Monitoring Land Use Planning to Maintain Grizzly Bears: A Partial Problem Analysis with 2010 Reconnaissance Survey Results for Grizzly Bear Habitat and Access Control, Babine River Watershed (BWMT Project 2009-3)

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Executive Summary

Chapter 1: General Introduction

More than two decades ago, in response to a controversial plan for forest development, land use planning was initiated for the Babine River watershed. Located in north central British Columbia, the river freely flows from Babine Lake (B.C.'s largest natural lake) for 95 km to the Skeena River and then to the Pacific Ocean, approximately 360 km. The watershed is within the traditional territories of the Nat'oot'en (Lake Babine) and Gitxsan First Nations. It is also within the Skeena Region, Skeena–Stikine Forest District and it includes portions of the Bulkley and Kispiox timber supply areas. The river corridor is highly valued for First Nations' food and commercial fish harvest, wilderness character, world-class steelhead fishing, salmon fishing, whitewater river expeditions, and wildlife viewing, particularly for grizzly bears (*Ursus arctos*). Overall, the watershed is rich, from economic, environmental, cultural and social perspectives, inspiring passions that led to conflicts.

Initiated in 1991, planning emerged from an exploration of options for development. The Babine Technical Advisory Committee (Babine TAC, an interagency, multi-stakeholder group) made a consensus decision for a compromise option that would allow access to the area for forestry while maintaining wilderness qualities along the river (Ministry of Forests [MOF], Ministry of Environment [MOE] and Babine TAC 1991). They rejected an option that favoured wilderness values and another that favoured timber development. The area of focus was a ten-kilometer wide band encompassing most of the Babine River within a wilderness zone, approximately 1 km on each side of the river; and a special management zone, approximately 1 km on each side of wilderness zone. Conditions included direction to legislate part of the plan area as wilderness, implement a regulated access plan and emphasize monitoring. With this, a general course was set.

In 1994, MOF and Ministry of Environment, Lands and Parks (MELP) initiated the first planning process with the support of the Babine TAC and in consultation with various stakeholders to produce an interim landscape level plan with objectives and management prescriptions for development of the area, focusing on forestry. This process, initiated before provincial direction for land and resource management plans had been completed, produced the *Babine River Interim Local Resource Use Plan* (*Babine LRUP*, MOF and MELP 1994a). Management direction in this plan was subsequently endorsed and deferred to by two consensus-based, multi-stakeholder planning table processes for a sub-regional (higher) level of planning, producing the Kispiox Land and Resource Management Plan (*Kispiox LRMP*, Kispiox Land and Resource Management Planning Team [KLRMPT] 1996, amended 2001) and *Bulkley LRMP* (Bulkley Valley Community Resources Board Interagency Planning Team [BVCRBIPT] 1998). Both provided direction to designate the Babine River wilderness zone as a provincial park, subsequently established in 1999.

In 2002, the Province of B.C. initiated a major regime shift moving from the Forest Practices Code prescription-based forest management model to a result-based professional reliance model. In the latter, government sets legally binding objectives for land and resource

management and forest industry identifies strategies to achieve them in forest stewardship plans.

Grizzly bears figured prominently throughout all stages of subsequent planning. The planning for this area now covers 4,024-km^2, the entire river portion of the watershed, which includes expansions made in the LRMP process.

The Babine Watershed Monitoring Trust (BWMT) was established in 2005. A major function of the trustees is to plan, prioritize, direct, facilitate and fund impartial monitoring of land use plans and related natural resource management activities (BMWT 2005). In the same year, a Babine Watershed Monitoring Framework was developed (Price and Daust 2005a, 2009; Osborn 2009). This innovative endeavour facilitates transparent decisions to establish priorities for monitoring by linking indicators (e.g., road density, km/km^2) to strategies (e.g., avoid road development in specified areas) to plan objectives (e.g., minimize human–bear interactions; Price and Daust 2005a). Using the framework, researchers can formulate knowledge-based hypotheses about the probability of achieving specified objectives as a function of changing values for selected indicators. The trustees use it to prioritize land-use plan objectives for monitoring and research. All reports are publicly available (http://www.babinetrust.ca/).

This report is based on the Babine Watershed Monitoring Framework concept and it provides a partial problem analysis using the policy sciences approach to problem solving. I examine the grizzly bear knowledge base and how it has been utilized in the land use planning component of the decision making process (Clark 2002); and a 2010 reconnaissance survey for important grizzly bear habitat and access control points (ACP) for access management zones. Initiated as a small contract to monitor land use objectives for grizzly bear habitat, out of necessity this project evolved into an extensive examination of land use planning for grizzly bears in this area.

The overall goal of this project was to support monitoring for the implementation and effectiveness of land use planning for achieving management and conservation goals to maintain grizzly bears over the long term in the BWMT area of interest.

The objectives were to conduct a

1. Provisional assessment of the knowledge base for grizzly bears and their habitats to identify available information and estimate reliability for decision-making support.
2. Review of land use planning for grizzly bears with focus on objectives and associated strategies for their habitat and access control to better determine how the knowledge base (Objective 1) was incorporated into land use planning.
3. Preliminary monitoring survey to examine implementation and effectiveness of strategies to maintain important grizzly bear habitat and reduce undesirable human–bear interactions focusing on important grizzly bear habitats and access control points identified in land use planning.
4. Preliminary assessment of implementation and effectiveness monitoring of land use planning specific to grizzly bears to support the development of methods for monitoring.

Reporting for this project includes

1. *Monitoring Land Use Planning to Maintain Grizzly Bears: A Partial Problem Analysis with 2010 Reconnaissance Survey for Grizzly Bear Habitat and Access Control, Babine River Watershed* (this report)
2. *Appendix 1. History of Land Use Planning for Grizzly Bears in the Babine River Watershed: Goals, Objectives, Strategies, Indicators and Targets* (Wellwood 2014a)
3. *Appendix 2. Detailed Results for 2010 Reconnaissance Monitoring Survey for Grizzly Bear Habitat in the Babine River Watershed* (Wellwood 2014b)
4. *Appendix 3. Detailed Results for 2010 Reconnaissance Monitoring Survey for Access Control in the Babine River Watershed* (Wellwood 2014c).

These build on previous monitoring of land use planning for grizzly bears reported in *Monitoring Land Use and Human Activities and Assessing their Potential Effects on Grizzly Bears in the Babine Watershed Monitoring Trust Study Area: Phase 1 Preliminary Analysis of Road Development and Access and Proposed Framework for Monitoring* (Wellwood and Pfalz 2009). Ciarniello et al. (2012) reports human–grizzly bear interactions and bear awareness education baselines for this area.

Chapter 2: Review of Knowledge Base

A solid understanding of the knowledge base for grizzly bears and their habitats was considered essential to complete this project. I reviewed

- Two landscape-level studies to determine grizzly bear food habits and habitat use
- Three projects to complete landscape-level ecosystem mapping with grizzly bear habitat interpretations, one of which was completed in stages (three versions)
- Eight studies to investigate grizzly bear habitat at local or site levels
- One study to assess potential impacts to grizzly bear habitats and populations associated with various options for development of a mainline logging road accessing areas north of the Babine River
- A multi-year project attempting to detect grizzly bear population trend in landscape level monitoring for grizzly bears
- A project to support human–bear management in an area of the upper Babine River.

Area-specific knowledge regarding grizzly bear ecology and behaviour was found to be relatively limited from a scientific perspective. Some of these projects subsequently formed the basis of grizzly bear habitat polygons presented in land use planning (see Chapter 3). All but one of these numerous projects were limited in scope and/or duration; known or apparently completed with limited time and resources; or discontinued before completion. The *Predictive Habitat Mapping with Grizzly Bear Habitat Suitability Ratings for the Kispiox and Cranberry Timber Supply Areas* project was the most comprehensive endeavour completed. Collectively, these resources provide valuable sources of information and suggest a relatively unique ecotype of grizzly bears, as compared to those that have been well studied in other areas of their range in North America.

Some Key Findings

Landscape Level Grizzly Bear Food Habits and Habitat Use

Best available information regarding grizzly bear food habits and habitat use is for the Kispiox TSA portion of the study area (MacHutchon and Mahon 2003). Unfortunately, this study was discontinued before its planned completion.

Landscape Level Grizzly Bear Habitat Mapping

- Best available grizzly bear habitat mapping is the 2003 version of Predictive Habitat Mapping (PHM, Mahon et al. 2004), completed for the Kispiox TSA portion of the monitoring area.
- Grizzly Bear Habitat Complex Mapping, Kispiox Forest District (Mahon 2003a). This report provides information for grizzly bear habitat complexes in areas of the Kispiox Forest District that are outside of the West Babine SRMP area.
- Earliest mapping products (i.e., biophysical and grizzly bear habitat mapping completed for Babine River Interim LRUP) were precursors to methodology based on standards established by the Resources Inventory Committee (RIC). With the exception of projects culminating in Mahon et al. (2004), I did not find any that were revisited or updated.
- Benchmarks, against which grizzly bear habitats were rated, were not defined for some projects or were inconsistent among mapping projects when they were defined. Due to differences in methods used, these projects cannot be directly compared with each other.
- Some specific limitations of interpretive mapping for grizzly bears and examples of early assumptions that are now known to be or are likely to be invalid are presented.
- Consideration for Bulkley TSA portion: Best available information for the Kispiox TSA portion provides useful information to support decisions about how to proceed with landscape level habitat management in the Bulkley TSA portion.

Area-Specific Grizzly Bear Habitat Mapping

Field Investigations for the Development of a Bear-Human Conflict Management Plan for the Southern Park Access Area of Babine River Corridor Provincial Park (Wellwood 2008) provide best available information for the Bulkley TSA portion of the BWMT area of interest. However, this project only covered a small area.

Guidelines for Forest Management at an Operational-Level

Mahon (2003b) *Kispiox Focal Wildlife Species Management Guidelines: Grizzly Bear.* The target audience for this document was operational forest planners. This was a draft document that was not carried forward by others for collaborative input.

Summary of Provisional Assessments

A summary of provisional assessments for ecosystem mapping and interpretations for grizzly bear habitat completed is provided in the following Table.

Table. A summary of provisional assessments of landscape-level ecosystem mapping and interpretations for grizzly bear habitat completed for the BWMT.[1]

Map Resources	Reported In	Assessment[2]
Babine River Interim LRUP Area		
Biophysical Mapping	Lea and Kowall (1992)	• Reconnaissance level • Low reliability
Interpretations for Grizzly Bear Habitat	Simpson (1990, 1992)	• Reconnaissance level • Low reliability
Bulkley LRMP Area		
1995 Wildlife Habitat Mapping in *Bulkley LRMP*	Unknown	Methods unknown. Does not appear to have been used in subsequent planning.
Kispiox LRMP Area		
Wildlife Habitat Suitability Mapping for Kispiox Forest District in *Kispiox LRMP*	Turney (1996)	Only reference found for this mapping. Does not appear to have been used in subsequent planning.
Upper Nilkitkwa Area		
Terrestrial Ecosystem Mapping	Oikos (1998)	• Reconnaissance level • Low reliability
Interpretations for grizzly bear habitat	Keystone Wildlife Research (1999a, 1999b)	• Reconnaissance level • Low reliability
Kispiox Forest District Area		
Habitat Suitability Mapping for Grizzly Bears (2000-2001 version, precursor to predictive habitat mapping)[3]	Ministry of Forests and Ministry of Environment (2001)	Predictive Habitat Mapping • Reconnaissance level • Low reliability
		Interpretations for Grizzly Bear Habitat • Reconnaissance level • Low or Moderate reliability
No report (2002 version, used in Mahon and Marsland 2001)[3]	In Mahon et al. (2003a)	Predictive Habitat Mapping • Reconnaissance level • Low or Moderate reliability
		Interpretations for Grizzly Bear Habitat • not assessed
Predictive Habitat Mapping with Grizzly Bear Habitat Suitability Ratings (2003 version)[3]	Mahon et al. (2004)	Predictive Habitat Mapping • Detailed level • Moderate or High reliability
		Interpretations for Grizzly Bear Habitat • Detailed level • Moderate or High reliability

[1] A provisional assessment of reliability was conducted for the purpose of this study only.
[2] Reliability for the purpose of locating specific habitat types or important grizzly bear habitats on the ground.
[3] Three versions of this mapping were completed (in 2000-2001, 2002, 2003).

Chapter 3: Review of Land Use Planning

I reviewed twenty-five planning documents of relevance to grizzly bears and their habitat that provided management direction for land use, coordinated access, recreation access, human–bear interactions and the park; and established legal objectives for land use. Six of these are summarized in the land-use planning component of the BWMT Framework (Price and Daust 2004). I did not review forest stewardship plans.

Some Key Findings

The Origin of Land Use Planning

The LRMPs deferred to the *Babine River Interim LRUP* and *Interim Babine River Coordinated Access Management Plan, Bulkley Portion* (*Interim Babine River CAMP, Bulkley Portion*); therefore, it is essential to include these documents in the BWMT Land Use Plan Summary and consider them for monitoring for grizzly bears.

Babine River Interim LRUP

- The *Babine River Interim LRUP* stated that the Wilderness Zone protected grizzly bear habitat and that a study was in progress to determine objectives for this zone (MOE, MOF and BTAC 1994).
- Two treatment units were specific to grizzly bear habitat, high value grizzly bear habitat (also referred to as important grizzly bear habitat, Treatment Unit 4) and moderate value grizzly bear habitat (Treatment Unit 5). Management prescriptions specific to grizzly bears were provided for these units. For mixed forest management (Treatment Unit 4a), management direction for grizzly bears was less clear with conflicting information that made it difficult to determine if it was intended to be a discrete unit or a sub-unit of Treatment Unit 4. Management direction specific to grizzly bears was also provided for Treatment Unit 1 (i.e., riparian ecosystems, upland buffer/movement corridors) and high value grizzly bear habitat types fitting specified criteria encountered in Treatment Unit 6. No management direction was provided for grizzly bears in Treatment Unit 2 but high value habitat was identified for this unit in Appendix 7.
- Grizzly bear habitat polygons in Appendix 12 were based on Simpson (1990, 1992).
- High value grizzly bear habitats were probably mapped within areas delineated as Riparian Ecosystems, Forest Ecosystem Networks and Babine River Corridor Provincial Park but they were not delineated within these map units in the Appendix 12 map.
- Of all planning, management direction in this plan most closely reflected recommendations originally provided by Simpson (1992) for grizzly habitat.
- This interim plan was not revisited for the entire plan area. The Ministry of Sustainable Resource Management (MSRM, 2004a) stated that the *Xsu gwin lik'l'inswx: West Babine Sustainable Resource Management* Plan (*West Babine SRMP* hereafter) was "intended to implement the objectives of the Kispiox Land and Resource Management Plan and the Babine Interim Local Resource Use Plan within the area of the Kispiox Timber Supply Area" (MSRM 2004:p. iii); whereas, no updates to interim planning have been completed for the Bulkley TSA portion. This resulted in a major divergence in management trajectories.

Planning Direction for Grizzly Bear Habitat

- All land use plan maps for grizzly bear habitat are based on knowledge resources that I provisionally estimated as reconnaissance level with low or moderate reliability for the probability of predicting important grizzly bear habitat on the ground.

Changes in Planning Direction for Grizzly Bear Habitat

- Bulkley LRMP portion: For area within Babine River Corridor Provincial Park (Sub-unit 2-1) and the Babine River Special Management Zone 2 (Sub-unit 2-2), the *Bulkley LRMP* deferred to guidelines set out in the *Babine River Interim LRUP*. For the Babine River Integrated Resource Management Zone (Sub-unit 2-3), the *Bulkley LRMP* deferred to the *Babine River Interim LRUP* and *Interim Babine River CAMP, Bulkley Portion*.
- Kispiox LRMP portion: The *Kispiox LRMP* deferred to the *Babine River LRUP* for Babine River Corridor Provincial Park, Babine River Valley — Scenic/Recreation/Habitat Special Management Zone and management of grizzly bear habitat.
- Objectives and strategies for habitat types and treatment units were carried forward, to varying extents, from the *Babine River Interim LRUP* to subsequent planning documents relevant to the management of grizzly bear habitat. Some major changes were made. Some objectives and strategies of interest were dropped.
- Earliest land-use planning products were precursors to (i.e., *Babine River Interim LRUP*, *Bulkley LRMP*, *Kispiox LRMP*) or did not incorporate (e.g., *Babine Landscape Unit Plan* [*Babine LUP*], *Nilkitkwa Landscape Unit Plan* [*Nilkitkwa LUP*]), possibly due to simultaneous works in progress, guidelines that were established by the Forest Practices Branch for land use planning (e.g., *Guide to Writing Resource Objectives and Strategies*, MOF 1998).
- When the *West Babine SRMP* (MSRM 2004a) was developed, standards had become better established and, with respect to clarity of intent and expectations, this process appears to have benefited from lessons learned in earlier processes. Greater availability of personnel and other resources to do this work were probably also a factor.
- Legal objectives for grizzly bear habitat put constraints on habitat management. The original intent was to have no net loss of grizzly bear habitat. Now objectives only apply to specified grizzly bear habitat types within polygons that were delineated as grizzly bear habitat.
- The *Bulkley LRMP OSG* (ILMB 2006) changed the term *maintain* to *provide*. This change is considered inappropriate because it is possible to *provide* human-disturbed habitats with abundant bear foods and concomitantly increase their risk of human-caused mortality.
- The *West Babine SRMP* (MSRM 2004a) dropped management direction for moderate value habitat in its entirety.
- The feasibility of monitoring grizzly bear habitat is limited by changes in land use planning direction, gaps in information and limitations of data. Plans were not designed or were not well designed to support monitoring.

Origins and Limitations of Grizzly Bear Habitat Polygons in Land Use Planning

- The knowledge base used to delineate grizzly bear habitat polygons in land use planning was probably appropriate for general planning purposes, as originally intended and expressed by the authors, but not for making well-informed management decisions about specific areas of land.

- Grizzly bear habitat interpretations for mapping were primarily based on feeding for food plants. Other important life requisites were not specifically covered in grizzly bear habitat interpretations.
- Babine River Interim LRUP: Treatment Unit mapping was completed at 1:50,000 scale; the minimum mappable type was 50 hectares. This interim plan identified the need for more detailed mapping at 1:20,000 scale with air photo interpretation and ground truthing.
- It is unclear what habitat types are being managed for in polygons delineated as mixed forest management because they were not specified in the *Babine River Interim LRUP*. Simpson (1992:p. 25) identified four deciduous dominated habitat types within his criteria to rate high sensitivity habitats.
- All areas: Ground investigations will be needed to verify information and locate unidentified and unmapped important habitats. For example, those that have not been captured in interpretive mapping due to a range of factors such as level and quality of existing knowledge, pattern and distribution of habitat types, survey intensity and map scale.
- Babine River Interim LRUP, Appendix 12 map and subsequent planning utilizing this map: grizzly bear habitat was not mapped for parkland and alpine areas.
- Upper Nilkitkwa Planning Unit: The two grizzly bear habitat polygons delineated for this unit are of unknown origin. Grizzly bear habitat polygons have not been delineated in land use planning for most of this unit. Interpretive mapping for grizzly bear habitat that was completed for the upper Nilkitkwa was not used in land use planning.
- West Babine SRMP area: Best available ecosystem mapping and interpretations for grizzly bear habitat were not included or referenced in the *West Babine SRMP* (MSRM 2004a).

Changes to Grizzly Bear Habitat Polygons in Land Use Planning

In a cursory comparison of land use plan maps with interpretive maps produced for grizzly bear habitat, I found several differences.

Planning for Babine River Corridor Provincial Park

- The *Bulkley LRMP* did not identify existing land uses and activities occurring in the area around the southern park entrance, DFO fish counting fence and Babine River bridge. Overlap in use of this area, by people and grizzly bears, pose major threats to the people and grizzly bears (Wellwood 2007b).
- LRMPs provided limited management direction for the park, largely deferring to the *Babine River Interim LRUP*. The *Babine Interim LRUP* (MOF and MELP 1994a) highlighted the need for a park management plan if the proposed protected area was approved. The *Bulkley LRMP* (BVCRBIPT 1998) plan directed the completion of a park management plan. The *West Babine SRMP* does not address management for Babine River Corridor Provincial Park (MSRM 2004). However, this document stated that it was developed to be consistent with the Management Direction Statement for the park.

Planning for Coordinated Access Management

- Objectives were not provided and strategies were poorly defined for grizzly bears in the *Interim Babine River CAMP, Bulkley Portion* (MOF and BC Environment 1994b). Objectives and strategies were poorly defined for grizzly bears in the *Access Management Direction for the Babine Watershed, Kispiox Forest District* (Kispiox Forest District Access Management Planning Technical Group [KFDAMPTG] 2000).
- In 1997, the Province of B.C. repealed the legislated requirement for licensees to prepare access management plans with forest development plans (Forest Practices Board 2005).
- I found little for management direction aimed at preventing people from driving (or riding) all types of motorized vehicles into access-controlled areas that was explicit or enforceable.

Planning for Recreation Access Management, Bulkley Portion

- The Recreation Access Management Plan (RAMP) processes were aimed at managing conflicts between motorized and non-motorized recreationists and allocating use.
- This plan does not assess or address effects on wildlife and the Interim Babine River CAMP is outdated. Given current situation and context, the Summer Ramp Table (2013) recommendation to allow restricted recreational access beyond gated ACPs appears to conflict with the objective to minimize human–bear interactions.

Implementation Monitoring

- I identified two to four main periods that would be needed for implementation monitoring in each of four areas. Approximately, seven different monitoring protocols would be needed to address differences in management direction, spatially and temporally, for the period from 1994 to present. This does not include monitoring for implementation of forest stewardship plans.
- I strongly suspect that few people working on natural resource management, planning and development endeavors for this area understand the full extent or potential implications of changes that have occurred in land use planning over time. Interpretations of management direction for grizzly bear habitat have probably been variable.
- Preliminary findings indicate that efforts needed to conduct implementation monitoring, post development for multi-year periods, will be expensive and associated uncertainties might be considered excessive to some.

Effectiveness Monitoring

- Across all planning for this area, the goal to maintain grizzly bears, and objectives to support it, have been variably expressed. These need to be ecologically relevant, clearly expressed and consistent across the plan area.
- There is also a need to differentiate between conservation goals and objectives, based on best available science, and management goals and objectives, identified by decision-makers.

- Many important principles and concepts for achieving the goal of maintaining grizzly bears were missing or dropped in land use planning or were not within the mandate of these plans. A conceptually and scientifically sound grizzly bear conservation framework, at an ecologically relevant scale (e.g., grizzly bear population unit), is needed to support management decisions and effectiveness monitoring.
- Potential implications of divergences between recommendations made by biologists providing expertise and advice and decisions made in land use and operational planning have not been formally qualified or quantified. It is not known how decision makers might be taking these into consideration. A means of linking the knowledge base to management decision-making processes is needed for effectiveness monitoring.

Chapter 4: Selecting Indicators for this Project

I conducted a literature review to assess indicators specific to grizzly bear habitat and access presented in the BWMT Monitoring Framework (Price and Daust 2005b) as compared with indicators being used in other areas. I used this information to identify indictors for use in this project (this chapter), as an interim measure to support implementation and effectiveness monitoring.

I propose a conceptual framework for grizzly bear conservation and management. It includes conservation objectives with examples of potential strategies and indicators for discussion purposes only in Chapter 6 (Effectiveness Monitoring) and appendices 3–5 (review drafts). The intent of this framework is to support discussions regarding next steps for adaptive management to maintain grizzly bears. Peer review is needed to use, revise or further adapt this proposed framework for other uses.

Some Key Findings

Habitat-related

- Explicitly defined and consistently used habitat-related terminology is needed.
- Habitat units (i.e., habitat types, habitat polygons) identified for a particular project cannot be directly compared with those identified in some or all other research projects or plans because of differences in methodology.

Access-related

- A preliminary survey can be completed for the forestry status of roads (e.g., restricted by gate, active, deactivated) for the purpose of implementation monitoring based on GIS analysis. However, additional work is needed to update databases and fieldwork is required for verification.
- Fieldwork is also required to determine the accessibility status of roads (open or closed) for the purpose of effectiveness monitoring. For the purpose of considering core secure area for grizzly bears, closed roads (and trails) are defined as those that effectively exclude all types of motorized vehicles.
- Given direction provided in land use planning, it would be prudent to assume that most roads are open until ground investigations can be conducted to verify status.

Indicators Selected for Use in this Project

Goal: To maintain the grizzly bear population

- Implementation Consideration: Planning direction provided for grizzly bear habitat and access management for the period of interest.
- Effectiveness Consideration: Principles, concepts, standards and best practices for conservation of grizzly bear populations, as compared to land use planning direction for this area, to identify gaps in and limitations of planning objectives and strategies for achieving goal.

Objective: To maintain important grizzly bear habitats

- Implementation Indicators: Distribution and proportion of important grizzly bear habitat polygons with development (e.g., roads, cutblocks), as detectable in available databases. As development was permitted in these polygons, within planning direction provided, this can be used to identify priorities for fieldwork for implementation monitoring but not to evaluate implementation. Databases need to include all cutblocks and roads and be up-to-date.
- Effectiveness Indicators: Proportion of important grizzly bear habitat polygons delineated in interpretive mapping for grizzly bear habitat that overlap with management zones and units delineated for other values in land use planning including considerations for the following:
    - Reliability and accuracy of ecosystem mapping and reliability of interpretations for grizzly bear habitat
    - Reliability of grizzly bear habitat polygons delineated in land use planning
    - Management direction, by management zone or unit, of relevance to the objective to maintain grizzly bear habitat.

Objective: To minimize human–bear interactions in the area outside of Babine River Corridor Provincial Park

- Implementation Indicators
    - Locations of important grizzly bear habitat polygons with development, as detectable through GIS analysis. As previously stated, this can only be used to identify priorities for field investigations for implementation monitoring. Databases need to include all cutblocks and roads and be up-to-date.
    - Installation of ACPs.
- Effectiveness Indicator: Length and density of roads in important grizzly bear habitat polygons and by bear management unit. These could be used as indicators of potential displacement.

Objective: To minimize human–bear interactions within Babine River Corridor Provincial Park

- Implementation Indicator: Management planning in place to address negative effects of human–bear interactions, as compared to direction provided.
- Effectiveness Indicator: Historical and current management of people and bears as compared to principles, concepts, standards and best practices for human–bear management.

Chapter 5: Implementation Monitoring

High Value Grizzly Bear Habitat

- With respect to legal objectives, the *Bulkley LRMP Objectives Set by Government* ([*Bulkley LRMP OSG*] ILMB 2006a) did not provide a list of high value grizzly bear habitat types, thus it was not clear whether habitat-related objectives apply to the entire area within a high value grizzly bear habitat polygon or only the high value habitat types within it.
- The West Babine SRMP (ILMB 2004) clearly specified that objectives only apply to the identified critical grizzly bear habitat types within high value grizzly bear habitat polygons.
- No preliminary investigations or conclusions regarding implementation of management direction for important grizzly bear habitat types or grizzly bear habitat polygons can be made based on GIS analysis for roads and cutblocks located in delineated high value grizzly bear habitat polygons. Fieldwork is required for all aspects of implementation monitoring for important grizzly bear habitat.

Access Control Points

2010 Survey for Bulkley TSA Access Control Points

- Boucher Gate (1.8 km on 465 Road): Implemented
- South of Nichyeskwa Management Unit: Implemented
- Nichyeskwa North Management Unit (2 km on 456 Road): Implemented
- Nilkitkwa Gate (21 km on 481 Road): Implemented. Land use planning does not specify expectations and direction for this gate.

2010 Survey for Kispiox TSA Control Points

- Sperry-Rosenthal (ACP1): Not yet required
- Shenismike West (ACP2): Not implemented
- Big Slide AMZ (ACP3): Implemented
- Shenismike-Shelagyote Access Management Zone (ACP4): Not yet required
- Shelagyote Crossing (ACP 5): Not yet required
- Thomlinson (ACP6): Not implemented. There is a plan to install this gate in 2014 (Vanderstar pers. comm. 2013).
- Nichyeskwa Connector (ACP7): Implemented

Management of Access Control Points

- The Ministry of Forests, Lands, and Natural Resource Operations (MFLNRO) has a gate lock procedure that is given to people working in these areas (R. Donnelly pers. comm.).
- I did not determine whether or not rationale has been provided to or by the Province of B.C. for the lack of implementation of designated ACPs in the Kispiox TSA portion.

Babine River Corridor Provincial Park

- Prior to park establishment, direction in the *Options for the Babine River* report to establish a no shooting zone for 3-km downstream of the fish counting fence (MOF, MOE and Babine TAC 1991) was implemented. An area extending from the

north end of Nilkitkwa Lake to Nilkitkwa River was closed. This included area within and outside of the wilderness zone.
- The Wilderness Zone was designated as Provincial Park.
- Several land use plans directed the completion of a park management plan for Babine River Corridor Provincial Park. The Management Direction Statement for the park directs the completion of recreation management and human–bear management plans, identified as high priorities (MELP 2000a). These directions have not been implemented.
- No area closures have been implemented to address serious bear incidents in the southern park entrance area. This conflicts with regional and provincial direction for human–bear management in provincial parks.

Chapter 6: Effectiveness Monitoring

Overall Management Direction in Land Use Planning

- The *Babine River Interim LRUP* was divided into two planning areas for the Kispiox and Bulkley LRMP processes, each of which was expanded to include the Babine LRUP Treatment Unit Extension area for Kispiox portion and the Upper Nilkitkwa Planning Unit for the Bulkley portion. This resulted in planning history that was a disjointed and challenging to track.
- Planning has a minimum of five very different outcomes for the 1) Babine River Corridor Provincial Park, 2) Babine Planning Unit, 3) Upper Nilkitkwa Planning Unit, 4) West Babine SRMP, Babine River Interim LRUP portion, and 5) West Babine SRMP, Babine LRUP Treatment Unit Extension portion.
- The BWMT area of interest is too small to support a goal of maintaining or conserving grizzly bears. Management and associated effectiveness monitoring needs to be conducted over a much larger area that considers the ecology, behaviour and demographics of grizzly bears; and Province of B.C. management of the grizzly bear population including hunter harvest.
- While grizzly bears figured prominently throughout land use planning, priorities for their conservation appear to have diminished over time, based on changes made in management direction.
- Some key limiting factors for maintaining grizzly bears appear to be insufficient understanding or application of scientific knowledge about them and their needs for conservation; gaps in roles, responsibilities and resources to address some important management issues including cumulative effects of land and resource use at sub-regional and landscape-levels; and diminishing resources and capacity for action.
- Many recommendations made by biologists and expressed intentions presented in planning have not come to fruition.
- The *Bulkley LRMP* largely focused on the Babine and Upper Nilkitkwa planning units for grizzly bear habitat. Some additional direction was provided for grizzly bear habitat for a narrow corridor along the Telkwa River and for the Serb Creek watershed. Grizzly bear habitat mapping was never completed for these areas.

- The *Kispiox LRMP* provided more direction for grizzly bears in areas outside of the BWMT area of interest. These have major relevance to potential outcomes for grizzly bears in the project area. I did not review these in detail.
- The Fort St. James and Morice LRMP areas also border the BWMT area of interest. These also have major relevance to potential outcomes for grizzly bears in the project area. I did not review these in detail.
- A conceptual framework for grizzly bear conservation is needed, for discussion purposes, to identify gaps in and limitations of land use planning for achieving grizzly bear conservation and management goals; and to support adaptive management for grizzly bears and their habitat, and human–bear interactions. Peer review and expert input can be used to revise or adapt a draft framework that I have proposed here, as considered appropriate. This should be done in collaboration with the Province of B.C. with consideration for other grizzly bear initiatives in progress, as appropriate.

Objectives to Maintain Grizzly Bear Habitat

- A conservation objective is needed for grizzly bear habitat. None of the land use plans clearly and comprehensively identify and describe important grizzly bear habitat, as currently described based on best available standards.
- Constraints on legal objectives to mapped grizzly bear habitat polygons severely reduce the potential effectiveness of habitat management for grizzly bears. Confining the objectives to mapped habitats may be a reasonable option if map products are highly reliable, they are completed at an appropriate scale for their intended application, risk and associated uncertainty are considered, long-term habitat supply is considered, and effectiveness monitoring can be conducted to detect and address potential issues that may need to be addressed.

Strategies to Maintain Grizzly Bear Habitat

- Terminology and standards used to describe ecosystems and grizzly bear habitat types and associated value interpretations were highly variable throughout the knowledge acquisition and land-use planning processes.
- Inaccurate or inconsistent use of terminology, differences in methods, and limited rationale for changes to strategies for grizzly bear habitat may contribute to variable use of information resources and their interpretations and, I suspect, frustration for some of those trying to manage resources, particularly at the operations and site-level of planning and development.
- Interpretive mapping for grizzly bear habitat provides tools to highlight areas estimated as having greater concentrations of important grizzly bear habitat and support landscape level decisions. Their reliability varies depending on the product used and for what purposes.
- Not all important grizzly bear habitats delineated by researchers were identified as such in land use planning. Other treatment units and management zones overlap some important habitat polygons. For example, the “best of the best” grizzly bear habitat in the *West Babine SRMP* Babine LRUP Treatment Unit Extension area was mapped as Core Ecosystem (Treatment Unit 2, T. Mahon pers. comm.).

- Map products were largely based on estimated habitat value for food plants. Thus there are major gaps in available information and direction to maintain habitats to fulfill other life requisites (e.g., food animals, denning, travel). These also need to be considered.
- Other concerns reducing potential effectiveness of grizzly bear habitat management include
    - No wildlife habitat areas have been designated for grizzly bears. A proposal for a Wildlife Habitat Area for Shenismike West, adjacent to Grizzly Drop on the Babine River, has been presented and discussed over numerous years.
    - Grizzly bear habitat polygons have not been delineated in land use planning for parkland and alpine areas in the Bulkley TSA portion and the portion of the Kispiox TSA that was originally mapped in the Babine River Interim LRUP and maps in subsequent plans derived from this map.
    - Landscape and sub-regional level planning direction is needed to address affects on grizzly bear habitat of forest harvesting associated with mountain pine beetle and non-forestry land and resource developments and uses including commercial recreation, mineral exploration and development, linear corridor development (e.g., pipelines, transmission lines, transportation routes), and others; and ensure sufficient habitat supply over the long term.

Objectives to Minimize Human–Bear Interactions

Land use planning does not provide a conceptually sound foundation to manage human–bear interactions. The set of conservation objectives is needed to support effectiveness monitoring because it would more explicitly and appropriately define human–bear management, from the perspective of maintaining the grizzly bear population for the long term; some of these will fall outside of the mandate of land use planning and others may have multiple parties with mandates relevant them. By providing a comprehensive set of conservation objectives, decision-makers and others will have a better understanding of the overall management context to better support their decisions.

Strategies to Minimize Human–Bear Interactions

- Most notably, there was no management direction to maintain secure areas (for grizzly bears (i.e., areas providing important grizzly bear habitats with low risk of human-caused mortality).
- Land use planning did not identify several major access-related risk factors for areas where bears and people overlap.
- Implemented strategies controlling access (e.g. road deactivation, gates) prevent people in some types motorized vehicles (e.g., cars, 2 and 4 wheel drive trucks) from driving in some areas for some or all of the period bears are active. However, effectiveness has been compromised because little direction was provided to explicitly exclude all types of motorized vehicles (e.g., All Terrain Vehicles [ATV], other Off Road Vehicles [ORV]).
- The effectiveness of some gates may have been further compromised because designated closure periods were shorter than that recommended by biologists, and even these time periods probably would not provide an appropriate measure of

security for the entire season that bears are active, at least in some years. In addition, the active period for bears can be anticipated to increase over time as climate changes.

- The issue of motorized access has apparently only been explicitly directed to ensure effectiveness for
    - Big Slide Access Management Zone in the Kispiox TSA (MSRM 2004a). Major re-contouring has been completed along the roadbed (R. Donnelly pers. comm.)
    - All secondary and tertiary roads south of the mainline in the Shenismike-West access management zone (MSRM 2004a)
    - A short spur road leading to the Babine River in the Bulkley TSA. Major re-contouring has been completed along the roadbed (R. Donnelly pers. comm.).
- Interviews indicate that some roads in the Bulkley TSA portion probably achieve closed status (i.e., not accessible by any type of motorized vehicle). This may also be the case for the Kispiox TSA portion. More detailed interviews and field investigations are needed to determine accessibility status for roads.
- Efforts to prevent people in highway-class vehicles from driving circle routes through the plan area appear to have been relatively effective. However, people on ORVs could easily drive around the gate installed for the Nichyeskwa Connector.
- Several trade-off based decisions, reducing the effectiveness of access control, appear to have been made in selecting the designated locations of ACPs in the Kispiox TSA portion. This reduced the amount of area with controlled access and potential effectiveness, as compared to locations recommended by biologists.
- Some concerns compromising effectiveness of management to address human–bear interactions include
    - gaps in direction to identify important grizzly bear habitat
    - gaps in direction to avoid, prevent or mitigate negative effects associated with attractive human-disturbed habitats
    - gaps in direction to avoid, prevent or mitigate negative effects associated with anthropogenic food sources
    - uncertain status or prospects for deterring motorized travel on other potential circle routes linking adjacent plan areas
    - gaps in direction to address negative effects of human–bear interactions stemming from non-forestry related land and resource development
    - gaps in direction to address risk factors associated with access (e.g., air and ground, motorized and non-motorized, on and off roads).

Effectiveness Monitoring for Grizzly Bear Habitat

- Bulkley TSA Portion: Analysis to determine effectiveness of maintaining grizzly bear habitat was not feasible, given estimated reliability of habitat mapping for identifying the locations of grizzly bear habitat on the ground, gaps in information and limitations of data. Extensive fieldwork required.
- Kispiox TSA Portion: More reliable habitat mapping is available to support GIS analysis to examine potential effectiveness of land use planning for maintaining grizzly bear habitat. This could include a more comprehensive comparison of best

available interpretive mapping with mapping used and direction provided in land use planning.
- Further GIS analysis could be conducted to determine proportion of Class 1 and Class 2 grizzly bear habitat afforded varying levels of protection in special management zones and units for the Kispiox TSA portion. This type of analysis cannot be completed for the Bulkley TSA portion.
- Decisions about if and how to proceed with effectiveness monitoring for grizzly bear habitat should consider gaps in and limitations of the knowledge-base and planning; historically limited resources for grizzly bear-related initiatives; and more immediate priorities such as determining core secure area or source-like habitats.

Effectiveness Monitoring for Access Control Points

2010 Survey Bulkley TSA Portion

- Boucher Gate (1.8 km on 465 Road): Gate appeared to exclude most types of motorized vehicles.
- South of Nichyeskwa Management Unit: No access control points were specified for this management unit. This gate is on Kispiox TSA side. It was installed to control access for a circle route, as directed through the *Bulkley LRMP*. See next section for Kispiox TSA portion.
- Nichyeskwa North Management Unit (2 km on 456 Road): Gate appeared to exclude most types of motorized vehicles.
- Nilkitkwa Gate (21 km on 481 Road): The gate location is only mapped in the *Nilkitkwa LUP* (MOF 1999b) and no land use plans provided management direction specific to it. People could easily drive ORVs around this gate.
- Nilkitkwa Bridge: An ACP (e.g., through bridge removal) was initially recommended for the Nilkitkwa Bridge (Nilkitkwa FSR) in the *Options for the Babine River* report and deferred by the *Babine River Interim LRUP* to the *Interim Babine River CAMP, Bulkley Portion* for management direction. It was not subsequently designated in land-use plans. The largest hot spot identified based on grizzly bear reports (i.e., Compulsory Inspections for dead bears, Problem Wildlife Occurrence Reports for bears, and relocated or translocated bears; 1990–2011) was in the Nilkitkwa–Babine confluence area (Ciarniello et al. 2012). This area could have been made inaccessible or less accessible for motorized access had effective access control been implemented as recommended in early planning.

2010 Survey Kispiox TSA Portion

- Big Slide AMZ: Appears to effectively exclude all motorized access. One major deactivation was implemented for the Big Slide AMZ with interviewees reporting that the major re-contouring of the road bed and other strategies have apparently been successful for excluding all types of motorized vehicles. This type of strategy appears to provide the most effective means for achieving road closure to exclude all types of motorized (land) vehicles.
- Nichyeskwa Connector ACP: Ineffective for excluding ORV access. One gate has been installed at the Nichyeskwa Connector. People riding ORVs could, and based on anecdotal reports apparently frequently did, drive around this gate.

- Sperry-Rosenthal ACP: The road ends at the specified ACP location and was thus not yet required. This ACP location was established well beyond the Shedin Creek location recommended for access control by Province of B.C. and consulting biologists.
- Thomlinson ACP: Ineffective. A sign specifying road closure was moved to the roadside when I visited. Recreationists use this road to access the Babine River, via a short hike through a cutblock. As previously stated, there is a plan to install this gate in 2014 (Vanderstar pers. comm. 2013).
- Shenismike West: Ineffective. A trail that appeared to be well used by people traveling on ORVs had been cleared from the end of the Sperry Road. Reports indicate a well-established trail was being used to access a cabin in the subalpine (de Groot 2011). I did not investigate further. The ACP location for the Shenismike West AMZ is well beyond the Shedin Creek location recommended by biologists.
- Tommy Jack Pass: Biologists strongly recommended an ACP for this area. No direction was provided for access control in land-use planning.

