional District of East Kootenay (RDEK)

Relevant Public Comments on Application and Draft Specifications

- Valley is not pristine, but trees will grow back, once logged. In meantime, other cut-blocks are being laid-out in area, which will continue to be harvested until re-growth of first cut is completed, at which time it will be cut again, unless a different economy has emerged that is not dependent on logging. (17o)

Relevant Public Advisory Committee Comments on Draft Specifications

- Re. draft spec. #2 - add to 1st sentence "...of both indirectly (*including infrastructure*) and directly..."
- Re. draft spec. #2 - add to 1st bullet "...to ski facility development *and infrastructure development*..."
- Re. draft spec. #6 - add to last sentence "...and in the future, *and its needs for transitional employment*..."

Relevant Proponent Comments on Draft Specifications and Specifications Feedback

- Re. draft specs. #6 and #7 – proponent and visitors will not be anti-logging. Whistler and Fairmont resorts grew without interfering with logging.

Related Issues and Relevant Specifications

- Re. land use and related land use planning issues, see section A.7.
- Re. timber harvesting issues, see section D.4(A).
- Re. economic profile of the regional project setting, see section E.1.
- Re. visual quality management issues, see sections D.4(A) and E.5(C).
- Re. wildfire hazard management issues, see sections C.4 and E.6(E).
- Re. local governance of the resort - see section F.2.

Additional EA Reporting Requirements?

Yes – see below.

Evaluation

Forest Land Reserve (FLR)

The *Forest Land Reserve Act (FLR Act)* came into effect in July of 1994, with the intent of creating a legislative framework for protecting the commercial forest land base of the province by establishing the Forest Land Reserve (FLR). The FLR is administered by the Forest Land Commission (FLC), which is based in Burnaby.

Legislative Context

The legislative basis for the FLC's interest in the review of the Jumbo Glacier project is section 4 of the *FLR Act*, which states that:

“...The object of the commission is to minimise the impact of urban development and rural area settlement on forest reserve land and to work to this end with local governments, first nations and other communities of interest...”

This object is reinforced by section 17 of the *FLR Act*, which states:

“...(1) A local government must not

(a) adopt a bylaw under any enactment, or

(b) issue a permit under Part 21 or 29 of the Municipal Act

that would have the effect of restricting, directly or indirectly, a forest management activity relating to timber production or harvesting

(c) on land that is forest reserve land, or

(d) on managed forest land other than forest reserve land, so long as the managed forest land continues to be used only for that purpose.

(2) For certainty, this section applies if the bylaw or permit would have the effect described in subsection (1) even though the bylaw or permit does not directly apply to land referred to in that subsection...”

Section 13 of the *FLR Act* identifies the permitted uses within both the private land and Crown land portions of the FLR. Land use on the Crown portion is defined by the *Forest Act* and the *Forest Practices Code of BC (FPCBC) Act*, while the *FLR Act* and Regulations define permitted uses on the private land portion. Since the resort proposal lies on Crown land, section 13(1) of the *FLR Act* applies.

The FLC points out that, where a proposed use of Crown land in the FLR cannot be accommodated under the *Forest Act* or the *FPCBC Act*, by way of either lease or use permits, the land must be removed from the Provincial Forest by Ministerial Order. At the same time, Cabinet must decide whether or not to approve the removal of the land from the FLR by Order-in-Council under section 25 of the *FLR Act*, following receipt of the FLC’s recommendations and comments.

If the land is not removed from Provincial Forest and FLR concurrently, and prior to the issuance of any Crown grant or direct sale, the land may then be considered to be private land within the FLR, and section 13(2) would apply, whereby the FLC would define allowable uses. At that point, an application to the FLC would be necessary under section 14 for the proposed use, or under section 18 for removal, and the FLC would have the sole discretion as to approval or refusal of the proposed use.

Any construction of utilities through the FLR would require the approval of the FLC under section 14, or their removal under section 18.

Thus, the interest of the FLC is focused on the reduction or restriction loss of the land base dedicated to for commercial forest operations, whether from Crown or private land, and whether or not this loss is due to the direct effect of through formal removal from the FLR for non-forestry uses, or as a result of the indirect inhibiting effect of neighbouring land uses.