Both Areas

- With the exception of the Big Slide Access Management Zone, ACP measures rely on voluntary compliance by members of the public, disregarded by some and possibly overlooked by others (e.g., Tomlinson).
- All gates: Reports indicate periodic problems with vandalism (e.g., gate destroyed, lock destroyed), gates being left open during closure periods, and people using portable ramps (and possibly other means) to off-load ORVs over gates. Incidents of people driving ORVs around the Nilkitkwa and North Nichyeskwa gates were also reported and evidence for this was observed during field investigations.

Effectiveness Monitoring Babine River Corridor Provincial Park

- Lack of appropriately detailed plans (i.e., park management plan, recreation management plan and human–bear management plan) for Babine River Corridor Provincial Park is a major concern. Comprehensive area-specific planning is also needed to address human–bear interactions in the area of major overlap between people and bears that includes the southern park entrance and area outside of BC Parks' jurisdiction (i.e., DFO Lease Lot, Forest Service Road and Babine River bridge and right-of-way, Crown Land).
- Grizzly bears were not considered in the Skeena Quality Waters Strategy, a process involving decisions regarding angler use on the Babine and other rivers (MOE 2010). It is not clear how decisions made might affect potential options to address human–bear management issues on the Babine River, most notably the area around the southern park entrance and Babine River bridge and weir.
- A recommendation to conduct a risk assessment for human–bear interactions, within the context of planning for human–bear management, to support decisions about if and how to proceed with development was not completed for a parking lot built in 2009. The rationale for not doing so was not determined.

Other Monitoring Initiatives

Findings in this report and the occurrence of multiple parties (e.g., industry, MFLNRO, Forest Practices Board) conducting monitoring for a variety of land use and natural resource management related values point to a need and potential opportunity for collaboration. Efforts to solicit interest and establish common agreement and standards and guidelines for monitoring for grizzly bears could provide much needed support. Universal or compatible and complimentary implementation monitoring would probably better utilize resources and could build on previous studies to support more rigorous effectiveness monitoring and reporting on successes and challenges of major relevance to grizzly bears and their habitat.

Chapter 7: Conclusions, Management Implications and Recommendations

Conclusions

Knowledge Base

- In general, attempts to conduct grizzly bear research appear to have been fraught with challenges securing adequate funding and other resources.
- While collectively grizzly bear-related studies provide a valuable resource to support decision-making, more rigorous studies are needed to better understand area-specific aspects of grizzly bear ecology, behaviour and demographics; and determine population trend and status. In the interim, a large body of scientific evidence from other areas indicates that application of the precautionary principle would be prudent and provides scientifically sound concepts and principles for moving forward to achieve goals and objectives for grizzly bears.
- For this monitoring project, it was necessary to generate assumptions based on more reliable knowledge about bears gained through studies in other areas. By considering area-specific information within the context of stronger evidence from other areas, I believe this project's conclusions are conceptually defensible.

Land Use Planning in General

- In general, attempts to plan for grizzly bears also appear to have been fraught with challenges securing adequate funding and other resources. Major changes in overall land use planning direction coincide with changes in management regime (i.e., Forest Practices Code, results-based professional reliance). Land use planning has not progressed through the adaptive management process that was originally intended.
- The grizzly bear population that utilizes the BWMT area of interest is clearly regionally significant from a land use planning perspective, ecologically, culturally, socially, and economically. For more than two decades, many people have dedicated considerable time and effort through various land use planning processes to address the challenges and complexities of conserving grizzly bears and other values in a landscape designated for multiple land uses.
- The Lake Babine and Gitxsan nations have expressed an interest in grizzly bears and to varying extents have participated in some aspects of planning. However, because they did not directly participate in decisions made at planning tables, these were not

fully collaborative processes, an important gap to consider in determining next steps.
- Land use planning provided little direction to address non-forestry related land and resources use and development to achieve the goal to maintain grizzly bears. This report provides information of relevance to other natural resource sectors.
- The results-based, professional reliance management regime provides little assurance for achieving the goal of maintaining grizzly bears, in part because higher level, interdisciplinary and inter-jurisdictional supports for comprehensive and collaborative landscape and sub-regional management of risk factors are limited.
- Gaps in important land use planning mandates, roles and responsibilities that were formerly filled or committed to by government do not appear to have been filled or have only been partially filled by others.

Land Use Planning for Specific Objectives

Land use planning direction provided for grizzly bear habitat and gated ACPs indicate potentially high risk for achieving conservation objectives to maintain grizzly bear habitat and minimize human–bear interactions, respectively. While many uncertainties remain, this preliminary assessment has been made with considerable attention to available information and placed within the context of principals, concepts, standards and practices in bear management and human–bear interaction management so that decision makers and others can consider how best to proceed in resolving the problem of conserving grizzly bears in this area.

Important Grizzly Bear Habitat

Some preliminary conclusions for important habitat

- Land use planning constrained to specified habitat types within delineated high value grizzly bear habitat polygons to maintain grizzly bear habitat provides direction with a relatively high risk for achieving a conservation objective to maintain important grizzly bear habitats.
- Forestry development has probably resulted in an overall reduction in area of intact (or undisturbed) important habitats for grizzly bears.
- Forestry might be inappropriately constrained, specific to grizzly bears, in some areas. More information is needed.
- Forestry development has probably resulted in a major increase in the area of human-disturbed habitat (e.g., road right-of-ways, cutblocks) that is high quality for grizzly bear foraging on food plants (i.e., attractive habitat), an issue of concern from a risk of human-caused mortality perspective.
- As forested human-disturbed habitats reach mid-seral stages, habitat value will probably decline in some areas; the location, duration and extent of which will be influenced by the biogeoclimatic subzone and variant, habitat type, site preparation, silviculture practices, and subsequent development-, natural-, or climate change-related disturbance events.

Access Control Points

Some preliminary conclusions for ACPs

- Land use planning for access control did not consider issues associated with human-disturbances that increase food availability for bears. When and where people and grizzly bears overlap in use, risk of human-caused mortality will be greater.
- Risk of human-caused mortality associate with road access appears to be among the most challenging and contentious issues to address, as indicated by the histories of coordinated access management planning and recreation access management planning for this area.

Linking these conclusions to the overall objective to minimize human–bear interactions, I strongly suspect that the development of roads and cutblocks has resulted in a major increase in the area of attractive sink-like habitat (i.e., high quality habitat with high mortality risk). Nielsen (2011) and Ciarniello (2012) also provide evidence that mortality issues need to be addressed.

Land Use Planning for Babine River Corridor Provincial Park

Although largely anecdotal, there is substantial evidence that the frequency and nature of human–bear interactions occurring in the area around the southern park entrance to Babine River Corridor Provincial Park, the Babine River Bridge, and the DFO fish counting fence poses major threats to grizzly bears and people. The area of greatest concern includes land within and outside of B.C. Parks' jurisdiction. If considered within a landscape level context of land and resource use, this is one area where dedicated resources and innovative problem solving could conceivably make a major contribution to better outcomes for grizzly bears.

Effectiveness of Land Use Planning

- This project gathered much information to support an estimate of the overall effectiveness of land use planning for achieving the goal of maintaining grizzly bears. As an interim measure, given limited area-specific scientific information, well-informed assumptions about the potential effectiveness of land use planning for grizzly bears can be made. This project has identified gaps in and limitations of planning for grizzly bears by comparing land use planning to maintain grizzly bears with best available knowledge, concepts, principles, standards, and practices for grizzly bear conservation and management in other areas.
- Based on the findings in this project, Wellwood and Pfalz (2009), Nielsen (2011), and Ciarniello et al. (2012), grizzly bears that utilize the BWMT area of interest appear to be increasingly exposed to human-related hazards and for those that are exposed their vulnerability may be relatively high. Focused efforts are needed to mitigate risk of human-caused mortality in areas that are used by grizzly bears and are readily accessible to people.
- For a period, forest harvesting may have some positive effects; for example, increases in occurrence of some types of grizzly bear foods (Roever et al. 2008), which may be beneficial to growth and reproduction. However, as regeneration progresses to mid-seral stages food supply will decrease to some extent, particularly if site preparation and silviculture or other disturbances do not support ongoing

maintenance of food plants for bears. There may also be other negative effects; for example, by creating conditions that support competitive exclusion by black bears (see Mattson et al. 2005).

- Research is needed to determine the effects and management implications of land and resource use and human activities on grizzly bears in this area.
- What is certain is that a much greater portion of the BWMT area of interest is now readily accessible to people that was not accessible in 1992. Focused efforts will be needed to fill major gaps and reduce uncertainty in land use planning. Ultimately, the effectiveness of land use planning for achieving the goal of maintaining grizzly bears is inextricably tied to those grizzly bear-related objectives and associated strategies that fall outside of the mandate of land use planning and overall cumulative effects of land and resource development on grizzly bears.

Framework for Grizzly Bear Conservation

The proposed framework for grizzly bear conservation supported assumptions made in this project and provides a basis to support discussions about how to proceed for next steps. With input from additional qualified biologists, peer-review and collaboration with the Province of B.C. and others, the framework could potentially be applied, in whole or in part, for research and management purposes beyond the scope of this project.

Problem Orientation

- In this partial problem analysis, I determined how the knowledge base was developed and then used in land and resource use planning processes with the expressed intent of maintaining grizzly bears. Then I focused on select strategies for implementation within the context of the conceptual framework for grizzly bear conservation and management to consider potential effectiveness of land use planning decisions. In general, I was able to extract much useful information through reviews of grizzly bear-related research and monitoring reports. Reports forming the knowledge base provide important information regarding gaps in knowledge, limitations of data, and recommendations relevant to grizzly bear management and conservation to support informed decisions regarding land use planning.
- For most of the 1990s, grizzly bear-related planning for the BWMT area of interest was done on a reconnaissance level, interim basis with a vision of gathering more information. For a short period in the early 2000s, an increased level of expert support and resources allowed for couple or few years of relatively rigorous research and planning initiatives in the Kispiox portion of the BWMT area of interest, benefiting from biologists and others contributing a diversity of knowledge, expertise, and skill sets.
- The *Babine River Interim LRUP* and the *Bulkley LRMP* planning processes were among the earliest land and resource use planning processes in the province, lack of or simultaneous development of standards and guidelines for land use and resource use planning probably influenced the lesser clarity of these plans, as compared to the *West Babine SRMP*.
- For the Babine Planning Unit, some limiting factors for a conservation objective to maintain grizzly bear habitat are planning direction was not well designed to

support monitoring and *interim* direction was based on reconnaissance level information that was intended to be revisited and updated. In 2000, the *Bulkley LRMP HLPO* constrained objectives to mapped grizzly bear habitat, effectively eliminating management direction for important grizzly bear habitat in areas outside of mapped polygons in the Babine Planning Unit.

- By contrast the *West Babine SRMP* (MSRM 2004a) expressed intent more clearly and explicitly. Some limiting factors with a probable effect on outcomes for a conservation objective to maintain grizzly bear habitat were as follows:
    - Best available information for grizzly bear habitat not presented or otherwise referenced in the plan
    - Legal objectives constrained to specified habitat types within mapped grizzly bear habitat polygons
    - Loss of management direction for important grizzly bear habitats in other areas
    - Loss of management direction for moderate value habitat
    - Loss of management direction for some identified important habitats types (e.g., forest types with devil's club and horsetail) identified by Simpson (1990, 1992) and listed in the *Babine River Interim LRUP* (MOF and MELP 1994a)
    - Some planning direction was also based on reconnaissance level information that was intended to be revisited and updated.
- For the Nilkitkwa Planning Unit, the knowledge base summarized in this report was not used in land use planning and very little direction was provided to support an objective of maintaining grizzly bear habitat.
- None of the plans were particularly effective for addressing risk to grizzly bears associated with human–bear interactions.

Problem Solving: Where to from Here?

- The findings in this study indicate effective problem solving appears to be limited by
    - Challenges gathering sufficient resources to support grizzly bear conservation in an area designated for integrated resource management
    - Divergences from best available scientific knowledge, expertise and advice
    - Inaccurate or inappropriate information, or both, about grizzly bears, their life requisites, and threats to their conservation expressed in land use planning
    - Multiple small planning units with major variation in planning direction and insufficient area with planning direction for grizzly bears
    - Insufficient structure, processes and resources for monitoring
    - Unfulfilled intentions for adaptive management.

  This project highlights a need for more effective problem solving for grizzly bear conservation, a conclusion that has also been reached in other areas of North America (e.g., Mattson et al. 1996, Clark et al. 2005, Clark and Slocombe 2010).
- Natural resource professionals involved in research, management, planning and policy development aimed at the complex problem of managing and conserving grizzly bears in rapidly changing environments may be able to shift this trend by

using policy-oriented professional approaches and practices (see Clark 2002, Gibeau 2012). Reporting on successes and challenges provide a basis for learning to find better ways of moving forward to maintain grizzly bear populations in areas where human developments and use are expanding and secure areas for grizzly bears are diminishing.

- This report provides a broad spectrum of information highlighting the successes, challenges, and limitations of land use planning for supporting a goal to maintain grizzly bear populations for the long term.

Problem Solving: Some Specific Considerations

- A major gap in process is that the Gitxsan and Nat'oot'en first nations were not full partners in land use planning. They are affected by land and resource use and development decisions; their input, support, and full partnership in problem solving will be important for clarifying and achieving goals and objectives.
- At a landscape level, land-use planning has not sufficiently identified and addressed the risk that open road- and trail-related factors, notably motorized access of any type, pose to the grizzly bear population. In a site-specific example, land-use planning has not addressed risks associated with human–bear interactions in the area around the Babine River fish counting fence, bridge and southern entrance to Babine River Corridor Provincial Park. Overall, these two clearly contentious issues have received relatively little emphasis in land-use plans and have been largely deferred to planning processes that were not fully realized. Failures to effectively address these issues in planning, from a grizzly bear conservation perspective, or other means (e.g. regulatory processes), as required to effectively mitigate risk of human-caused grizzly bear mortality, are major concerns that are worthy of more comprehensive problem analysis to identify alternative options more compatible with goals and objectives for grizzly bears.
- Many changes of relevance to deciding how to proceed have occurred over the course of land use planning for this area, particularly within the last decade. Locally established intuitions (e.g., BWMT, Babine River Foundation, Bulkley Valley Community Resources Board, Bulkley Valley Research Centre) might provide additional or alternative supports to government to restore and build community relationships to address these and other issues.

Problem Solving: Babine Watershed Monitoring Trust

- Despite severely limited budgets for grizzly bear-related monitoring, the locally led and largely volunteer supported BWMT has been able to provide useful knowledge in a range of key areas.
- To the best of my knowledge, this is the first comprehensive attempt to initiate monitoring for effectiveness of land use planning for grizzly bears in B.C.
- Any successful endeavours will probably need to find ways of extending well beyond the constraints and limitations of conventional approaches to problem solving to maintain grizzly bears. The BWMT provides a large part of the foundation to do this.

Management Implications

For the Babine Watershed Monitoring Trust

A comprehensive review of the history of grizzly bear research and management in the BWMT area of interest was essential for the completion of this monitoring project. In general, there is relatively little in the structure of land use planning for grizzly bears that can be used to support a scientifically rigorous monitoring program. Any on-the-ground effectiveness monitoring to rigorously quantify maintenance of important grizzly bear habitat or prevention and mitigation of human-caused grizzly bear mortality associated with road access will be expensive, particularly relative to budgets available for monitoring to-date. Costs of additional monitoring of land use planning for grizzly bears, in addition to what has been completed (Wellwood and Pfalz 2009, Ciarniello 2012; this report), should probably be weighed against the need for more defensible and perhaps more compelling means of garnering support for finding better ways of moving forward. Efficacy of monitoring could be improved with intergovernmental, interagency and stakeholder collaboration.

For Government and Proponents

There are insufficient resources, institutional structures, and processes to coordinate and support the level of comprehensive and collaborative governance that will be needed to achieve conservation and management goals and objectives for grizzly bears in the BWMT area of interest. Any assurance of achieving desired results for grizzly bears over the long-term will require commitment to and innovation in problem solving.

For Biologists

Based on the findings in this study, it is not clear how important scientific information and expert opinions and recommendations made by biologists working on grizzly bear-related projects in this area are being considered in the decision-making process. In some cases, some information and advice may not be reaching those with the authority to make decisions; and in others, they might not be considered due to insufficient resources, other priorities, trade-offs made, or for some other reason. More effort is needed to find better ways of engaging decision-makers, stakeholders and others in the importance of science in decision-making, and linking science to policy and other decision-making processes in order to achieve conservation objectives for grizzly bears. Other forms of knowledge (e.g., local, traditional) could also be integrated into the knowledge base, as appropriate to support better-informed decisions.

For Managers and Other Decision Makers

Mangers and other decision makers that are responsible for land and resource use decisions affecting grizzly bears within and adjacent to the BWMT area of interest are faced with making increasingly risky decisions as land uses and activities expand into remaining undeveloped areas. Notably, the goal to maintain grizzly bears is incrementally undermined by initiatives that do not appropriately maintain important grizzly bear habitats and address issues associated with the following: bears gaining access to anthropogenic foods; attractive human-disturbed habitats; lethality of interactions with people; and loss of core secure areas. More effort is needed to link decision-making to knowledge in a way that allows biologists, First Nations, stakeholders, the public and others to understand considerations, trade-offs made and rationale for them.

For Planners

Land use planning direction for grizzly bears in the BWMT area of interest changed considerably over the coarse of planning for this area. Ministries and agencies responsible for planning and their mandates have also undergone major changes over the planning period. While some argued that early objectives for grizzly bears were not achievable given other values and interests in this area, I did not determine rationales for many changes. The overall probability of successfully achieving the goal of maintaining grizzly bears appears to have decreased over time, considering principles and concepts for adaptive bear management and human–bear management (e.g. Hopkins et al. 2010). Within the context of the conceptual framework for grizzly bear conservation proposed here, objectives expressed in land use planning do not completely address habitat requirements and human-caused mortality risk factors. Some additional planning components are needed, and while other management needs are not within the scope of planning (e.g., grizzly bear harvest, planning in adjacent areas), they could be provided for context.

If land use planning could be anchored within the context of a conceptual framework for grizzly bear conservation and management, then land use plan goals and objectives for them can be expressed, discussed, debated, planned and monitored more meaningfully. A means of tracking land use planning decisions could provide subsequent decision-makers and others with a better understanding of the history, rationales for trade-offs made to address other values, and a means of transparent reevaluation; as required, to maintain public interests. Most importantly, all factors influencing prospects for achieving goals for grizzly bears (however this is defined) can be considered to support a fully informed exploration of options and innovation in the planning component of problem solving.

Overall Implications

- Innovation in problem solving is needed.
- Grizzly bear research and management initiatives need to extend to areas beyond and be linked back to the BWMT area of interest.
- Qualified professional biologists with relevant grizzly bear expertise will be needed to fulfill professional reliance responsibilities and achieve desired results.
- Additional and more reliable commitments are needed to fulfill grizzly bear research and management, human–bear interaction management, and bear awareness and safety education needs, and most importantly, to learn how to solve complex and challenging problems, such as grizzly bear conservation, more efficiently and effectively.

Recommendations for BWMT and Considerations for Others

Improving the Foundation for Problem Solving

General Considerations

The following stand out as priorities for consideration

- Maintain and restore secure or source-like habitat.
- Address serious human–grizzly bear interaction issues associated with the management, and gaps in and limitations thereof, for the area around the southern entrance area of Babine River Corridor Provincial Park (within and outside of park jurisdiction).

- Address mortality hotspots identified by Ciarniello (2012).

Recommendations to BWMT: Knowledge Base

- Obtain peer-review for the proposed conceptual framework for grizzly bear conservation (review drafts, appendices 2-4) to decide if and how to move forward on it as a foundation to support monitoring needs.
- Update the annotated bibliography and collection of digital files for these resources completed by de Groot (2004) to include additional information gathered in this project.
- Revise and update the Knowledge Base to better support monitoring to maintain grizzly bears.
- Uncouple land use objectives provided in the Land-use Planning Summary from the Knowledge Base.
- Add an explicit link between the goal to maintain grizzly bears and associated conservation objectives needed to achieve the goal.

Recommendations to BWMT: Land Use Plan Summary

- Add the *Babine River Interim LRUP* (MOF and MELP 1994a) and *Interim Babine River CAMP, Bulkley Portion* (MOF and MELP 1994b) to the Land-use Plan Summary.

Some Considerations for Government and Others: Problem Solving

The following stand out as some priorities for consideration:

- Conduct a policy process problem analysis (see Clark 2002) to provide comprehensive support for decisions about how to proceed.
- Identify ecologically sound conservation goal and objectives and clarify management goal and objectives so that empirically conclusive monitoring can be conducted. Collaborate so that goals and objectives are applicable at an ecologically relevant scale.
- Find or innovate more effective ways of problems solving.

Some Considerations for Government and Others: Professional Reliance

The following stand out as some priorities for consideration:

- Gather interdisciplinary expertise to support an open learning problem solving process.
- Retain qualified professionals with relevant expertise in grizzly bear research and management and human–bear management to support problem solving.

Some Considerations for Government and Others: Risk Management

The following stands out as a priority for consideration: Conduct population inventory and monitoring studies, using hair-snag/DNA sampling methods DNA-analysis (see Apps 2011b for needs assessment and design recommendations).

Some Considerations for Government and Others: Planning

The following stand out as some priorities for consideration:

- Anchor planning in a conceptual framework for grizzly bear conservation.
- Ensure other planning processes (e.g., RAMP, Skeena Quality Waters Strategy, Mountain Pine Beetle planning) and forestry and other land and resource uses (e.g., mineral exploration and mining, commercial recreation, pipelines, air and off-trail

access) of relevance to grizzly bears in this area are appropriately integrated into planning and other elements of decision-making.
- Plan for climate change related effects on salmon and other life requisites and on other factors influencing risk to grizzly bears.
- Assess and manage cumulative effects.

Some Considerations for Government and Others: Collaboration
The following stand out as some priorities for consideration:
- Promote and support collaborative and interdisciplinary innovations, such as the BWMT and BWMT Framework, to foster a culture of learning and adaptive management.
- Support a comprehensive data- and knowledge-sharing network (BWMT and others in progress).

Improving Habitat-Specific Problem Solving
Recommendations to BWMT: Knowledge Base
- Revise terms and definitions used to describe important grizzly bear habitats to be managed.
- Revise habitat-related objectives.
- Revise indicators used in the hypothetical cause-effect curves for risk to achieving objective.

Recommendations to BWMT: Land Use Plan Summary
- Provide direction for how to address variability and inconsistencies in the use of and definitions and intent for habitat-related terms among various plans and the BWMT Framework.
- Provide direction for how to address major divergences from original intent in Babine River Interim LRUP and that of some subsequent plans for grizzly bear habitat.

Some Considerations for Government and Others: Knowledge Base
The following stand out as some priorities for consideration:
- Compile best available species and habitat information so that it is readily available and utilized, as appropriate.
- For the Bulkley TSA portion: update grizzly bear species accounts, habitat suitability models, ratings tables, and habitat mapping.
- Delineate important habitats at appropriate scales (e.g., patch, stand, landscape, Grizzly Bear Population Unit).
- Provide information in reporting and on maps regarding intended purpose, reliability and accuracy of ecosystem mapping, and reliability of interpretations for grizzly bears.
- Gaps could be filled and uncertainty reduced by conducting a radiotelemetry study of grizzly bears to determine food habits, seasonal habitat use, and movements of grizzly bears; and implications of natural resource development and recreation activities on grizzly bears.

Some Considerations for Government and Others: Landscape-Level Planning and Monitoring
The following stand out as some priorities for consideration:

- Review and amend legal objectives for grizzly bear habitat to maintain sufficient supply of important grizzly bear habitats for the long term.
- Ensure best available knowledge and map products are utilized appropriately given the management context (e.g., intended purpose, reliability and accuracy of mapping, reliability of interpretations for grizzly bear habitat, gaps in information, limitations of data).
- Identify and address important life requisites and habitat types that have not been captured in habitat-related studies and planning to date. Some gaps in direction include some important habitat types, microhabitats or patches of important habitat, and habitat features (e.g., mark trees, mark trails, dens).
- Support the development and refinement of scientifically defensible indicators and thresholds or targets for grizzly bear habitat.

Some Considerations for Government and Others: Site-level Planning, Development and Monitoring
The following stand out as some priorities for consideration:

- Work with professional organizations or others (e.g., Forrex) to develop professional guidelines and training for grizzly bear habitat assessment and management to maintain grizzly bear habitat.
- Use airphoto or orthophoto interpretation or another scientifically sound method to identify potentially important grizzly bear habitat on the ground.
- Use silviculture, stand management and other techniques to mitigate negative effects of land and resource use on important grizzly bear habitat to maintain sufficient habitat supply for the long-term. Risk of human-caused mortality will need to be addressed.

Improving Access-Specific Problem Solving

Recommendations to BWMT: Knowledge Base

- Revise the objective for human–bear interactions to be more specific. This might include objectives or sub-objectives specific to displacement (and perhaps disturbance), human-caused mortality and anthropogenic fragmentation (see USDA 1990, MacHutchon 1998a, Proctor et al. 2012).
- Revise indicators used in the hypothetical cause-effect curves for risk to achieving objectives.

Recommendations to BWMT: Land Use Plan Summary
Provide direction for if and how to deal with major divergences from early intentions to manage access and that of subsequent means for managing access; for example, consider *Options for the Babine River* (MOF, MOE and Babine TAC 1991), *Interim Babine River CAMP, Bulkley Portion* (MOF and MELP 1994b), and *Forest Practices Code Act* (Province of B.C. 1996), as compared to later initiatives.

Some Considerations for Government and Others: Planning and Monitoring
The following stand out as some priorities for consideration:

- Review and address major divergences from early intentions to manage access and that of subsequent initiatives for managing access to improve prospects for achieving the goal to maintain grizzly bears.
- Define Bear Management Units (BMU). These have been delineated, but not presented in land use planning, for the Kispiox TSA portion. Review these to update, if and as appropriate. Bear Management Units have not been defined for the Bulkley TSA portion.
- Support the development and refinement of scientifically defensible indicators and associated thresholds or targets for access management.

Some Considerations for Government and Others: Management
The following stands out as a priority: Identify, secure and (if necessary) restore core secure areas or source-like habitats for grizzly bears to more effectively mitigate risk of human-caused mortality.

Implementation Monitoring: Collecting Indicator Data
Have strategies to maintain important grizzly bear habitat and reduce human–bear interactions been implemented?

General Recommendations to BWMT
- Identify appropriate indicators and targets or thresholds and promote their use in implementation monitoring conducted by government, industry and other monitoring- and certification-focused organizations. Work with Province of B.C and others to do this.
- Develop an implementation monitoring program.
- Build capacity to monitor implementation for grizzly bear habitat and access management. If this can be achieved then the following are also recommended:

Recommendations to BWMT for Grizzly Bear Habitat
- Review Babine River Interim LRUP treatment unit mapping for Bulkley TSA to assess accuracy of line-work.
- Consult with a vegetation ecologist, preferably with local knowledge, to assess the feasibility and reliability of identifying each of the identified habitat types, post-road and -cutblock development.
- Interview forestry practitioners that have had longer-term involvement in management and development decisions regarding grizzly bear habitat in the monitoring area to support decisions for implementation monitoring for grizzly bear habitat.
- Conduct implementation monitoring for grizzly bear habitat as frequently as required to allow for monitoring in the operations phases (e.g., layout, pre-harvest). More frequent monitoring is needed so that important habitat features and habitat types can be more reliably identified.

Access
Have access-related strategies to reduce bear-human interactions been implemented?

Recommendations to BWMT for Access

- Contact Province of B.C. for a problem definition to better understand and discuss the problem of controlling access to reduce risk of human-caused grizzly bear mortality and identify barriers to lack of implementation of designated ACPs in Kispiox TSA portion of study area. Plans were underway to install the Tomlinson gate (L. Vanderstar pers. comm.).
- Develop an implementation-monitoring program that includes frequent investigations to determine gate status. Obliterating (e.g., re-contouring) roads could eliminate or at least greatly reduce the need for costly monitoring.

Effectiveness Monitoring: Detecting Consequences
Have strategies to maintain important grizzly bear habitat and reduce human–bear interactions been effective?

General Recommendations to BWMT

- Solicit input from other bear experts to gather a range of opinions, experiences and expertise to debate and determine the most defensible means of monitoring access related risk factors associated with human–bear interactions. Multiple viewpoints would probably produce the best solutions and be more broadly accepted; and potentially be considered suitable for context specific application at a regional scale or sub-regional scale.
- Identify appropriate indicators and targets or thresholds and promote their use in implementation monitoring conducted by government, industry and other monitoring- and certification-focused organizations. Work with Province of B.C and others to do this.
- Develop an effectiveness monitoring program.
- Build capacity to monitor effectiveness for grizzly bear habitat and access management. If this can be achieved then the following are also recommended:

Recommendations to BWMT for Grizzly Bear Habitat

- Conduct reconnaissance level effectiveness monitoring for important grizzly bear habitat in the Kispiox TSA for the treatment unit mapping extension to the Babine River Interim LRUP (where more reliable information was used in planning).
- Consult with forestry practitioners to determine if and how Mahon et al. (2004) or other more reliable products might have been used in combination with grizzly bear habitat mapping provided in land use planning.

Access

Have access-related strategies limited undesirable human–bear interactions?

Recommendations to BWMT for Access

- Until better information is available, assume all roads are open, until information has been gathered to confirm they are closed (e.g., Big Slide road deactivation) so that no motorized vehicles can gain access.
- For preliminary evaluations of risk to grizzly bears associated with human–bear interactions, assume all roads are located in important grizzly bear habitat or attractive human-disturbed habitat until better information has been gathered. Research (MacHutchon and Mahon 2003) and anecdotal observations (D. Wellwood pers. obs.) indicate attractive habitats for grizzly bears are common within cutblocks and along road right-of-ways.
- Further analysis might include reanalyzing data presented in Wellwood and Pfalz (2009) that were based on length of road per area (km/km^2) to determine open road density, total road density and core secure area using roving window analysis (e.g., Summerfield 2004) or further examination of source-sink habitats (i.e., Nielsen 2011). Additional expert input is needed.
- Expand monitoring area and conduct analyses at scientifically relevant scales (e.g. Bear Management Unit, Babine River watershed, Babine GBPU).

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To those that have played a role in planning and management of relevance to grizzly bears in this area, I strongly believe that the fundamental issues that challenge the goal of maintaining grizzly bears has much to do with our culture and place in history. Incremental declines and extirpations of grizzly bear populations have occurred along the frontlines of human development for generations. By the end of the 20th Century, when planning for this area started, rates of decline had subsided in some areas and some populations even increased in North America. The 21st Century is unfolding in a period of rapid change and major uncertainty—environmentally, socially and economically. I think the findings in the report reflect this. With the most recent rush to find and extract natural resources in northern regions of British Columbia, it appears the problem of grizzly bear conservation might be put to the test in a region long considered their stronghold. If any community (that is, those that cherish the Babine River watershed) can rise above these challenges to find a way of making room for bears where mothers have faltered, it is this one. The very existence of the Babine Watershed Monitoring Trust, Bulkley Valley Research Centre, Bulkley Valley Community Resources Board and Babine River Foundation give me hope.

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Chapter 1: General Introduction

1 Setting the Context

1.1 Land Use Planning Goals and Objectives

Initiated over two decades ago, the Babine River watershed has an extensive history of land use planning that was primarily focused on forestry-related development and activities but also (to some and varying extent depending on plan) recreation, mineral exploration and mining, oil and gas exploration and development. The goal to maintain grizzly bears (*Ursus arctos*) was one of numerous goals or objectives that were identified in planning to manage for a wide range of stakeholder values. They were selected as a focal species due to their ecological, social and economic value; provincial and regional significance; and vulnerability to human impacts. Other values broadly expressed in the earliest stage of land use planning included wilderness, fisheries, forestry, wildlife (in general), recreation and tourism (Ministry of Forests, B.C. Environment and Babine Technical Advisory Committee [MOF, MOE and BTAC] 1991). In subsequent planning, this list was expanded to consider additional interests. Objectives for other environmental values ranged from mountain goats (*Oreamnos americanus*, another species vulnerable to human impacts) to biodiversity, an umbrella for conservation of ecosystem and species diversity. Given wide-ranging interests, planning processes for this area were clearly ambitious, challenging and complex endeavors. The following sections provide a historical overview of planning processes for context.

1.2 Investigation of Options for the Babine River Area

Intense debates regarding plans to develop road access for forest harvesting in the Babine River area came to the forefront as early as 1986 (Forest Planning Canada 1988), perhaps earlier. In 1988 and in response to controversy around competing interests in land uses, the Minister of Forests and Minister of Environment initiated a collaborative land use planning process (MOF, MOE and BTAC 1991). The BTAC was established to gather existing information and provide recommendations for studies to fill gaps in information, needed to support planning decisions. A Babine Steering Committee (BSC) was established as a multi-stakeholder consultation committee to provide input for the planning process. The initial plan area was a 10-kilometer wide band centered on the Babine River, extending from the outlet of Nilkitkwa Lake to the Kisgegas Indian Reserve (approximately 900 km^2). It encompassed most of the Babine River and it included a wilderness zone, approximately 1 km on each side of the river; and a special management zone, approximately 1 km on each side of wilderness zone. It is located within portions of the Bulkley and Kispiox timber supply areas (TSAs).

Together MOF, MOE and the BTAC, with review by the BSC, produced an *Options for the Babine River Area* report, presenting three broad options for land use (MOF, MOE and BTAC 1991). By consensus, the BTAC endorsed a compromise option "…to retain wilderness qualities along the river while accessing the planning area for timber" (MOF, MOE and

BTAC 1991:p. ii). The other two options gave greater priority to wilderness and forest development values, respectively. Three options were also considered for road development to access forest resources to the north of the Babine River. Again a compromise was made and the Shenismike option was selected. This included a bridge crossing the lower Babine River and road accessing areas north of the river. This was followed up with a *Public Review Summary of Options for the Babine River Area* report (MOF and Ministry of Environment Lands and Parks [MELP] 1992). With a broad coarse of action established in 1992, land and resource use planning was well underway.

Around the same time, also in response to controversy, and in this case emerging from increasing land use conflicts provincially; the Province of B.C. initiated the Commission on Resources and Environment (CORE). The commission was mandated "…to develop a sustainable land use strategy for the province, and to develop and implement a regional planning process" (Frame 2002:p. 3).

1.3 Babine River Interim Local Resource Use Plan: Original Vision

In 1994, MOF and MELP collaborated to complete the *Babine River Interim Local Resource Use Plan* (*Babine River Interim LRUP*) based on information and comments gathered from stakeholders (MOF and MELP 1994a). The *Babine River Interim LRUP* (MOF and MELP 1994a:p. 23) stated: "the long term intent is to have no net loss of important grizzly bear habitat and no displacement of grizzly bears from this drainage." The initial planning area considered in the *Options for the Babine River Area* was expanded, in part matching TSA boundaries. This plan provided prescriptive strategies to achieve a range of objectives for land use but deferred direction for management of road access, directing a the development of a coordinated access management plan (CAMP) that would be completed separately.

1.4 Subsequent Land Use Planning Processes

In 1994, the same year that the *Babine River Interim LRUP* was completed, a four volume *Provincial Land Use Strategy* series of reports was completed by CORE and the Land Use Coordination Office was established as the central agency for management of land and resource management plan (LRMP) processes (Day et al. 2003). The LRMP process established direction for the development of higher-level land use objectives and strategies aimed at a sub-regional scale (Frame 2002). It was designed as a consensus-based shared decision-making process encouraging participation by all levels of government, First Nations, stakeholders and the general public. Plans were reviewed and approved by government.

The *Babine River Interim LRUP* area was subsequently divided along TSA boundaries as it was considered for higher-level planning, one portion falling within the Kispiox LRMP process completed in 1996 and amended in 2001 (Kispiox Land and Resource Management Planning Team [KLRMPT] 2001) and the other falling within the Bulkley LRMP process completed in 1998 (Bulkley Valley Community Resources Board Interagency Planning Team [BVCRBIPT] 1998). For some specified aspects of planning, both higher-level plans deferred to the *Babine River Interim LRUP* and *Babine Coordinated Access Management Plan* (*Babine CAMP*) for management direction, including the Babine River and Upper Nilkitkwa

planning units for grizzly bears in the Bulkley LRMP portion; and general direction for grizzly bears, the proposed Babine River Corridor Provincial Park and the Babine River Special – Scenic/Recreation/Wildlife management zone in the Kispiox LRMP portion. Each of the LRMPs provided direction to designate the Babine River Wilderness Zone as Provincial Park, for respective sections. Through these processes, the size of the area with planning that deferred to the *Babine River Interim LRUP* for management direction expanded. First Nations, whose traditional territories the plan areas fall within, did not participate in planning tables or endorse these plans.

The LRMP planning processes were followed up with landscape level planning. Plans produced for the Babine River watershed include the *Babine Landscape Unit Plan* (*Babine LUP*, MOF 1999a) and *Nilkitkwa Landscape Unit Plan* (*Nilkitkwa LUP*, MOF 1999b) for the Bulkley TSA portion and the *Xsu gwin lik'l'inswx: West Babine Sustainable Resource Management Plan* (West Babine SRMP hereafter, Ministry of Sustainable Resource Management [MSRM] 2004a) for the Kispiox TSA portion.

The *Bulkley LRMP* and *Kispiox LRMP* largely deferred to the *Babine River Interim LRUP* for management direction for the Wilderness Zone (later Babine River Corridor Park). Subsequent forestry focused plans did not cover the Wilderness Zone, for which a management plan was to be completed through an independent process for the entire corridor when park status was achieved, as specified in the *Babine River Interim LRUP* (MOF and MELP 1994a) and *Bulkley LRMP* (BVCRBIPT 1998).

1.5 Babine River Corridor Provincial Park

In 1999, the Wilderness Zone was established as a Class A Provincial Park, Babine River Corridor Provincial Park. In 2000, a *Management Direction Statement for Babine River Corridor Provincial Park* was completed to provide interim management direction for the entire park (MELP 2000a), crossing the Bulkley–Kispiox TSA boundary. The direction statement recommended that a human–bear management plan and a recreation management plan be expeditiously completed due to grizzly bear conservation and public safety concerns. Several reports examined issues and provided recommendations to support planning for recreation (e.g., Hillcrest Consulting et al. 2001) and human–bear management (e.g., MacHutchon 1998b; Hillcrest Consulting Inc. 2001; Dale and Harstone 2005; Wellwood 2007a, b; 2008; 2011a, b). Development of a park management plan for the southern park entrance area was in progress (BC Parks in prep.) but has not been completed.

1.6 Legal Objectives

In 2000, the first legally binding objectives for the Babine River watershed were established with the *Bulkley LRMP Higher Level Plan Order* (*Bulkley HLPO*, Province of B.C. 2000). In 2004, following the transition from the *Forest Practices Code of British Columbia Act* to the *Forest and Range Practices Act*, Appendix 1 Objectives in the Bulkley HLPO were amended through the *Bulkley LRMP Objectives Set by Government* (Bulkley OSG, ILMB 2006a). In 2004, higher-level plan objectives were established through an *Order to Establish the West Babine Landscape Unit and Objectives and to Vary the Atna/Shelagyote and Babine River Special Management Zone Boundaries* in the West Babine SRMP (MSRM

2004). In summary, a portion of the *Bulkley HLPO* (appendices 2-4), all of the *Bulkley OSG* and the *West Babine SRMP* provide objectives with current legal effect.

1.7 Access Management Planning

Provincially, access management plans were legally mandated in 1995, a piece of legislation that was soon rescinded with the streamlining of the Code in 1997 (Forest Practices Board [FPB] 2005). Over the course of planning for the Babine River watershed, with the exception of the initial examination of *Options for the Babine River Area* (MOF, MOE and Babine TAC 1991), access management planning initiatives have been conducted independently for the Bulkley and Kispiox TSA portions. In 1994, an *Interim Babine River Coordinated Access Management Plan, Bulkley Portion* report (Babine CAMP, MOF and MELP 1994b) was completed. No subsequent access management planning initiatives were completed for this area. In 2000, an *Access Management Direction for the Babine Watershed Kispiox Forest District* report was completed for the Kispiox TSA (Kispiox Forest District Access Management Planning Technical Group [KFDAMPTG] 2000). This was followed up with access management direction provided in the *West Babine SRMP*, replacing previous direction (MSRM 2004) for the Kispiox TSA portion.

1.8 Monitoring of Land Use Plans

1.8.1 Babine River Interim Land and Resource Use Plan Monitoring Committee

In 1994, the *Babine River Interim LRUP* monitoring committee was established, comprised of government, forest industry and other stakeholder representatives (Babine River Interim Land and Resource Use Plan Monitoring Committee [Babine River Interim LRUPMC] 1995). This committee produced annual monitoring reports for the Babine River Interim LRUP for 1994 to 1996 with focus on a range of values (Quanstrom 1995, Quanstrom no date; Babine River Interim LRUPMC no date). Their last meeting was held in 2002 (J. Cuell pers. comm.). Subsequently, a proposal was made to establish a monitoring trust following the completion of the *West Babine SRMP* (MSRM 2004).

1.8.2 Babine Watershed Monitoring Trust

In 2004, draft terms of reference for the Babine Watershed Monitoring Governance Design Group were prepared (J. Cuell pers. comm.). By 2005, this group had evolved to establish the Babine Watershed Monitoring Trust (Babine Watershed Monitoring Trust [BWMT] 2005). A major function of the BWMT is to plan, prioritize, direct, facilitate and fund impartial monitoring of land-use plans and related natural resource management activities (BMWT 2005). In 2005, a structured Babine Watershed Monitoring Framework was developed (Price and Daust 2005a, 2009; see Osborn 2009). This innovative framework was developed to facilitate conceptually sound and transparent decisions to establish priorities for monitoring land-use plans by linking monitoring indicators (e.g., road density, km/km^2) to strategies (e.g., avoid road development in specified areas) to plan objectives (e.g., minimize human–bear interactions, Price and Daust 2005a). It is used to formulate knowledge-based hypotheses about the risk to achieving specified objectives as a function of changing values for selected indicators, graphically expressed as risk curves. Levels of uncertainty (i.e., knowledge-, data-, and management-related) around each strategy–objective relationship can also be expressed. The BWMT uses the framework to prioritize

land-use plan objectives for implementation, effectiveness and validation monitoring, and associated research. Major components of the framework include a knowledge base summarizing existing knowledge and identifying gaps in information that can be updated as additional information becomes available; a comprehensive land-use plan summary; setting indicator targets (decisions made through the planning process); collecting indicator data (implementation monitoring); detecting consequences (effectiveness monitoring); and improving probability of success (validation monitoring). Knowledge and information gained is made publicly available (http://www.babinetrust.ca/).

1.9 Problem Solving Process for Grizzly Bear Conservation

As many grizzly bear researchers and managers have experienced, the problem of conserving (or maintaining) grizzly bears is complex, challenging and oftentimes contentious (Mattson et al. 1996, Clark and Slocombe 2005, Clark et al. 2005, Clark 2009, Clark and Slocombe 2011, Ritchie et al. 2012; for polar bears Clark et al. 2010). The policy sciences framework provides a comprehensive foundation for problem solving for natural resource professionals to work from. Described in detail in *The Policy Process: a practical guide for natural resource professionals* (Clark 2002), the framework covers three dimensions 1) problem orientation, focusing on the problem to find solutions, 2) social process, mapping the context of the problem; and 3) decision making process, clarifying and securing common interests. Three additional features are key to policy sciences approach 1) the participant or observer of the process determines and remains cognizant of their standpoint in relation to the process; 2) multiple methods are needed to gather, interpret and integrate information to support decision making and execution; and, ultimately, 3) all problem solving efforts are aimed at achieving the goal of securing common interests. This framework provided a basis for a partial problem analysis of endeavours to conserve grizzly bears for this project.

1.10 Observational Standpoint

In this partial problem analysis, I provide my knowledge, expertise and perspective as a wildlife biologist that has specialized in grizzly and black bears and human–bear interactions. Since 1990, I have led, collaborated or assisted in a diverse range of bear research, management and education related projects. Through my work, I travelled extensively in coastal, interior and northern British Columbia; Kluane National Park and Reserve and Ivvavik National Park in the Yukon; and Glacier Bay National Park and Preserve in Southeast Alaska. In fall 1996, I arrived in Smithers, B.C. to work on a grizzly bear study on the upper Babine River. Even though the study was discontinued within weeks of its initiation, the land and community inspired me to stay.

Between 1996 and 2011, I gained experience working on grizzly bear-related projects in the Babine River area including an interim monitoring study; radio-telemetry study; human–bear interaction assessment and planning; and a short posting as auxiliary BC Park Ranger. As a whitewater rafter, I have traveled down the Babine River for work and recreation. To expand my perspective, between 2007 and 2009, I also travelled to rivers renowned for grizzly bear and people interactions, some with intensive management programs (e.g., Khutzeymateen, B.C.; Brooks River, Anan Creek and Pack River, Alaska) and others with limited management (e.g., Atnarko River, B.C.; Russian River AK). Collectively,

these experiences helped me to develop a broader understanding of and appreciation for many of the issues and challenges and the complexity of grizzly bear management and conservation around the Babine River.

2 Project Goal and Objectives

The overall goal of this project was to support monitoring for the implementation and effectiveness of land use planning for achieving management and conservation goals to maintain grizzly bears over the long term in the BWMT area of interest.

The objectives were to conduct a

1. Provisional assessment of the knowledge base for grizzly bears and their habitats to identify available information and estimate the reliability for decision-making support.
2. Review of land use planning for grizzly bears with focus on objectives and associated strategies for their habitat and access control to better determine how the knowledge base (Objective 1) was incorporated into land use planning.
3. Preliminary monitoring survey to examine implementation and effectiveness of strategies to maintain important grizzly bear habitats and reduce undesirable human–bear interactions focusing on identified important grizzly bear habitats and access control points identified in land use planning.
4. Preliminary assessment of implementation and effectiveness monitoring of land use planning specific to grizzly bears to support the development of methods for monitoring.

3 Report Organization

This report provides a partial problem analysis—focusing on the use of knowledge in the decision making process (Clark 2002)—for land use planning and development specific to the goal of maintaining grizzly bears, and a 2010 reconnaissance survey to monitor grizzly bear habitat and access control points (ACPs). I initiated an examination of strategies and associated indicators for the objective to maintain high value grizzly bear habitat and build on a previous examination of access control strategies and associated indicators to minimize human–bear interactions (Wellwood and Pfalz 2009). This includes an overview of bear-related research and planning; scientific knowledge base applied to and gaps remaining in planning to conserve grizzly bears; and some of the successes and challenges of prolonged efforts to maintain grizzly bears in the BWMT area of interest. Chapter 1 establishes context for this project. Objectives 1 to 3 aimed to fill major gaps in information needed to complete this contract, including the need for a better understanding of the knowledge base in Chapter 2 and land use planning specific to grizzly bears in Chapter 3. I used this information to identify indicators for monitoring in this project (Chapter 4). Objective 4 was fulfilled through a preliminary survey of land use planning to support implementation monitoring (Chapter 5) and effectiveness monitoring (Chapter 6). Management conclusions, implications and recommendations are provided in Chapter 7.

This was a relatively low budget project ($10,000), supported by many hours of volunteer work; as such it was necessarily largely an office-based endeavor. Johanna Pfalz completed all of the GIS analysis and maps for this report. I conducted four days of field investigations. Together we conducted interviews and gathered a plethora of information from a variety of sources (e.g., emails, unpublished reports, websites). I reviewed and summarized this information to gain a better understanding for this project and to support others in resolving the complex and challenging problem of maintaining grizzly bears. Limitations of this study are presented in chapters 2 and 3 and 5 and 6.

Reporting for this project includes

1. *Monitoring Land Use Planning to Maintain Grizzly Bears: A Partial Problem Analysis with 2010 Reconnaissance Survey for Grizzly Bear Habitat and Access Control, Babine River Watershed* (this report)
2. *Appendix 1. History of Land Use Planning for Grizzly Bears in the Babine River Watershed: Goals, Objectives, Strategies, Indicators and Targets* (Wellwood 2014a)
3. *Appendix 2. Detailed Results for 2010 Reconnaissance Monitoring Survey for Grizzly Bear Habitat in the Babine River Watershed* (Wellwood 2014b)
4. *Appendix 3. Detailed Results for 2010 Reconnaissance Monitoring Survey for Access Control in the Babine River Watershed* (Wellwood 2014c).

These build on previous monitoring of land use planning for grizzly bears reported in *Monitoring Land Use and Human Activities and Assessing their Potential Effects on Grizzly Bears in the Babine Watershed Monitoring Trust Study Area: Phase 1 Preliminary Analysis of Road Development and Access and Proposed Framework for Monitoring* (Wellwood and Pfalz 2009). Information in this report is for BWMT to support decisions regarding monitoring initiatives and their priorities. As knowledge gained through monitoring is a component of an effective adaptive management cycle, it will also be of interest to others involved in research-, planning-, development-, monitoring- and policy-related activities relevant to the BWMT area of interest. For additional grizzly bear-specific monitoring studies initiated by the BWMT, also see Ciarniello et al. (2012) for human–grizzly bear interactions and bear awareness education baselines collected to support monitoring for this area.

4 Project Area

The project area, 4,024 km^2, is located in the Babine River watershed in mid-western British Columbia (Figure 1). The southeastern extent is the outflow of Babine Lake, approximately 65 km northeast of Smithers. The western extent is the confluence of the Babine and Skeena rivers, approximately 55 km north of Hazelton. The project area does not include Babine Lake (B.C.'s largest natural lake) or its tributaries. It corresponds to the BWMT's specified area of interest for monitoring activities (hereafter BWMT area of interest). The boundary corresponds to the provincially designated watershed boundary for the Babine River watershed (Freshwater Atlas, B.C. Government 2008) with the exception of the southern portion, which extends beyond the Freshwater Atlas watershed boundary to also include a small portion of the Babine Lake watershed. The southern boundary was modified slightly to match the Babine LUP boundary.

The BWMT area of interest is within portions of the traditional territories of the Nat'oot'en and Gitxsan first nations. It is within the former Northern Interior Forest Region and it includes portions of the Bulkley TSA and Kispiox TSA, which are currently managed through the Skeena-Stikine Forest District, Ministry of Forests, Lands and Natural Resource Operations (MFLNRO).

4.1 Ecosystems

The project area is relatively diverse with respect to vegetation, geology and climate. It has major biogeoclimatic transitions from east to west and from low to high elevations with six biogeoclimatic zones represented (Figure 2).

Biogeoclimatic subzone/variants include

- Sub-Boreal Spruce Zone, Moist Cold subzone, Babine variant (SBSmc2)
- Interior Cedar-Hemlock zone, Moist Cold subzone, Nass variant (ICHmc1)
- Interior Cedar-Hemlock zone, Moist Cold subzone, Hazelton variant (ICHmc2)
- Engelmann Spruce-Subalpine Fir Moist Cold subzone (ESSFmc) and associated parkland (ESSFmcp)
- Engelmann Spruce-Subalpine Fir Wet Very Cold subzone (ESSFwv) and associated parkland (ESSFwvp, Banner *et al.* 1993)
- Boreal Altai Fescue Alpine, undifferentiated subzone (BAFAun, MOFR 2006).

4.2 Fauna

Provincially, grizzly bears are Blue-listed (Special Concern) and black bears (*U. americanus*) are Yellow-Listed (secure and not at risk of extinction) (B.C. Conservation Data Centre [BCCDC] 2013). Both species occur throughout the area, probably with greater use of higher elevation areas (i.e., sparsely treed or no trees) by grizzly bears than black bears. It is not known which species is more abundant in the area. The Province of B.C. estimates grizzly bear numbers by Grizzly Bear Population Unit (GBPU, Hamilton et al. 2004). Fifty-six units were delineated for the province, each approximating a sub-population of bears or bear *ecotype*. The BWMT area of interest is entirely within and covers 29% the Babine GBPU (14,039 km^2). The grizzly bear population estimate for this unit was 487 in 2004 (Hamilton 2004), 286 in 2008 (Hamilton 2008), and 313 in 2012 (MFLNRO 2012b). These numbers should not be interpreted as actual changes in the population size because changes were made in methodology and new information was incorporated into population modeling at a provincial level (MFLNRO 2012b).

The rich diversity of terrestrial and aquatic ecosystems in this area supports an impressive diversity of invertebrate, fish, mammal and bird species, a small sampling of which is briefly highlighted in the following, largely focusing on some of the species grizzly bears can be anticipated to interact with in their environment.

Other carnivore species include wolverine (*Gulo gulo*), fisher (*Martes* pennanti), marten (*M. americana*), river otter (*Lutra canadensis*), wolf (*Canis lupus*), coyote (*C. latrans*) and red fox (*Vulpes vulpes*). Moose (*Alces alces*), mountain goats (*Oreamnos americanus*) and mule deer (*Odocoileus hemionus*) are also present. Many species of birds such as ravens (*Corvus*

corax) and bald eagles (*Haliaeetus leucocephalus*), and small mammals such as hoary marmots (*Marmota caligata*) and several species of microtines also occur in the area. Seasonal runs of Pacific salmon include Chinook (*Oncorhynchus tshawytscha),* chum (*O. keta*), coho (*O. kisutch*), sockeye (*O. nerka*), pink *(O. gorbuscha)* and steelhead (*O. mykiss)*.

Figure 1. Project area for monitoring land use planning to maintain grizzly bears in the Babine Watershed Monitoring Trust area of interest, Babine River, B.C.

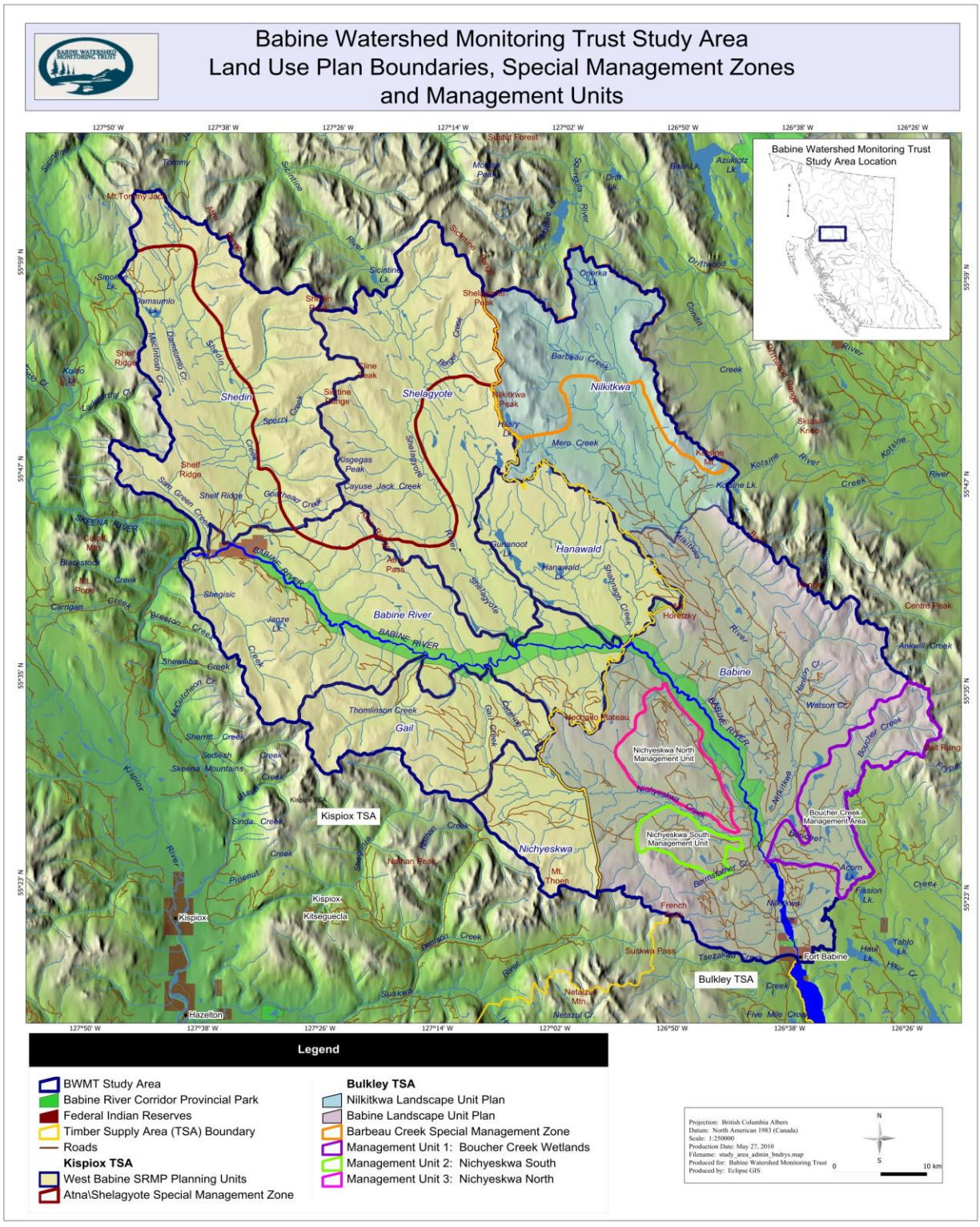
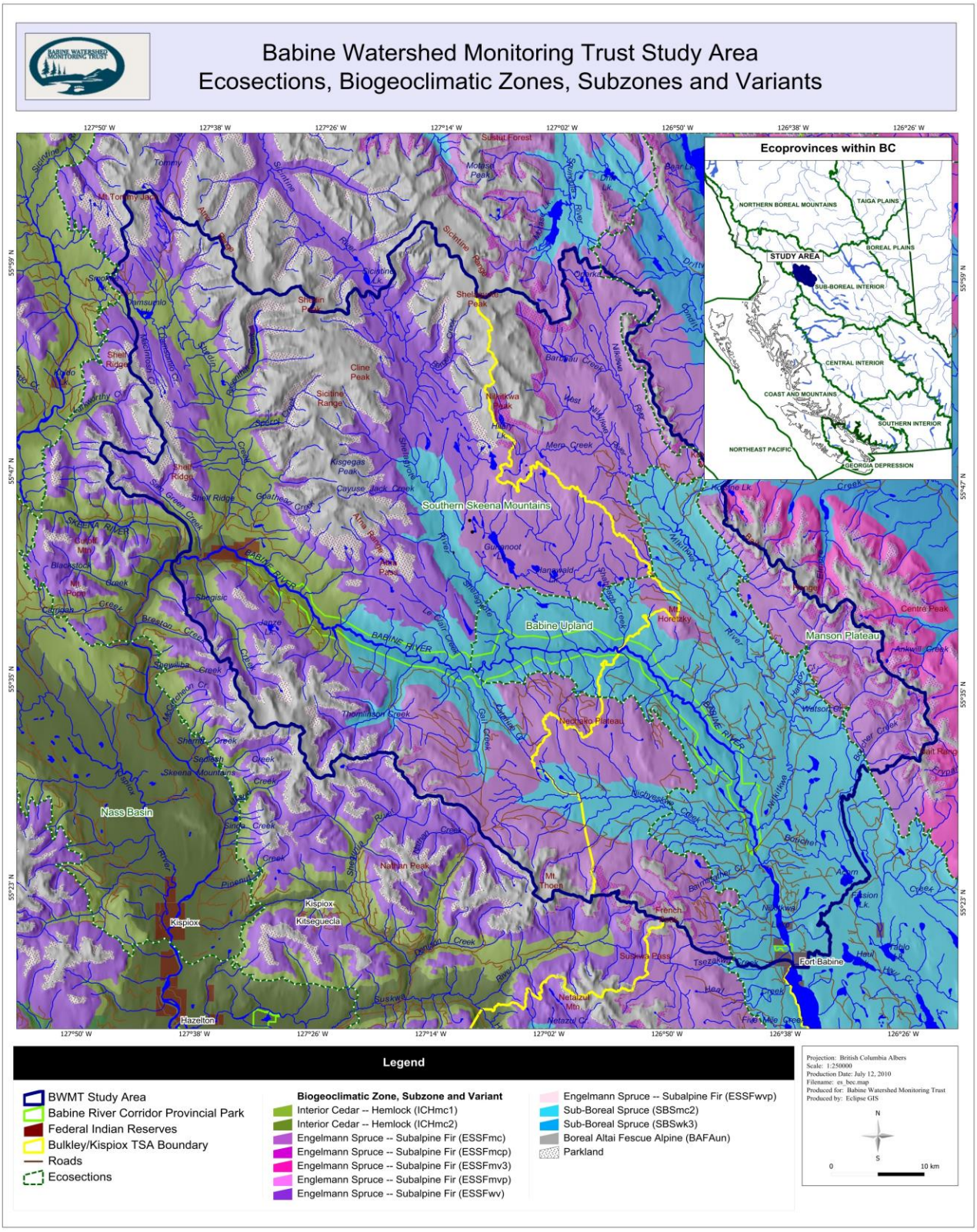


Figure 2. Ecosections, biogeoclimatic zones, subzones and variants delineated within the Babine Watershed Monitoring Trust area of interest, Babine River, B.C.



4.3 Additional Information

In this report, the term *grizzly bear population* loosely refers to grizzly bears that utilize the BWMT area of interest to fulfill some or all of their life requisites (Resources Inventory Committee [RIC] 1999). This is a description that varies from, for example, a biologically defined and delineated population based on unique characteristics or the collective of bears that utilize the Babine GBPU or Wildlife Management Units (6-7 and 6-8) within the Babine GBPU; units delineated by the Province of B.C. for grizzly bear conservation and management. With rigorous scientific study (e.g., radiotelemetry, genetic sampling) grizzly bears within the monitoring area may one day be better described as an ecotype(s) that extends well beyond the boundaries of the BWMT monitoring area. Nevertheless, Peek et al. (2003) considered it unlikely that discrete biological populations exist in much of B.C.

Goals relevant to maintaining grizzly bears have been variably defined in different planning processes, from broad statements advocating maintenance of the current population (MOF and MELP 1994a) to more clearly defined expectation for some, although mitigated, population decline (MSRM 2004a). For this report, the goal for grizzly bears is simply expressed as *to maintain grizzly bears* or *to maintain the grizzly bear population*. I have assumed that the minimum expectation was to maintain a healthy and viable subpopulation of grizzly bears with connectivity to subpopulations in adjacent areas. I do not attempt to qualify or quantify this statement and expect that interpretations will be variable, depending on planning document reference point, people's perspectives and other factors, until a common definition can be agreed upon for this area.

A list of acronyms used in the document is provided for reference in Appendix 1.

Chapter 2: Review of Knowledge Base

1 Methods

Following the initiation of this project, I determined that a considerable amount of additional work was needed to develop a better understanding of information forming the knowledge base for grizzly bears and their habitat. This included literature review and interviews with industry and government personnel and questions submitted to biologists that worked in the area. Literature sources were digital and paper versions of maps, reports and other forms of communication (e.g., emails, bulletins, letters). This information builds on and updates information provided in *Appendix 2 Knowledge Base: Information used for Estimating Risk, Uncertainty and Probability of Success* (Price and Daust 2005b) and grizzly bear specific information in *The Babine River Watershed: an annotated bibliography of inventory, monitoring, research and planning reports* (de Groot 2004). The following provides methods used to assess ecosystem mapping with grizzly bear habitat interpretations.

1.1 Ecosystem Mapping with Grizzly Bear Habitat Interpretations

1.1.1 Components of Grizzly Bear Habitat Interpretive Mapping

Interpretive mapping for grizzly bear habitat was the primary information resource used in land use planning for grizzly bears. Conceptually and explicitly expressed within the current framework of RIC Standards (RIC 1998a, 1999), the production of interpretive maps consists of the following components

1. Ecosystem mapping (e.g., biophysical mapping, Broad Ecosystem Inventory, Terrestrial Ecosystem mapping [TEM], Predictive Ecosystem Mapping [PEM], Predictive Habitat Mapping [PHM])
2. Grizzly bear habitat interpretations for ecosystem mapping, presented in ratings tables and grizzly bear interpretive maps. Interpretations can be generalized into three sub-components

- Preliminary knowledge base (e.g., researcher knowledge and expertise, development of a preliminary species-habitat model)
- Field sampling
- Update and revision of the knowledge base and completion of a final report (e.g., final species-habitat model, food habits and habitat use report).

As feasible and considered appropriate, I reviewed available information for each of these components (explicit or implied).

1.1.2 Accuracy and Reliability Assessments

Assessments of ecosystem-mapping projects for accuracy and reliability and of interpretations for habitat mapping for reliability are needed to support decisions regarding appropriate uses of these resources. Meidinger (2003:p. 18) described an accuracy assessment for ecosystem maps stating analysis

> "*focuses on the thematic content of polygons. Polygon boundaries are not assessed. The results are essentially "non-spatial," in that they do not show explicitly where errors can be found over the whole map. However, information is provided about overall accuracy of the selected ecosystem mapping entities. This is useful because it provides potential users of the map or project with a level of confidence in the results*."

While considered a critical step for determining appropriate use of the mapping, accuracy assessments are rarely completed due to cost (Meidinger 2000).

Reliability of ecosystem maps is influenced by map scale and survey intensity, a measure of sampling density (RIC 1998a). Decisions regarding appropriate map scale and survey intensity can be made by balancing the project objectives and the proposed use of the ecosystem mapping with estimated costs to produce it. The RIC (1998a:p. 49) states: "if the map is to be used for making specific management decisions about portions of land (e.g., soil sensitivity, site preparation options, tree species selection), then the map needs to be very reliable". This can be achieved through higher survey intensity and larger map scale. However, these factors increase cost. If a map will only be used for general planning purposes a lower survey intensity and smaller scale may be considered acceptable. Other factors that influence reliability include the complexity of ecosystems, ease or difficulty of airphoto interpretation, and surveyor knowledge and experience.

The outputs of an accuracy assessment are needed to assess reliability of ecosystem maps (i.e., polygon accuracy, global accuracy, positional accuracy, topological accuracy, consequences of error; Sims and Matheson 1999). They conclude it "is more difficult to quantify reliability than to determine accuracy. In some cases, the map accuracy will also be its reliability if the map is used for the exact purpose as what it shows" (Sims and Matheson 1999:p. 27). In addition, "reliability must be stated in terms of the method used by which it was assessed and the application of the map" (Sims and Matheson 1999:p. 28). For wildlife habitat interpretations "the reliability qualifier reflects the level of information available on a species' life requisites as well as the corresponding understanding of the species habitat relationships and their application to ecosystem mapping" (RIC 1999a:p. 46).

I completed a review of accuracy and reliability of ecosystem mapping and reliability of interpretations for grizzly bear habitat. A preliminary review of reports and maps found relatively little information available to assess some projects. For the purposes of this project, I decided that provisional accuracy and reliability ratings would be acceptable, as needed, for ecosystem and interpretive mapping that did not explicitly provide this information. This was a coarse, qualitative assessment for the relative probability that a particular product would support identification of important grizzly bear habitats on a particular piece of land (RIC 1998); that is, accuracy and reliability of information for the purpose of planning and monitoring to maintain important grizzly bear habitats.

1.1.3 Standards for Assessment

Locally and provincially, methods varied and standards evolved considerably for ecosystem mapping and interpretations for grizzly bear habitat over the period of interest

(i.e., 1989–present) for this project. I identified standards available, overtime, with submission dates as follows

- 1990: *Biophysical Habitat Mapping Methodology* (Demarchi et al. 1990)
- March 1995: *Standards for Terrestrial Ecosystem Mapping in British Columbia* (RIC 1995, first version). This evolved from *Methods for Biogeoclimatic Mapping* (Mitchell et al. 1998) and *Biophysical Habitat Mapping Methodology* (Demarchi et al. 1990).
- April 1998: *Standards for Wildlife Habitat Capability and Suitability Ratings for British Columbia* (RIC 1998a)
- May 1998: *Standard for Terrestrial Ecosystem Mapping in British Columbia* (RIC 1998b)
- May 1999: *British Columbia Wildlife Habitat Rating Standards* (RIC 1999a, version 2.0)
- November 1999: *Standards for Predictive Ecosystem Mapping* (RIC 1999b, version 1.0)
- October 2007: *Mapping Methods for Important Coastal Grizzly Bear Habitat* (MacHutchon 2007)
- October 2010: *Coastal Grizzly Bear Habitat Mapping and Review Methods* (Grizzly Bear Habitat Mapping Technical Review Team 2010).

1.1.4 Indicators and Benchmark for Assessment

I identified a benchmark and several indicators to support my assessment. For wildlife habitat capability and suitability projects, the RIC (1998a) considered Level 4 survey intensity (15 – 25% polygon inspections) to be a reasonable balance of cost and reliability of ecosystem mapping and an appropriate scale was considered 1:20,000 or 1:50,000. This decision would be influenced by the complexity of ecosystems and the requirement for accuracy. Prior to this, RIC (1995) recommended Level 3 (26 – 49%) for wildlife capability. I did not determine why intensity was reduced. MacHutchon (2007) recommended using large-scale air photos or preferably orthophotos (i.e., 1:20,000 or larger) to delineate grizzly bear habitat polygons with digitized transfer to ArcInfo GIS and minimums of 5-10% ground assessments and 20-25% air assessments for polygons (i.e., within the range of survey intensity level 3).

Generally, the benchmark projects against which I compared projects reviewed here were grizzly bear habitat mapping completed for the B.C. coast (e.g., MacHutchon 2000, 2001, 2007). Even at a high level of reliability, limitations and appropriate uses for mapping still need to be considered, as highlighted by MacHutchon (2007:p. 23) that most of the coastal B.C. projects "…in effect 'flag' important grizzly bear habitat polygons across the landscape; the boundaries of which may have to be further refined on the ground during any development occurring in the area. This will likely continue to be true for future polygon mapping, whether when identifying grizzly bear sensitive habitat for meeting LRMP objectives or as candidate WHAs". That is, mapping used to identify grizzly bear habitat should be accurate and reliable enough to locate most important habitats on the ground but some adjustments to polygon boundaries may still be needed.

I used the most recent RIC Standards and *Mapping Methods for Important Coastal Grizzly Bear Habitat* (MacHutchon 2007) to identify indicators to support my evaluation.

Indicators for assessing accuracy of ecosystem mapping:

- Any issues of potential relevance to accuracy reported by authors or others
- Any accuracy scores reported by authors

Indicators for assessing reliability of grizzly bear habitat interpretation:

- Knowledge base
- Assumptions regarding seasonal food habits and habitat use
- Identified or apparent gaps in knowledge
- Limitations of data
- Surveyor knowledge and expertise (e.g., grizzly bear research, grizzly bear habitat assessment, MacHutchon 2007)

Primary indicators for assessing reliability of ecosystem mapping with grizzly bear habitat interpretation that I considered, based on information reported, were

- Type of mapping (e.g., biophysical, PHM, TEM)
- Seasonal (e.g., spring, summer, fall) habitat use delineated and rated (RIC 1999a, MacHutchon 2007)
- Use of a 6-class rating scheme (RIC 1999a, MacHutchon 2007)
- Polygon ratings based on the collective contribution of habitat types (MacHutchon 2007)
- As feasible, factor the availability of animal foods, intra- and interspecific competition among bears, and local human influences (MacHutchon 2007)
- For photo-based projects (i.e., excluding Predictive Ecosystem Mapping [PEM], Predictive Habitat Mapping [PHM]), large scale air or orthophotos (i.e., 1:20,000 or larger) used (MacHutchon 2007)
- Use of large map scale (i.e., 1:20,000 or larger, MacHutchon 2007)
- 1 to 3 ecosystem units per delineated polygon (RIC 1998a, MacHutchon 2007)
- Delineation of "polygon boundaries based on terrain and vegetation features such as slope breaks, other natural landscape breaks, changes in forest cover type, and edges between non-forested and forested habitat" (MacHutchon 2007:p. 23)
- "Delineate buffers around non-forested or open forest feeding habitats as part of a polygon whenever a polygon is not adjacent to another polygon that is also mapped" and "…buffer widths should vary according to site-specific conditions (e.g., terrain type, forest cover type, evidence of grizzly bear use" (MacHutchon 2007:p. 23)
- "As much as possible, consider other factors than food or cover value that may influence a the suitability of a habitat polygon to grizzly bears" (MacHutchon 2007:p. 26)
- Surveyor experience (i.e., ecosystem mapping) (MacHutchon 2007)
- Minimums of 5-10% ground assessments and 20-25% air assessments for polygons (i.e., within the range of survey intensity level 3) (RIC 1995, MacHutchon 2007).

See RIC 1999a and MacHutchon 2007 for complete details regarding standards and methods, respectively.

1.1.5 Evaluation

I identified a general statement of purpose for ecosystem mapping and grizzly bear habitat interpretations based on reported information. For the purposes of this project, reliability was broadly defined as the probability of the map predicting habitats important to grizzly bears on the ground (adapted from Sims and Matheson 1999). I summarized information to support an understanding of accuracy and reliability of ecosystem mapping and reliability of interpretations for grizzly bear habitat and assigned provisional reliability ratings. As these were coarse evaluations and original data sources were not reviewed, I used a three-class rating scheme (low, moderate, high), and for some I provided two ratings (e.g., low or moderate), indicating greater uncertainty. These reconnaissance-level, provisional assessments were based on the following definitions for reliability qualifiers:

- For ecosystem mapping, from *Problem Analysis on Reliability Quality Control and Validation of Predictive Ecosystem Mapping* (Sims and Matheson 1999:p. 28)
    - *"Low Reliability. Map is not appropriate for this application."*
    - *"Moderate Reliability. Predictions made using this map for this application have a moderate degree of reliability. If implications of an incorrect decision are severe, this map should not be used."*
    - *"High Reliability. Predictions made using this map for this application have a high degree of reliability*."

- For species habitat models (or comparable product) and interpretive habitat maps for grizzly bears, from "*British Columbia Wildlife Habitat Ratings*" (RIC 1999a:p. 46)
    - *"Low Reliability. Available information is based on studies in other provinces or countries with some or little local information on the species-habitat relationships. No verification has been done."* Or for the purpose of this study if there was little empirical information from ecologically similar areas (or similar ecotypes), considered suitable for extrapolation.
    - *"Moderate Reliability. Available information is based mainly on studies, reports and expertise on the species-habitat relationships gained within British Columbia. Some information from ecosystems in the study area, but mostly extrapolated from similar ecosystems. No verification or limited verification has been done."*
    - *"High Reliability. Available species-habitat relationship information is based mainly on detailed studies, reports and expertise gained within British Columbia and pertaining directly to the ecosystems in the study area. Ratings have been verified*."

1.2 Other Grizzly Bear-Related Reports

I also reviewed numerous other reports of relevance to grizzly bears and their habitat that were completed for the Babine River watershed over a twenty three-year period (1989–2012). This was to develop a better understanding of how grizzly bear-related

information has been used and could be used in grizzly bear management and conservation endeavours for the BWMT area of interest.

2 Results and Discussion

An understanding of the knowledge base, gaps in information and limitations of data within an overall management context was considered essential to complete this monitoring project. In particular, interpretive grizzly bear habitat mapping was a key decision making tool used in land use planning (Chapter 3). Methods used evolved and improved over time as standards were developed and further refined. Information for some components was not clearly expressed in earlier projects.

Overall, my review of the knowledge base included projects involving

- Landscape-level investigations
  - Grizzly bear food habits and habitat use
  - Ecosystem mapping
  - Interpretations for grizzly bear habitat
- Area- or activity-specific investigations
  - Ecosystem mapping
  - Forestry focused assessments of grizzly bear habitat and potential impacts to them
- Other areas of focus
  - Grizzly bear access to salmon
  - Babine LRUP Monitoring
  - Grizzly Bear Monitoring Index (attempting to monitor population trend)
  - Monitoring indicators for objectives expressed in land use plans for grizzly bears

This chapter provides a summary of results and discussion of the knowledge base for grizzly bears and their habitat. More detailed information is provided in *Appendix 2. Detailed Results for the 2010 Reconnaissance Monitoring Survey for Grizzly Bear Habitat in the Babine River Watershed* (Wellwood and Pfalz 2013b).

2.1 Landscape-level Grizzly Bear Studies

Two landscape-level projects were conducted to determine grizzly bear food habits and habitat use including

1. *Seasonal Habitat Use by Grizzly Bears in the Babine River Drainage* (Simpson 1990)

- This relatively limited study was focused on the *Babine River Interim LRUP* area of interest. Fieldwork consisted of one day for aerial over-flight and seventeen days of ground investigations conducted in mid-June (3 days), mid-July (4 days) and early to mid September (10 days).
- No studies of grizzly bear ecology had been conducted in ecologically similar areas.
- Expert knowledge and bear sign were used to support habitat assessments.
- Sampling effort was focused on ecosystem units that were anticipated to have moderate or high seasonal (spring, summer, fall) use by grizzly bears.

- Investigations were made in SBS, ICH and ESSF zones but not parkland or alpine tundra, apparently because these zones were not of interest from a forestry perspective.
- Denning habitats were not assessed.
- Noted problems differentiating between grizzly bear and black bear sign.
- Based on my visual count of plot locations on Figure 1 map (Simpson 1990:p. 2), a minimum of 85 habitat-sampling sites (i.e., not counting potential overlap due to scale) appears to have been conducted.

2. *Habitat Use by Grizzly Bears and Implication for Forest Development Activities in the Kispiox Forest District* (MacHutchon and Mahon 2003)

- This was a short duration telemetry study with of radiocollared grizzly bears (two adult males, two subadult males, one adult female) initiated in 2001. Two grizzly bears (one adult female, one adult male) continued to be tracked in 2002.
- Seasonal food habits were determined through scat collection and analysis and site investigations at feeding sites.
- A list of possible, likely or known grizzly bear foods with seasons of use (spring, summer, fall) was prepared for the Kispiox Forest District based on Simpson (1990), Halter (1998), MacHutchon (1998), this study and authors' knowledge regarding plant food availability in the study area and grizzly bear food habits in other areas.
- Only two den locations were identified.
- This project was terminated before completion due to discontinuation of funding.

In addition, an attempt was made to initiate a multi-year radio telemetry study of grizzly bears in the Bulkley TSA portion of the study area. Five grizzly bears were radio-collared in 1996 with plans to increase the sample size by up to 30 more bears in 1997 (T. Smith pers. comm. in Babine LRUP Monitoring Committee 1996). This study was discontinued in 1997. Apparently, relatively little information was gathered from these bears and no reports were located.

2.2 Landscape-level Ecosystem Mapping with Grizzly Bear Habitat Interpretations

Six landscape-level ecosystem-mapping projects with grizzly bear habitat interpretations have been conducted in the BWMT area of interest. One of these projects was completed in three versions. These are summarized in the following sections.

2.2.1 Biophysical Mapping with Grizzly Bear Habitat Sensitivity to Development for Babine River Interim LRUP

Between 1989 and 1992, Biophysical Habitat Mapping was a completed producing four map sheets at 1:50,000 scale (map sheets 93M/12, 93M/11, 93M/10, 93M/07) with interpretations for grizzly bear habitat sensitivity to development. Projects centered on Babine River within the Bulkley and Kispiox TSAs. This project was completed to support the development of the *Babine River Interim LRUP* and it formed the basis of grizzly bear habitat mapping in subsequent stages of land use planning (see Chapter 3).

Reports reviewed were:

1. *Biophysical Habitat Units of the Babine River Study Area* (Lea and Kowall 1989, 1992)

- Implied Purpose: To support interim planning for local resource use in the Babine River area.
- This project included a draft report with broad descriptions for biogeoclimatic subzones and biophysical units (i.e., dominant and associate plant species and abundant and moderate winter forage for ungulates and summer forage for bears). A correlation table linking biophysical units to site series, as applicable, was provided.

2. *Grizzly Bear Habitats and Biodiversity Guidelines in the Babine River Drainage* (Simpson 1992)

- Implied purpose: to predict important grizzly bear habitats in the Babine River area for general planning purposes for local resource use.
- Interpretations for grizzly bear habitat for the *Babine River Interim LRUP* area were based on work completed by Simpson (1990).
- Provided management guidelines for habitat units (biophysical units) and rated them as low, moderate or high sensitivity to development. He used the qualitative ratings that he determined for ecosystem unit types based on estimates of bear use (low, moderate, high, Simpson 1990) to evaluate biophysical polygons (Lea and Kowall 1989 *in* Simpson 1992), commonly comprised of two or three biophysical units, for sensitivity to development (low, moderate, high).
- A list of assumptions and rationale for determining ratings was not provided. It would be possible to compile at least a partial list of various assumptions and indicators for habitat value based on information provided in results and discussion. However, it was not possible to reliably identify gaps in information or limitations of data based on information provided.
- Potential movement corridors and biodiversity reserves were also identified as high sensitivity to development.
- Only an overall rating for the period grizzly bears are active was given (i.e., seasonal ratings were not provided) for sensitivity to development, although seasonal ratings for habitat types were provided in Simpson (1990).
- As previously mentioned, parkland and alpine tundra biophysical units were not assessed. Habitats for denning were also not assessed. Therefore, guidelines for grizzly bear habitat do not cover some parts of the watershed and some important life requisites.
- Simpson drafted two (of four) map sheets "…to illustrate the classification, distribution and location of habitats with high or moderate sensitivity to resource development within the Babine River drainage." I contacted K. Simpson and BC MOE and MOFR personnel and searched office files to locate the original maps (hand coloured, paper maps) but I was unsuccessful in finding them.