Land Status

The Jumbo Glacier project is sited on lands almost all of which fall within the Windermere provincial forest (other than a MELP (BC Parks) map reserve (#0160300), issued under the *Land Act*, and covering centred over the Lake of the Hanging Glacier). Under Order in Council 0821, enacted on July 13, 1995, all land in the provincial forest which is the subject of the March 1995 *East Kootenay Land-Use Plan* falls within the FLR.

At this point in time, it is not clear whether or not, and to what extent, it may be necessary to remove land from the provincial forest, and hence from the FLR, if the development proceeds. While, at the Panorama resort, the entire area of the ski area Master Plan has been removed from provincial forest (and hence, is not part of the FLR), provincial policy is still evolving on this issue, and it may be that only newly-created private land would be removed from the provincial forest/FLR at the Jumbo Glacier resort at the time that it is Crown-granted.

Significance for EA Review of Jumbo Glacier Project

In any event, the intent over the longer term is to create fee simple parcels of land in the vicinity of the ski resort base, which will then be subject to local government zoning. If that eventuality occurs, any local government bylaws (Official Community Plan or zoning bylaws) would be subject to the scrutiny of the FLC to determine the extent of possible loss of the productive forest land base. The area is currently subject to RDEK zoning, and is designated A-1 (Rural Resource Zone), which is not inconsistent with the maintenance of ongoing forestry operations. Rezoning would be required before resort development could proceed.

It is important for the proponent and local government to be aware of the implications of section 17 of the *FLR Act*. While the FLC has had little experience to date in dealing with section 17, it anticipates that issues which may require attention as part of the EA review could include any pressure to protect the new ski settlement community from the impacts of forestry-related noise and dust, and the visual impacts of forest management activities. For its part, the FLC would be anxious to ensure that, if the resort project proceeds, there would be little or no effect on the ability of forest companies to access the timber in the area.

Under the *FLR Act*, any measures to protect the resort from forestry-related disturbances must be achieved in a manner which does not limit the adjacent forest management activities themselves. Perimeter buffering provisions need to be carefully examined, and must be built into the design of the community before development proceeds, since it may not be possible retroactively to adopt measures such as noise reduction initiatives and restrictions on the hours of forestry operations after community development is underway. This may also apply to the ongoing use of the access road for timber haul, and mitigation measures must be addressed there also.

The project committee recognises the necessity of involving the FLC in the EA review of the project, and addressing its interests and concerns as far as is possible prior to any government certification decision. In that way, if the project is approved, there will be minimal risk of significant new issues, either for the proponent or for local government, which will have to consider a new OCP and zoning bylaw changes to accommodate the project.

Specific Issues

The FLC has advised the project committee that its issues of concern with respect to the project are as follows:

- direct removal of Provincial Forest land from the FLR - some components of the physical facilities (resort base, roads, lifts and ski runs) will remove land from the inventory of lands dedicated to forestry;
- indirect impacts of project development – one concern is, including the potential removal from forest production of surrounding lands within the sphere of influence of the development (for example, any forested areas which are visible from the resort [i.e. from the resort base, lifts, ski runs and access road] may be subject to pressure for removal from the operable forest because of pressures to protect natural viewscapes);
- potential restriction of the use of the access road for forestry purposes - for public safety or other reasons, as the road becomes more heavily used by resort visitors (since this may tend to further restrict forestry operations); and
- the potential for the resort project to lead to a reduction in overall negative economic impacts on the forest industry of the area in terms of fibre supply to local mills, and related employment impacts of reduced harvesting activity.

MoF is able to provide the proponent with the maps and information necessary for it to respond meaningfully to the issues raised by the FLC.

Project Report Specifications – D.4(B)

1. The proponent, in its project report, must document specific and generalised forest land quality data for areas to be affected not only directly (i.e. by physical development), but also indirectly (e.g. where the operable forest is located within viewscapes which are visible from the resort base, access road or ski lifts/runs). This analysis must include, at minimum, such parameters as site indices, forest capability, logging and replanting history, and species composition.

2. In the project report, the proponent must present data on the total area in hectares of both indirectly and directly affected forest lands, including both resort development areas and infrastructure areas, recorded as a proportion of the area of the local Provincial Forest. Any affected harvesting tenures must be identified, as must the implications for the annual allowable cut (AAC). More specifically, the project report must analyse how removal of land from forest production might affect the operations of forest companies in the area. In calculating the potential land base either affected or entirely removed from forest management, the proponent must include:

- direct reductions in the forest land base due to ski facility development, including on-site facilities and off-site physical infrastructure;
- potential indirect reduction in harvestable timber volumes due to factors such as any enhanced visual management requirements for forestry or increased wildfire hazard at the project site and along the access corridor; and
- restrictions (if any) on forestry-related traffic using the resort's access road.

3. The project report must summarise the current forest management activities on adjacent Crown lands (e.g. the scale of current logging activities and existing plans for future forest management activities, including logging), and where the cut timber in the area is now processed?

4. The proponent should base its reporting with respect to forest land management potential on available information, obtained from either government or adjacent landowners. (Note - In order to avoid misunderstanding, the project committee notes that the proponent is not required to conduct forest management planning on lands for which recognised plans have not already been prepared.)

5. In the project report, the proponent must evaluate the wildfire risk associated with resort construction and operation, and explain how the adjacent forest lands are to be protected from fires started within the community. The present fire protection plan does not address that issue.

6. For the project report, the proponent must assess whether or not local, regional or other mills will be significantly affected by any change to the timber supply? The project report must indicate how many forestry employees (loggers, truckers, etc.) could be affected by any loss of the land base for forest production, both now and in the future, and the industry need for transitional employment.

7. The proponent must present options for mitigating any impacts which have the effect of restricting forest management options on lands outside the development property.

These should include any measures which the proponent could adopt to ensure that the new resort's residents and visitors will be tolerant of logging activities on adjacent lands.

RESPONSE – D.4(B)

1. Boyd Porteous, Manager, Information Systems and GIS, Provincial Agricultural Land Commission reported on July 30, 2003: "There is no private land FLR in the Jumbo Creek valley. The valley is in the Crown FLR, however, under the current legislation this is technically removed awaiting the composition and sign off of an order-in-council." Information available from the Ministry of Forests and Slovan Forest Products indicates that the only logging planned and carried out in upper Jumbo Creek in the last quarter century has been to cut ski runs and to do some glading for the heli-ski company. Site indices, forest capability, logging and replanting history, and species composition data have not been made available in detail by either the Ministry of Forests or Slovan Forest products. In terms of viewsapes it is necessary to distinguish between the Farnham Creek drainage and the Jumbo Creek drainage. Some distant view of future logging operations would exist from the ski runs descending from Commander and Farnham Glacier, but from a tourism perspective this view would be insignificant and less noticeable than the cut blocks that are visible from Whistler Mountain, for example. The upper Jumbo Creek and Glacier Dome ski run would have no visual exposure to future logging operations in lower Jumbo Creek and would have minimal exposure to viewsapes in the Leona Creek drainage, which would be hardly visible because of the distance (five kilometers or more). Viewsapes along the access road would be reviewed under the Forest Practices Code, but the Proponent is of the opinion that its clientele would not be affected by the activities of the contemporary forest industry along the Toby and Jumbo Creek drainages. The access route will not have a significant impact on forestry values as it will utilize primarily existing access corridors of existing roads. Meetings and discussions with Serge Perzeveroff of the Ministry of Forests' office in Invermere indicated that the Ministry and the local forest products company did not consider the impact of the proposed project significant for local operations or for the forest industry in general.

For specific land quality data and analysis please see Appendix 3-L Supplementary Forestry Information.

2. Mr. Rory Hromadnik of Slovan Forest Products was contacted to discuss timber values and the data requirements for this specification in the Jumbo Creek valley. His calculations are attached as Appendix 3-H of this report. The total development area in hectares to be utilized by the resort will be approximately 105 hectares. The ski runs will involve minimal cutting because most of the skiing will be in high alpine terrain and glaciers, and the runs to the resort site have been mostly cut already by the heli-ski company. The impact with respect to the anticipated annual allowable cut (AAC) is rated as insignificant by earlier discussions with the Ministry of Forests. Slovan Forest Products, which in any event would continue to be involved with the management of the forest in the future, has calculated that the Jumbo Creek drainage future timber harvesting land base involved in the Controlled Recreation Area would equal approx. 36% of the total. The actual development area would equal about 10%. Specifically: direct reductions in the forest land base will be approximately 100 ha, potential indirect reduction is negligible and there will be no restrictions to forestry related traffic using the resort access road.