Assessment of Data Sources

My provisional reliability assessments of these data sources were as follows:

1. Biophysical Mapping (i.e., Lea and Kowall 1992)

- The mapping may have been appropriate for general planning purposes with the following considerations:

  - Reporting for this project was draft. These reports were as complete as was typically achieved for biophysical mapping at that time.
  - Mapping was completed pre-RIC standards at a time when mapping standards and practices were rapidly evolving. Biophysical mapping was a precursor in combination with biogeoclimatic mapping to RIC Standards for TEM (RIC 1998).
  - I did not find any records to determine time dedicated to field investigations or survey intensity and little information to assess reliability. However, based on the number and distribution of plot locations hand written on paper copies of draft maps, survey intensity may have been Level 5, perhaps less.
  - The lead surveyor had extensive expertise and was a contributor to the development of biophysical mapping and, subsequently, TEM (B. Fuhr pers. comm., RIC 1998).
- Given apparently low survey intensity and a mapping scale of 1:50,000, my provisional evaluation is that this project was a reconnaissance level mapping project with low reliability for locating specific habitat types on the ground. The mapping and draft report were not further refined.

2. Interpretation for Grizzly Bear Habitat (i.e., Simpson 1990, 1992)

- This work was also completed pre-RIC standards.
- Simpson (1992:p. 36) qualified this work with statements such as:
  - "general guidelines and mapping are intended only to highlight areas of concern. Where conflicts arise, site specific planning should be used to determine best alternatives. Specific conflicts can often be resolved within guidelines if more detailed interpretation of maps and air photos is combined with site inspections."
  - "Editing and correction of the habitat maps should be completed and an accurate database constructed from updated files…".

  Notably, important grizzly bear habitats were to be identified through investigations on the ground.
- My provisional evaluation is that this project was also a reconnaissance level of investigation with low reliability for the purpose of locating important grizzly bear habitat types on the ground. A biologist with bear expertise completed this project. However, field surveys were limited and no studies of radiocollared bears had been conducted in this or similar ecosystems at that time. Knowledge gained and information gathered in this project supported the development of some studies subsequently conducted in the area (e.g., MOF and MOE 2001, MacHutchon and Mahon 2003, Mahon et al. 2004).

2.2.2 1995 Wildlife Habitat Mapping for Bulkley LRMP

I found evidence that a wildlife habitat-mapping project might have been completed in 1995 in a map titled *Bulkley Plan Area Wildlife Habitat – 1995* that was in the *Bulkley LRMP* (BVCRBIPT 1998:p. 12). Some of the polygons delineated for grizzly bear habitat appeared to be from the *Babine River Interim LRUP*, Appendix 12 map but, specific to the BWMT area of interest, other polygons in the Nilkitkwa Planning Unit and the northern portion of the Babine River Planning Unit were new to me. Moose, mountain goat, mule deer and caribou habitat polygons were also delineated. This was the only reference that I found for this mapping project. Despite focused effort, I was unable to determine where it came from. To

the best of my knowledge, no reports were produced for this mapping project. It does not appear to have been used in any subsequent stages of land use planning considered in this report and I did not examine it further.

2.2.3 Wildlife Habitat Suitability Mapping for Kispiox Forest District

In 1996, Wildlife Habitat Suitability Mapping with interpretations for grizzly bear habitat suitability was completed for the Kispiox Forest District (see Figure 4, map and data model from Turney 1996 *in* KLRMPT 2001:p. 40). I did not encounter any further reference to this mapping project and it does not appear to have been used in any subsequent stages of land use planning covered in this report. I did not examine this project further.

2.2.4 TEM with Grizzly Bear Habitat Suitability for Upper Nilkitkwa River

In 1998 and 1999, TEM with interpretations for grizzly bear habitat suitability and capability (spring, summer, fall) was completed for two map sheets at 1:20,000 scale (map sheets 93M.076, 93M.086). This project was centered on a mid-section of the Nilkitkwa River within the Bulkley TSA.

Reports reviewed were

1. *Terrestrial Ecosystem Mapping of the Upper Nilkitkwa River Drainage* (Oikos Ecological Services Ltd. 1998)

- Implied purpose: To support landscape management planning for the upper Nilkitkwa River Drainage.
- I did not find a report for this project and was unsuccessful in efforts to determine whether or not one had been completed.
- Information gathered for this project was limited and largely based the Introduction Legend (File name: NKIntroleg.doc). 1:20,000 black and white air photos were used. Survey intensity level 5.

2. *Grizzly bear Habitat Capability and Suitability Models for the Upper Nilkitkwa River, Bulkley Forest District, Species Accounts and Preliminary Ratings* (Keystone Wildlife Research 1999a) and *Terrestrial Ecosystem Mapping: Ecosystem Attributes and Wildlife Habitat Interpretations for the Upper Nilkitkwa River, Bulkley Forest District* (Keystone Wildlife Research 1999b)

- Stated purpose (i.e., overall objective): "to provide wildlife habitat capability and suitability maps to assist with landscape and stand-level forest management planning" (Keystone Wildlife Research 1999a).
- Literature sources limited.
- Gaps in information and limitations of data not specified.

Assessment of Data Sources

My provisional reliability assessment for these data sources was as follows:

- Terrestrial Ecosystem Mapping ([TEM] Oikos Ecological Services Ltd. 1998). Standards of the day (RIC 1998a) indicate that this mapping may have been appropriate for general planning purposes with the following considerations:
  - Survey intensity Level 5 was "the level recommended when level 4 is too costly and lower reliability is acceptable" (RIC 1998a:p. 48).

  - RIC (1998:p. 48) interpretive examples included "forestry; wildlife capability; ecosystem representation; general forest productivity; local resource use planning; landscape management planning."
  - Given apparently low survey intensity, my provisional evaluation is that this project was a reconnaissance level-mapping project with low reliability for the purpose of locating the specific habitat types on the ground.
- Interpretations for grizzly bear habitat (Keystone Wildlife Research 1999a, 1999b). Standards of the day (RIC 1998a) indicate that interpretations may have been appropriate for general planning purposes with the following considerations:
  - I found little information to assess reliability. However, statements regarding limited sample sizes indicate survey intensity was relatively low, apparently Level 5 or less.
  - Keystone Wildlife Research (1999b:p. 1) stated "the wildlife habitat attribute data provide a preliminary quantification of relative abundance of key habitat characteristics identified in the *Species Model* (Keystone 1999) for each ecosystem unit and structural stage." In another statement, intent is implied as "to assist with operational planning, we have identified ecosystems and management prescriptions that highlight where logging should be avoided or permitted with proper access management (Table 7)" (p. 36). Table 7 summarized management guidelines for ecosystem units. This project concludes with the following statement: "Despite small samples, this information together with further sampling (recommended) can provide guidance to field crews conducting wildlife habitat capability/suitability assessments. Further work should be carried out to test the ratings…" (p.38).
  - My provisional evaluation is that this project was also a reconnaissance level project with low reliability for locating important grizzly bear habitats on the ground due to limited field surveys and area-specific knowledge about bears, and at the time no studies had been conducted for bears in ecologically similar areas.

2.2.5 PHM with Grizzly Bear Habitat Suitability for Kispiox Forest District (2001–2004)

Mahon (1996 *in* Mahon and Marsland 2001) completed draft report *A Preliminary Review of the Wildlife and Habitat Issues Related to Proposed Road Network Options in the Northern Chart Areas* and Mahon and Marsland (2001) refer to draft grizzly bear habitat rating maps for Skeena Cellulose Inc. northern chart areas in Kispiox Forest District (Mahon 1996 *in* Mahon and Marsland 2001). I was unable to locate the maps, information from which was incorporated into the Predictive Habitat Mapping (PHM) discussed in the following.

Between 2001 and 2004, PHM with grizzly bear habitat suitability ratings for spring, summer and fall (at least three versions) were completed jointly at 1:20,000 scale for the entire Kispiox Forest District. Early work completed by Mahon (1996 *in* Mahon and Marsland 2001) was used to support the development of the PHM products that formed the basis for land use planning in the Babine LRUP Treatment Unit Mapping Extension (i.e., area not originally covered in the *Babine River Interim LRUP* within the Kispiox TSA).

Reports reviewed were

1. *Habitat Suitability Mapping for Grizzly Bears, Kispiox Forest District* (Ministry of Forests and Ministry of Environment 2001, also referenced for same title and year as Edie 2001 *in* Mahon and Marsland 2001):

- Stated Goal: "to develop suitability mapping of grizzly bear habitat at a 1:20,000 scale for use during planning of forestry activities in the Kispiox Forest District" (MOF and MOE 2001:p. 1).
- This was the earliest version that I found for this project. It was a precursor for PHM. It was also done with limited information and funds.
- Authors described in detail the model construction, variables and output. It was developed as an expert-based model using Forest Cover and TRIM (with a moisture model) data.
- Reported in MOF and MOE (2001), habitat values were inferred from Simpson 1990, 1992; Keystone Wildlife Research 1999; and the Nass (LGL 1999) with local knowledge of Todd Mahon and Laurence Turney, both wildlife biologists that had worked in the area for several years. In addition, information for grizzly bear habitat from the Kimsquit (Hamilton 1987) and Khutzeymateen (MacHutchon et al. 1993) was used and for habitat interpretation information from Fuhr and Demarchi (1970), Banner et al. 1993 and TerraMar (1999) was used (*in* MOF and MOE 2001).
- Statement that field sampling for 1:50,000 mapping completed by Simpson (1992) was far greater than for this project.
- Considered potentially less detailed and less accurate than TEM or PEM but an improvement over 1:250,000 mapping alternative.
- Mahon (2003a) reported accuracy results for earlier versions.

2. *Babine LRUP Treatment Unit Mapping Extension, Kispiox Forest District* (Mahon and Marsland 2001)

- Stated Goal: "…to complete Treatment Unit Mapping over the remaining portions of the Babine watershed within the Kispiox Forest District not originally completed when the Babine River Interim Local Resource Use Plan was released in 1994" (Mahon and Marsland 2001:p. 2).
- This was a mid-version of the PHM series.
- All biogeoclimatic subzones were included in the mapping.
- As noted previously, Mahon (2003a) reported accuracy results for earlier versions.

3. *Grizzly Bear Habitat Complex Mapping, Kispiox Forest District* (Mahon 2003a)

- Stated Purpose: "…to evaluate the Predictive Habitat Mapping, with respect to habitat type, suitability and context issues, and identify concentrations that are of high value to grizzly bears which may warrant special management considerations" (p. 2).
- Grizzly Bear Habitat Complexes were concentrations of important grizzly bear habitat that were delineated in mapped polygons;
- This mapping covered the remaining portion of the Kispiox Forest District that had not been previously mapped.

- Areas excluded were the *Babine River Interim LRUP* (i.e., Appendix 12, MOF and MELP 1994a) and Babine LRUP Treatment Unit Mapping Extension (see Mahon and Marsland 2001).

4. *Predictive Habitat Mapping with Grizzly Bear Habitat Suitability Ratings for the Kispiox and Cranberry Timber Supply Areas* (Mahon et al. 2004)

- Stated goal:

  "*The overall goal of this project* was *to produce suitability mapping of grizzly bear habitat at a 1:20,000 scale across the Kispiox and Cranberry Timber Supply Areas (TSAs). Suitability maps produced by the mapping projects were intended for:*
    a) *Deriving grizzly bear Treatment Units for as yet unmapped portions of the Babine LRUP*
    b) *Identifying high value grizzly bear complexes across the remainder of the District to be used in Landscape Unit planning and stand-level habitat protection*
    c) *Monitoring habitat retention goals of the Kispiox LRMP*" (Mahon et al. 2004:p. 2).
- This version contributed to further refinement of the model and map products. It was the last version of mapping completed for this project.
- All biogeoclimatic subzones were included in the mapping.
- Benchmark for rating habitat suitability was relative to the best available in the project area. They also considered ratings relative to B.C. coastal (i.e., Khutzeymateen) and interior (i.e., Flathead Valley) benchmarks, and although habitat suitability was considered somewhat lower in the project area, the difference was not considered enough to warrant a downward adjustment of a full class. For important grizzly bear habitat polygons, only the very best were rated as high and the majority was rated as moderately high.
- Only rated suitability for food plants because of poor understanding or complicating-factors for determining other life requisites (e.g. thermal and security cover, denning, migration [or travel]).
- Food animals were not included in habitat ratings due to: lack of direct association with vegetated site series and other data sources to determine availability; poor understanding of habitat relationships of prey species (e.g., moose calving areas, marmot burrowing areas); and relatively random distribution for some food types (e.g., ungulate carcasses).

Assessment of Data Sources

My provisional reliability assessments of these data sources were

- Standards of the day (RIC 1998a) indicate that conceptually mapping and interpretations for grizzly bear habitat were appropriate for the intended purpose with the following considerations:
    - It was established within a framework that considered and was made compatible with general principles and standards for PEM and British Columbia Wildlife Habitat Rating Standards.

  - The authors provided rational for developing PHM and a description for similarities and differences between PHM and EcoGen PEM.
  - Accuracy scores were calculated for two earlier versions and roughly estimated for the final version.
  - A species habitat model was provided and assumptions and limitations of this project were discussed (Mahon et al. 2003).

Assessment for PHM component

- Survey intensity and validation were not quantified in these reports.
- Based on accuracy assessment scores (Mahon et al. 2003), provisionally I estimated reliability as low for the 2000–2001 version, low or moderate for the 2002 version and moderate or high for the 2003 version for locating specific habitat types on the ground.

Assessment for grizzly bear habitat component

- Mahon and Marsland (2001) report suitability ratings were inferred from Simpson (1990), Mahon (1996) and Turney (2000).
- Apparently, a report was not prepared for the 2002 version.
- MacHutchon and Mahon (2003) gathered additional information from radio-collared grizzly bears and ground truthing for habitat mapping that were used to support revisions for the final version.
- My provisional reliability assessment for interpretations was low or moderate (2000-2001 version), not assessed (2002 version) and moderate or high (2003 version) for locating important grizzly bear habitats on the ground. The primary uncertainty for the final version was that, while extensive and multi-researcher expertise was utilized in model development and information from previous studies had been incorporated, no long-term radio telemetry studies of grizzly bears had been conducted in ecologically comparable areas (i.e., transition area with ICH and SBS subzones and associated subzones with highly productive habitats for salmon and ungulates, notably moose). Some food or habitat types might have been undervalued, missed or overvalued.

This project started out as a reconnaissance level of investigation but with subsequent investigations and revisions the final version would be more appropriately described as a detailed level.

2.2.6 Grizzly Bear Habitat Suitability Index for Bulkley TSA (2008)

A Grizzly Bear Habitat Suitability Index was completed at 1:50,000 scale for winter denning and fall foraging life requisites for the entire Bulkley TSA area. Ground truthing/field verifications were conducted in 2007 and 2008 (D. Whelan pers. comm.). Information gathered was limited but this mapping was based on BEC, forest cover maps, orthophoto interpretation, and other variables. It has not been used in land use planning examined in this report (T. Manning pers. comm.). Darrell Whelan (pers. comm.) reported “the project was carried out to guide BCTS planners in locating areas of high suitability to maintain on the landbase. It is also used to determine the best areas to maintain connectivity and place wildlife tree retention areas to assist landscape level biodiversity”. B.C. Timber Sales (2008) also provides wildlife management guidelines for planners. Grizzly bear specific information was also limited to winter denning (applicable to Lakes TSA only) and

important late summer and fall foraging habitat. Here they state (p.1), "forest practitioners/timber sale managers should also refer to appropriate high level plans, Forest Stewardship Plans, and related government documentation (e.g., Ministry of Environment Section 7 Notices) for any additional planning or management information". I did not investigate these projects further for this report.

2.3 Local-level Ecosystem Mapping with Grizzly Bear Habitat Interpretation

I identified nine reports of relevance to grizzly bear habitat at more local or site levels as follows:

1. Big Slide Area: *Ecosystem Mapping and Wildlife Interpretations Big Slide Study Area* (Madrone Consultants Ltd. 1994)
2. Babine River Bridge (across lower Babine River): *Mitigative Measures to Protect Grizzly Bears and Moose: Babine River Bridge – Kispiox Forest District* (Turney and Pankras 1996)
3. Nichyeskwa Connector: *Nichyeskwa Connector LRUP Treatment Unit Assessment Wildlife Habitat Assessment Report* (Mahon 2000a)
4. Tommy Jack Pass: *Habitat Assessment and Suitability Mapping for Grizzly Bear and Mountain Goat in Tommy Jack Pass, Kispiox Forest District* (Turney and Blume 2000). This was followed up with a letter re: *Mainline location – Tommy Jack Pass* (Turney 2000)
5. Cutting Permit 991: *CP 991 LRUP Treatment Unit Assessment, Wildlife Habitat Assessment Report* (Mahon 2000b)
6. Shenismike West: *Shenismike West WHA* (Draft 1.1, Anonymous 2003). This document refers to a report *How Grizzly Bear Conservation Can Contribute to Protecting the Roadless Babine* (Huntington 2003 *in* Anonymous 2003)
7. Shedin Valley: *Road Options Review: Wildlife Habitat Assessment Report* (Mahon 2001)
8. North of Gunnanoot Lake: *Potential Babine LRUP designations north of Gunnanoot Lake* (Mahon 2000c *in* Mahon and Marsland 2001). I did not obtain a copy of this letter
9. Southern Park Access area of Babine River Corridor Provincial Park: *Field Investigations for the Development of a Bear–Human Conflict Management Plan for the Southern Park Access Area of Babine River Corridor Provincial Park* (Wellwood 2008) including
    - Terrestrial Ecosystem Mapping (1:10,000 scale, Level 2 Survey Intensity)
    - Grizzly bear habitat suitability assessment
    - Human–bear interaction risk assessment.

Reports (or letters) in points 2 to 8 provided some of the knowledge base and were superseded by the PHM with grizzly bear habitat suitability rating completed by Mahon et al. (2004). I did not find any further reference to or subsequent use of information provided in Madrone Consultants Ltd. (1994) or Wellwood (2008). In addition, Turney (1996) completed a report for *Potential Impacts to Grizzly Bear Habitats and Populations in the Babine River Watershed: A Review of Northern Mainline Route Options*.

All of these reports were limited in scope but provide useful area and context specific information specific to grizzly bear habitat for the BWMT area of interest. I reviewed reports for background information but I did not summarize them for this project, due to time constraints.

2.4 Additional Landscape-Level Ecosystem Mapping

In 2002-2003, Pacific Inland Resources completed a PEM project for the Bulkley TSA with an accuracy assessment in 2004 that found "thematic accuracy was below the minimum threshold of 65% require for approval for use for ecosystem based timber supply analysis" (Simonar and Migabo 2009:p. 4). In 2009, a new PEM project was completed with a Level 4 accuracy assessment (Simonar and Migabo 2009). Banner (2009 *in* Simonar and Migabo 2009:p. 23) stated: "based on the second Bulkley TSA PEM by Timberline and a subsequent accuracy assessment undertaken in 2009, the PEM can now be confirmed to be of sufficient quality for use in SIBEC-based timber supply analysis", also noting that there are some issues in using this PEM for Timber Supply Review. I did not review this work further.

2.5 Additional Grizzly Bear-Related Projects

2.5.1 Babine River LRUP Grizzly Bear Monitoring Studies

In 1994, Hatler (1995) initiated the development of methods for a grizzly bear monitoring study to detect trend in the population as an indicator of potential impacts of forestry development in the Babine River LRUP area. At the time, Hatler (1998:p. 1) stated, "…there was no established protocol for routine, systematic, affordable monitoring of a grizzly bear population. Given the high priority aspect of Babine grizzly bear management, waiting for development of suitable methodologies or the promise of sufficient budgets was not a viable option." Hence, this interim monitoring study was initiated to establish baseline information. The project included the development of a grizzly bear monitoring index for inter-annual comparisons of several survey methods including

1. road transects documenting bear observations and scats
2. river surveys documenting bear observations and tracks
3. bear observation sessions at Babine River bridge (Nilkitkwa FSR) and weir area
4. an estimate of minimum number of individual grizzly bears observed by researchers and others working in the area
5. reported grizzly bear incidents and mortalities.

Surveys were conducted in the Babine River LRUP area, primarily within the Bulkley TSA portion with some survey components conducted along the Babine River (see Hatler 1995, 1996, 1997, 1998; Wellwood 2002, 2004, 2005). The budget was reduced in the last two years of the project but it was completed with a major contribution of volunteer work. Wellwood (2005) strongly recommended that any decisions about how to proceed with this work be made based on peer-review of the grizzly bear monitoring index and a review of benefits, costs and feasibility of initiating genetic sampling studies of population status and trend. While more expensive, the later could be used to gather scientifically rigorous and more defensible results.

2.5.2 Babine River Corridor Focused Grizzly Bear Studies

2.5.2.1 Grizzly Bear Access to Salmon

Two studies gathered anecdotal information to identify areas along the Babine River with concentrations of salmon and bears based on interviews producing the following reports:

- *A Compilation of High Grizzly and Fish Use Areas on the Babine River and Tributaries* (Steciw 1990)
- *Seasonal Concentrations of Salmonids and Bears in the Kispiox Forest District* (Roberts 2000).

2.5.2.2 Human–Bear Interactions Along the Babine River

Since 1994, several people have conducted grizzly bear research, management and monitoring activities in Babine River Corridor Provincial Park, formerly the Babine River Wilderness Zone. All of them identified it as an area well used by bears and people during the salmon-spawning season. These reports provide recommendations to address human–bear interaction issues along the river, in general, or for the area around the southern park entrance, Babine River bridge and DFO fish counting fence, more specifically.

Earliest reports providing recommendations for management of human–bear interactions were the following:

- Ministry of Forests and Ministry of Environment: *Human/Bear Interaction in the Vicinity of the Babine Bridge and Fish Weir Area* (Hillcrest Recreation Consulting Inc. 1995)
- BC Parks: *Bear Hazard Evaluation at Campsites on the Babine River, B.C.* (MacHutchon 1998b)
- Department of Fisheries and Oceans: *Managing Human/Bear Conflict at the DFO Babine River Counting Fence and Living Compound* (Shelton 2000).

Two published papers providing guidance for assessment and recommendations include

- *Assessing the Risk of Bear–Human Interaction at River Campsites* (MacHutchon and Wellwood (2002a)
- *Reducing Bear–Human Conflict Through River Recreation Management* (MacHutchon and Wellwood 2002b)

2.5.2.3 Detailed Grizzly Bear-Related Studies for Southern Park Entrance Area

Most recently, an intensive study was conducted for the development of a human–bear management plan in the area around the southern park entrance, Babine River bridge and DFO fish counting fence producing the following reports:

- *Field Investigations for the Development of a Bear-Human Conflict Management Plan for the Southern Park Access Area of Babine River Corridor Provincial Park* (Wellwood 2008) including
  - Terrestrial Ecosystem Mapping (TEM)
  - Grizzly bear species account and habitat suitability model for the development of habitat suitability maps

  - A bear-human interaction risk assessment for selected areas, sites and trails.
- *South Park Entrance Area, Babine River Corridor Provincial Park: Background Report for the Bear–Human Conflict Management Plan with an Overview of Phases 1 to 3* (Review Draft, Wellwood 2007a) that provided
  - An overview of land use and human activities in and immediately adjacent to the park bear-human conflict management plan area
  - A problem analysis and overview of reported bear incidents (1994 to 2006)
  - A summary and evaluation of management scenarios considered for this area.
- *South Park Entrance Area, Babine River Corridor Provincial Park Bear–Human Conflict Management Plan: Phase 1 Plan* (Review Draft, Wellwood 2007b) providing an interim plan for the southern park access area of Babine River Corridor Provincial Park for delivery by BC Parks.

Six maps displaying the results of the TEM project, grizzly bear habitat suitability model and features (e.g., bear beds, mark trees, mark trails) observed during field investigations were also completed (Wellwood 2007c).

Following up on these reports and with the input of the Bear-People Management Advisory Committee, I completed a risk assessment for seven management scenarios that considered human–bear management issues, feasibility of delivery, and benefits and costs to people and bears. This included single agency (i.e., BC Parks) and interagency management scenarios (Wellwood 2007d, Wellwood 2007e). BC Parks personnel have also prepared presentations and a video aimed at highlighting issues and gathering support to address human–bear interactions in this area (D. Wellwood pers. obs.). Subsequently, these were presented and discussed in meetings with the bear-people management advisory committee.

Wellwood (2008:p. 5) reported "the Terrestrial Ecosystem (TEM) for this project was completed following *Standards for Terrestrial Ecosystem Mapping in British Columbia* (RIC 1998) to a Survey Intensity Level 2 (51-75% of polygons visited) overall at a scale of 1:10,000 for the project area." Subsequently, in *Rare Ecosystems of Babine River Watershed,* Bartemucci and Williston (2012:p. 54) reported " in our study, only one TEM project achieved sampling intensity close to standards set for sensitive ecosystem inventories: the Southern Park Entrance Area TEM (Wellwood 2008 Table 28). The sampling intensity resulted in data that was reliable for identifying several rare ecosystems, though the scope of the project was limited to a small area."

Reporting on gaps in knowledge and potential data limitations, Wellwood (2008:p. 44) stated

> *"…Terrestrial Ecosystem Mapping and habitat suitability information at this scale and survey intensity is suitable for management discussion and preliminary planning purposes only. Depending on the level of on the ground site-specific information that is available and the management activity that is being considered, additional site-specific investigations may be required to support sound bear-human conflict management decisions. Long-term studies of bear use (e.g., food habits, habitat use, movements) of*

this area, further investigations of habitat potential and suitability and bear-human interactions would reduce the limitations of the bear-human interaction risk assessment."

For the purposes of this project, I rated the reliability of TEM as high for identifying specific ecosystems on the ground, given scale and survey intensity, and the reliability of interpretations for grizzly bear habitat as moderate for identifying important grizzly bear habitats on the ground, given relatively little area specific knowledge for grizzly bear food habits and habitat use. This work was done to a detailed level.

2.5.2.4 Additional Grizzly Bear-Related Considerations for Southern Park Entrance Area

While management of human–bear interactions along the entire Babine River is needed, the overlap in use of the southern park entrance area by relatively large numbers of people and grizzly bears is arguably among the most complex and challenging issues seriously affecting the probability of maintaining grizzly bears in the BWMT area of interest (Wellwood 2007a, 2007b, 2008). This area has major significance for the Lake Babine Nation and it falls within four jurisdictions for land management, provincial and federal. The Ministry of Forests' Forest Service Road (Permit RO 3780) transects the southern park entrance area via the Babine River bridge and DFO leases land (District Lot 7042) for management of a fish counting fence that borders the south end of the park. Adjacent lands fall within areas designated as Provincial Park and Crown Land (**Figure 3**).

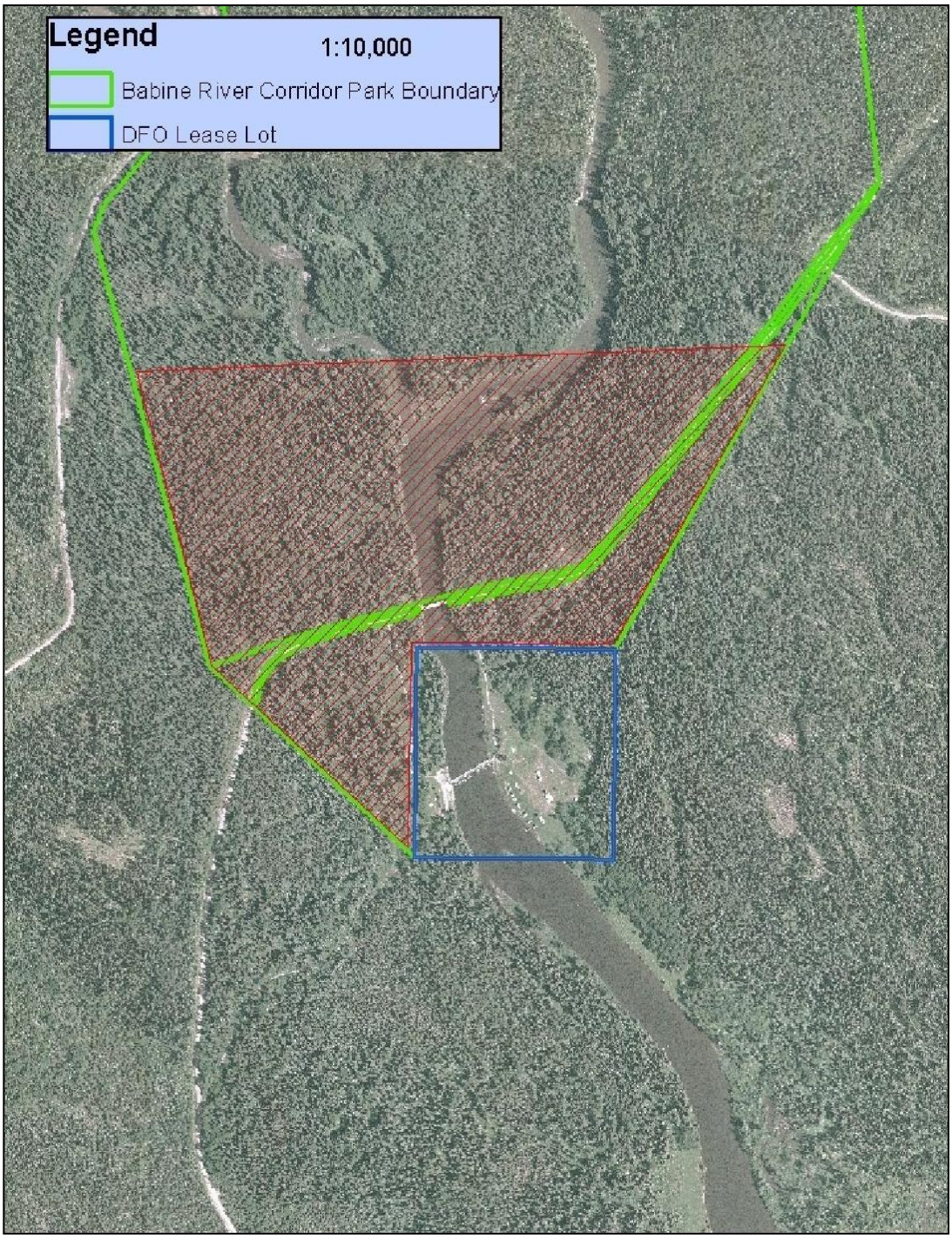
The southern park entrance area is within the immediate vicinity of a historic Lake Babine First Nations village site and salmon processing camp (Arcas 2000 in Crossroads Cultural Resource Management 2008). In 1991, the Lake Babine Nation Fisheries (Ned'u'ten Fisheries) was established in a cooperative agreement between DFO and Lake Babine Nation. Lake Babine Nation conducts fish counting operations as well as a food and commercial fishery from the fence. Clearly the area has an extensive and rich history of traditional land use as documented in *Babine River Bridge/Weir Area Archaeological Overview Assessment*, stating that "both side of the Babine River within the Study Area are inundated with CMTs, trails, shelters, depressions and 'pit' like features" (Crossroads Cultural Resource Management 2008). Interestingly, Wellwood (2007b) described many of the same features from a grizzly bear habitat use perspective. Bears were documented marking culturally modified trees and using some of the pit-like features for beds (D. Wellwood unpublished data, R. Buhdwa pers. comm.).

The area is also well used by anglers and bear viewers. Jet boaters and whitewater recreationists (mostly kayakers and rafters) use a boat launch on the DFO property for single and multi-day trips. Seasonal use by people and grizzly bears has been documented in numerous reports including annual BC Park Ranger reports. Grizzly bear observations in this area are also reported in Babine LRUP Grizzly Bear Monitoring reports (Hatler 1995, 1996, 1997, 1998; Wellwood 2002, 2004, 2005). I did not summarize these for this report.

The mix of people and bears in this area results in frequent and occasionally intense interactions, considered a serious threat to people and grizzly bears (e.g., Wellwood 2007b). In the early 2000s, a series of interagency meetings were conducted in response

to serious concerns regarding human–bear interactions in the area around Babine River bridge and fish weir and in attempts to resolve the problem of human–bear management in this area (Wellwood in prep.). In 2005, BC Parks initiated a more inclusive process to gather First Nation and stakeholder input to address these issues. They invited the Lake Babine Nation, agencies responsible for land use and stakeholders with an interest in this area to participate in a bear-people management advisory committee. The committee's key recommendation to the Regional Manager for B.C. Environment, Skeena Region, was to "…initiate comprehensive Bear Management Plan for the broader area immediately including research and data collection, education and information programs" (Babine Bridge Bear–People Management Advisory Committee 2006). In the fall of 2006, B.C. Ministry of Environment contracted the preparation of a human–bear management plan for the southern park entrance area of the park.

Figure 3. The area around the southern entrance of Babine River Corridor Provincial Park also includes a Department of Fisheries and Oceans lease lot with a fish counting fence (established 1946) and a Forest Service Road with a bridge over the Babine River. Figure prepared by B.C. Parks, taken from Wellwood 2008.



3 Summary of Key Findings

Area-specific knowledge regarding grizzly bear ecology and behaviour was found to be relatively limited from a scientific perspective. Some of these projects subsequently formed the basis of grizzly bear habitat polygons presented in land use planning (see Chapter 3). All but one of these numerous projects were limited in scope and/or duration; known or apparently completed with limited time and resources; or discontinued before completion. The *Predictive Habitat Mapping with Grizzly Bear Habitat Suitability Ratings for the Kispiox and Cranberry Timber Supply Areas* project was the most comprehensive endeavour completed. Collectively, these resources provide valuable sources of information and suggest a relatively unique ecotype of grizzly bears, as compared to those populations that have been well studied in other areas of their range in North America.

The following provides an overview of key findings

Landscape Level Grizzly Bear Food Habits and Habitat Use

Best available information regarding grizzly bear food habits and habitat use is for the Kispiox TSA portion of the study area (MacHutchon and Mahon 2003). Unfortunately, this study was discontinued before its planned completion.

Landscape Level Grizzly Bear Habitat Mapping

- Best available grizzly bear habitat mapping is the 2003 version of PHM (Mahon et al. 2004), completed for the Kispiox TSA portion of the monitoring area. Assumptions, gaps in knowledge and data limitations were provided. Accuracy of mapping was assessed. Information gained through these projects regarding grizzly bear food habits and habitat use and grizzly bear habitat mapping (2003 version) is not identified in land use planning for grizzly bear habitat. Interpretations for grizzly bear habitat cover the entire Kispiox portion of the BWMT area of interest but they do not include denning, animal foods, security and thermal or travel life requisites.
- Grizzly Bear Habitat Complex Mapping, Kispiox Forest District (Mahon 2003a). This report provides information for grizzly bear habitat complexes in areas of the Kispiox Forest District that are outside of the West Babine SRMP area.
- Earliest mapping products (i.e., biophysical and grizzly bear habitat mapping completed for Babine River Interim LRUP) were precursors to methodology based on standards established by the RIC, thus methods were evolving and have since undergone substantial clarification and improvements. All of these were identified as or appeared to be draft documents and most specified the need for additional work to improve these resources. With the exception of projects culminating in Mahon et al. (2004), I did not find any that were revisited or updated.
- Benchmarks, against which grizzly bear habitats were rated, were not defined for some projects or were inconsistent among mapping projects when they were defined (i.e., relative to the best in the province or relative to the best in the project area). Simpson (1990, 1992) did not specify a benchmark. Keystone Wildlife Research (1999a, 1999b) work was relative to a provincial benchmark. The grizzly bear interpretations for the PHM completed for the Kispiox TSA were relative to the best in the study area, and although the authors indicated that the habitat was lower

quality than the provincial benchmark, it did not warrant a downgrade of a full rating class. Due to differences in methods used, these projects cannot be directly compared with each other.

- Some specific limitations of interpretive mapping for grizzly bears include
  - Important habitats and associated attributes for denning were not identified.
  - Grizzly bear habitat interpretations that subsequently formed the basis of the *Babine River Interim LRUP* did not cover parkland and alpine tundra zones. Notably, all land use plan maps that utilized this information do not have coverage for grizzly bear habitat in these zones. This information is not specified on maps.
  - Some important food plant species were not incorporated into habitat interpretation including a variety of known or probable major food plant species.
  - No animal foods (e.g., salmon, ungulates, small mammals, invertebrates) were directly incorporated in habitat interpretations.
  - Trails that were well used by grizzly bears were not incorporated into mapping, although Simpson (1990) and others identified the general or specific locations of some.
- Some examples of early assumptions that are now known to be or are likely to be invalid include
  - "The annual range of movement for individual bears can be large particularly for males (200 – 350 km2)" (Simpson 1992:p. iii). MacHutchon and Mahon (2003) reported female and male home range sizes ranging from 149 km^2 (an adult female) to 8,549 km^2 (an adult male) using 95% Fixed Kernel estimates and 125.3 and 6,479.0 for the same bears, respectively, using 95% Minimum Convex Polygon estimates.
  - Grizzly bears do not use root crops in the Babine River Interim LRUP area. The underground storage organs (e.g., corms, roots, bulbs) of several food plant species have been identified for their known or potential use in the project area.
  - Grizzly bears den at higher elevations and are unlikely to den within 5 km of the lower river and 25 km of the upper river (Simpson 1990). This assumption has also been variably expressed in land-use planning for this area. Ciarniello et al. (2006) documented dens at lower elevations in the SBS. Furthermore, snow cover and relatively predictable cold winter conditions, for which freeze-thaw cycles are less problematic for staying warm and dry. I speculate that it is more likely than not that some grizzly bears will den at lower elevation in the SBSmc2 and potentially in other lower elevation BEC subzones.
  - "Parkland and alpine habitats were not assessed since no impacts of human activities are expected at high elevations above the productive forest zone" (Simpson 1992:p. iv). Roads through the productive forest zone provide access to higher elevations for a range of motorized and non-motorized recreation and more recently mineral exploration. While not formally documented for this study, other types of use have clearly increased since this project was completed.
- Consideration for Bulkley TSA portion: Best available information for the Kispiox TSA portion includes a list of known and potential plant foods and seasonal habitat

ratings for PHM habitat types by biogeoclimatic subzone that also occur in the Bulkley TSA portion. Thus best available information for the Kispiox TSA portion provides useful information to support decisions about how to proceed with landscape level habitat management in the Bulkley TSA portion.

Area-Specific Grizzly Bear Habitat Mapping
Field Investigations for the Development of a Bear-Human Conflict Management Plan for the Southern Park Access Area of Babine River Corridor Provincial Park (Wellwood 2008) provide best available information for the Bulkley TSA portion of the BWMT area of interest. However, this project only covered a small area.

Guidelines for Forest Management at an Operational-Level
Mahon (2003b) *Kispiox Focal Wildlife Species Management Guidelines: Grizzly Bear.* The target audience for this document was operational forest planners. It provides "…a concise synthesis of the status, habitat requirements, availability of inventory and mapping information, and management recommendations for specific species within the Kispiox that will facilitate effective prescription and approval of operational forestry plans that incorporate habitat requirements for those species".

He also states "This is the first draft of the grizzly bear guidelines. It is anticipated that this document will be reviewed by forest licensees, the Ministry of Forests, and the Ministry of Water, Land and Air Protection, and that a revised final guidelines document will be released if consensus can be reached among the stakeholders". This was a draft document that was not carried forward by others for collaborative input.

Some Additional Key Points

- Kispiox TSA portion: best available information and practices (above) benefited from collective knowledge and opinions and collaborative decision-making that included a grizzly bear expert, multiple biologists with grizzly bear expertise and others covering a range of relevant expertise and area-specific knowledge. I provisionally assessed this version of interpretive mapping for grizzly bear habitats (i.e., Mahon et al. 2004) as detailed level and moderate or high reliability for the purposes of identifying important grizzly bear habitats on the ground. I did not narrow my assessment to a single reliability rating class because area-specific scientific information for grizzly bear food habits, habitat use and movements were limited, thus uncertainty greater.
- Bulkley TSA portion: I provisionally rated landscape-level studies providing interpretive mapping for grizzly bear habitats as reconnaissance level, low reliability for the purpose of identifying important grizzly bear habitats on the ground. I rated the local-level study conducted in the area around the southern entrance of Babine River Corridor Provincial Park providing interpretive mapping for grizzly bear habitats as detailed level, moderate reliability for locating important grizzly bear habitats on the ground.

I did not assess the reliability of best available information from the Kispiox TSA portion for application in the Bulkley TSA portion because relatively little area-specific scientific

information has been gathered and determination of a reliability rating will be influenced by how it is used.

Additional Grizzly Bear Projects
In addition to landscape level studies of grizzly bears and their habitat, numerous other types of studies of relevance to grizzly bears have been conducted. While all of these reports were limited in scope or scientific rigor, they provide useful area and context specific information.