3. Adjacent Crown lands are the Toby Creek and the Horsethief Creek drainages, which have no visual or other relation with the proposed resort, except for a potential use of existing access

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roads. The Toby Creek access road is a public highway which is already managed under the Forest Practices Code. The cut timber is in area managed by Slocan Forest Products, which processes it in its mill operations in the Columbia Valley.

For reporting on current forest management activities please see Appendix 3-L Supplementary Forestry Information.

4. The above noted observations are based on discussions regarding forest land management potential with the Ministry of Forests and with Slocan Forest Products. There are no adjacent landowners. There are some small isolated parcels of land at the old Mineral King Mine site with no significant forestry value.

Please see Appendix 3-L Supplementary Forestry Information.

5. Both fire protection and wildfire risk are addressed in the Master Plan in Volume 7, Governance, Section 7.7.4.7 and 7.7.4.8

6. As discussed above, in the opinion of the Ministry of Forests and of the local forestry company, the project will not significantly affect local or regional mills because of a change of timber supply caused by it. It is not expected that a single job will be lost in forestry because of the project. But the project will create hundreds of jobs that will assist the transitional employment concerns.

7. The resort project will not restrict forest management options on land outside the development property. The resort visitors normally accept forestry activity, as they have done at Whistler in its first twenty five years and as they have done in the majority of the B.C. resorts. It is not reasonable to ask the Proponent to control what the visitors will think, as the Proponent cannot ensure that visitors will be tolerant of logging activities (which in any event in this project will NOT be on adjacent lands as the Project Specifications imply), but experience and regulatory powers imposed in the past indicate that visitors cannot affect forestry operations unless Government staff in some Ministry causes some action to be taken on their behalf. Tourists of ski resorts are not known for opposing forestry operations, even when they were more objectionable as in the past at Whistler. Helicopter skiers that frequent the area are not known for objecting to forestry operations. The Proponent is quite confident that the clientele of the resort will be happy with forestry operations as currently carried out in the lower portions of the drainage.

D.5 Mineral Resources

EA Issues Profile

Topic

Implications of project development for mineral resource use.

Issues

- Identification of mineral exploration activity in vicinity of project site.
- Assessment of any possible restrictions on access of mineral sector to, and use of, mineral lands as result of project development and resulting incompatibility between resort activities and mining.

Relevant Project Components

All on-site and off-site project components within Toby/Jumbo Creek drainage.

Lead Agency

Ministry of Energy and Mines (MEM)

Relevant Public Advisory Committee Comments on Draft Specifications

- Amalgamate draft specs. #2 and #3.

Relevant Proponent Comments on Draft Specifications and Specifications Feedback

- Proponent has no intention of restricting mining in nearby drainages. Proponent will try to preserve as much of area as possible for mining.

Related Issues and Relevant Specifications

- Re. land use and related land use planning issues, see section A.7.
- Re. economic profile of the regional project setting, see section E.1.

Additional EA Reporting Requirements?

Yes – see below.

Background/Evaluation

Current Mineral Tenure and Activity

There are currently no valid mineral tenures within the study area boundary. Figure 1.3.6(b) in *Volume 1* the application is now dated, since claims which are shown there have been allowed to lapse. However, this lack of mineral tenure is not an indicator of low mineral potential or interest. It merely reflects the presence, since August 29, 1991, of a no-staking reserve over the study area. A no-staking reserve is a disincentive to holders of existing claims, and it precludes new claims-staking. The duration of the no-staking reserve has been extended at least twice, and as of May 1998, a further extension is now being considered by MEM. valid until September 1, 1997.

Valid mineral tenures do exist in the area surrounding the project site. Most notably, there is a group of claims immediately west of Black Diamond Mountain (BJ 3, etc.), and another group due south of Black Diamond Mountain (Jumbo 1-34 and Purcell 1). The latter group (Jumbo) is very close to Farnham Glacier.

The Jumbo claim group has been the site of exploration activity. As recently as 1995, Birch Mountain Minerals was exploring a shear system containing barite, lead and zinc, which may be on strike with the Mineral King deposit. That exploration program included geological mapping and shallow backhoe trenching, centred in a small area at the headwaters of Black Diamond Creek, about one kilometre south of Black Diamond Mountain. Surface disturbance is being limited to existing roads. During 1996, exploration (a relatively small geophysical/geochemical/drilling program) has been conducted by Miner River Resources on the Hot Punch prospect, located a few kilometres away near the headwaters of Delphine Creek.