4 Project Limitations

Limitations include

- *Provisional assessments of ecosystem mapping and interpretations for grizzly bear habitat*: Generally, the availability of reported information to assess accuracy and reliability was limited. As such, ratings presented here are provisional, aimed solely at supporting decisions about how to proceed in management of grizzly bear habitat in this area.
- *Missing information*: For example, I was unable to locate the two draft grizzly bear habitat maps completed by K. Simpson (reported as submitted with Simpson 1992).
- *Undetermined status of information*: Some reports were labeled as draft or were labeled as final but appeared to be draft. I was unable to locate subsequent versions. Where applicable, I contacted authors to confirm report was the most recent version and where uncertainty still existed I recorded the file name for digital reports.
- *Interpretive limitations*: I reviewed numerous reports, many of which required interpretation of authors' meaning or intent. It is possible that I have misinterpreted some information. I did attempt to confirm or clarify, not always successfully, key pieces of information by contacting the author or someone else familiar with the project. I have highlighted any uncertainties that I am aware of.
- *Review limitations*: I did not review raw data forming the basis of reports and maps.

People interested in information in this report will need to refer to original documents, as required, to ensure that they understand the context of information and that it is used and referenced appropriately.

Chapter 3: Review of Land Use Planning

1 Methods

Following the initiation of this project, it also became clear that considerable work would be needed to develop a better understanding of information forming the basis for land use planning for grizzly bears and their habitat.

I reviewed land use plans and maps to

1. Summarize the history of land use planning (i.e., goals, objectives, strategies) of relevance to grizzly bears and their habitat.
2. Identify changes in management direction that occurred over time for grizzly bear habitat units (i.e., grizzly bear habitat types, treatment units specific to grizzly bear habitat) starting with the initial guidelines provided by biologists for their management followed by management direction provided in each subsequent plan.
3. Identify the knowledge base (i.e., ecosystem mapping with grizzly bear habitat interpretations) that formed the basis of polygons delineated for grizzly bear habitat in land use plan maps and identify changes that were made to mapping that was carried forward to subsequent plans.
4. Identify changes in management direction that occurred over time for coordinated access management and recreation access management starting with initial access control guidelines provided by biologists followed by management direction provided in subsequent planning processes.

I conducted interviews and submitted questions to consulting biologists, MOFR, MOE, and ILMB, and later MFLNRO personnel, and industry representatives as needed to gather and clarify information.

I prepared a history of land use planning direction for grizzly bears and their habitat presented in detail in *Appendix 1. History of Land Use Planning for Grizzly Bears in the Babine River Watershed: Goals, Objectives, Strategies, Indicators and Targets* (Wellwood 2013a). It consists of direct quotes for goals, objectives and strategies relevant to grizzly bears and their habitat that were taken from each of the land use plan documents. For each objective and strategy in the *Babine River Interim LRUP*, as feasible, I listed related objectives and strategies of relevance in subsequent plans for side-by-side comparison and easier identification of changes that occurred over time. I also provided review comments regarding potential relevance of changes, rationale provided and uncertainty remaining.

For grizzly bear habitat types, I started by listing habitat types presented in the original biophysical (Lea and Kowall 1992) and associated grizzly bear habitat work (Simpson 1990, 1992) that was completed to support the development of the *Babine River Interim LRUP*. I tracked changes made from the initial guidelines or recommendations through subsequent management direction that was provided for each habitat type. For treatment

units, I used those presented in the *Babine River Interim LRUP* that were specific to grizzly bears as the basis for my review. I then tracked changes made in management direction for each treatment unit. I determined the knowledge base forming the basis of delineated grizzly bear habitat polygons presented in land use plan maps based on reported information and by comparing available interpretive maps with land use plan maps; and, where gaps in information remained, by contacting the biologists involved or Province of B.C. personnel that were familiar with this work.

Using information presented in Chapter 2 for interpretive mapping that formed the basis of grizzly bear habitat polygons delineated in land use plan maps, I estimated the quantity and quality of information using a two class rating scheme, detailed-level or reconnaissance-level survey, and the reliability of information using a three class rating scheme, low, moderate or high, for grizzly bear habitat polygons delineated in land use plans. I also identified any changes that were made when this information was carried forward to subsequent land use plans. I used this information to subjectively assess appropriate uses of these resources. Information gathered for grizzly bear habitat is presented in more detail in *Appendix 2. Detailed Results for 2010 Reconnaissance Monitoring Survey for Grizzly Bear Habitat in the Babine River Watershed* (Wellwood 2013b).

I summarized the history of access, recreation and park management planning in this area including changes in management direction that occurred over time. Information gathered for access-specific considerations is presented in more detail in *Appendix 3. Detailed Results for 2010 Reconnaissance Monitoring Survey for Access Control in the Babine River Watershed* (Wellwood 2013c).

Best Standards and Practices for Reference

I used knowledge and expertise gained through my work on a wide diversity of bear management and human–bear management related projects and my knowledge of relevant literature to identify best standards and practices as benchmarks for my review of management planning including (but not limited to) the following

- Alberta Grizzly Bear Recovery Plan 2008-2013 Alberta Species at Risk Recovery Plan No. 15 (Alberta Grizzly Bear Recovery Team 2008)
- A habitat-based framework for grizzly bear conservation (Nielsen et al. 2006)
- A Proposed Lexicon of Terms and Concepts for Human–Bear Management in North America (Hopkins et al. 2010)
- Assessing the Risk of Bear–Human Interaction at River Campsites (MacHutchon and Wellwood 2002a)
- Reducing Bear–Human Conflict through River Recreation Management (MacHutchon and Wellwood 2002b)
- Staying Safe in Bear Country: a behavioral-based approach to reducing risk (Safety in Bear Country Society 2008)
- Working in Bear Country: for industrial managers, supervisors and workers (Safety in Bear Country Society 2001)
- Living in Bear Country (Safety in Bear Country Society 2005).

2 Results and Discussion

This chapter provides a summary of results, presented as key findings, and discussion.

2.1 Land-use Planning Documents

I reviewed twenty-five plan-related documents of relevance to grizzly bears and their habitat for the BWMT area of interest that were aimed at providing management direction for land use, coordinated access, recreation access, human–bear management, and park management and establishing legal objectives for land use. A majority of these documents were reviewed in-depth for this report, of which six (listed in **bold text** below) are summarized in the Land-use Planning component of the BWMT Framework (Price and Daust 2004).

In chronological order, the following reports were reviewed

The first two planning documents were prepared by MOF and MELP

1. *Babine River Interim LRUP* (MOF and MELP 1994a)
2. *Interim Babine River Coordinated Access Management Plan, Bulkley Portion* (MOF and MELP 1994b)

These were based on direction provided in

3. the *Options for the Babine River Area* report that was completed by MOF, MOE and BTAC (1991) and reviewed by the BSC and
4. public comments presented in the *Public Review Summary of Options for the Babine River Area* report (MOF and MELP, unknown year).

Two higher-level plans were developed through consensus-based agreement at multi-stakeholder tables and reviewed and approved by provincial government

5. ***Bulkley LRMP* (BVCRBIPT 1998)**
6. ***Kispiox LRMP* (KLRMPT 1996, amended 2001)**

As previously stated, both of these plans deferred to management direction provided in the *Babine River Interim LRUP* and the *Interim Babine River CAMP, Bulkley Portion* for several aspects of specific relevance to monitoring completed for this report.

Three landscape unit plans were prepared by B.C. Ministry of Forests, based on direction provided in the Bulkley LRMP and approved by the Province of B.C.

7. ***Babine LUP* (MOF 1999a)**
8. ***Nilkitkwa LUP* (MOF 1999b)**
9. *Torkelson LUP* (MOF 1999c)

Based on direction provided in the Kispiox LRMP, multi-stakeholder discussion around planning for access management produced

10. *Access Management Direction for the Babine Watershed Kispiox Forest District* (KFDAMPTG 2000)

BC Parks prepared three management direction statements for newly established provincial parks, based on direction provided in the Bulkley LRMP

11. ***Babine River Corridor Park Management Direction Statement*** **(Ministry of Environment, Lands and Parks [MELP] 2000a) based on Bulkley LRMP and Kispiox LRMP**
12. *Rainbow Alley Provincial Park Management Direction Statement* (MELP 2000b) based on Bulkley LRMP
13. *Nilkitkwa Lake Provincial Park Management Direction Statement* (MELP 2000c) based on Bulkley LRMP

A higher level plan order to establish legal objectives were prepared and approved by the Province of B.C.

14. *Bulkley LRMP HLPO* (Province of B.C. 2000). This order established resource management zones and objectives for them for the Bulkley LRMP area

One plan was prepared by MSRM, for the West Babine Landscape Unit, based on direction provided in the *Babine River Interim LRUP* and the *Kispiox LRMP* and approved by the Province of B.C.

15. ***West Babine SRMP*** **(MSRM 2004a)**

In a summary for how this plan links with previous plans, MSRM (2004a) states

- "*The SRMP brings together planning direction from the Babine Interim Local Resource Use Plan (LRUP) and the Kispiox Land and Resource Management Plan (LRMP), into one document. The plan is written to be results-based i.e., to clearly describe the desired future condition of the landbase, allowing users of the land to apply best practices and professional knowledge to achieve the desired results. The management direction for the West Babine incorporates the best data, information, and analytical technology available at this time.*" (p. 1)
- "*The Bulkley TSA also has a Coordinated Access Management Plan in place that guides access across the eastern portion of the Babine watershed. The West Babine SRMP access management direction is consistent with the intent of the Coordinated Access Management Plan in the Bulkley TSA.*"(p. 7)

Two higher level plan orders to establish legal objectives were prepared and approved by the Province of B.C. The West Babine SRMP included the *Order to Establish the West Babine Landscape Unit and Objectives and to vary the Atna/Shelagyote and Babine River Special Management Zone Boundaries* (MSRM 2004a). This order establishes objectives, indicators and targets in the *West Babine SRMP* as landscape unit objectives. It is presented in the *West Babine SRMP* document. The second was the

16. *Bulkley LRMP OSG* (ILMB 2006a). With this order, legal objectives for the Bulkley TSA in Appendix 1 (Province of B.C. 2000) were rescinded and replaced by this order. It "streamlined" objectives provided in the Bulkley LRMP Higher Level Plan Order, Biodiversity Objectives, Landscape Unit plans and the Bulkley Valley Sustainable Resource Management Plan.

A planning process to produce a park management plan and human–bear management plan for the southern entrance area of Babine River Corridor Provincial Park was initiated to address human–bear interactions and others issues. This process was discontinued. The following reports were completed but have not been formally adopted or remain in progress. No plans for implementation or completion were identified. Reports aimed at providing management direction include

17. *South Park Entrance Area, Babine River Corridor Provincial Park Bear–Human Conflict Management Plan: Phase 1 plan*, Review Draft (Wellwood 2007a)
18. *2011 Human-Bear Management Plan for the Southern Park Entrance Area, Babine River Corridor Provincial Park* (Bear Emergency Response Plan and Responsive Bear Management Strategies Not Included) (Wellwood 2011a, b)
19. Babine River Corridor Provincial Park, Preliminary Draft Management Plan (BC Parks in prep.)

Recreation access management plan (RAMP) processes included

20. *Recreation Access, Trails and Areas, Bulkley TSA, Current Recreational Access Agreements: Bulkley TSA* (ILMB 2006b)
21. *Bulkley Valley Summer RAMP Index Map A Planning Units 1 & 2* (Summer RAMP Table 2012)
22. *Summer Recreational Access Management Plan for the Bulkley LRMP* (Summer RAMP Table 2013).

A planning process to produce an angling management plan to address perceived overcrowding and conflicts among user groups was initiated. A draft plan was produced with recommendations submitted to the Province of B.C. Ministry of Environment provided a response and implementation

23. *Angling Management Plan Skeena Quality Waters Strategy*, Draft (Dolan 2008)
24. *Recommendations of the Working Groups, Skeena Quality Waters Strategy Angling Management Plans* (Dolan 2009)
25. *Ministry of Environment Response to Working Group Recommendations for Skeena Angling Management Plans, Skeena Quality Waters Strategy* (Ministry of Environment 2010).

I only conducted a cursory review of the following reports, to gather additional background information and context regarding planning: the management direction statements for Rainbow Alley and Nilkitkwa Lake Park (MELP 2000a, 2000b), two small parks (listed above) and four Forest Stewardship Plans (following) that were prepared by licensees and approved by the B.C. Ministry of Forest and Range

- *Bulkley Forest Stewardship Plan for B.C. Timber Sales, Babine Business Area Operations within the Bulkley Timber Supply Area in the Skeena Forest District* (B.C. Timber Sales 2007) based on the Bulkley LRMP–Higher Level Plan Order (Province of B.C. 2000) and Bulkley LRMP Objectives set by Government (ILMB 2006a)
- *Forest Stewardship Plan for Forest Licences A-16830/A-16829/A-57077, Bulkley Timber Supply Area* (West Fraser Mills Ltd. 2007) based on the Bulkley LRMP–

Higher Level Plan Order (Province of B.C. 2000) and Bulkley LRMP Objectives Set by Government (ILMB 2006a)
- *Hazelton Forest Stewardship Plan 2007-2012 for Operations in the Skeena District, Kispiox and Cranberry Timber Supply Areas* (B.C. Timber Sales 2008a, 2008b) based on direction provided in the West Babine SRMP (MSRM 2004a)
- *Gitxsan Short-Term Forestry Agreement* (Gitxsan Hereditary Chiefs, Gitxsan Treaty Society and Province of B.C. 2006). Gitxsan Forest Enterprises have also completed a Forest Stewardship Plan. However, I did not obtain a copy of this report.

I do not discuss these further in this report. I did not gather or review Forest Development plans applicable to this area for the pre-FRPA period (i.e., pre-2007) or Forest Stewardship plans subsequent to or in progress following the ones listed here.

2.2 Babine River Interim LRUP and Interim CAMP: The Origin of Land Use Planning

The starting points for the Babine Watershed Monitoring Framework and Land-use Plan Summary were the *Bulkley LRMP* and the *Kispiox LRMP*, both higher-level plans that were agreed upon by multi-stakeholder groups and approved by the Province of B.C. (Price and Daust 2004, Osborn 2009).

The *Bulkley LRMP* provided direction to follow guidelines in the
- *Babine River Interim LRUP* for the Babine River Special Management Zone
- *Babine River Interim LRUP* and *Interim Babine River CAMP, Bulkley Portion* for the Babine River Integrated Resource Management Zone
- *Babine River Interim LRUP* for Babine River Corridor Park.

In addition, direction was provided for the Nilkitkwa Integrated Resource Management Zone to complete grizzly bear interpreted ecosystem mapping to be incorporated into management prescriptions, as directed in the *Babine River Interim LRUP*, and a CAMP as completed for the Babine River planning unit. No reference to the *Babine River Interim LRUP* or *Interim Babine River CAMP, Bulkley Portion* was made for the Barbeau Creek Sub-unit. Although forestry is not permitted in this area, other land uses such as mineral exploration and development are.

The *Kispiox LRMP* provided management direction to apply the
- *Babine River Interim LRUP* prescriptions for moderate and high value grizzly bear habitat
- *Interim Babine River CAMP, Bulkley Portion* to manage the effects of access on grizzly bears
- *Babine River Interim LRUP* for Babine River Corridor Provincial Park.

It also stated that the *Babine River Interim LRUP* applied to the Kispiox planning area and that "a committee of public and government representatives will monitor implementation of the Babine River LRUP" (KLRMPT 2001:p. 10).

All of the park management direction statements (MELP 2000a, b, c), the *Babine LUP* (MOF 1999a) and the *Nilkitkwa LUP* (MOF 1999b) indicated that they were developed based on management direction provided in the *Bulkley LRMP*. I did not find any specific reference to management directions in the *Babine River Interim LRUP* or *Interim Babine River CAMP, Bulkley Portion* in my review of the landscape unit plans. Objectives and strategies for grizzly bears in the *Babine LUP* (MOF 1999a) were based on those provided in the *Babine River Interim LRUP*. No objectives specific to grizzly bears or their habitat were presented in the *Nilkitkwa LUP* (MOF 199b). An objective for the Barbeau Creek Special Management Zone identified a diversity of values, which included grizzly bear habitat "…while allowing for continued exploration and development of the mineral potential in the Upper Nilkitkwa SMZ" (MOF 1999b). The *West Babine SRMP* (MSRM 2004a) stated that it: "…was developed to be consistent with pre-existing strategic plans, including the Babine LRUP and the Kispiox LRMP. These plans were developed with significant public input and provide an important foundation for the SRMP".

2.3 Management Direction for Grizzly Bear Habitat

This section provides a summary of management direction for identified grizzly bear habitat types and treatment units specific to grizzly bear habitat. This information is further supported in detail in Wellwood (2013b).

2.3.1 Habitat Types and Grizzly Bear Treatment Units

Based on Simpson (1992), a list of habitat types with ratings for moderate and high value for grizzly bears was presented in the *Babine River Interim LRUP*, Appendix 5 (MOF and MELP 1994a). The *Babine River Interim LRUP* also identified seven Treatment Units with management prescriptions as a basis for land use planning as follows

- Treatment Unit 1 – Riparian Ecosystems
- Treatment Unit 2 – Forest Ecosystem Networks
- Treatment Unit 3 – Linkage Areas
- Treatment Unit 4 – High Value Grizzly Bear
- Treatment Unit 4a – Mixed Forest Management
- Treatment Unit 5 – Moderate Value Grizzly Bear Habitat
- Treatment Unit 6 – Integrated Resource Management

Treatment Units 1 to 5 were delineated as polygons in the Babine River Interim LRUP map with remaining area identified as Treatment Unit 6 (Appendix 12, MOF and MELP 1994a). Management prescriptions specific to grizzly bears were provided for Treatment Unit 4 and Treatment Unit 5. For Treatment Unit 4a, management direction for grizzly bears was less clear. Managing for a variety of a wide variety of wildlife species including birds, moose and grizzly bears appeared to be the intent of this unit. Management direction was also provided for important grizzly bear habitat types in Treatment Unit 1 and Treatment Unit 6.

In reviewing the habitat types and treatment units for grizzly bears in the *Babine River Interim LRUP* and Appendix 12 map as compared to biophysical habitat mapping and interpretations for grizzly bear habitat, I identified numerous points of relevance to monitoring. I found several differences for grizzly bear habitat units and their ratings

between Simpson (1992) and the *Babine River Interim LRUP* (MOF and MELP 1994a). As previously stated, I was unable to find the two draft map sheets coloured for sensitivity to development referenced in Simpson (1992); therefore, I was not able to compare maps to look for any changes that might have been made. Digital files for the *Babine River Interim LRUP* provided treatment unit information but not other important information such as biophysical unit and percentiles for units typed. Based on a visual comparison of polygon line work on paper maps, conducted prior to locating digital files, the map presenting Treatment Unit polygons in Appendix 12 of the Babine River Interim LRUP appeared to be largely based on line work and polygon typing completed by Lea and Kowall (1992) and grizzly bear habitat interpretations completed by Simpson (1992). Other treatment units and special management zones overlapped treatment unit polygons for grizzly bear habitat. When this was done, the treatment unit with the most ecologically conservative prescription was applied to the polygon (J. Lloyd-Smith pers. comm.). I also found reference to high value grizzly bear habitats in forest ecosystem networks (Treatment Unit 2) in the *Babine River Interim LRUP*, Appendix 7 (MOF and MELP 1994a:p. 60) but not the main text.

2.3.2 Changes in Land Use Planning Direction for Grizzly Bear Habitat

Need for Adaptive Management

"*It is anticipated with proper planning of harvesting activities and access control, particularly beside high value habitat, management objectives for the Babine River grizzly bear population can be met. The Babine LRUP must be adaptable through time since bears may change their use of habitat due to changes in cover, forage and population as development proceeds within the watershed*." (MOF and MELP 1994a:p. 13)

In this report, I focused my review of the history of treatment units on those that were specifically identified for grizzly bears; that is, high value grizzly bear habitat (Treatment Unit 4), mixed forest management (Treatment Unit 4a, specific to grizzly bears in later plans), moderate value grizzly bear habitat (Treatment Unit 5), and grizzly bear management areas. However, available information clearly indicates that habitats important to grizzly bears have been identified or can be anticipated to occur in all other treatment and management units.

The following sections provide an overview of changes in management objectives for specific to grizzly bear habitat from the *Babine River Interim LRUP* to the *Bulkley LRMP Objectives Set by Government* for the Bulkley TSA portion and to the *West Babine SRMP* for the Kispiox TSA portion. **Bolded text** is used to highlight major changes. Wellwood (2014a) provides a detailed history of land use planning for grizzly bears with goals, objectives, strategies, indicators and target showing changes that were made over time.

High Value Grizzly Bear Habitat (Treatment Unit 4)

Babine River Interim LRUP

Babine River Interim LRUP Objective: "*...minimize human–bear conflicts and preserve high value grizzly bear habitat*" (MOF and MELP 1994a:p. 23)

Bulkley LRMP
Regarding management objectives for planning sub-units

Sub-unit 2-1: Babine River Corridor Provincial Park
- Objective: "*To maintain the wilderness quality of the high-value grizzly bear habitat located inclose* (sic) *proximity to the river through dersignation anf* (sic) *management as a protected area. To manage according to the guidelines set out in the Babine River Interim Local Resource Use Plan (LRUP)*" (BVCRBIPT 1998:p. 57)

Comment: No management direction specific to grizzly bears was explicitly provided.

Sub-unit 2-2: Babine River Special Management Zone
- Objective: "*To protect and buffer the river-based resource values within the protected corridor (Sub-unit 2-1). To follow the guidelines set out in the Babine River Interim Local Resource Use Plan (LRUP)*" (BVCRBIPT 1998: p. 58)
    - Grizzly bear specific management direction under biodiversity: "*an emphasis will be on grizzly bear management focusing on the importance of maintaining grizzly bear habitat, especially for travel and denning*" (BVCRBIPT 1998: p. 58)

Sub-unit 2-3: Babine Integrated Resource Management
- Objective: "*to manage for a variety of values and activities in an integrated and compatible manner. Follow guidelines set out in the Babine River Interim Local Resource Use Plan (LRUP) and Coordinated Access Management Plan (CAMP)"*
    - Grizzly bear specific management direction under biodiversity: "*an emphasis will be on grizzly bear management focusing on the importance of maintaining grizzly bear habitat, especially for travel and denning*"
    - Grizzly bear specific direction under fish and wildlife habitat: *"An emphasis will be placed on grizzly bear management"* (BVCRBIPT 1998:p. 59).

Comment: Travel routes and denning habitat were not assessed in any grizzly bear habitat studies.

Babine LUP
- *Babine LUP* Objective 2.3: "*Avoid human–bear conflicts and maintain high value grizzly bear habitat identified* ***on Map 2***" (MOF 1999a:p.16).

Comment: Objective constrained to mapped high value grizzly bear habitat.

Bulkley LRMP Higher Level Plan Order
"***Provide*** *for the following important grizzly bear habitat[5] elements:*
- *high-value habitat buffered for security and bedding, and*
- *opportunities for movement with minimal disturbance from humans between important landscape features*" (Province of BC 2000).

Footnote: "[5] ***Wildlife habitat as mapped and made available at the landscape level***".

Comment: Constraint to mapped high value grizzly bear habitat carried forward. *Maintain* changed to *provide*.

Bulkley LRMP Objectives Set by Government

- *"**Provide** high-value habitat buffered for security and bedding for grizzly bears in the locations identified **in Map 5**".*
    - *"Avoid human-bear conflicts in **high-value grizzly bear habitat identified in Map 5**"* (ILMB 2006a: p. 9–10).

Comment: Constraint to high value grizzly bear habitat and *provide* carried forward.

Kispiox LRMP
Wildlife Objectives provided in the *Kispiox LRMP* included

- *"To maintain natural ecosystems and habitat to sustain viable populations of all native wildlife within their natural ranges.*
- *To protect or enhance populations and habitat of rare or endangered and regionally significant species* (KLRMPT 2001:p. 45).

The *Kispiox LRMP* deferred to the *Babine River Interim LRUP* for grizzly bear habitat (see Section 2.2). High-level objectives are provided for wildlife values but no objectives specific to grizzly bears or their habitat were provided in the *Kispiox LRMP*.

West Babine SRMP
The West Babine SRMP has three objectives for grizzly bear habitat

- Objective 7 : "*To maintain the integrity of and linkage amongst critical grizzly bear habitats.*[23] (sic)*"*
- Objective 8: "*To provide forest cover adjacent to non-forested critical habitats*[23] (sic) *in order to provide visual (security) and resting (bedding) cover."*
- Objective 9 : "*To minimize the impact of road building and forest harvesting activities on critical habitat.*[23] (sic)"(MSRM 2004a:p. 29)

Note: footer reference is 23 in text and 27 in footer. In 2012, this was amended to correct (Ministry of Forests, Lands and Natural Resource Operations 2012a).

Listed critical habitat types in *West Babine SRMP* (in Footer 27, MSRM 2004a:p. 29) correspond to high value habitat types (Treatment Unit 4) and mixed forest management types (Treatment Unit 4a) identified in the *Babine River Interim LRUP* (MOF and MELP 1995). Based on Simpson's recommendations for high sensitivity habitat types, the following habitat types are not on this list: Black spruce bog (BS), Devil's club-oak fern lower slope (DO), Horsetail swamp (HO), Spruce-devil's club lower slope (SD) and Spruce-horsetail flat (SH). Specifically, some forest types identified by Simpson (1990:p. 29) as "access and disturbance most harmful to bears" have no management direction. The only forest types identified as critical habitat types in the *West Babine SRMP* were floodplain and

mixed forest habitat types. Incorporating mixed forest habitat types trembling aspen-Douglas maple (AM), trembling aspen-beaked hazelnut (AH), paper birch-red osier dogwood (BD), paper birch-false box (BF) (Treatment Unit 4a, Mixed Forest Management, *Babine River Interim LRUP*) into high value grizzly bear habitat was a major change from the *Babine River Interim LRUP* to the *West Babine SRMP*. See *Babine River Interim LRUP* objectives for mixed forest management (Treatment Unit 4a, this section). In 2012, an amendment was made to correct habitat types that were dropped (Ministry of Forests, Lands and Natural Resource Operations 2012a).

The *West Babine SRMP* (MSRM 2004a:p. 25) states "areas containing the highest habitat values have been identified as high value grizzly bear habitat (see **Map 7, page 72**). Management within these zones will focus on maintaining the necessary structural features of grizzly bear habitat*".* As the *West Babine SRMP* did not included reference to the *Babine River Interim LRUP* direction for airphoto and ground investigations to identify high value grizzly bear habitats in Treatment Units 5 and 6, which have not been included in this plan, and it does not specify expectations for high value grizzly bear habitat that is not captured within delineated polygons on Map 7, it is uncertain whether high value habitat types (referred to as critical habitats in this plan) that are not within high value polygons have been or will be considered in operational-level planning. If not, this would be a major concern given the gaps in information and limitations of biophysical and ecosystem mapping and associated grizzly bear interpretations forming the basis of grizzly bear habitat mapped in this plan.

Mixed Forest Management (Treatment Unit 4a)

Babine River Interim LRUP

Babine River Interim LRUP Objective (implied): "*these habitats require periodic disturbance to maintain the aspen, Douglas maple and other shrubs"* (MOF and MELP 1999a:p. 24).

Bulkley LRMP

Regarding management objectives for planning sub-units

Sub-unit 2-2: Babine River Special Management Zone

- Objective" "*To protect and buffer the river-based resource values within the protected corridor (Sub-unit 2-1). To follow the guidelines set out in the Babine River Interim Local Resource Use Plan (LRUP)* (BVCRBIPT 1998: p. 58)
- Grizzly bear specific management direction under biodiversity: "*an emphasis will be on grizzly bear management focusing on the importance of maintaining grizzly bear habitat, especially for travel and denning*" (BVCRBIPT 1998: p. 58).

Sub-unit 2-3: Babine Integrated Resource Management

- Objective: "*to manage for a variety of values and activities in an integrated and compatible manner. Follow guidelines set out in the Babine River Interim Local Resource Use Plan (LRUP) and Coordinated Access Management Plan (CAMP)"* (BVCRBIPT 1998: p. 59)

- Grizzly bear specific management direction under biodiversity: "*an emphasis will be on grizzly bear management focusing on the importance of maintaining grizzly bear habitat, especially for travel and denning*" (BVCRBIPT 1998: p. 59)
- Grizzly bear specific direction under fish and wildlife habitat: *"An emphasis will be placed on grizzly bear management"* (BVCRBIPT 1998:p. 59).

Comment: Travel and denning habitat were not assessed in any grizzly bear habitat studies.

Babine LUP
Babine LUP Objective 2.4: "*Maintain the diverse understory with high-value mixed forest identified* ***on Map 2"*** (MOF 1999a:p. 17).

Comment: Objective constrained to mapped high value mixed forest.

Bulkley LRMP Higher Level Plan Order
No objective for mixed forest habitat.

Bulkley LRMP Objectives Set by Government
Objective: "*Provide diverse understory within high-value, mixed forest habitat* ***identified in Map 5***" (ILMB 2006a:p. 9).

Comment: Constraint to mapped high value, mixed forest habitat carried forward. *Maintain* changed to *provide*.

Kispiox LRMP and West Babine SRMP
The *Kispiox LRMP* deferred to the *Babine River Interim LRUP* for grizzly bear habitat (see Section 2.2). As previously discussed, the *Babine River Interim LRUP* objectives for this management unit were not clear. High-level objectives are provided for wildlife values but no objectives specific to grizzly bears or their habitat were provided in the *Kispiox LRMP*. The *West Babine SRMP* did not differentiate between high value grizzly bear and mixed forest management habitat types (i.e., all types identified as high value grizzly bear habitat). Therefore, direction for periodic disturbance was dropped for these deciduous dominated units. Previously, Simpson (1992) recommended no roads in deciduous dominated units identified as high sensitivity. See *West Babine SRMP* objectives for high value grizzly bear habitat (Treatment Unit 4, this section).

Moderate Value Grizzly Bear Habitat (Treatment Unit 5)

A notable change is that *West Babine SRMP* dropped management direction for moderate value grizzly bear habitat types (Treatment Unit 5). Simpson (1990, 1992) identified these types as having moderate sensitivity to development based on the potential for an increase in habitat-value (i.e., increased berry productivity) with forest harvest and provided guidelines for their management. These habitat types included black huckleberry bramble (BB), black huckleberry-bunchberry mesic (HB), western hemlock-blueberry southerly aspect (HH), lodgepole pine-dwarf blueberry (LB) and lodgepole pine-soapberry fluvial terrace (LS). The *Babine River Interim LRUP* identified management objectives and strategies specific to grizzly bears for these units.

Grizzly Bear Management Area

Direction for the establishment of Grizzly Bear Management Areas presented in the *Kispiox LRMP* was not carried forward in the *West Babine SRMP*.

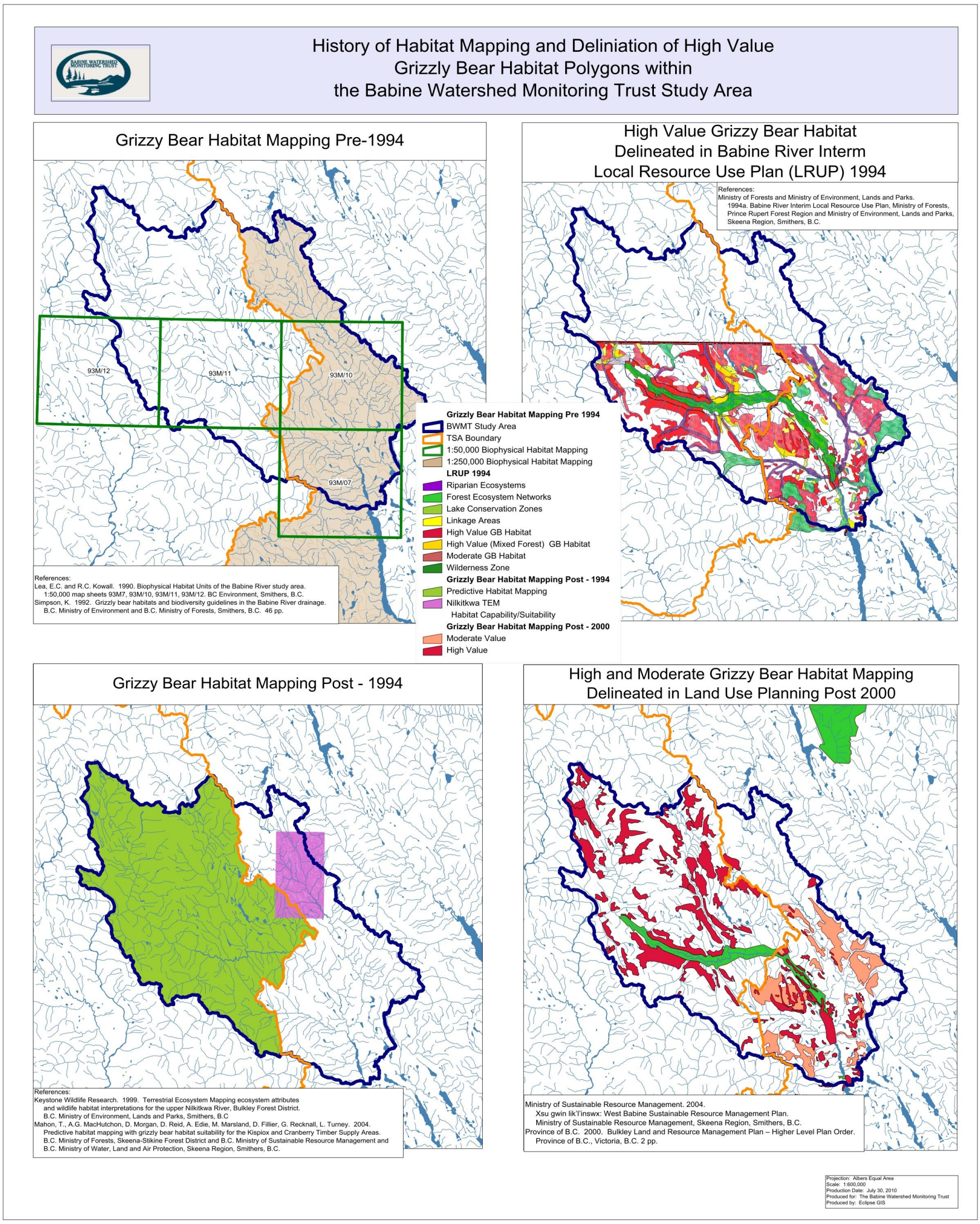
2.3.3 Origins and Limitations of Grizzly Bear Habitat Polygons in Land Use Planning

Need for More Detailed Grizzly Bear Habitat Mapping

"*Airphoto interpretation and ground work will result in more detailed mapping at 1:20,000 of the spatial arrangement of habitat types within Treatment Units 4 to 6 thus refining what treatment unit prescription is required (see Lea and Kowall 1990 for a description of habitat types). This is a necessary requirement for the development of Total Chance Plans in this drainage as the minimum mappable type at 1:50,000 is 50 hectares.*" (*Babine River Interim LRUP*, MOF and MELP 1994a:p. 20)

Preliminary investigations for this project determined that it was necessary to consider the origins of grizzly bear habitat polygons presented in land use planning before implementation and effectiveness monitoring could be initiated. An overview of the history of landscape-level ecosystem mapping with interpretations for grizzly bear habitat and delineations of grizzly bear habitat polygons in land use planning is provided for reference in Figure 4. Wellwood (2014b) provides detailed results for a review of habitat types and units with ratings identified by Simpson (1990, 1992) as compared with those that were presented at various stages of land use planning. This allowed me to track changes to habitat types and treatment units that occurred over time.

Figure 4. An overview of the history of landscape-level ecosystem mapping with interpretations for grizzly bear habitat and grizzly bear habitat delineated in land use planning within the Babine Watershed Monitoring Trust area of interest. [1, 2]



[1] Polygons identified as Mixed Forest Management in the *Babine River Interim LRUP* were later identified as High Value Grizzly Bear Habitat in *West Babine SRMP* and Grizzly Bear - Mixed Forest in *Bulkley LRMP OSG*.

[2] High Value polygons in Grizzly Bear Habitat Mapping Post – 2000 (above) includes Mixed Forest Management and High Value Grizzly Bear Habitat polygons that were lumped together in the *West Babine SRMP* (Kispiox TSA portion) and apparently lumped together in the *Bulkley LRMP HLPO* and then treated separately in the *Bulkley LRMP OSG* (Bulkley TSA portion).

2.3.3.1 Babine River Interim LRUP Mapping

Biophysical mapping (Lea and Kowall 1992) with grizzly bear habitat assessment and interpretations for sensitivity to development (Simpson 1990, 1992) formed the basis for delineation of moderate and high value grizzly bear habitat polygons in Appendix 12 of the *Babine River Interim LRUP* (B. Fuhr pers. comm.).

Land Use Planning Utilizing Babine River Interim LRUP Polygons

Based on interviews and visual comparisons of the *Babine River Interim LRUP* with maps in subsequent land use plans, *Babine River Interim LRUP* polygons for grizzly bear habitat were carried forward to

1. *Babine LUP*, Map 2 (MOF 1999a: no page number)
2. *Bulkley LRMP*, Bulkley Plan Area Wildlife Habitat – 1995 map (BVCRBIPT 1998:p. 12) for area originally mapped in the *Babine River Interim LRUP*. Also see Section 2.2.2, Chapter 2 regarding the possible origin of other grizzly bear habitat polygons delineated on this map.
3. Apparently the *Bulkley LRMP HLPO* (Province of B.C. 2000). It stated: "Wildlife habitat as mapped and made available at the landscape level."
4. *West Babine SRMP* Map 7 (MSRM 2004a:p. 72), area originally mapped in the *Babine River Interim LRUP*. This document only incorporated high value grizzly bear habitat and mixed forest management (lumped together). As previously stated, some high value habitat types were dropped. Moderate value grizzly bear habitat polygons that were delineated for the *Babine River Interim LRUP*, Appendix 12 (MOF and MELP 1994a) were also dropped.
5. *Bulkley LRMP OSG*, Map 5 (ILMB 2006a:p. 14) for the area originally mapped in the *Babine River Interim LRUP* with grizzly bear-high value, grizzly bear-mixed forest habitats (formerly mixed forest management) and moderate value habitat incorporated. These only fall within the Babine Planning Unit.

Some key points to consider for plans utilizing Babine River Interim LRUP Polygons

- Non-forestry stakeholders and others interested in developing or otherwise accessing parkland and alpine areas may erroneously assume that important grizzly bear habitats do not exist there. Habitats for parkland and alpine tundra biogeoclimatic subzones were not interpreted or mapped. Land-use plans and maps do not specify this limitation in coverage.
- Monitoring that only considers treatment unit polygons delineated specifically for grizzly bears will be incomplete. Some habitat polygons with specific focus on grizzly bears (i.e., high value grizzly bear habitat, mixed forest management [in part], moderate value grizzly bear habitat) are *underneath* other mapped treatment units (e.g., riparian ecosystems, forest ecosystem networks). As such, important information relevant to grizzly bear habitat is not displayed.
- Intentions for the mixed forest management unit were not clear in the *Babine River Interim LRUP*. This unit was named differently in subsequent plans (e.g., high value mixed forest, grizzly bear-mixed forest) or lumped with high value grizzly bear habitat; a unit that was apparently originally identified to manage habitat

considered important to a diversity of wildlife species is now specific to grizzly bears.

- Moderate value habitat is an important management consideration to address risk of mortality associated with human-caused disturbances such as roads and cutblocks (i.e., attractive sink-like habitat, Delibes et al. 2001). This unit was labeled as moderate value, implying that the habitat is mid-range in importance to bears. However, this is incorrect because Simpson (1990, 1992) originally identified it as *moderate sensitivity to development*. He anticipated that this unit would have high potential for feeding if harvested due to increased berry production.
- The boundaries of some high value habitat polygons delineated in the *Babine River Interim LRUP* do not appear to be directly derived from Lea and Kowall's biophysical habitat polygons. In addition, based on biophysical unit labels and descriptions, some of Lea and Kowall's mapped polygons appear to have warranted delineation as high value grizzly bear but were not identified as such in the *Babine River Interim LRUP*.
- As compared to current best available information, the grizzly bear food plant list in Table B1 (MOF and MELP 1994a:p. 54a) is a poor reference for their food habits. It was taken from Fuhr and Demarchi (1990), a list compiled for British Columbia that is now considerably outdated. It only presents a small portion of known or probable food plants used by bears. In addition, numerous species on the list do not occur in the planning area and, potentially, some species listed may not be used or well used.
- Mahon and Marsland (2001) identified errors and inconsistencies in the original treatment units delineated for the *Babine River Interim LRUP* when the treatment unit mapping extension was being completed. They indicated that the portion of the Kispiox TSA that was originally mapped for the *Babine River Interim LRUP* warranted revision, but no changes were made because forest development planning had already been completed for this area. Similar types of problems might exist in the original *Babine River Interim LRUP* mapping for the Bulkley TSA portion.
- From the perspective of maintaining important grizzly bear habitat, restriction of land use objectives to mapped polygons is considered inappropriate, given statements regarding the intended use of the grizzly bear habitat mapping and my provisional estimates for reliability of the grizzly bear habitat mapping (for the purposes of locating important grizzly bears on the ground) forming the basis of these maps.

2.3.3.2 Bulkley Area Wildlife Habitat – 1995 Mapping

Only two grizzly bear habitat polygons were delineated for the Upper Nilkitkwa Planning Unit. In attempts to determine where these polygons came from, it was initially thought that they had been delineated based on information gained through the upper Nilkitkwa mapping project (i.e., Oikos 1998; Keystone Wildlife Research 1999a, 1999b). However, further review of available information indicated that these polygons were probably delineated in 1995 (see Map *Bulkley Plan Area Wildlife Habitat – 1995* in *Bulkley LRMP*, BVCRBIPT 1998:p. 12). The Bulkley LRMP map has grizzly bear habitat polygons that are the same shape as those delineated in the *Babine River Interim LRUP* plus others of unknown origin, including the two polygons in the Upper Nilkitkwa Planning Unit. In subsequent discussion, an unconfirmed report indicated polygons that did not originate

from the *Babine River Interim LRUP* might have been derived from Broad Ecosystem Mapping (1:250,000). However, given the relatively small size of the polygons and lack of other polygons nearby, this does not seem particularly plausible. Despite considerable searching, I was unsuccessful in gathering more information to verify their origin.

Grizzly bear habitat suitability and capability models (Keystone Wildlife Research 1999b) and Terrestrial Ecosystem Mapping (Oikos Ecological Services 1998) with ecosystem attributes and wildlife habitat interpretations for the upper Nilkitkwa River (Keystone Wildlife Research 1999a) were not utilized in land use planning and no grizzly bear habitat polygons were delineated in land use plans for the area that these projects covered.

When comparing Bulkley LRMP mapping (i.e., *Bulkley Plan Area Wildlife Habitat – 1995* (*Bulkley LRMP*, BVCRBIPT 1998:p. 12) with the Babine River Interim LRUP mapping, (i.e., Appendix 12 Map, MOF and MELP 1994a) and then with mapping in following plans, I identified grizzly bear habitat polygons in the northern portion of the Babine River Planning Unit that do not show up in mapping for grizzly bear habitat prior or subsequent to the *Bulkley LRMP*.

Land Use Planning Utilizing Polygons from Bulkley Area Wildlife Habitat - 1995
Nilkitkwa LUP: This plan did not have objectives specific to grizzly bear habitats or habitat mapping for them. I did not determine if management direction for the two grizzly bear habitat polygons might have been otherwise provided. As previously, mentioned a mixed-value objective that includes *grizzly bear habitat* is provided for the Barbeau Special Management Zone.

Two grizzly bear habitat polygons from Wildlife Habitat – 1995 map in the *Bulkley LRMP* of unknown origin were or might have been carried forward to the following plans:
1. *Bulkley LRMP HLPO*: It states: "Wildlife habitat as mapped and made available at the landscape level" (Province of B.C. 2000).
2. *Bulkley LRMP OSG*: Bulkley HLP: Map 5 – Ecosystem Network, Enhanced Timber Development Areas and Wildlife (ILMB 2006A: p. 15, map dated 13 September 2006). Other polygons appear to be from the Babine River Interim LRUP (see Section 2.2).

Some key points to consider for plans utilizing polygons of unknown origin from Bulkley Area Wildlife Habitat - 1995

- The methods used to delineate grizzly bear habitat polygons for the Upper Nilkitkwa Planning Unit were not determined.
- Of the reports gathered for this project, interpretive grizzly bear habitat mapping was only completed for a portion of the Nilkitkwa Planning Unit (i.e., within Integrated Resource Management area; Keystone Wildlife 1999a, 1999b). To the best of my knowledge, this information has not been directly incorporated into land use planning in this unit.
- I strongly suspect that grizzly bear habitat polygons delineated for land use planning only captured a very minor portion of important grizzly bear habitats in the Upper Nilkitkwa Planning Unit.

- Given the body of information that I amassed for this project and my inability to find reporting for the grizzly bear habitat polygons of unknown origin, I strongly suspect that they were also derived from mapping of low reliability (as defined for this project).
- It is inappropriate to use these polygons in land use planning that limits management objectives for important grizzly bear habitat to mapped polygons (i.e., *Bulkley LRMP HLPO*, *Bulkley LRMP OSG*).

2.3.4 Babine LRUP Treatment Unit Extension Mapping

As described in Chapter 2, three versions of grizzly bear habitat modeling (i.e., in 2001–2002, 2002 and 2003) were completed for the Kispiox TSA (Mahon et al. 2004). It was intended to support the extension of treatment unit mapping for the *Babine River Interim LRUP*; identify high value grizzly bear habitat complexes for remaining areas in the district; support landscape unit planning and stand-level habitat protection; and support monitoring for objectives related to the goal to maintain grizzly bear habitat in the *Kispiox LRMP*. To the best of my knowledge, an early precursor version of PHM formed the basis of high value grizzly bear habitat polygons delineated in *West Babine SRMP* for areas that were not originally mapped in the *Babine River Interim LRUP* (Mahon and Marsland 2001). The *Xsu gwin lik'l'inswx: West Babine Sustainable Resource Management Plan Technical Report* (West Babine SRMP Technical Report hereafter, MSRM 2004b:p. 9) stated, "high value grizzly bear habitat has been identified based on the Treatment Unit 4 and 4a mapping from the Babine Local Resource Use Plan". Presumably, the author missed referencing the treatment unit extension work completed by Mahon and Marsland (2001). Apparently, the PHM was used in the risk analysis, as terms high and moderately high habitats were used, but I did not find specific reference to it or determine the version that was used.

Some key points to consider for grizzly bear habitat polygons delineated in West Babine SRMP, Babine LRUP Treatment Unit Mapping Extension only

- An early version of PHM for grizzly bears (Mahon and Marsland 2001) was used to delineate treatment units for this area. A more reliable version of PHM for grizzly bear habitat is available (see Mahon et al. 2004). This resource was not referenced in the *West Babine SRMP*.
- Treatment unit designations were completed for this area that included the upper portions of the Shedin, Shelagyote, Gail, Hanawald and Nichyeskwa watersheds. Moderate value grizzly bear habitats were not carried forward to the *West Babine SRMP*, as directed in the *Babine River Interim LRUP* and recommended by Mahon and Marsland (2001). The *West Babine SRMP Technical Report* (MSRM 2004b:p. 3), reported "poor confidence any available maps accurately depict the highest concentration of huckleberry sites" for this unit. All management direction for this treatment unit was dropped in the *West Babine SRMP*. As such, opportunities to manage human–bear interactions (notably risk of human-caused mortality), as recommended by Simpson (1992) and MacHutchon and Mahon (2003), have been lost in management direction for this treatment unit.
- As previously discussed, Mahon and Marsland (2001) identified errors and inconsistencies in the original treatment units delineated for the Babine River

Interim LRUP. They attempted to correct the most significant problems for the treatment unit mapping extension area. See Chapter 3, Section 2.3.3.1 for additional information specific to the portion of the *West Babine SRMP* area originally mapped in the Babine River Interim LRUP.

- It is not considered appropriate to use the early version of predictive habitat mapping in planning that restricts objectives to mapped polygons (i.e., West Babine SRMP). Mahon and Marsland (2001:p. 11) state "the intent of this planning process is that management guidelines will be the same as initially defined in the Babine River LRUP (MOF and MELP 1994a). Refer to that document for more detailed guidelines and rational for each unit." Their work originally predicted large areas of grizzly bear habitat (delineated in mapped treatment units) with an expectation that airphoto interpretation and ground truthing would be conducted to identify important grizzly bear habitats within and outside of mapped areas.

2.4 Changes to Grizzly Bear Habitat Polygons in Land Use Planning

A cursory comparison of land use plan maps with interpretive maps produced for grizzly bear habitat was also needed to support monitoring. I did not do this comparison with the *Bulkley Plan Area Wildlife Habitat – 1995* map presented in the *Bulkley LRMP* because I was unable to determine its origins.

2.4.1 Options for the Babine River to Babine River Interim LRUP

Differences noted from the hand drawn, hand coloured map that I found (possibly accompanying the *Options for the Babine River Area* report) and the *Babine River Interim LRUP* include

- The Bulkley TSA portion had a deletion of a moderate value grizzly bear habitat polygon and part of a moderate value habitat polygon was incorporated into Forest Ecosystem Network.
- The Kispiox TSA portion had a deletion of a relatively large high value polygon, delineated along an unnamed creek on the south side of the Babine River just downstream of Hanawald Creek; a high value polygon in the Special Management Zone was changed from high to moderate value; and a high value polygon in the Tomlinson Creek area was increased in size.
- A moderate value polygon on the Bulkley-Kispiox TSA boundary was reduced.

The hand drawn, hand coloured map was the only map that I found with high and moderate value grizzly bear habitat delineated in the wilderness zone, now Babine River Corridor Provincial Park.

2.4.2 Babine River Interim LRUP to Babine LUP

Differences noted between the *Babine River Interim LRUP* and *Babine LUP* maps included

- Conflicting information with three high value grizzly bear habitat polygons identified as high value habitat in Map 2 and moderate value habitat in Map 2a.
- Changes in designation for an Ecological Reserve at the mouth of Nilkitkwa River. Part of it was incorporated into Babine River Corridor Provincial Park and the remainder into integrated resource management zone. The area of the reserve that fell outside of the park was not identified as a goal 2 protected area in the *Bulkley*

LRMP. However, it appears that at least some of the area should have been designated for greater protection because the Nilkitkwa River is now the only major tributary that does not have some type of special management along its entire length.

- Addition of Indian Reserves with removal of treatment unit designations that had been inappropriately identified within reserve area.
- Removal of a southeastern section of *Babine River Interim LRUP* area. A Core Ecosystem delineated around Tsezakwa Creek in the *Babine River Interim LRUP* was carried forward to the *Torkelson LUP* area but no management direction is provided for grizzly bears in this plan. Three small grizzly bear habitat polygons of unknown origin were delineated in the map for this plan. One high value grizzly bear habitat polygon that was delineated in the *Babine River Interim LRUP* was dropped. This portion of the *Babine River Interim LRUP* area is not within the BWMT area of interest.

2.4.3 Babine LUP to Bulkley LRMP OSG

Differences noted between the Babine LUP and Bulkley LRMP OSG maps included

- Reduced size of high value grizzly bear habitat polygon in Boucher Creek area
- Section of former Ecological Reserve near mouth of the Nilkitkwa River remains integrated management
- Possible deletion of a mixed forest polygon (unverified)
- Correction of problem with high value polygons mapped as moderate value habitat in *Babine LUP*.

2.4.4 Babine River Interim LRUP to West Babine SRMP

Differences noted between the Babine River Interim LRUP and West Babine SRMP maps included

- Deletion of large area of high value habitat in Thomlinson Creek area
- Increase in area of high value habitat in Shegisic Creek area
- Moderate value grizzly bear habitat polygons dropped entirely.

In 2012, the West Babine SRMP map was amended to correct delineation of high value habitat (Ministry of Forests, Lands and Natural Resource Operations 2012a).

2.5 Planning for Babine River Corridor Provincial Park

The *Babine River Interim LRUP* identified a large area adjacent to the southern end of the wilderness zone and extending south to Nilkitkwa Lake as high value grizzly bear habitat, as well has high value grizzly bear habitats along the river that were to be protected within Babine River Corridor Provincial Park (formerly Wilderness Zone).

2.5.1 Zoning

As proposed in the *Bulkley LRMP* and the *Kispiox LRMP*, in 1999, the Babine Wilderness Zone was established as a Class A Provincial Park (MELP 2000a). In 2001, an addition was made to the park to include area immediately upstream of the bridge to the downstream edge of the Department of Fisheries and Oceans lease lot (Bill 15, Schedule C, Province of

B.C. 2001). This addition was formerly identified as Special Management Zone in the *Options for the Babine River Area* and *Babine River Interim LRUP* reports.

Preliminary zoning for the park presented in the *Babine River Corridor Provincial Park Management Direction Statement* identified the upstream section of the park from the park boundary to the Babine-Nilkitkwa confluence as Natural Environment due to established trails and levels of human use. This same zoning extended to Gail Creek due to established jet boat use of the river. Grizzly Drop was identified as a Special Feature "to protect bears as they fish the rapids" (BC Parks 2000:p. 15). The remainder of the park was zoned as Wilderness Recreation due to wilderness character and difficulty of access.

2.5.2 Babine River Corridor Provincial Park

The trajectory of land use planning for Babine River Corridor Provincial Park (formerly Babine River Wilderness Zone) diverges considerably from that of other planning units. I found relatively little explicit direction of specific relevance to grizzly bears and their habitat for this area. An overview of grizzly bear-specific management objectives and direction (explicit or implied) that is specific to the park is provided in Table 1and general direction for areas within and outside of the park is provided in Table 2. A summary of management direction for the Special Management Zone, prior to park establishment, is provided in Table 3.

At the outset, the *Options for the Babine River Area* report (MOF, MOE and Babine TAC 1991) deferred to the Ministry of Forest's *Managing Wilderness in Provincial Forests: a policy framework* (MOF 1989 in MFLNRO 2012c) for management direction for the Wilderness Zone. This document directed the completion of a wilderness management plan. The *Babine River Interim LRUP* further endorsed the need for planning in this area by stating a wilderness plan would be required (MOF and MELP 1994a). This document had a forestry emphasis. While it expressed broad expectations, it did not provide specific management direction for the Wilderness Zone. It also did not consider the potential impacts of other types of land uses such as those associated with recreation-related human–bear interactions (e.g., habitat displacement, risk of human-caused mortality) in the Wilderness Zone. The gap to be filled is underscored with the statement that "it is anticipated that with proper planning of harvesting activities and access control, particularly beside high value habitat, management objectives for the Babine River grizzly bear population can be met"(MOF and MELP 1994a:p. 13).

The *Bulkley LRMP* and *Kispiox LRMP* recommended the wilderness zone for protected areas status through the Protected Areas Strategies process (BVCRBIPT 1998, KLRMPT 2001). Both defer to the *Babine River Interim LRUP* for management of the Wilderness Zone. Only the *Bulkley LRMP* provided an explicit statement regarding the need for planning in this zone; marked as a high priority.

A management direction statement was prepared for Babine River Corridor Provincial Park highlighting planning needs in the following:

> "*While some management issues can be dealt with directly, others will need further*

> *planning. Specifically, the complexity of bear/human issues necessitates collecting further information, and the multiplicity of interests involved in recreation activities necessitates further public involvement. Both planning activities* [for a human–bear management plan and recreation management plan] *have a high priority, but will take at least two years. Hence this Management Direction Statement provides interim actions to guide management until the plans are complete. These interim actions are subject to modification as the plans develop or as new information arises* (MELP 2000a:p. 10).

The management direction statement also highlighted some of the challenges in problem solving for the Babine River area as follows:

> "*Several planning processes dealing with the Babine River have been completed (Babine LRUP, Bulkley and Kispiox LRMPs); others have stalled (e.g. Babine Angling Use Plan, Kispiox Co-ordinated Access Management Plan). Stalled planning processes and perceived lack of action have led to a high level of public energy. The high public profile, increasing public use, potential for increased conflict between park users and potential for increased human/bear interactions impacting both bear conservation and human safety suggest an expeditious start to developing a human/bear management plan and recreation management plan*" (MELP 2000a:p. 14).

Direction for planning included

- A MELP (2000a:p. 18) statement that "as well as referring to the BC Parks Bear-People Conflict Prevention Plan, a plan must be developed specifically for Babine River Corridor Park. The plan must deal with reducing opportunities for conflict at the park entrance, education, enforcement, Grizzly Drop regulations, hunting and viewing."
- In addition, this document provided considerations under headings for reducing negative human–bear interactions at the park entrance, bear awareness and safety education, enforcement, Grizzly Drop, hunting, bear viewing, float craft, water jet craft, angling, camping and access.

Other planning documents that are of interest for this project, including the *Bulkley LRMP HLPO*, *West Babine SRMP* and *Bulkley LRMP OSG*, do not address management within Babine River Corridor Provincial Park.

While a management direction statement has been completed, no management plans have been approved for Babine River Corridor Provincial Park (MELP 2000a), thus the park has little for explicit management direction specific to grizzly bears. However, albeit it out dated as compared to best practices for bear management (e.g., Hopkins et al. 2010), direction has been provided by the province for management of human–bear interactions in the *Skeena District Bear–People Conflict Prevention Plan* (BC Parks 2001) and *Bear–People Conflict Prevention Plan for Parks* and *Protected Areas in British Columbia* (Ministry of Water, Land and Air Protection 2002).

Table 1. Management direction of relevance to grizzly bears and their habitat for Babine River Corridor Provincial Park, for area formerly designated as Wilderness Zone. This information is presented for reference purposes for this project only. Anyone interested in using this information needs to refer to original documents. Text in *italics* is for direct quotes with page number in brackets.

Plan	Objectives (Explicit or Implied)	Direction
Managing Wilderness in Provincial Forests: a policy framework (MOF 1989 in MFLNRO 2012c)[1]	"*Purpose: The Ministry of Forest's wilderness program will maintain and protect a wilderness resource in relation to other uses of provincial forests, and provide maximum benefits to the citizens of British Columbia*" (*Forest Act*, s.2, 3, 4, 6). "*Ministry wilderness objectives are:* • *research – to assess the use, demand, and value of wilderness* • *inventory – to develop and maintain an inventory of wilderness* • *planning – to identify, assess, and recognize wilderness resources, make recommendations on areas that cabinet may decided to designated as a wilderness area, and to ensure wilderness is adequately considered in integrated resource management* • *management- to prepare, implement, and monitor a wilderness management plan for each designated wilderness area*" (MFLNRO 2012c).	Not applicable (i.e., none specific to Babine River Wilderness Zone)
Options for the Babine River: Wilderness Zone (MOF, MOT and Babine TAC 1991)	"*The management intent will be consistent with the Ministry of Forests policy "Managing Wilderness in Provincial Forests"*" (MOF, MOE and Babine TAC 1991:App37).	Summary: • Tree cutting only permitted for safety, fire fighting and pest management • Mineral exploration and development "must ensure that the wilderness values are considered and not compromised" • No public roads will be constructed • Pest and wildfire suppression management direction also provided (MOF, MOE and Babine TAC 1991)
Babine River Interim LRUP: Wilderness Zone (MOF and MELP 1994a)	• "*This management option retains wilderness values along the river while allowing for timber extraction outside the proposed wilderness zone*" (MOF and MELP 1994a:p. vi) • "*The Babine LRUP considers wildlife habitat, particularly grizzly bear habitat, fisheries, timber, recreation and biodiversity resource values. The wilderness zone protects the resource values associated with the Babine River. Grizzly bear habitat will be managed outside the wilderness zone to meet cover, feeding and denning requirements*" (MOF and MELP 1994a:p. vii) • "*This zone plays an important role in maintaining the riparian area intact along the Babine River, protecting water quality, fish habitat, tourism, guiding, and recreation activities and grizzly bear habitat*" (MOF and MELP 1994a:p. 1)	Summary: • Presented features for a provincial forest wilderness area. • The Babine River Wilderness Zone was referred to the Protected Areas Strategy process for park status. A wilderness plan would be required. Noted that a study was initiated to determine objectives for wilderness, recreation and tourism for while remaining within the "limits of acceptable change" (MOF and MELP 1994a: p. 1)
Interim Babine River CAMP, Bulkley Portion (MOF and MELP 1994b)	Not applicable	"*The Babine LRUP calls for coordinated access management plan in order to manage access to the entire watershed. The impact on grizzly bear and recreational use is of particular concern. The CAMP IS NOT mandated to deal with access within the Wilderness Zone identified in the Babine Local Resource Use Plan. Access within the wilderness zone will be addressed by a wilderness management plan*" (MOF and MELP 1994b:p. 1)

Table 1. Continued

Plan	Objectives (Explicit or Implied)	Direction
Bulkley LRMP: Sub-unit 2-1: Babine River Corridor (Protected Area; BVCRBIPT 1998)	"*Objective: To maintain the wilderness quality of the high-value grizzly bear habitat located in close proximity to the river through dersignation (sic) anf (sic) management as a protected area. To manage according to the guidelines set out in the Babine River Interim Local Resource Use Plan (LRUP)*" (BVCRBIPT 1998:p. 57)	Access • "*Access planning within the corridor must be part of the formal Management plan for the Protected Area*". • "*Access within the Protected Area will be co-ordinated with access to the entire planning unit with input from the Board and the public as necessary".* Timber Management • "*Permit cutting of trees where fire safety and pest management are concerns*" • "*Utilize fall and burn and other measures in accordance with Park Act, preferably between November and March*. Water Quality • "*Maintain existing levels of water quality, clarity, hydrologic stability in the Babine River and its tributaries*" Fish and Wildlife Habitat • No specific direction was provided for grizzly bears. • "*Maintain fish habitat*" Outdoor Recreation and Tourism • "*Maintain the provincially significant angling values associated with the Babine River*" Future Planning Processes • "*Completion of a Park Management Plan is a priority in this area*" • "*Management Plan will address motorized access and motorized access users will be included in the planning process*" (BVCRBIPT 1998:p. 57)
Kispiox LRMP: Goal 1 Representative Protected Areas (KLRMPT 2001)	"*Babine River Wilderness Corridor (9,403 ha), as recommended in the Babine River Interim Local Resource Use Plan, to protect a nationally significant unregulated river corridor, high salmonid values, a Class 1 angling river and critical grizzly bear habitat*" (KLRMPT 2001:p. 26)	"*The Babine River wilderness corridor will be established as a new protected area. The Babine River wilderness corridor was a PAS study area and mineral potential was assessed as low. Timber harvesting and mineral exploration or development will no longer be permitted in the area. The Babine River Local Resource Use Plan will provide the basis for future management of the protected area*" (KLRMPT 2001:p. 26)

Table 1. Continued

Plan	Objectives (Explicit or Implied)	Direction

Babine River Corridor Provincial Park Management Direction Statement: Class A Provincial Park (MELP 2000a)	"*Protect the park's grizzly bears*" (MELP 2000a:p. 11)	Summary:
		• Work with Babine LRUP Monitoring Committee to discuss watershed concerns
		• Review development proposals for Special Management Zone to minimize impacts to grizzly bears
		• Pursue an expansion of the park boundary to include area immediately adjacent to the DFO weir.
		• Develop a human–bear management plan (see considerations)
		• Initiate as interim measures
		  ○ Review *Bear Hazard Evaluation at Campsites on the Babine River* (MacHutchon 1998b) and select recommendations to implement
		  ○ Implement on-going monitoring
		  ○ Assess potential impacts of lodges
		  ○ Several points provided to develop and deliver bear awareness and safety information
		  ○ Manage garbage within the park so that it does not accumulate and work with other agencies to develop a protocol for garbage management outside the park
		  ○ Work with other agencies to restrict recreational use to the east side of the river
		  ○ No camping at park entrance
		  ○ Close area 30 min before dusk
		  ○ Work with other agencies to design, develop and manage campsite outside of park entrance and post signs to alternative campsites
		  ○ Provide enforcement and extension services from 1 August to 31 October
		  ○ Consider closure period for recreation (i.e., from 30 min before dust to 30 min after dawn) within the upper 3 km of the park and for motorized travel on the river for the same period
		  ○ Manage recreation use at Grizzly Drop (see section 2.5.3.2)

	Natural Environment Zone Objective: "*To protect scenic values and to provide for backcountry recreation opportunities in a largely undisturbed natural environment*". Special Feature Zone Objective: "*To protect and present significant natural or cultural resources, features or processes because of their special character, fragility and heritage values*". Wilderness Recreation Objective: "*To protect a remote, undisturbed natural landscape and to provide backcountry recreation opportunities dependent on pristine environment where air access may be permitted at designated sites*" (MELP 2000a:p. 25)	None provided

[1] Ministry of Forests, Lands and Natural Resource Operations Policy Manual, Volume 1 – Resource Management, Chapter 4 – Recreation Management, Policy 4.3 (effective date 01 June 1996, updated 15 October 1997). This document presents "policy highlights" for *Managing Wilderness in Provincial Forests: a policy framework.* (MOF 1989 in MFLNRO 2012c).

Table 2. General management direction of relevance to grizzly bears for areas within and outside of Babine River Corridor Provincial Park. This information is presented for reference purposes for this project only. Anyone interested in using this information needs to refer to original documents. Text in *italics* is for direct quotes with page number in brackets.

Plan	Objective	Direction
Options for the Babine River (MOF, MOE and Babine TAC 1991:App 36)	• "*General: Identify and maintain important grizzly bear habitat*" • "*Maintain grizzly bears in at least present numbers and manage them primarily as a viewing resource*" • "*Identify and maintain known grizzly bear movement corridors to and along the river as well as those areas back from the river utilized by bears*" • "*Maintain or increase wildlife habitat diversity*"	• "*Immediately impose a no shooting zone in the area (i.e., three kilometres downstream from the weir) where most destructive bear/man interactions occur*" • "*Conduct a study in the spring/summer/fall of 1990 in the Babine River corridor in order to identify important grizzly bear habitat*" • "*Habitat diversity may be achieved through retention of special habitats and guidelines for rate of cut and silvicultural systems*"
Babine River Interim LRUP (MOF and MELP 1994a:p.12)	"*Specific management objectives outlined for grizzly bears in the Options for the Babine River Area include maintaining the present population and managing for grizzly bear viewing opportunities identified along the Babine River corridor. Results of the "Limits of Acceptable Change" survey may have implications for the extent of development possible for these viewing sites*".	General discussion is provided for potential impacts of resource development and human activities with a summary of management strategies.
Bulkley LRMP: General Management Direction, Fish and Wildlife Habitat (BVCRBIPT 1998:p. 34)	"*General management direction is designed to conserve the wide abundance of all fish and wildlife habitats and populations in the Plan Area*"	• "*Critical wildlife habitats will be managed to maintain habitat values including habitats currently identified through this LRMP process, and areas yet to be identified under the Forest Practices Code as wildlife habitat areas*" • "*In addition, agencies will follow guidelines set out in the Forest Practices Code and other existing legislation and policy on species and habitat management. Existing critical habitat inventory maps and prescriptions developed by the Technical Working Groups in this LRMP process will be reviewed as part of the Landscape Unit Planning process and in operational planning*" • "*BC Environment will collect 1:50,000 habitat inventories for areas where this information is not currently available, and in areas where specific species have been identified as a priority for management*"

Table 2. Continued

Plan	Objective	Direction
Kispiox LRMP (Resource Management Objectives for General Wildlife and Specific to Grizzly Bears, KLRMPT 2001:p. 45-46)	• "*To maintain natural ecosystems and habitat to sustain viable populations of all native wildlife within their natural ranges*". • "*To protect or enhance populations and habitat of rare or endangered and regionally significant species*". • "*To provide for sustainable harvest of big game species (i.e., moose, mule deer, white-tailed deer, mountain goat, black bear and grizzly bear) and furbearers*". • "*To provide for aboriginal use of wildlife resources*". • "*To maintain viable guiding and trapping industries*". • "*To provide and promote opportunities for viewing, study and appreciation of wildlife in their habitat*".	General • "*The Code guidebooks on biodiversity, riparian management areas and managing identified wildlife will be considered*". • "*Critical and regionally significant wildlife habitat for identified wildlife species will be identified in landscape level planning*". • "*Forests will be managed to provide a diversity of age classes and stand structures for wildlife habitat (i.e., a combination of opening sizes, silvicultural systems, slower rates of cut, smaller clearcuts, new forestry practices and higher road standards)*". • "*B.C. Environment and the Ministry of Forests will establish wildlife habitat objectives for review and provide input at landscape and operational planning levels to facilitate protection of wildlife resources*". • "*Fragmentation of wildlife habitat will be minimized at the landscape planning level*". • "*Concerns about the effects of access on wildlife will be addressed at landscape and operational planning levels*". • "*Mapping of habitat capability and suitability for moose, grizzly bear, deer and mountain goat will be developed based on methods in Demarchi (1995). This habitat mapping will be used in landscape and operational planning*". Grizzly Bear Habitat • "*High value grizzly habitat will be identified and mapped at the landscape planning level and will include floodplain and riparian areas, movement corridors, avalanche chutes and berry producing areas*". • "*High value grizzly bear habitat will be protected through application of management strategies such as buffering with reserves, modifying silvicultural systems (e.g., selection harvesting in appropriate cover and devil's club sites; clear cuts to increase berry production in summer feeding sites) and minimizing clear cut sizes (i.e., <15 hectares)*". • "*Selection harvesting will be applied to a minimum of 5% of the forested portion of high value grizzly bear habitat outside riparian management areas or wildlife habitat areas*". • "*Established strategies for management of grizzly habitat (i.e., Babine LRUP prescriptions for moderate and high value grizzly habitat; stocking standards from the Coastal Grizzly Bear Habitat Management Guidelines) will be used in the development and review of landscape and operational plans*". • "*Designation of grizzly bear management areas, as directed under the B.C. Grizzly Bear Conservation Strategy, will be considered in future LRMPs*". • "*Effects of access on grizzlies will be addressed through coordinated access management plans (e.g., Babine CAMP) and modified road construction practices (i.e., minimum lines of sight, reduced widths of rights of way, accelerated deactivation, temporary construction standards)*". • "*Regulated grizzly bear hunting may be restricted in portions of the planning area, such as the Babine River corridor, as part of the provincial conservation strategy*."

Table 3. Management direction for the addition to Babine River Corridor Provincial Park, an area formerly designated as Special Management Zone. This information is presented for reference purposed for this project. Anyone interested in using this information needs to refer to the original document. Text in *italics* is for direct quotes with page numbers in brackets.

Plan	Objective	Direction
Options for the Babine River	"*to act as a buffer which will ensure that wilderness management objectives are met*" (MOE, MOF and Babine TAC 1991:App 38)	Summary • No harvesting within 1 km of the river for first five years of plan • Use partial cutting to sure environmental values are maintained or enhanced • Locate any temporary access to use natural barriers and do not construct roads closer than 300 m from one kilometer line or wilderness boundary, whichever is greatest • Winter harvest only • Maximum 15 ha cutblocks with leave strips greater than block size • Slow rate of cut in majority of this zone • Identify and protect grizzly bear habitat. Minimize sight lines and do not exceed 300 metres • Largely the same pest and fire management as wilderness zone • Smoke management to be addressed • Develop from outer boundary of planning area to inter boundary to evaluate and ensure objectives are being met • Establish operational trials and demonstration sites in this zone to evaluate and demonstrate management techniques and prescriptions • Ensure integrity of natural surroundings for three fishing lodges on the river.
Babine River Interim LRUP	"*The main objective for this zone is protection of the river based resource values within the wilderness zone*" (MOF and MELP 1994a:p. 31)	Summary • Harvesting deferred subject to the development of a plan to regulate small-scale forest management activities • Plan over 150 to 200 year rotation • No less than 30% of forest ≥ 140 years • Use partial cutting systems with any cutblocks <15 ha with leave strips > cut block size • No second pass harvest until green-up achieved (i.e., trees > 3 m tall) • No unrestricted, permanent road access north of the Babine River bridge will be established. All temporary access will be ≥ 300 m from wilderness zone boundary. Only exception is the Big Slide Chart area as identified in the *Options for the Babine River Area* report. • Winter harvest only. • Manage high value grizzly bear habitat and movement corridors as per direction provided for Treatment Unit 4. • Do not exceed 300 m line of sight distances along roads • Prioritize harvesting in areas where mountain pine beetles have attacked or risk of attack is high. Otherwise plan harvesting to proceed from outer to inner boundary of this zone. Refer to *Options for the Babine River Area* report for pest and fire management directions.

Table 3. Continued

Plan	Objective	Direction
Bulkley LRMP: Planning Unit 2-2: Babine River (SM2) (BVCRBIPT 1998: p. 50 & 58)	**"***To protect and buffer the river-based resource values within the protected corridor (Sub-unit 2-1). To follow the guidelines set out in the Babine River Interim Local Resource Use Plan (LRUP)"* (p. 58)	"*Note that any development within Special Management Zones must minimize impacts on the identified major values in the sub-unit (e.g. goat and grizzly bear habitat, water quality and visual quality)*" (p. 50). Biodiversity • "*Preserve representative examples of all ecosystems within each biogeoclimatic subzone through landscape level plans*". • "*Represent older seral stages over the landscape according to FPC guidelines*". • "*An emphasis will be placed on grizzly bear management, focusing on the importance of maintaining grizzly bear habitat, especially that required for travel and denning*". Access • "*There will be no permanent unrestricted road access north of the Babine River bridge*". • "*Maintain all temporary access at least 300 metres from the Babine River Corridor boundary*". Timber Management • "*Limit logging to select harvests or small clearcuts up to 15 hectares*". Water Quality • "*Maintain existing levels of water quality, clarity and hydrologic stability in the tributaries of the Babine River*". Fish and Wildlife Habitat • "*Maintain fish habitat*". Visual Quality • "*Follow Visual Quality Objectives (VQOs) established for the Babine River*". Outdoor Recreation and Tourism • "*Maintain the provincially significant angling values of the Babine River*" (p.58).

2.5.3 Area Specific Planning within the Park

2.5.3.1 Southern Park Entrance Area

Prior to the establishment of the park, direction was provided in the *Options for the Babine River* report to establish a no shooting zone within 3-km of the fish counting fence this included area within the wilderness zone and special management zone.

In 2007, BC Parks initiated the development of a management plan for the southern entrance area of the park that included meeting that were government-to-government (i.e., Province of B.C. and Lake Babine Nation) and others with interagency representatives and management plan advisory committee. A preliminary draft plan was in preparation (BC Parks in prep.). However, this plan was not completed.

In conjunction with the park management planning process, a project to develop a human–bear management plan was initiated (Wellwood 2007a, b; 2008). Subsequently, reporting for this project was carried forward to produce a human–bear management plan, without a park management plan, as follows:

- *2011 Human-Bear Management Plan for the Southern Park Entrance Area, Babine River Corridor Provincial Park (Bear Emergency Response Plan and Responsive Bear Management Strategies not Included* (Wellwood 2011a)
- *2011 Human-Bear Management Plan for the Southern Park Entrance Area, Babine River Corridor Provincial Park, Executive Summary* (Wellwood 2011b).

This consultant prepared plan was developed to be compatible with provincial direction for human–bear management in BC Parks, adapted as appropriate given best available knowledge and practices and site-specific context. To be updated annually, it provided a comprehensive plan for adaptive human–bear management. It also include recommendations to B.C. Parks to prepare a Bear Emergency Response Plan and a plan for responsive management strategies, in consultation with the B.C. Conservation Officer Service and Fish and Wildlife.

2.5.3.2 Grizzly Drop

Relatively large numbers of grizzly bears, commonly including family groups, have been observed sharing this area for the outstanding fishing opportunities that it offers (e.g., Wellwood 2005). As previously stated, Grizzly Drop was identified as a Special Feature for the protection of grizzly bears (MELP 2000a).

Considerations provided in the *Management Direction Statement for Babine River Corridor Provincial Park* were as follows

Bears catch live fish at Grizzly Drop (and at several other side eddies and pools). This area should receive special management consideration. Only whitewater rafters and kayakers travel downstream through Grizzly Drop.

1) Do not allow camping
2) Close the area to hunting
3) Request a "no-fly" zone or height restriction
4) Do not develop land access

5) Limit stop at top of rapids to 30 min; at bottom of rapids to 10 min; no litter, no urinating
a) monitor restrictions and modify as necessary
b) consider signage
6) Consider other feeding locations in canyon for regulatory requirements as required (MELP 2000a: p. 18).

Despite the significance of this area for grizzly bears, there isn't a human–bear management plan to address displacement and risk of human-caused mortality for bears in this area. The BC Parks website provides information for people to limit their stops in this area. However, rangers and other government personnel rarely have the resources to visit this area or monitor use of it by people and bears.

Grizzly bears using the Grizzly Drop area, particularly those that are introduced to it as cubs, may have a greater lifetime risk for human-caused mortality. For example, the probability of some cubs becoming human-habituated appears is a concern. Human-habituated bears are at increased risk of finding human sources of food and becoming human food-conditioned (Safety in Bear Country Society 2008). Inexperienced and opportunistic subadult bears that are dispersing from their maternal home ranges will need to find new feeding areas to fulfill massive energy requirements. Major sources of anthropogenic foods within potential dispersal distances of Grizzly Drop include the southern park entrance, bridge and weir area; places that people live seasonally and permanently; and places where large volumes of fish are harvested, processed and stored.

2.6 Planning for Special Management Zones

2.6.1 Atna/Shelagyote – Scenic/Recreation/Wildlife Habitat

The objective for the Atna/Shelagyote was "to maintain provincially significant scenic resources, backcountry recreation opportunities, grizzly bear denning habitat, mountain goat habitat and extensive wetlands in the Sicintine and Shelagyote valleys" (KLRMPT 2001:p. 68). This objective does not identify extensive areas of important grizzly bear habitats for feeding identified by Mahon and Marsland (2001), MacHutchon and Mahon (2003) and Mahon et al. (2004), including the some of the best identified in the West Babine SRMP plan area (T. Mahon pers. comm.). No specific planning direction was provided to manage human–bear interactions, notably risk of human-caused mortality.

2.6.2 Proposed Shenismike West Wildlife Habitat Area

In 2003, an area bordering Babine River Corridor Provincial Park and adjacent to Grizzly Drop was proposed for designation as a Wildlife Habitat Area (WHA), referred to as the Shenismike West WHA (MOE 2003). This area was described as "the western epicenter of grizzly bear activity on the Babine River" (p. 1) because salmon are abundant and easily accessible. Rational for its protection was provided in this draft document. This initiative has not been carried forward. No WHAs have been identified for grizzly bears in the Bulkley or Kispiox LRMP areas.

2.7 Planning for Coordinated Access Management

Access management is a major component in human–bear management because human-caused mortality in close proximity to roads has been identified as a major risk factor for grizzly bears (e.g., Nielsen et al. 2004, Ciarniello et al. 2007). To examine access-related aspects of problem solving for grizzly bear conservation, Table 4 summarizes objectives and management direction specific to access presented in each of the land use planning documents reviewed. Also see *Appendix 3. Detailed Results for 2010 Reconnaissance Monitoring Survey for Access Control in the Babine River Watershed* (Wellwood 2013c).

Table 4. Objectives and management direction specific to access management presented in each of the land use planning documents providing direction for the BWMT area of interest. This information is presented for reference purposes for this project only. Anyone interested in using this information needs to refer to the original documents. Text in *italics* is for direct quotes with page number in brackets.

Plan	Objective	Direction and Comments Relevant to Access-related Effects on Grizzly Bears
Options for the Babine River (MOF, MOE and Babine TAC 1991)	Option 2: "*The management objective is to retain wilderness qualities along the river while accessing the planning area for timber*" (p. 3) "*Careful access planning is required to maintain the wilderness-like setting along the river and the grizzly bear population in the drainage*" (p. 27)	General Considerations • "*Any increased access has the potential to negatively affect the grizzly bear population*" • "*The more often grizzly bears must cross roads to move to seasonal habitat, the more likely negative effects occur*" • "*The degree of impact on grizzlies can be lessened by access control to high use bear habitat and by leaving strips of vegetation for visual screening along migration corridors*" (p. 3) Summary of Access Recommendations • Gail Creek bridge crossing over Babine River not recommended • Shenismike Route recommended • All mainline roads ≥2 kilometers from river • Develop coordinated access management plan. Statement: "*one aspect is to prevent four wheel drive and other all-terrain vehicles from reaching the river while providing access to those who would walk a few kilometres*" • Access control points for Nilkitkwa, Nichyeskwa and Big Slide Chart area, either by seasonally removing bridge spans or by deactivating roads to within 2 kilometres of the river, noting the former option is unpopular and the later option is expensive and difficult to do effectively. Annual monitoring would be required to determine effectiveness of road deactivation and if ineffective then bridge spans could then be removed. • Render secondary roads impassable when not required for forestry activities • Involve user groups in management planning Bulkley Forest District • Existing bridge will be the only crossing of the Babine River in the Bulkley Forest District • Mainline roads were ≥2 kilometers from river with a few exceptions, due to topographic constraints, approved by Technical Advisory committee • Proposed access control points at Nilkitkwa Bridge and Nichyeskwa Bridge. Consider removing bridge spans from1 September to 1 November • If bridges do not have removable span then beyond Nilkitkwa Bridge deactivate existing road and beyond Nichyeskwa Bridge deactivate within two kilometers of river Kispiox Forest District • Bridge crossing Babine River approved near Sam Green Creek, outside of planning area • Technical Advisory Committee recommended Shenismike Route so that another bridge will not be required • Mainline roads also ≥2 kilometres from river. The exception was the Big Slide Chart area, due to topographic constraints. This included section within the Wilderness Zone • Details for development of the Big Slide Chart area provided
Babine River Interim LRUP (MOF and MELP 1994a:p. 18)	"*It is anticipated that with proper planning of harvesting activities and access control, particularly beside high value habitat, management objectives for the Babine River grizzly bear population can be met*" (p. 13).	"*Access to the entire watershed will be addressed through development of a coordinated access management plan (CAMP). Suggestions arising from Options for the Babine River Area ensuring that motorized access to the river is prevented using bridges at the Nilkitkwa and Nichyeskwa crossings as control points. Bridge spans would be removed during periods of high recreation and grizzly bear use of the river*" (p. 18).