Given the mining history and mineral potential for the area (see below), the proponent should anticipate further claim staking and mineral exploration occurring in the immediate vicinity of the project site in the future.

Project Report Specifications – D.5

1. In the project report, the proponent must locate the boundaries of the no-staking reserve on a map, and must provide a brief history of the reserve.
2. The proponent has already indicated that the project report will reflect the existence of significant mineral potential and current exploration interest in the vicinity of the study area. Earlier suggestions that the project area has been exhaustively explored and that mining cannot make an economic contribution to the region, and is unable to leave the environment in a productive state at the cessation of mining activities (page 61, *Volume 1*), must be revised appropriately. The mineral tenure status in the vicinity of the Jumbo

proposal site (within a 5-km radius) at the time that the project report is filed must be listed and shown on a map (this information was included in the recent application, but needs to be updated and mapped). MEM's district staff would be pleased to provide more background information on mineral potential and current exploration focus, while the Gold Commissioner's Office in Vancouver could provide up-to-date mineral tenure information.

3. The project report must reaffirm that the proponent does not (in its own words): *"...wish to preclude any significant economic gain by the mining industry, and...[is] quite prepared to co-operate so that the project may minimise any adverse effect on the potential of the mining industry..."*

4. The project report must acknowledge that the project, if approved, will entail a long-term withdrawal of land from mineral exploration, with potential economic impacts.

5. MEM is concerned that any exploration and mining activity which is located close to the resort could have visual impacts on the resort or its access corridor, despite best efforts to minimise them. All exploration work proposals would be assessed by MEM (and referral agencies), and all approved work would respect sensitive views as far as possible. Any major mine proposal would itself be subject to the EA process. In the project report, the proponent, if possible, should clarify that all land outside the project site no-staking reserve will be available for exploration and potential subsequent developments, and if not possible, must explain any restrictions which are envisaged.

RESPONSE – D.5

1. The No Staking Reserve (Number 361896) that currently exists reflects the rough size of the original Study Area (except for the Farnham Glacier portion) and goes into part of the Horsethief Creek drainage. The area of the No Staking Reserve may be reduced, in consultation with the Mining Division of the Ministry of Energy and Mines, to the area of CRA or to the proposed resort development area in Upper Jumbo Creek and the part of the drainage that leads to the head waters of Jumbo Creek up to Glacier Dome. The history of the current No Staking Reserve is tied to the approval process of the project. The Formal Proposal was submitted in 1991. When the Province accepted the Formal Proposal and issued an Interim Agreement in March 1993 it also considered the effects of the Study Area that would comprise the future resort and its Controlled Recreation Area for skiing. For this reason the heli-ski tenure was significantly expanded and the area was also marked with a No Staking Reserve. At that time it was thought that within two or three years the Master Plan would be finalized and the area of the No Staking Reserve could be better defined. Please refer to Appendix 3-T for a map of the proposed No Staking Reserve.

2. The Proponent agrees with the objectives of the mining industry and does not intend that the project would adversely affect mining opportunities. As suggested in the letter by Mr. David Terry to the Environmental assessment Office of October 21, 2003, the Proponent recognizes that mining may be permitted in the general areas surrounding the CRA or within certain parts of it. The Proponent is confident that modern technology and sensitive development make possible the coexistence of tourism, in particular skiing, and mining operations. Many skiing locations in North America, in fact, started as mining operations. The 1995 report's statements have been corrected in the current Master Plan and the value and capabilities of the mining industry of today are

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acknowledged. The Controlled Recreation Area has been reduced and the Proponent has updated mining mapping according to current information. A map showing mineral tenure status within a 5 km radius of the resort has been included in Appendix 3-T. For ease of duplication, the mapping is included in 11 x 17 format. Full scale mapping is located in Volume 8: Map Volume of the Master Plan. A map showing an overview of mineral tenures in the surrounding drainages is also included in Appendix 3-T.

3. The Proponent reaffirms that it does not wish to preclude any significant economic gain by the mining industry and that it is prepared to cooperate so that the project may minimise any adverse effects on the potential of the mining industry.

4. The project, as currently planned, minimizes the potential removal of land from mineral exploration. The Proponent acknowledges that the project, if approved, will entail a long term withdrawal of land from mineral exploration, with potential economic impacts.