Table 4. Continued

Plan	Objective	Direction and Comments Relevant to Access-related Effects on Grizzly Bears

Interim Babine River CAMP, Bulkley Portion (MOF and MELP 1994b)	No grizzly bear specific objectives were provided in this document.	The following provides a summary for a selection of access control strategies of relevance to grizzly bears:
		• "Close vehicle access to high grizzly habitat areas and the Special Management Zone, using a variety of techniques as described in 4.0 Access Closure. Prevent any new access to the Wilderness Zone and close existing access to the Wilderness Zone except at the Babine River bridge" (p. 4)
		• Management Unit 1 (Boucher Creek)
		  o 465 Road (1.6 km) – Close vehicle access. Provides instruction for gate and removal of bridge when planting completed
		  o 459 Road Boucher Main – Mainline will remain open. Only construct temporary roads off the mainline and remove access using tank traps or culvert removal
		• Management Unit 2 (South of Nichyeskwa Creek)
		  o Mainline will remain open. Close access to all secondary roads using tank trap or culvert removal. Permanently deactivate temporary roads in high value grizzly bear habitat
		• Management Unit 3 (North of Nichyeskwa Creek)
		  o Limit access to industrial purposes only from 1 May to 1 November. Lock gate will be in place and monitored weekly. Remove the bridge span or deck in the inactive seasons. Install road closed sign
		• High value grizzly bear habitat, Riparian Areas, Forest Ecosystem Networks and Links (sic)
		  o Limit road construction through these areas
		  o High value grizzly bear habitat: establish designated control points in advance, narrow road right-of-ways (i.e.,< 20 m), post signs when roads closed, generally 1-2 years after harvest. Another point to establish good quality access roads or build winter roads without removing stumps, the former of which appears to be out of context and therefore appears to be inconsistent or poorly expressed
		• Road Density
		  o Minimize road density
		  o Deactivate roads when harvest activities complete
		  o "*Build temporary road where possible*" (p. 18)
		  o Guideline: primary roads 25 km/100 km^2 and secondary roads 50 km/100 km^2
		• Definition for Not Active was "when access in no longer possible with a four wheel drive pick up"
		• Circle routes were not considered in Options for the Babine River Report or the Babine River Interim LRUP. Therefore not considered in this report.

Table 4. Continued

Plan	Objective	Direction and Comments Relevant to Access-related Effects on Grizzly Bears
Bulkley LRMP: Access (BVCRBIPT 1998)	"*Managing recreational access is important to provide a variety of experiences and to minimize the impact of human disturbance on fish, wildlife, and other environmental resources*" (p. 31 & 32)	General • "*Road development is required to access the resources within a land base, including timber, minerals, range and recreational destinations. This plan allows opportunities for access to resources outside Protected Areas, subject to the constraints identified under specific planning unit directions.*" (p. 31) • "*The RAMP will address motorized and non-motorized access for both on-road and off-road vehicles, especially in terrain sensitive to site degradation by off-road vehicles. It will consider regulated motorized access in areas containing resource values that will be negatively impacted in the absence of regulation, and identify enforcement provisions that may be required. In addition, conflicts such as those between snowmobiling and back-country skiing will be resolved for example, by designating some areas for exclusive use.*" (p. 31) • "*Circular routes within the Bulkley Plan Area and connecting to adjacent districts can be potentially detrimental and should be discouraged wherever possible. This applies particularly when other values are paramount…"* (p. 31) • Directions for lake access and sensitive terrain, which may include alpine, sub-alpine, sensitive wetlands and designated recreational trails, were also provided
Bulkley LRMP: Sub-unit 1-1: Barbeau Creek (BVCRBIPT 1998)	*"To manage a watershed in a primitive state, while permitting sensitive mineral exploration and development. Water quality, goat and grizzly bear habitat, and wilderness recreation opportunities are all to be maintained"* (p. 53)	No direction specific to grizzly bears • "*Minimize and control access near goat habitat*" • "*Deactivation plans will be prepared for any approved access. The plans will ensure primitive qualities are maintained and wetlands and riparian zones are protected. Ensure remote lakes will remain without public road access*" • "*Timber harvesting is not allowed. Removal of trees is permitted only where required for approved mining exploration and development purposes, including access, and for other activities consistent with objectives and other specific direction for management stated in this planning unit and sub unit*" (p. 53)
Bulkley LRMP: Sub-unit 1-2: Nilkitkwa IRM (BVCRBIPT 1998)	None provided	"*A Coordinated Access Management Plan (CAMP) that addresses timber development, mineral potential, and biodiversity issues will be completed*" (p. 54)
Bulkley LRMP: Sub-Unit 2-1 Babine River Corridor (P) (BVCRBIPT 1998)	"*To maintain the wilderness quality of the high-value grizzly bear habitat located in close proximity to the river through dersignation anf* (sic) *management as a protected area. To manage according to the guidelines set out in the Babine River Interim Local Resource Use Plan (LRUP)*" (p. 57)	Access • "*Access planning within the corridor must be part of the formal Management plan for the Protected Area*" • "*Access within the Protected Area will be co-ordinate with access to the entire planning unit with input from the Board and the public as necessary*" (p. 57)
Bulkley LRMP: Sub-unit 2-2: Babine River (SM2) (BVCRBIPT 1998)	*"To protect and buffer the river-based resource values within the protected corridor (Sub-unit 2-1). To follow the guidelines set out in the Babine River Interim Local Resource Use Plan (LRUP)"* (p. 58)	Access • "*There will be no permanent unrestricted road access north of the Babine River bridge*" • "*Maintain all temporary access at least 300 metres from the Babine River Corridor boundary*" (p. 58)

Table 4. Continued

Plan	Objective	Direction and Comments Relevant to Access-related Effects on Grizzly Bears
Bulkley LRMP: Sub-unit 2-3: Babine River (SM2)(BVCRBIPT 1998)	"To manage for a variety of values and activities in an *integrated and compatible manner. Follow the guidelines set out in the Babine River Interim Local Resource Use Plan (LRUP) and Coordinated Access Management Plan (CAMP)*" (p. 59)	• "*Discourage circle routes to adjacent districts*" • "*Maintain public boat access at Mercury Landing or an alternate suitable location on Babine Lake*" (p. 59)
Bulkley LRMP HLPO (Province of B.C. 2000)	"*Provide for wildlife habitat[5] and populations by implementing and timing road location, development and maintenance activities in a manner that minimizes the effects on these values[1]*" (no page number). Footnotes: *[1] "Specific provisions for maintaining these values will be determined through landscape unit planning using landscape and stand level development strategies"* *[5] "Wildlife habitat as mapped and made available at the landscape level"* (no page number)	Not applicable. Only provides objectives
Bulkley LRMP OSG (ILMB 2006a)	"*Provide for wildlife habitat and populations by implementing and timing road location, development and maintenance activities in a manner that minimizes the effects on these values*" (p. 8)	Not applicable. Only provides objectives

Table 4. Continued

Plan	Objective	Direction and Comments Relevant to Access-related Effects on Grizzly Bears
Access Management Direction for the Babine Watershed, Kispiox Forest District (KFDA9MPTG 2000)	*Grizzly Bears and Timber Harvesting* (p. 4) Goal: "*To minimize the decline in grizzly bear populations within the Kispiox Forest District portion of the Babine Watershed, while providing cost-effective access opportunities to operable timber within the Babine watershed*" Objectives: • "*Limit grizzly bear – human interaction through access management*" • "*Maintain the effectiveness of high value grizzly bear habitat by managing human access*" • "*Maintain flexibility in forest harvesting operations, by providing effective access for long-term resource management and development needs*" *Harvesting Adjacent to Babine River Corridor Provincial Park* (p.7-8) Goal: "*To maintain the wilderness recreation and ecological values within the Babine River Corridor Park, while providing cost-effective access opportunities to operable timber within the Babine watershed outside of Babine River Corridor Park*" Objectives: "*Undertake forest management activities and access management planning outside Babine River Corridor Park in a manner that maintains the wilderness recreation and ecological values within Babine River Corridor Park, as outlined in the park management direction statement, through implementation of the following strategies*"	See access scenarios and strategies provided for mainline access through high value grizzly bear habitats, linkage areas, forest ecosystem networks, riparian ecosystems and upland buffers/corridors and harvesting in the SMZ adjacent to the park. Direction for development of an access management plan and considerations for deviations in operational plans from the access management plan and/or Babine LRUP were provided. Management strategies included • permanent deactivation of the mainline in the Big Slide Chart area • Access control measures between Shenismike Canyon and Shelagyote River • Access control measures northeast of Gunanoot Lake (additional details in FDP) • "*Within SBFEP Gail creek chart, SBFEP plans to utilize a "get in and out" approach for area to the east of 60 km on Suskwa Forest Service Road* (KFDAPTG 2000: p. 9)

Table 4. Continued

Plan	Objective	Direction and Comments Relevant to Access-related Effects on Grizzly Bears
Kispiox LRMP (Resource Management Objectives for General Wildlife and Specific to Grizzly Bears, KLRMPT 2001)	• "*To maintain natural ecosystems and habitat to sustain viable populations of all native wildlife within their natural ranges.* • *To protect or enhance populations and habitat of rare or endangered and regionally significant species.* • *To provide for sustainable harvest of big game species (i.e., moose, mule deer, white-tailed deer, mountain goat, black bear and grizzly bear) and furbearers.* • *To provide for aboriginal use of wildlife resources.* • *To maintain viable guiding and trapping industries.* • *To provide and promote opportunities for viewing, study and appreciation of wildlife in their habitat*" (p. 45)	• "*Construction of roads to support timber or mineral development may affect fish, wildlife, water and recreational resources and associated resource uses such as tourism or guiding operations. Restrictions on road development may affect the viability of resource development. Poor road design, construction and maintenance may result in damage to fish habitat from siltation, inadvertent diversion of watercourses or loss of terrestrial habitat. Development of new roads is a contentious issue in the planning area*" (p. 21) • "*The Code contains numerous provisions for road design, construction, maintenance, use and deactivation to protect public safety and minimize environmental damage. Road construction, modification and deactivation must comply with operational plans and permits. Road construction or modification must be consistent with forest development plans or access management plans or logging plans. Access management plans are required for construction, maintenance and deactivation of roads that are not covered in a forest development plan*" (p. 21) • "*A coordinated access management plan is being developed for the Babine LRUP within the Kispiox Forest District and has been completed for the area within the Bulkley Forest District*" (p. 21) • "*Concerns about the effects of access on wildlife will be addressed at landscape and operational planning levels*" (p. 45). • "*Effects of access on grizzlies will be addressed through coordinated access management plans (e.g., Babine CAMP) and modified road construction practices (i.e., minimum lines of sight, reduced widths of rights of way, accelerated deactivation, temporary construction standards)*" (p. 46).
Kispiox LRMP: Atna/Shelagyote/Kuldo – Scenic/Recreation/Wildlife Habitat (KLRMPT 2001)	"*To maintain provincially significant scenic resources, backcountry recreation opportunities and habitat for grizzly bears and mountain goats"* (p. 68)	• "*Commercial timber harvesting will be deferred so that additional information about scenic, recreation and wildlife resources can be collected*" (p. 68) • "*Backcountry use will be monitored to ensure recreational use is sustainable*" (p. 68)
Kispiox LRMP: Babine River Valley – Scenic/Recreation/Wildlife Habitat (KLRMPT 2001)	"*To protect and buffer river-based resource values within the Babine River wilderness corridor (i.e., protected area)"* (p. 69)	• "*Consistent with the Babine River LRUP, timber harvesting will be limited to selective harvesting or clearcuts less than 15 hectares, a slower rate of cut will be emphasized, roads will be temporary and will be deactivated when they are no longer required for forestry, and cutblocks and temporary roads will be located to minimize impacts on the adjacent protected area*" (p. 69) • "*Approval of both the district manager and the designated environment official will be required for forest development plans or amendments in this area as provided for under the Operational Planning Regulation of the Code*" (p. 69)

Table 4. Continued

Plan	Objective	Direction and Comments Relevant to Access-related Effects on Grizzly Bears
West Babine SRMP: General for Access (MSRM 2004a)		• "*The document Access Management Direction for the Babine Watershed, Kispiox Forest District (2000) provides direction to guide forest development in the interim until SRMPs are completed.. The West Babine SRMP will replace the interim direction in the access management document*" (p. 7) • "*The Bulkley TSA also has a Coordinated Access Management Plan in place that guides access across the eastern portion of the Babine watershed. The West Babine SRMP access management direction is consistent with the intent of the Coordinated Access Management Plan in the Bulkley*" (p. 8) • "*The risk assessment completed for this plan has shown that with increased access into the West Babine, the effect of mortality risk on bear populations will be much greater than the effect of habitat displacement (West Babine Grizzly Bear Technical Working Group, 2001). Therefore, direct mortality has been identified as a critical risk factor to grizzly bear conservation within the plan area*" (p. 22) • "*The present population has already been affected by development and mortality inside and outside the plan area. We expect this risk to increase as watersheds surrounding the plan area are developed*" (p. 25) • "*The population of the study area will decline because of the effects of access. The intent of the plan is to mitigate that decline. The step-down shown for the Babine plan is midway between the present population and the population expected without a plan. The actual result would vary depending on the effectiveness of the plan's management measures, but is very difficult to quantify*" (p. 25) • "*The step-down with no plan in place was assumed to be about 60 per cent in the long term, assuming conventional development. If all of the surrounding watersheds are to be developed conventionally as well, the step-down would likely be greater over the long term"* (p. 25) • "*The LRUP goal of "maintaining the present grizzly bear population" does not recognize that the range of many of the Babine bears extends beyond the plan boundaries or that integrated development as required in the LRUP and both LRMPs will have an affect on estimates of the bear population*" (p. 25)

Table 4. Continued

Plan	Objective	Direction and Comments Relevant to Access-related Effects on Grizzly Bears
West Babine SRMP: Babine River Special Management Zone (MSRM 2004a)	Management Direction in the Babine River Special Management Zone "*To maintain a single point for motorized road access to the Babine River Corridor Park, located at Nilkitkwa Forest Service Road, so wilderness values can be protected*." (p. 39)	• Indicator: "*Type and location of roads*" • Target/Measure: ○ "*No permanent motorized access within the SMZ*" ○ "*All temporary access will remain at least 300 m from the Park boundary*" ○ "*Access Control Points 5 and 6 established prior to entering the SMZ for the Thomlinson Road and Shelagyote Crossing (see Map 12, page 77*)". • Management Consideration: ○ *Deactivate roads when no longer required for forestry.* ○ "*No permanent motorized access" can be achieved through implementing access control points, deactivation strategies or temporary roads*. (p. 39). • Executive Summary: Babine River Special Management Zone ○ Values Managed For: wildlife (moose, grizzly bear), wilderness ○ Management Direction: "*No permanent motorized access, winter harvest only, openings <15ha in size"* (p. i)
West Babine SRMP: Atna Shelagyote Special Management Zone (MSRM 2004a)	Management Direction in the Atna/Shelagyote Special Management Zone "*To maintain provincially significant scenic resources, backcountry recreation opportunities, grizzly bear denning habitat, mountain goat habitat, and extensive uplands in the upper Sicintine and Shelagyote valleys*" (MSRM 2004a: p. 41)	• Indicator: "*Amount of resource development activity in the Atna-Shelagyote SMZ"* • *Target/Measure: "No commercial logging within the SMZ, except where required for mineral exploration and mine development*" • Management Considerations: ○ "*Exploration and development of mineral and energy resources is not precluded in this zone. However, activities will consider the ecological and recreational values for which the zone was established.* ○ *Backcountry use will be monitored to ensure recreation is sustainable*" (p. 41). • Executive Summary: Atna Shelagyote Special Management Zone ○ Values Managed For: ecological, backcountry tourism ○ Management Direction: "*No commercial logging or road building*" (p. i)

Table 4. Continued

Plan	Objective	Direction and Comments Relevant to Access-related Effects on Grizzly Bears

West Babine SRMP: Core ecosystems (West Babine SRMP Executive Summary, MSRM 2004a)	Management Direction for Biodiversity "*To maintain the structural and functional features of old forest ecosystems within Core Ecosystems (see Map 6, page 71)*" (p. 15).	• Indicator: "*Amount of alteration within Core Ecosystems*".
		• Target/Measure: "*No alteration within Core Ecosystems, except to manage natural processes that threaten resources outside of the zone*".
		• Management Consideration:
		  ○ "*No harvesting within Core Ecosystems (see Map 6, page 71) except for incidental tree cutting for mining and exploration purposes*.
		  ○ *No road building within Core Ecosystems with the exception of:*
		  ▪ *Accessing timber that would otherwise be inaccessible; and*
		  ▪ *For mineral development*[12]"
		• "*Allow natural processes (e.g., fire, insects) to occur within Core Ecosystems except where those processes threaten resources outside the zone*" (p. 15).
		• Executive Summary: core ecosystems
		  ○ Values Managed For: biodiversity: old forest
		  ○ Management Direction: "*No logging or road building*" (p. i)

West Babine SRMP: Landscape Riparian Corridors (West Babine SRMP Executive Summary, MSRM 2004a)	Management Direction for Biodiversity "*To maintain connectivity of old and mature forest cover within Landscape Riparian Corridors (See Map 6, page 71*)" (p. 16)	• Indicator: "a. *Amount and quality of old and mature forest cover within Landscape Riparian Corridors*"
		• Target/Measure:
		  ○ "*At least 70% retention of structure within Landscape Riparian Corridors*"
		  ○ "*No alteration of fluvial or floodplain ecosystems14 that may be subject to frequent or infrequent flooding*"
		• Management Considerations: "*Operational plans for harvesting within Landscape Riparian Corridors (see Map 6, page 71) should consider the harvest pattern adjacent to the corridor. For example, clearcuts adjacent to the corridor will constrain harvesting strategies within the corridor. Conversely, modified harvesting adjacent to the corridor will increase the flexibility for harvesting in a corridor (see Table 4, page 19)*" (p. 16).
		• Executive Summary: Landscape Riparian Corridors
		  ○ Values Managed For: biodiversity: connectivity
		  ○ Management Direction: "*Logging restricted, no road building*" (p. i)

Table 4. Continued

Plan	Objective	Direction and Comments Relevant to Access-related Effects on Grizzly Bears
West Babine SRMP: Shenismike Shelagyote Access Management Zone (portion of Shelagyote/Babine Tourism Node in this Zone, MSRM 2004a)	Management Direction for Tourism: Shenismike Shelagyote Access Management Zone [1] "*To Maintain* • *the remote access associated with the Babine River Corridor Park and the existing tourism facility around the confluence of the Shelagyote and Babine Rivers; and* • *high-value grizzly bear habitat*" (p. 48)	• Indicator: "*Amount of nonindustrial motorized use across the Shelagyote Bridge in the Shenismike Shelagyote Access Management Zone (see Map 12, page 77) during or between operations*". • Target: *No non-industrial motorized use across the Shelagyote Bridge (see access control point 4, Map 12, page 77).* • Considerations: ○ *"Gate to be installed to prevent non-industrial motorized use of bridge crossing".* ○ *"Bridge should be removed during prolonged periods of inactivity".* ○ *"If access control number 5 (leading into the SMZ) is effective in limiting non-industrial motorized access across the Shelagyote, a second access control point on the Shelagyote River (No. 4), is not necessary"* (p. 48). • Executive Summary: Shelagyote/Babine Tourism Node[2] ○ Values Managed For: tourism, visual quality, high value grizzly bear habitat ○ Management Direction: "*No logging. Access control for road*" (p. ii)
West Babine SRMP: High Value Grizzly Bear Habitat (MSRM 2004a)	Management Direction for Grizzly Bears (Sperry/Rosenthal Access Management Zone) "*Minimize the disruption to bear use of the high value habitat in the Sperry/ Rosenthal access management zone (see Map 12, page 77)* (p. 27)	• Indicator c: "*Amount of motorized use of the road network between operations*". • Target/Measure: "*No motorized use past the access control point 1 identified on Map 12, page 77 between operations*" (MSRM 2004a:p. 27) • Sperry/Rosenthal Access Management Zone with access control point: protects significant grizzly bear habitat (West Babine SRMP Executive Summary, p. ii)
	Management Direction for Grizzly Bears (Critical Habitats) "*To minimize the impact of road building and forest harvesting activities on critical habitat* (p. 29)	• Indicator: "*Distance of roads from critical habitats.*[23]" • Target/Measure: "*No permanent roads located within 150m of critical habitats,*[23] *unless no practical alternative exists*" (p. 29) • Executive Summary: high value grizzly bear habitat ○ Values Managed For: grizzly bear habitat ○ Management Direction: "*Restricted logging and road building adjacent to critical habitats*" (p. ii)
West Babine SRMP: Shenismike Corridor (MSRM 2004a)	Management Direction for Grizzly Bears: Shenismike Corridor [1] "*Minimize the disruption to bear movement along Shenismike Creek*" (p. 27)	• Indicator: "Amount of road built in Shenismike Corridor*".* • Target/Measure: "*No roads built in Shenismike Corridor"* (p. 27). • Executive Summary: Shenismike Corridor ○ Values Managed For: *wildlife (goat grizzly bear) (Grizzly Drop)* ○ Management Direction: *No Roads* (p.ii)
West Babine SRMP: Circle Route (MSRM 2004a)	Management Direction for Grizzly Bears "*Protect conservation values (wilderness, grizzly bear, moose, mountain goat, steelhead, bull trout) affected by increased access north of the Babine River and east of Shenismike Creek*" (p.28)	• Indicator: "*Amount of public access through the "Nichyeskwa Connector"*". • Target/Measure: "*Winter only access on the "Nichyeskwa Connector" (November 1 to April 30) except in the case of emergencies (access control point 7, Map 12, page 77)"* • Management Considerations: ○ "*Install a locked gat at Km 10.9 on the Nichyeskwa North Forest Service Road to prevent formation of a circle route.* ○ *Place large rip-rap in the ditch lines to deter ATVs.* ○ *Install road signs with closure rationale and contact information*" (p. 28).

Table 4. Continued

Plan	Objective	Direction and Comments Relevant to Access-related Effects on Grizzly Bears
West Babine SMRP: Babine River Corridor Park (MSRM 2004a)	Management Direction for Grizzly Bears: Big Slide Access Management Zone "*Minimize disruption to bear use of high value habitat within the Babine River Corridor Park and at Grizzly Drop due to forestry Activities within the Big Slide Access Management Zone*" (p. 27).	• Indicator c: "*Amount of motorized use of the road network within the Big Slide access management zone between operations*" • Target/Measure: "*No motorized use (including snowmobiles and ATVs) past access control point 3 (see Map 12, page 77) between operations*" • Management Considerations: o "*Consider the strategies presented in the May 23, 1997 Big Slide Agreement between Skeena Cellulose, MOF, and WLAP.* o *The primary access control is locally referred to as 4.5 km and a secondary access control at 7.9 km*" (p. 27)
	Management Direction for Grizzly Bears: Shenismike West Access Management Zone [1] "*Minimize the disruption to bear movement and the risk of bear/human interactions within the Shenismike West Access Management Zone*" (p. 28).	• Indicator c: "*Amount of motorized use of the road network between operations"* • *Target/Measure: "No motorized use past access control point 2 (see Map 12, page 77) between operations*" • Management Considerations: "*All secondary and tertiary roads in Shenismike-West access management zone (on the south side of the primary road (to be deactivated. This can be done through the building of winter roads only, with high stumps, right-of-way slash and logging slash pulled back onto road following completion of operations*" (p. 28).
West Babine SMRP: Hanawald and Shedin watersheds (MSRM 2004a)	Management Direction for Grizzly Bears "*To reduce number of human bear interactions*" (p. 26)	• Indicator a: "*Density of roads by mid-sized watersheds (see Map 5, page 70) open to timber harvesting activity at one time".* • Target/Measure a: "*80% of Shedin and Hanawald watersheds <0.6 km/km²".* • Management Considerations: o "*These thresholds should be monitored and re-evaluated in conjunction with the watershed assessments. Initial report should be completed in 10-15 years.* o *Deactivated roads* [defined as "roads which effectively prevent four wheel drive access"] *will not contribute towards road density target.* o *Minimize number of road networks open at any one time.* o *Mortality risk to bears within the plan area will be reduced by:* ▪ *Harvesting in winter;* ▪ *Deactivating or blocking temporary roads and secondary roads after operations are completed"* (p. 26).

Table 4. Continued

Plan	Objective	Direction and Comments Relevant to Access-related Effects on Grizzly Bears
West Babine SRMP: Access Management Summary (MSRM 2004a)	Statement (not expressed as objective) "*Minimizing active road densities is a critical part of decreasing grizzly bear mortality and habitat displacement risk associated with human-bear encounters*" (p. 61)	• No indicators, targets or measures specified. • "*In addition to the above access control points, secondary and tertiary roads throughout the plan area should be decommissioned following completion of planting, to the extent that motorized traffic is not practical or is prohibited. An emphasis will be placed in areas that contain a mosaic or a concentration of high value grizzly bear habitat (see Map 7, page 72). All secondary and tertiary roads in the Shenismike-West access management zone that are on the south side of the primary road should be deactivated to the extent that it inhibits foot travel. This can be done through the building of winter roads only, with high stumps, right-of-way slash and logging slash pulled back on to the road following completion of operations*" (p. 62). • Statement: "*Existing access to the Babine River Corridor Park for local residents will not be impacted by the access management direction within the plan. Future access will be affected only minimally to maintain high value grizzly bear habitat and to minimize human-bear interactions that may result in increased bear mortality or habitat displacement*" (p. 61)

[1] Shenismike Corridor is located within portions of the Shenismike West Access Management Zone and Shenismike Shelagyote Access Management Zone.

[2] Shelagyote/Babine Tourism node is locate within portion of the Shenismike Shelagyote Access Management Zone.

2.8 Planning for Recreation

Need for Recreation Access Management

"*The most difficult type of recreation opportunity to maintain is the opportunity for wilderness recreation. As the road network expands, so do motorized uses of the landscape. Over time there becomes less area which can be truly called wilderness. For this reason we feel that the highest priority for addressing this issue is at the wilderness end of the recreation opportunity spectrum*" (Primitive and semi-primitive ROS classes; Hillcrest Recreation Consulting Inc. 2001:p. 49)

Planning for recreation is an important consideration from the perspective of assessing risk to grizzly bears associated with recreation-related human–bear interactions. Access to anthropogenic sources of food is also considered a major risk factor influencing risk of non-hunting related human-caused mortality for grizzly bears. B.C. Parks is responsible for the management of recreation in provincial parks, including Babine River Corridor Provincial Park within the Bulkley and Kispiox TSA portions; and Nilkitkwa Lake Provincial Park and Rainbow Alley Provincial Park within the Bulkley TSA portion of the BWMT area of interest. Management direction statements have been prepared for all of these parks listing types of activities that are permitted but no management plans have been completed. In addition, numerous sanctioned recreation sites and trails located on Crown Land within the Kispiox and Bulkley LRMP areas are under the jurisdiction of Ministry of Forests, Lands and Natural Resource Operations.

To support an examination of recreation interests in the Bulkley LRMP portion, Table 5 provides an overview of

- Management direction with attractiveness ratings for recreation (Hillcrest Consulting Inc. 2001)
- 1997 RAMP management winter and summer designations and management direction (Ministry of Forests 1997)
- 2006 recreation access agreements (Integrated Land Management Bureau 2006)
- Summer RAMP Table designations for management units, features or areas (Summer RAMP Table 2012, 2013).

2.8.1 Overview Bulkley LRMP Portion

In the Bulkley LRMP portion, areas, sites and other features identified for recreation include:

- Alpine/Subalpine areas
    - North Bait Range
    - Kotsine Mountain
    - Sicintine Range
    - French Peak
    - South Bait Range
    - Southwest Bait Range

    - Mount Horetzky

- Trails
    - Fort Babine Trail (a.k.a. Babine Grease Trail)
    - An unconfirmed trail along Nilkitkwa River between Nilkitkwa Lake and Kotsine Pass
    - French Peak Trail

- Recreation Sites
    - Starvation Lake Recreation Site
    - Unofficial recreation site on 454 Rd near Babine River bridge and weir, aimed at servicing anglers

Numerous lakes, some designated as wilderness lakes, have also been highlighted for their recreational value. This list was summarized from Ministry of Forests (1996), Integrated Land Management Bureau (2006b), and Summer RAMP Table (2012, 2013).

The Bulkley LMRP recognized the need for and provided direction to initiate a recreational access management plan stating

> "*Managing recreational access is important to provide a variety of experiences and to minimize the impact of human disturbance on fish, wildlife, and other environmental resources. A strategic Recreational Access Management Plan (RAMP) is required for the Bulkley Plan Area to assist in meeting this objective. Input by various interest groups and lead agencies will assist in developing the RAMP. The RAMP will address motorized and non-motorized access for both on road and off-road vehicles, especially in terrain sensitive to site degradation by off-road vehicles. It will consider regulated motorized access in areas containing resource values that will be negatively impacted in the absence of regulation, and identify enforcement provisions that may be required*" (BVCRBIPT 1998:p. 31–32).

The following provides a timeline of major events leading up to and resulting in management direction for recreational access in the Bulkley LRMP area

- As early as 1975, conflicts between skiers and snowmobile users in the Smithers area were identified (FPB 1998).
- 1991: Bulkley Valley Community Resources Board established to make consensus-based decisions for sustainable land use to be presented in a Land Management Plan (FPB 1998).
- 1996: Recreation Access Sub-Committee for Bulkley LRMP established. Controversy, conflicts and complaints ensue throughout its development (FPB 1998). Two FPB investigation reports completed (FPB 1998, 1999).
- 1997: RAMP report completed for the Bulkley portion of the Skeena Stikine First District (MOF 1997). This report provides designations (i.e., motorized, non-motorized, future process, non-designated) for some areas, defers others to future planning process and leave some areas non-designated with the possibility of entering into a future planning process.

- 1998: The *Bulkley LRMP* directed the completion of a Recreation Access Management Plan (BVCRBIPT 1998).
- 1998: Forest Practice Board investigates restrictions on motorized vehicle access in Harold Price and Blunt Creek areas (FPB 1998).
- 1999: Forest Practices Board investigates complaint from mountaineering school operator regarding forest development in upper Blunt Creek that would allow for snowmobile access in alpine areas (FPB 1999).
- 2001: Bulkley Strategic Recreation Study completed. This study provides attractiveness ratings for recreation features and areas of interest (Hillcrest Recreation Consulting Inc. 2001).
- 2006: Integrated Land Management Bureau summarizes current recreation access agreements (ILMB 2006b).
- 2007: A proposed process for completing the Bulkley Recreation Access Management Plan was completed (Vold 2007).
- 2013: *Summer Recreation Access Management Plan for the Bulkley LRMP* (Summer RAMP Table 2012, 2013). This report provides community based recommendations to the Bulkley Valley Community Resources Board (BVCRB).

2.8.2 Bulkley RAMP Table (2013)

In the most recent RAMP process for the Bulkley TSA, the Summer RAMP Table (2013) recommended that motorized access with restrictions be permitted beyond gated areas in the Babine and Nilkitkwa Landscape Unit (see Appendix 5 Controlled Access Policy Proposal 2013:p. 32). Their perspective is that "the responsible use of Crown land for recreation is both a right and a privilege of every citizen" (p. 4). The planning table used the *Bulkley LRMP* and *Interim Babine River CAMP, Bulkley Portion* to guide their decisions. They reference general management direction in the *Bulkley LRMP* for wildlife habitat.

The terms of reference for the Summer RAMP Table (2013:p. 6) were

- *"Ensure that the Plan is based on the Bulkley LRMP and other existing higher level plans and ensure that consideration is given to government policies*
- *Ensure a balance of recreational opportunities, minimizing conflicts*
- *Ensure that key areas are identified for public use*
- *Ensure that the process is community-based*
- *Ensure that the plan promotes stewardship and sustainable resource use, considering economic, social and environmental factors*
- *Ensure that the plan can change over time"*

Recreation access principles potentially relevant to addressing environmental effects of access on grizzly bears include

- *"Ensure responsible use of Crown Land*
  - *All recreational users have an obligation for the responsible use of Crown land"*
- *"Prevent Harm*

    - *Responsible use does not cause undue harm to the environment, sensitive fish and wildlife, and their respective habitat values, does not endanger public safety and is in accordance with specific land use objectives that have been identified and will provide direction for recreational use. Extra diligence is required for use in Sensitive or Rare Ecosystems (i.e., Core Ecosystems, Landscape Corridors, sensitive Alpine, Alpine Forests or Woodland ecosystems)".*
- *"Educate Users*
    - *Education about responsible recreation practices requires communication and cooperation between communities, individuals, groups, organisations and government agencies. Education is the primary tool to ensure responsible, safe and enjoyable recreation.*
- *"Share Responsibility*
    - *Monitoring of recreational use of Crown land is the responsibility of both government agencies and users of the resource".*
- *"Provide for Changes through Time in Recreation Use*
    - *Responsible recreational use means that agencies, community organizations, and individuals employ a structured process to deal with complaints, new information, proposals for new recreation site and trail developments, and other changes over time"* (Summer RAMP Table 2013:p. 9).

A section on "Access and Human Effects on the Environment" (Summer RAMP Table 2013:p. 10) discussed trends for declining *primitive* and *wilderness* area and increasing *roaded* area for the 1997 to 2008 period based on a recreational opportunity spectrum measures in analysis completed by Wilden (2012 *in* Summer RAMP 2012). Best management practices for invasive plants are also provided. No other effects on the environment are presented. Recommended criteria for evaluating proposals for development and approval of recreation sites or trails of potential relevance to grizzly bears includes ecological effects on, as an example, wildlife.

Of major relevance to potential effects on grizzly bears in the BWMT area of interest is "Recommendation 1: Management agencies responsible for gates on Crown Land implement the Controlled Access policy proposal (Appendix 5)" (Summer RAMP Table 2013).

The only reference to grizzly bears in this document is in a summary of public comments "potential impacts to Babine grizzly bear population must be considered; direction from land use plans must be considered" and Table Remarks "table considered the Babine Coordinated Access Management Plan" (p. 30).

The recommendation to allow restricted access beyond gated ACPs is presented without indication that the goal of maintaining grizzly bears and associated land use planning objectives and the challenges of meeting them have been fully understood, considered and addressed. One major challenge will be addressing the risk of human-caused grizzly bear mortality. The Province of B.C. bear awareness and safety information is outdated:

incorrect and inappropriate information is common in educational resources made available to the public (D. Wellwood pers. obs.). To the best of my knowledge, there are no high quality guidelines or other resources that are easily identifiable and readily accessible to help people address human–bear interactions associated with non-commercial backcountry recreation, provided by the Province of BC or specific to the Skeena Region. There are no standards for bear awareness and safety training in B.C. and I suspect few people have the expertise to deliver such programs in the Skeena Region. Well-informed people will know that Safety in Bear Country Society provides best available resources (Safety in Bear Country Society 2001, 2005, 2008) but, with easy access to so many bear related resources that are less reliable, it would be challenging for most people to find good information.

Historically, there has been limited monitoring and enforcement capability and capacity for the BWMT area of interest. Unlike national parks, for example, responsible use that prevents bear incidents (e.g., securing food and other attractants so that bears can not gain access) and delivers safe and non-lethal response (e.g., using bear spray for defense) in those incidents that do occur are not well integrated practices in this area; and resources and support are not easily identifiable and readily available for those that might be interested in moving in this direction. Another challenge is that there appears to be relatively little core secure area remaining to mitigate risk of human-caused mortality and maintain effective grizzly bear habitat. Given current situation and context; it is difficult to determine how the Summer RAMP might effectively achieve expressed environmental objectives, as they relate to grizzly bears.

2.8.3 Kispiox LRMP Portion

The *Kispiox LRMP* also identified potential impacts of road access

> "*Construction of roads to support timber or mineral development may affect fish, wildlife, water and recreational resources and associated resource uses such as tourism or guiding operations. Restrictions on road development may affect the viability of resource development. Poor road design, construction and maintenance may result in damage to fish habitat from siltation, inadvertent diversion of watercourses or loss of terrestrial habitat. Development of new roads is a contentious issue in the planning area*" (KLRMPT 2001:p. 21).

Some recreation-specific objectives included

- "To maintain backcountry recreation opportunities in the East Kispiox/Kuldo, Atna/Shelagyote and Rocher Deboule areas"
- "To protect the following important recreational features…Babine corridor(s) for fishing and boating" (KLRMPT 2001:p. 31)

Some general strategies included

- "Significant recreational features and sensitive features will be identified and addressed at landscape and operational planning levels"
- "The Ministry of Forests will prepare a forest recreation strategy to address protection of backcountry recreation values, maintenance of existing recreation

sites, trails and opportunities, and development of new recreation sites and trails by the end of 1997"

- "A strategy for management of motorized recreation vehicles will be developed" (KLRMPT 2001:p. 31)

A trail was reported under constructed from Gisaga'as to T'am Smaax, Bear Lake. No RAMP processes were completed for the Kispiox TSA portion of the BWMT area of interest.

Table 5. Units, features and areas of interest for recreation within the Bulkley LRMP Area. Grey shading indicates topic was not covered in or relevant to reporting. This information is presented for reference purposed for this project. Anyone interested in using this information needs to refer to the original document. Text in *italics* is for direct quotes with page number in bracket (as available).