5. All land outside the reduced project no-staking reserve will be available for exploration and potential subsequent mining development. It is the Proponent's intent to facilitate the cooperation of the mining and tourism sector and to facilitate the mining industry wherever possible.

D.6 Agricultural Resources

EA Issues Profile

Topic

Implications of project development for agricultural activity.

Issues

- Identification of agricultural lands (if any) which may be affected by project development (grazing lands, ALR lands or private agricultural holdings).
- If any such lands are identified, proposed mitigation measures.

Relevant Project Components

Access road and transmission line routing.

Lead Agency

Ministry of Agriculture and Food (MAF)

Comments also Received From

Agricultural Land Commission (ALC)

Ministry of Forests (MoF)

Relevant Public Advisory Committee Comments on Draft Specifications

- Re. draft spec. #1 – add 'including Toby Creek', given livestock grazing in area.

Relevant Proponent Comments on Draft Specifications and Specifications Feedback

- Area is not suitable for livestock grazing, and is not used in that way.
- There is no private agricultural land or ALR land in 'vicinity of infrastructure developments'.
- 'Utility corridors' consist of existing road flanked by power and telephone lines.

Related Issues and Relevant Specifications

- Re. land use and related land use planning issues, see section A.7.
- Re. economic profile of the regional project setting, see section E.1.

Additional EA Reporting Requirements?

Yes – see below; draft spec. expanded to add focus to local grazing tenure.

Background

MAF evaluates development proposals to determine whether or not there is any potential for adverse effects only impact agricultural activity as a result of:

- infrastructure development (including corridors for transportation, electricity, etc.) which passes through, or otherwise affects, land in the Agricultural Land Reserve (ALR);
- expansion of existing corridors or creation of new corridors which pass through Crown land used for livestock grazing purposes;
- displacement of wildlife populations or measures to mitigate wildlife disruptions which may affect livestock grazing, diminish future farming opportunities or increase livestock management requirements and operating costs; and
- increased development activities which may lead to expanded noxious weed invasion.

Evaluation

Access Road and Agricultural Land Reserve (ALR)

Between Invermere and the Panorama resort, the access road passes through the ALR. The most upstream extent of the ALR is Lot 9244. This road has had some impacts on ALR lands. Increased use of the road could heighten these impacts, if associated with road upgrading (e.g. widening, straightening, etc.). Increased traffic also makes it more difficult to cross the road with livestock or agricultural vehicles.

The potential for such issues in this case needs to be examined. It is not clear to what extent any upgrading of this section of road would be needed specifically for the Jumbo Glacier project, given that MoTH and the Panorama resort are already engaging in discussions with respect to an upgrading program to accommodate that resort's current expansion.

Livestock Grazing Issues

MoF allocates grazing licenses on Crown land. It has maps which show currently used grazing areas, and is aware of grazing potential in areas which are not currently used. Where grazing lands are affected by an access road, livestock may tend to move around more (e.g. to graze on road-side forage). Managing the impacts may entail requirements for fencing, cattle guards, etc. as public use of grazing lands increases. Control of noxious weeds can also become a more significant problem.

This area is under both a guide/outfitter's license and grazing permit, held by the same person. He grazes his horses along the access road corridor, including the Jumbo Creek area (mostly just above the gate on the Jumbo Creek Forest Service Road). The proponent, in assessing potential impacts on this grazing activity, is advised to consult with the grazing tenure holder, but if such discussions are not possible for any reason, it should use its best efforts to provide an independent assessment.

Project Report Specifications – D.6

1. In the project report, the proponent must identify any Crown land livestock grazing areas, ALR lands and private agricultural lands in the vicinity of the project's infrastructure developments (e.g. road access, parking and utility corridors, etc.). To the extent that any such lands and agricultural activities are present in the vicinity of the access corridor, the proponent, in the project report, must assess those impacts and identify measures to mitigate them. If suitable arrangements can be made, the proponent should discuss issues raised by project development with the local grazing tenure holder in the Toby/Jumbo valley corridor.

RESPONSE – D.6

The available information indicates that the project area is not within current Crown Range Use areas for livestock grazing. This would be unusual for elevation 1700 meters and above, in a working forest. There is no history of grazing along the access road either. All available information and mapping indicates that the area is not part of the ALR. The access road also does not come near ALR land. The drainages affected are part of the working forest and available mapping indicates that there is no ALR reserve.