Area	Unit, Feature or Area of Interest	2001 Bulkley TSA Strategic Recreation Study [1, 2]		1997 RAMP [3]		2006 Current Recreation Access Agreements [4]		Summer RAMP [5, 6]	
		Attractiveness Rating, Designation	Comments	Summer/Winter Designation	Management Directions[1]	Summer/Winter Agreements	Comments	Use	Comments
Bulkley LRMP Sub-unit 1-1: Barbeau Creek Special Management Zone	Entire Sub-unit 1-1			Summer: Future Process Winter: Future Process	**Summer: "*CMD zoned SM1*"** **Winter: "*CMD: this area is zone Special Management 1 (for wilderness and wildlife values; no permanent access is permitted*"**			Non-motorized use[5]	"*Maintain primitive qualities*" (p. 14)[5]
	North Bait Range, Sub-alpine/alpine Area [1]	High	Inaccessible, forest development may make easily accessible						
	Kotsine Mountain, Subalpine/alpine Area) [1]	Low							
	Sicintine, Subalpine/alpine Area) [1]	High	Inaccessible, forest development may make easily accessible						
	Onerka Lake, Wilderness Lake	High							Mapped as Wilderness Lake[6]
	Hillary Lake, Wilderness Lake	Moderate							Mapped as Wilderness Lake[6]
	Un-named 3 Lake, Sicintine Area	Moderate							

Table 5. Continued

Area	Unit, Feature or Area of Interest	2001 Bulkley TSA Strategic Recreation Study [1, 2]		1997 RAMP [3]		2006 Current Recreation Access Agreements [4]		Summer RAMP [5, 6]	
		Attractiveness Rating, Designation	Comments	Summer/Winter Designation	Management Directions[1]	Summer/Winter Agreements	Comments	Use	Comments
Bulkley LRMP Sub-unit 1-2: Nilkitkwa (Integrated Resource Management Zone)	Entire Sub-unit 1-2							Motorized (with restrictions)[5]	"*Table recommends summer evaluation for Controlled M Access to end of resource roads; maintain wilderness lakes*" (p. 14)[5]
	Unnamed 2 Lake, Mid Nilkitkwa Area	Low							
	Mero Lake 1, Wilderness Lake								Mapped as Wilderness Lake[6]
	Mero Lake 2, Wilderness Lake								Mapped as Wilderness Lake[6]
Bulkley LRMP Sub-unit 2-1: Babine River Corridor Provincial Park	Babine River Corridor Provincial Park			Summer and Winter: Future Process/Motorized	Summer and Winter: "***CMD: Maintain the Class 1 angling status of the Babine River.*** *ATV Use permitted on existing trails."*	Summer and Winter, Non-motorized	"*Jet boat use is allowed within the park. Horses are not allowed in the park*". (p.1)	Park[5]	"*See BC Parks Management Plan"* (p. 14)[5]
	Unnamed Babine Lake 1, Wilderness Lake	Moderate							Mapped as Wilderness Lake[6]
Bulkley LRMP Sub-unit 2-3	Nilkitkwa Lake Provincial Park					Summer and Winter, Non-motorized	"*Access is by boat only*" (p. 2).	Park[5]	"*See BC Parks Management Plan - Boat access only*" (p. 14)[5]

Table 5. Continued

Area	Unit, Feature or Area of Interest	2001 Bulkley TSA Strategic Recreation Study [1, 2]		1997 RAMP [3]		2006 Current Recreation Access Agreements [4]		Summer RAMP [5, 6]	
		Attractiveness Rating, Designation	Comments	Summer/Winter Agreements	Comments	Use	Comments	Use	Comments
Bulkley LRMP Sub-unit 2-3	Rainbow Alley Provincial Park					Summer and Winter, Non-motorized	"*Access is by boat only*" (p. 2).	Park[5]	"*See BC Parks Management Plan - Boat access only*" (p. 14)[5]
Bulkley LRMP Sub-unit 2-3: Babine (Integrated Resource Management Zone)	Entire Sub-unit 2-3							Motorized (with restrictions)[5]	'*Babine River Coordinated Access Management Plan*" (p. 14)[5]
	French Peak, Sub-alpine/Alpine Area	High		Summer: Motorized Winter: Non-designated	Summer: "***CMD: planning must be compatible with Babine Coordinated Access Management Plan.*** *Note grizzly bear habitat. Recognize motorized use."*	Summer: Motorized Winter: Non-designated		Motorized (with restrictions)[5]	"*Motorized to end of resource road*" (p. 14)[5]
	Southwest Extension Bait Range, Sub-alpine/Alpine Area	High	Inaccessible, forest development may make easily accessible						

Table 5. Continued

Area	Unit, Feature or Area of Interest	2001 Bulkley TSA Strategic Recreation Study [1, 2]		1997 RAMP [3]		2006 Current Recreation Access Agreements [4]		Summer RAMP [5, 6]	
		Attractiveness Rating, Designation	Comments	Summer/Winter Designation	Management Directions[1]	Summer/Winter Agreements	Comments	Use	Comments
Bulkley LRMP Sub-unit 2-3: Babine (Integrated Resource Management Zone)	Mt Horetzky, Sub-alpine/Alpine Area	Moderate						Motorized (with restrictions)[5]	"*Upper limit of motorized access requires summer field assessment*" (p. 14)[5]
	South Bait Range, Sub-alpine/Alpine Area	Low	Inaccessible, forest development may make easily accessible					See Planning Unit 2-2	See Planning Unit 2-2
Bulkley LRMP Sub-unit 2-3: Babine (Integrated Resource Management Zone) Trails and Lakes	French Peak Trail	Moderate							Labeled on map[6]
	Fort Babine Trail/Babine Grease Trail	Low							Labeled on map[6]
	Un-named Trail: Nilkitkwa Lake-Kotsine Pass[7]								
	Nichyeskwa 1, Wilderness Lake								Labeled on map[6]
	Nichyeskwa 2, Wilderness Lake								Labeled on map[6]
	Nilkitkwa Lake	Very High							Labeled on map[6]
	Starvation Lake	Moderate							Labeled on map[6]
	Boucher Lake	Low							
	Acorn Lake	Low							Labeled on map[6]
	Starvation Lake Recreation Site							Recreation Site[6]	

Table 5. Continued

Area	Unit, Feature or Area of Interest	2001 Bulkley TSA Strategic Recreation Study [1, 2]		1997 RAMP [3]		2006 Current Recreation Access Agreements [4]		Summer RAMP [5, 6]	
		Attractiveness Rating, Designation	Comments	Summer/Winter Designation	Management Directions[1]	Summer/Winter Agreements	Comments	Use	Comments
Bulkley LRMP Sub-unit 2-3: Babine (Integrated Resource Management Zone)	454 Road, Unofficial Recreation Site								

[1] Hillcrest Recreation Consulting Inc. 2001. Bulkley Strategic Recreation Study.
[2] Location of lake referenced in Hillcrest Recreation Consulting Inc. (2001) as Nilkitkwa North was not determined.
[3] Ministry of Forests. 1997. Recreational Access Management Plan (RAMP) for the Bulkley portion of the Skeena Stikine Forest District. Bold text from Bulkley Land and Resource Management Plan, V 01.1: Consensus Management Direction *in* MOF (1997). Page numbers not provided in this document.
[4] Integrated Land Management Bureau. 2006. Recreation Access, Trails and Areas Bulkley TSA, Current Recreational Agreements: Bulkley TSA
[5] Summer RAMP Table. 2012 Bulkley Valley Summer RAMP Index Map A Planning Units 1 & 2
[6] Summer RAMP Table. 2013. Summer Recreational Access Management Plan for the Bulkley LRMP report
[7] Unconfirmed report of trail between Nilkitkwa Lake and Kotsine Pass

2.9 Planning for Skeena Quality Waters

In 2006, a planning process was initiated for Skeena Quality Waters. In the *Recommendations of the Working Group, Skeena Quality Waters Strategy Angling Management Plan*, Dolan (2009) describes some of the issues and challenges, this process aimed to resolve:

> "*For years, resident anglers, non-resident anglers, guides, members of the Ministry of Environment's Sport Fish Advisory Committee, members of the Department of Fisheries and Oceans' Sport Fish Advisory Board, and local Fish and Game Clubs have told the Ministry of Environment that some waters in the Skeena River system have persistent steelhead angler-use issues — crowding, disproportionate numbers of non-resident anglers or guided anglers, lack of opportunities for resident anglers, illegal guiding, poor angler etiquette — all contributing to a degraded quality of angling experience.*
>
> *In response to these concerns, the ministry implemented the Quality Waters Strategy on 13 waters of the Skeena River in 2006. The Quality Waters Strategy is a province-wide process that aims to maintain and improve the angling experiences offered in BC's waters, by managing angler-use. The strategy includes a community engagement process to help identify problems and find solutions through new or revised angling regulations*" (Dolan 2009:p. 2).

The Babine River was one of the rivers that fell within this process. Potential management implications for grizzly bears were not considered. Occurring simultaneously, it was not coordinated with human–bear management or park management planning processes for Babine River Corridor Provincial Park. It is not clear how decisions made might affect potential options to address human–bear management issues on the Babine River, most notably the area around the southern park entrance and Babine River bridge and weir.

3 Summary of Key Findings

3.1 Babine River Interim LRUP and Interim CAMP: The Origin of Land Use Planning

Key finding: The LRMPs deferred to the *Babine River Interim LRUP* and *Interim Babine River CAMP, Bulkley Portion*; therefore, it is essential to include these documents in the BWMT Land Use Plan Summary and consider them for monitoring for grizzly bears.

3.2 Management Direction for Grizzly Bear Habitat

Key findings

- The *Babine River Interim LRUP* stated that the Wilderness Zone protected grizzly bear habitat and that a study was in progress to determine objectives for this zone (MOE, MOF and BTAC 1994).
- In the *Babine River Interim LRUP*, two treatment units were specific to grizzly bear habitat: high value grizzly bear habitat (also referred to as important grizzly bear habitat, Treatment Unit 4) and moderate value grizzly bear habitat (Treatment Unit 5). Management prescriptions specific to grizzly bears were provided for these

units. For mixed forest management (Treatment Unit 4a), management direction for grizzly bears was less clear with conflicting information that made it difficult to determine if this was intended to be a discrete unit or a sub-unit of Treatment Unit 4. Management direction specific to grizzly bears was also provided for Treatment Unit 1 (i.e., riparian ecosystems, upland buffer/movement corridors) and high value grizzly bear habitat types fitting specified criteria encountered in Treatment Unit 6. No management direction was provided for grizzly bears in Treatment Unit 2 but high value habitat was identified for this unit in Appendix 7.

- Grizzly bear habitat polygons in Appendix 12 were based on Simpson (1990, 1992).
- High value grizzly bear habitats were probably mapped within areas delineated as Riparian Ecosystems, Forest Ecosystem Networks and Babine River Corridor Provincial Park but they were not delineated within these map units in the Appendix 12 map.
- Management direction in the *Babine River Interim LRUP* most closely reflected recommendations originally provided by Simpson (1992) for grizzly bear habitat, as compared to subsequent planning.
- This interim plan was not revisited for the entire plan area. The Ministry of Sustainable Resource Management (2004a) stated that the *West Babine SRMP* was "intended to implement the objectives of the Kispiox Land and Resource Management Plan and the Babine Interim Local Resource Use Plan within the area of the Kispiox Timber Supply Area" (MSRM 2004:p. iii); whereas, no updates to interim planning have been completed for the Bulkley TSA portion. This resulted in a major divergence in management trajectories.

3.3 Planning Direction for Grizzly Bear Habitat

- Grizzly bear habitat interpretations for mapping that formed the basis of land use plan maps were provisionally assessed as reconnaissance-level with low or moderate (Babine LRUP Treatment Unit Extension area of West Babine SRMP) and low (all other areas) reliability for the probability of predicting important grizzly bear habitats on the ground.

3.4 Changes in Planning Direction for Grizzly Bear Habitat

Some major changes included

- Bulkley LRMP portion: For the area within Babine River Corridor Provincial Park (Sub-unit 2-1) and the Babine River Special Management Zone 2 (i.e., Sub-unit 2-2), the *Bulkley LRMP* deferred to the *Babine River Interim LRUP*. For the Babine Integrated Resource Management Zone (Sub-unit 2-3), the *Bulkley LRMP* deferred to the *Babine River Interim LRUP* and the *Interim Babine River CAMP, Bulkley Portion*.
- Kispiox LRMP portion: The *Kispiox LRMP* deferred to the *Babine River LRUP* for Babine River Corridor Provincial Park, Babine River Valley — Scenic/Recreation/Habitat Special Management Zone and management of grizzly bear habitat.
- Objectives and strategies for habitat types and treatment units were carried forward, to varying extents, from the *Babine River Interim LRUP* to subsequent planning documents relevant to the management of grizzly bear habitat. Major changes were made. Some objectives or strategies of interest were dropped. I did

not find rationale for most changes and was unable to determine if some might have been inadvertently made.

- Earliest land-use plans were precursors to (i.e., *Babine River Interim LRUP*, *Bulkley LRMP*, *Kispiox LRMP*) or did not incorporate (e.g., *Babine LUP*, *Nilkitkwa LUP*), possibly due to simultaneous works in progress, guidelines that were established by the Forest Practices Branch for land use planning (e.g., *Guide to Writing Resource Objectives and Strategies*, MOF 1998).
- When the *West Babine SRMP* (MSRM 2004a) was developed, standards had become better established and, with respect to clarity of intent and expectations, this process appears to have benefited from lessons learned in earlier processes. Greater availability of personnel and other resources to do this work were probably also a factor.
- Legal objectives for grizzly bear habitat put constraints on habitat management. The original intent was to have no net loss of grizzly bear habitat. Direction was provided to use air photo interpretation and groundwork to identify high value grizzly bear habitats throughout the plan area with strategies applicable to habitat types meeting specified criteria regardless of where they occurred. Now objectives only apply to specified grizzly bear habitat types within polygons that were delineated as grizzly bear habitat.
- The *Bulkley LRMP OSG* changed the term *maintain* to *provide*. No definitions were provided for these terms. This change is considered inappropriate because it is possible to *provide* human-disturbed habitats with abundant bear foods and concomitantly increase their risk of human-caused mortality.
- The *West Babine SRMP* (MSRM 2004a) dropped management direction for moderate value habitat in its entirety.
- The feasibility of monitoring grizzly bear habitat is limited by changes in land use planning direction, gaps in information and limitations of data. Plans were not designed or were not well designed to support monitoring.

3.5 Origins and Limitations of Grizzly Bear Habitat Polygons in Land Use Planning

Key findings

- The knowledge base used to delineate grizzly bear habitat polygons in land use planning was probably appropriate for general planning purposes, as originally intended and expressed by the authors, but not for making well-informed management decisions about specific areas of land.
- Grizzly bear habitat interpretations for mapping were primarily based on feeding for food plants. Life requisites associated with foraging for animals (e.g., salmon, insects, small mammals, ungulates), security/thermal cover, travel and denning were not specifically covered in interpretations.
- Babine River Interim LRUP: Treatment Unit mapping was completed at 1:50,000 scale; the minimum mappable type was 50 hectares. This interim plan identified the need for more detailed mapping at 1:20,000 scale with air photo interpretation and ground truthing.
- It is unclear what habitat types are being managed for in polygons delineated as mixed forest management because they were not specified in the *Babine River*

Interim LRUP. Simpson (1992:p. 25) identified four deciduous dominated habitat types within his criteria to rate high sensitivity habitats.

- All areas: Ground investigations will be needed to verify information and locate unidentified and unmapped important habitats. For example, those that have not been captured in interpretive mapping due to a range of factors including level and quality of existing knowledge, pattern and distribution of habitat types, survey intensity and map scale.
- Babine River Interim LRUP, Appendix 12 map and subsequent planning utilizing this map: Grizzly bear habitat was not mapped for parkland and alpine areas.
- Upper Nilkitkwa Planning Unit: The two grizzly bear habitat polygons delineated for this unit are of unknown origin. Grizzly bear habitat polygons have not been delineated in land use planning for most of this unit. Interpretive mapping for grizzly bear habitat completed for the upper Nilkitkwa was not used in land use planning. The rationale for this was not determined.
- West Babine SRMP area: Best available ecosystem mapping and interpretations for grizzly bear habitat were not included or referenced in the *West Babine SRMP* (MSRM 2004a).

3.6 Changes to Grizzly Bear Habitat Polygons in Land Use Planning

In a cursory comparison of land use plan maps with interpretive maps produced for grizzly bear habitat, I found several differences. I did not find reporting or determine the rationale for these changes, or whether or not any changes might have been inadvertent.

3.7 Planning for Babine River Corridor Provincial Park

Key findings

- The *Bulkley LRMP* did not identify existing land uses and existing activities in the area around the southern park entrance, DFO fish counting fence and Babine River bridge. Overlap in use of this area, by people and grizzly bears, pose major threats to people and grizzly bears (Wellwood 2007b).
- LRMPs provided limited management direction for the park, largely deferring to the *Babine River Interim LRUP.* The *Babine River Interim LRUP* (MOF and MELP 1994a) highlighted the need for a park management plan if the proposed protected area was approved. The *Bulkley LRMP* (BVCRBIPT 1998) plan directed the completion of a park management plan. The *West Babine SRMP* does not address management for Babine River Corridor Provincial Park (MSRM 2004). However, this document states that it was developed to be consistent with the Management Direction Statement for the park.

3.8 Planning for Coordinated Access Management

Key findings

- Objectives were not provided and strategies were poorly defined for grizzly bears in the *Interim Babine River CAMP, Bulkley Portion* (MOF and BC Environment 1994b). Objectives and strategies were poorly defined for grizzly bears in the *Access Management Direction for the Babine Watershed, Kispiox Forest District* (Kispiox Forest District Access Management Planning Technical Group [KFDAMPTG] 2000).

- In 1997, the Province of B.C. repealed the legislated requirement for licensees to prepare access management plans with forest development plans (Forest Practices Board 2005).
- I found little for management direction aimed at preventing people from driving (or riding) any type of motorized vehicle into access-controlled areas that was explicit or enforceable. The West Babine provided a statement that would have been useful for addressing all types of motorized access but unfortunately it was in the access summary and several statements in main sections indicate otherwise.

3.9 Planning for Recreation Access Management

Key findings

- The RAMP processes were aimed at managing conflicts between motorized and non-motorized recreationists and allocating use.
- This plan does not assess or address effects on wildlife and the Interim Babine River CAMP is outdated. Given current situation and context, the Summer Ramp Table (2013) recommendation to allow restricted recreational access beyond gated ACPs appears to conflict with the objective to minimize human–bear interactions.

3.10 Key Findings for Monitoring

Knowledge gained in this Chapter was considered in the context of knowledge gained in the Chapter 2 to determine implementation and effectiveness monitoring management direction for grizzly bear habitat and ACPs.

3.10.1 Implementation Monitoring

Key findings

- I identified two to four main periods that would be needed for implementation monitoring in each of four areas (Table 6 and Table 7). Approximately seven different monitoring protocols would be needed to address differences in management direction, spatially and temporally, for the period from 1994 to present. This does not include monitoring for implementation of forest stewardship plans.
- I strongly suspect that few people working on natural resource management, planning and development endeavors for this area understand the full extent or potential implications of changes that have occurred over time. Interpretations of management direction for grizzly bear habitat have probably been variable.
- Preliminary findings indicate that efforts needed to conduct implementation monitoring, post development for multi-year periods, will be expensive and associated uncertainties might be considered excessive to some.

Table 6. Land-use plans providing management direction for grizzly bear habitat in the Bulkley TSA portion of the BWMT area of interest.

Management Area	Land Use Planning Map Products Based On	Land Use Plan					
		Babine River Interim LRUP 1994	Bulkley LRMP 1998	Babine LUP 1999	Nilkitkwa LUP 1999	Bulkley LRMP HLPO 2000	Bulkley LRMP OSG 2006
Bulkley LU Area	Biophysical Mapping (Lea and Kowall 1992) with Grizzly Bear Habitat Sensitivity to Development (Simpson 1992)	Babine River Interim LRUP	Babine River Interim LRUP[1]	Babine LUP	Not Applicable	Bulkley LRMP HLPO	Bulkley LRMP OSG
Nilkitkwa LU Area	Bulkley Area Wildlife Habitat – 1995 Mapping (unknown origin)	Not Applicable	Babine River Interim LRUP[1]	Not Applicable	Nilkitkwa LU	Bulkley LRMP HLPO	Bulkley LRMP OSG

[1] *Bulkley LRMP* defers to *Babine River Interim LRUP* management direction.

Table 7. Land-use plans providing management direction for grizzly bear habitat in the Kispiox TSA portion of the BWMT monitoring area.

Management Area	Land Use Planning Map Products Based On	Land Use Plan		
		Babine LRUP 1994	Kispiox LRMP 1996	West Babine SRMP 2004
West Babine SRMP Area – Babine River Interim LRUP mapped portion	Biophysical Mapping (Lea and Kowall 1992) with Grizzly Bear Habitat Sensitivity to Development (Simpson 1992)	Babine River Interim LRUP	Babine River Interim LRUP[1]	West Babine SRMP
West Babine SRMP Area – Babine River Interim LRUP treatment unit mapping extension portion	Babine LRUP Treatment Unit Mapping Extension (Mahon and Marsland 2001)[2]	Not Applicable	Babine River Interim LRUP[1]	West Babine SRMP

[1] *Kispiox LRMP* defers to *Babine River Interim LRUP* for some management direction.
[2] Based on first of three versions of predictive habitat mapping for grizzly bears completed for this area.

3.10.2 Effectiveness Monitoring

Key findings

- Across all planning for this area, the goal to maintain grizzly bears, and objectives to support it, have been variably expressed. These need to be ecologically relevant, clearly expressed and consistent across the plan area.
- There is also a need to differentiate between conservation goals and objectives, based on best available science, and management goals and objectives, identified by decision-makers.
- Many important principles and concepts for achieving the goal of maintaining grizzly bears were missing or dropped in land use planning or were not within the mandate of these plans. A conceptually and scientifically sound grizzly bear conservation framework, at an ecologically relevant scale (e.g., grizzly bear population unit), is needed to support management decisions and effectiveness monitoring.
- Potential implications of divergences between recommendations made by biologists providing expertise and advice and decisions made in land use and operational planning have not been formally qualified or quantified. It is not known how decision makers might be taking these into consideration. A means of linking the knowledge base to management decision-making processes is needed for effectiveness monitoring.

4 Project Limitations

Limitations include

- *Incomplete review*: This study missed or only touched on land use planning direction that has relevance to the goal to maintain grizzly bears including but not limited to management direction for moderate value grizzly bear habitat, non-grizzly bear specific treatment units and traditional berry harvest.
- *Gaps in information*: A considerable volume of material was reviewed and summarized for this chapter. Gaps in important information likely remain and, although I dedicated major effort to avoiding this problem, I might have misinterpreted some information.
- *Review limitations*: Reconnaissance reviews of maps consisted of visual examination of polygons on paper versions of maps. Comparisons between maps were made based on general shape of polygons to find polygons that were added or dropped. I did not review digital data to see if polygons were spatially the same.

People interested in information in this report will need to refer back to original documents, as required, to ensure that they understand the context of information and that it is used and referenced appropriately.

Chapter 4: Selecting Indicators for This Project

1 Methods

The *West Babine SRMP* objectives, indicators and targets provide legally established landscape unit objectives (MSRM 2004a). Other plans presented objectives with management prescriptions or strategies but not indicators and targets. Price and Daust (2005b) identified indictors for the objective to maintain high value grizzly bear habitat and reduce human–bear interactions in *Appendix 2 Knowledge Base: Information used for Estimating Risk, Uncertainty and Probability of Success,* based on a review of land use plans and the knowledge base including interviews with MOE wildlife biologists.

I reviewed land use planning documents to identify habitat-related terms and, as feasible, their definitions as explicitly stated or implied. I also conducted a literature review to identify and evaluate indicators specific to grizzly bear habitat and access presented in the BWMT Monitoring Framework (Price and Daust 2005b) as compared with indicators being used in other areas. I used this information to identify indictors for use in this project (this chapter), as an interim measure to support implementation and effectiveness monitoring.

I propose a conceptual framework for grizzly bear conservation and management. It includes objectives with examples of potential strategies and indicators for discussion purposes only in Chapter 6 (Effectiveness Monitoring) and appendices 3–5 (review drafts). The intent of this information is to support discussions regarding next steps for adaptive management to maintain grizzly bears. Collaboration with Province of B.C. and peer review are needed to use (in whole or in part), revise or further adapt this proposed framework for other uses.

2 Results and Discussion

2.1 Habitat Indictors

The BWMT Knowledge Base summarized references to grizzly bear habitat in land use plans as 'mapped high value habitat' and 'critical habitat within mapped areas', as well as high value habitat adjacent to mapped areas (e.g., Sperry-Rosenthal). Habitat related definitions in this framework were as follows

- High value grizzly bear habitat - "describes groups of biogeoclimatic site series that are important to bears, but not rare. This habitat is important over the year, but it is not possible to determine any one patch is critical" (Price and Daust 2005b:p. 52).
- Critical grizzly bear habitat - "As opposed to the relatively common site series making up high-value habitat, critical habitats are individually important. Wetlands, south-facing chutes and riparian ecosystems are critical seasonally" (Price and Daust 2005b:p. 52).

For the objective to maintain high value grizzly bear habitat, the BWMT indicators summarized from land-use plans were

- "% of intact high-value habitat"
- "% of intact critical habitats; % of critical habitats with sufficient adjacent forested habitat for cover and bedding" (Price and Daust 2005b:p. 52).

I identified a need to revise these indicators based on a literature review and an assessment of feasibility given existing land use planning for grizzly bear habitat. I found considerable variability and inconsistency in use of habitat-related terms in planning and monitoring documents, often without explicit definitions. Terms and their definitions provided in the BWMT Framework for grizzly bear habitat were different than those implicitly or explicitly expressed in research and planning documents. MacHutchon (2007) also noting inconsistency in terms, proposed the use of *important grizzly habitat to* describe Class 1 (high grizzly bear habitat suitability) and Class 2 (moderately high grizzly bear habitat suitability) habitats (see RIC 1999) that he found variably described as *important*, *critical* or *sensitive*.

For clarity and as an interim measure for the purposes of this monitoring project, I use the terms *important grizzly bear habitat types* and *important grizzly bear habitat polygons* to generically describe the following:

Important Grizzly Bear Habitat Types
The term *important grizzly bear habitat types* generically refers to identified biophysical units, ecosystem units or predictive habitat mapping units evaluated in previous studies as

- high use (e.g., Simpson 1990)
- high sensitivity to development (i.e., Simpson 1992)
- high value grizzly bear habitat, important grizzly bear habitat or mixed forest management (e.g., MOF and MELP 1994a)
- high and moderately high suitability to grizzly bears (e.g., Keystone Wildlife Research 1999a, 1999b; MOF and MOE 2001, Mahon et al. 2004)
- biophysical units listed as high value in Appendix 5 (p. 53) in *Babine River Interim LRUP* (MOF and MELP 1994a) and critical patch habitat listed in footer (p. 29) in *West Babine SRMP* (MSRM 2004a).

Important Grizzly Bear Habitat Polygons
The term *important grizzly bear habitat polygons* generically refers to polygons identified as

- high sensitivity to development (i.e., Simpson 1992)
- moderately high and high grizzly bear habitat suitability (e.g., Keystone Wildlife Research 1999a, 199b; Mahon et al. 2004)
- high value (Treatment Unit 4) and mixed forest management (Treatment Unit 4a) in *Babine River Interim LRUP* Appendix 12 Map (see MOF and MELP 1994),
- high value grizzly bear habitat in Map 2 and mixed forest habitat in Map 2a in *Babine LUP* (MOF 1999a)
- high value habitat in Map 7 in *West Babine SRMP* (MSRM 2004a)
- high value habitat in Bulkley HLPO "...as mapped and made available at the landscape level" (Province of B.C. 2000)

- high value habitat in Map 5 in *Bulkley LRMP OSG* (ILMB 2006a).

When referencing specific reports, I use habitat related terms as expressed in the document. Table 8 provides a summary of terms used to describe *important grizzly bear habitat types* and *important grizzly bear habitat polygons*, as defined here, in grizzly bear habitat mapping and land use planning.

As habitat-related investigations for this project did not involve comprehensive field study, only the amount or proportion of important grizzly bear habitat polygons that are potentially intact (e.g., no reported roads constructed or forest harvested) could be examined for this project. The amount or proportion of important grizzly bear habitat types that are intact could not be examined because this unit can only be identified through ground truthing and investigations, not solely through GIS-based analysis. In part, this is due to the scale, resolution and other limitations (e.g., complex polygons) of mapping but also management direction indicated that forestry development was permitted within important grizzly bear habitat polygons provided management direction for important grizzly bear habitat types within these areas were achieved. Ground truthing and investigations will be essential to monitor implementation for this indicator.

Table 8. Grizzly bear habitat-related terms used in grizzly bear habitat mapping and land use planning for the Babine Watershed Monitoring Trust monitoring area.

Grizzly Bear Habitat Reference	Terms Used	Important Grizzly Bear Habitat Polygons (Landscape-level)	Important Grizzly Bear Habitat Types (Stand-level/Operation-level)	Definitions Provided and Comments
Biophysical-based Grizzly Bear Habitat Mapping (Simpson 1990, 1992)	• High, medium and low grizzly bear use • High, medium and low sensitivity to development based on occurrence of key grizzly bear habitats	Mapped high, medium and low sensitivity to development polygons	Listed high, medium and low use habitat types to be identified through airphoto interpretation and ground investigations	• No definitions for habitat-related terms • Clearly stated editing and correction of habitat maps needed (only two of four maps were drafted). Did not determine whether this was done • Maps could not be located
Babine River Interim LRUP (MOF and MELP 1994a)	• Important grizzly bear habitat and high value grizzly bear habitat (Treatment Unit 4) • Mixed forest management (Treatment Unit 4a) • Moderate value grizzly bear habitat (Treatment Unit 5)	Appendix 12: Babine River LRUP Treatment Units, map displaying treatment units 1-6	Appendix 5 (p. 53): Habitat ratings for grizzly bear habitat and season of use. Lists biophysical units for high value (includes TU4 and TU4a types), moderate value, and integrated resource management units.	• No definitions for habitat-related terms • Not clear if mixed forest management was high value for grizzly bears. Noted for importance to a variety of species. Was lumped with high value grizzly bear habitat in some subsequent plans.
Kispiox LRMP (KLRMPT 1996, amended 2001)	• Critical wildlife habitat • Regionally significant wildlife habitat • Habitat capability • Habitat suitability • High value bear habitat • Moderate value grizzly bear habitat • Key grizzly bear habitat	Habitat suitability	Not applicable	• Defers to Babine River Interim LRUP for "*management strategies to address critical habitat needs*" • No definitions for habitat-related terms • Map and model from Turney (1996). These habitat units were not carried forward into subsequent planning but various reports indicate researcher knowledge and perhaps some data from this work was incorporated into some subsequent grizzly bear habitat mapping projects.

Table 8. Continued

Grizzly Bear Habitat Reference	Terms Used	Important Grizzly Bear Habitat Polygons (Landscape-level)	Important Grizzly Bear Habitat Types (Stand-level/Operation-level)	Definitions Provided and Comments
Bulkley LRMP (BVCRBIPT 1998)	• Critical wildlife habitat • High value grizzly bear habitat • Important grizzly bear habitat	Grizzly bear habitat	Not applicable	• Defers to Babine River Interim LRUP • Defines **"Critical Wildlife Habitat:** part or all of a specific place occupied by a wildlife species or a population of such species and recognized as being essential for the maintenance of the population." (BVCRBIPT 1998:p. 120) • Some green polygons for grizzly bear habitat on wildlife habitat map (p. 12) do not appear to be on any other maps reviewed for this report, notably in Nilkitkwa Planning Unit. I was unable to determine how they were derived.
TEM-based Grizzly Bear Habitat Capability and Suitability (Keystone Wildlife Research 1999a, 1999b)	• Habitat capability • Habitat suitability • High value (foraging) • Moderately high value (foraging)	Mapped grizzly bear habitat suitability and capability	Moderate to high value (i.e., moderate, moderately high and high) habitat types listed (Table 3:p. 27). None given rating of high.	• Data considered preliminary. Caution in interpretation recommended • Definitions for habitat capability and suitability based on RIC Standards (RIC 1997 in Keystone 1999a, 1999b)
Babine LUP (MOF 1999a)	• High value grizzly bear habitat • Mixed forest habitat • Moderate value grizzly bear habitat	Only applies to high value habitat fitting specified criteria located within habitat polygons delineated for high value and high value, mixed forest on Map 2 and moderate value on Map 2a	High value habitats provided in Table 7 (p.17). Only applicable to habitat types within mapped polygons.	• No definitions for habitat-related terms
PHM-based Grizzly Bear Habitat Suitability (Mahon et al. 2004)	• Habitat suitability • Spring, summer, fall suitability for foraging on food plants • 6-class rating scheme	Mapped grizzly bear habitat suitability	Grizzly bear habitat suitability ratings tables for ecosystem units	Definitions for habitat capability and suitability based on RIC Standards (RIC 1999)

Table 8. Continued

Grizzly Bear Habitat Reference	Terms Used	Important Grizzly Bear Habitat Polygons (Landscape-level)	Important Grizzly Bear Habitat Types (Stand-level/Operation-level)	Definitions Provided and Comments
West Babine Sustainable Resource Management Plan (MSRM 2004a)	• High value grizzly bear habitat • Critical grizzly bear habitat • Significant grizzly bear habitat • Important grizzly bear habitat • Grizzly bear habitat capability • Grizzly bear habitat effectiveness	High value habitat (polygons) presented in Map 7 (p. 72)	Listed (in footer 27:p. 29) critical habitat types in mapped high value habitat polygons presented in Map 12	• Critical Habitat: "*Areas considered to be critically important for sustaining a population and where development may cause an unacceptable decline in the population*" (MSRM 2004a:p. 83). • Critical Grizzly Bear Habitat: "*Critical habitats are areas that are considered essential for bear survival. These areas have high forage, bedding or proven denning value, particularly in situations where these habitats are in short supply. Critical habitat areas tend to receive repeated and/or prolonged use by at least one bear. Overall, these relatively small areas of habitat can contribute in a large way to the overall seasonal requirements of a bear, and thus of a population. Critical habitat areas are defined at the stand level and are typically one to five hectares in size*" (MSRM 2004a:p. 23). • High Value Grizzly Bear Habitat "*Areas containing the highest habitat values have been identified as high value grizzly bear habitat (see **Map 7, page 72**). Management within these zones will focus on maintaining the necessary structural features of grizzly bear habitat*" (MSRM 2004a:p. 25). • Habitat Capability: "*A habitat interpretation for a species, which describes the greatest potential of a habitat to support that species. Habitat potential may not be reflected by the present habitat condition or successional stage*" (MSRM 2004a:p. 82). • Habitat Suitability: "*A habitat interpretation that describes the current potential of a habitat to support a species. Habitat potential is reflected by the present habitat condition or successional stages*" (MSRM 2004a:p. 84).

Table 8. Continued

Grizzly Bear Habitat Reference	Terms Used	Important Grizzly Bear Habitat Polygons (Landscape-level)	Important Grizzly Bear Habitat Types (Stand-level/Operation-level)	Definitions Provided and Comments
Bulkley LRMP Higher Level Plan Order (Province of B.C. 2000)	• Important grizzly bear habitat element • High value habitat buffered for security and bedding	High value habitat	Not provided	• Important habitat: "*wildlife habitat as mapped and made available at the landscape level*" (Province of B.C. 2000) • High value habitat is one of two important *grizzly bear habitat elements* that were presented. Not clear if the objective for habitat applies to entire high value polygon. • No information indicating 'important habitat types' within polygons
Bulkley LRMP Objectives set by Government (ILMB 2006a)	• High value habitat buffered for security and bedding • High value grizzly bear habitat • High value, mixed forest habitat • Moderate value grizzly bear habitat	Locations identified on Map 5? Not clear	High value habitat? Not clear	• No definitions for habitat-related terms • Not clear, for example: "*provide high-value habitat buffered for security and bedding for grizzly bears in the location identified in Map 5*" • No information indicating 'important habitat types' within polygons
BWMT Framework (Price and Daust 2005b)	• High value habitat • Critical habitat	Not Applicable	Not Applicable	• High value habitat: "*describes groups of biogeoclimatic site series that are important to bears but not rare. This habitat is important over the year, but it is not possible to determine that any one patch is critical*" (Price and Daust 2005b:p. 52) • Critical Habitat: "*As opposed to the relatively common site series making up high-value habitat, critical habitats are individually important. Wetlands, south facing chutes and riparian ecosystems are critical seasonally*" (Price and Daust 2005b:p. 52) • These definitions are different than those provided in some land use plans.
TEM-based Grizzly Bear Habitat Capability and Suitability (Wellwood 2008)	• Habitat suitability • Spring, summer, fall suitability for foraging on food plants • 6-class rating scheme	Mapped complex polygons for grizzly bear habitat suitability	Ratings tables for grizzly bear habitat suitability by ecosystem units	• Definitions for habitat capability and suitability based on RIC Standards (RIC 1999) • To-date has not been used in land use planning

2.2 Access-related Indicators

For the objective to minimize human–bear interactions, the BWMT indicators summarized from land-use plans and some implications for monitoring were

- "density of open roads per watershed." A preliminary survey can be done through GIS analysis.
- "length of road in high-value habitat". Generally roads were permitted in high value habitat polygons provided they were not within specified habitat types, variably expressed depending on the plan.
- length of road <150 m from critical habitat". Ground investigations required.
- "% of road through listed areas. Ground investigations required.
- "% of road through habitats with screening". Ground investigations required.
- "% of road with >300 m line-of-sight distance in Babine River SMZ (Babine River Corridor Provincial Park) and SM2 (Babine River Special Management Zone)." Roads not permitted in Babine River Corridor Provincial Park. Ground investigation required.
- "Initiation of education programs" (Price and Daust 2005b:p. 42; see Ciarniello et al. 2012). Not considered for this project.

The following components were used in the risk assessment tool in the *West Babine SRMP Technical Report* for the development of the *West Babine SRMP* (MSRM 2004b)

- High value Grizzly Bear Habitat: "High value grizzly bear habitat has been identified based on the Treatment Unit 4 and 4a mapping from the Babine Local Resource Use Plan" (MSRM 2004b:p.9).
- Core Secure Area: "A core security area is any patch of ground that does not contain an open road (any existing roads must be in an *inaccessible condition*) or the influence of a road and where the impact of roads on grizzly bear mortality is minimized. To be effective grizzly bear habitat, a core security area must be of sufficient size. In this plan, the minimum size an area must be in order to be considered an effective core security area is 1000 hectares" (MSRM 2004b:p. 9).
- Habitat Displacement: "Habitat displacement is a concern when addressing grizzly bears in this plan because as the density of roads in an area increases, so to does the impact to grizzly bears" (MSRM 2004b:p. 10). They also stated "For the purposes of this plan, only areas where the [Road Density Index] is greater than 0.6 kilometres of road per square kilometre were considered" (MSRM 2004b:p. 10).

I reviewed the history of terms used to describe access management and their definitions, when provided, in each of the land-use plans and identified indicators to examine in this project. Although complete exclusion of all types of motorized vehicles was not explicitly directed in land use planning for most of the project area, strategies aimed at managing some types of motorized access were gates across roads and road deactivation.

2.3 Key Findings

2.3.1.1 Habitat-Related

- Explicitly defined and consistently used habitat-related terminology is needed.
- Habitat units (i.e., habitat types, habitat polygons) identified for a particular project cannot be directly compared with those identified in some or all other research projects or plans because of differences in methodology.

2.3.1.2 Access-Related

- A preliminary survey can be completed for the forestry status of roads (e.g., restricted by gate, active, deactivated) for the purpose of implementation monitoring based on GIS analysis. However, additional work is needed to update databases and fieldwork is required for verification.
- Fieldwork is required to determine the accessibility status of roads (open or closed) for the purpose of effectiveness monitoring. For the purpose of considering core secure area for grizzly bears, closed roads (and trails) are defined as those that effectively exclude all types of motorized vehicles.
- Given direction provided in land use planning, it would be prudent to assume that most roads are open until ground investigations can be conducted to verify status.

2.4 Indicators Selected for Use in the Project

Goal and objective specific indicators selected for use in this project were

- Goal: To maintain the grizzly bear population
    - Implementation Consideration: Planning direction provided for grizzly bear habitat and access management for the period of interest.
    - Effectiveness Consideration: Principles, concepts, standards and best practices for conservation of grizzly bear populations, as compared to land use planning direction for this area, to identify gaps in and limitations of planning objectives and strategies for achieving goal.
- Objective: To maintain important grizzly bear habitats
    - Implementation Indicators: Distribution and proportion of important grizzly bear habitat polygons with development (e.g., roads, cutblocks), as detectable in available databases. As development was permitted in these polygons, within planning direction provided, this can be used to identify priorities for fieldwork for implementation monitoring but not to evaluate implementation. Databases need to include all cutblocks and roads and be up-to-date.
    - Effectiveness Indicators: Proportion of important grizzly bear habitat polygons delineated in interpretive mapping for grizzly bear habitat that overlap with management zones and units delineated in land use planning including considerations for the following:
        - Reliability and accuracy of ecosystem mapping and reliability of interpretations for grizzly bear habitat
        - Reliability of grizzly bear habitat polygons delineated in land use planning

        - Management direction, by management zone or unit, of relevance to the objective to maintain grizzly bear habitat.
- Objective: To minimize human–bear interactions in the area outside of Babine River Corridor Provincial Park
    - Implementation Indicators
        - Locations of important grizzly bear habitat polygons with development, as detectable through GIS analysis. As development could occur in these polygons, within planning direction provided, this can only be used to identify priorities for field investigations for implementation monitoring. Databases need to include all cutblocks and roads and be up-to-date.
        - Installation of ACPs.
    - Effectiveness Indicators:
        - Length and density of roads in important grizzly bear habitat polygons and by bear management unit. These can be used as indicators of potential displacement.
- Objective: To minimize human–bear interactions within Babine River Corridor Provincial Park
    - Implementation Indicator: Management planning in place to address negative effects of human–bear interactions, as compared to management direction provided in planning.
    - Effectiveness Indicator: Historical and current management of people and bears with principles, concepts, standards and best practices for human–bear management.

Effectiveness indicators can be used to subjectively assess risk; that is, the probability of a management strategy not achieving its objective (see Osborn 2008).

Chapter 5: Implementation Monitoring

1 Methods

1.1 Previous Monitoring Studies

I reviewed reports prepared by other parties monitoring in the BWMT area of interest including the Babine LRUP Monitoring Committee, Province of B.C., Forest Practices Board (FPB) and consultants of potential relevance to, but not necessarily specific to, grizzly bears and their habitat. This was to gather any information relevant to grizzly bears to support decisions about how to proceed with implementation monitoring.

Reports were completed for a range of purposes from implementation of Babine River Interim LRUP Treatment Unit prescriptions to implementation of legislated requirements for forest practices. These included

- Babine LRUP implementation monitoring studies completed by consultants
- Annual reports of the Babine LRUP Monitoring Committee, in part a summary of the aforementioned consultant reports
- Babine LRUP grizzly bear monitoring index completed by consultants
- Bulkley and Kispiox LRMP implementation monitoring reports
- A State of the Forest in the Bulkley Timber Supply Area report
- Forest Practices Board reports for investigations and audits that included portions of the BWMT area of interest.

1.2 Implementation Monitoring Periods

I documented changes in land use planning for grizzly bear habitat (see Chapter 3, Section 3.9.1) to identify monitoring periods that would be needed to conduct implementation monitoring covering the entire history of planning for this area.

1.3 Grizzly Bear Habitat

As a preliminary examination of GIS-data to support decisions regarding the development of implementation monitoring methods, Johanna Pfalz completed preliminary GIS analysis for high value and moderate value grizzly bear habitat polygons with current legal effect presented in the *Bulkley LRMP OSG* (ILMB 2006a) for the Bulkley TSA portion and in the *West Babine SRMP* (MSRM 2004a) for the Kispiox TSA portion of the BWMT area of interest.

She also completed another preliminary GIS analysis for total and active road densities within high value grizzly bear habitat polygons (i.e., high value and mixed forest management; both TSA portions) and moderate value (Bulkley TSA portion only) grizzly bear habitat polygons that have legal effect (i.e., *Bulkley LRMP OSG*, ILMB 2006a; *West Babine SRMP*, MSRM 2004a).

All GIS analyses were completed in July 2010.

1.4 Access Control Points

In 2010 and 2011, I conducted four days of field investigations, two days in each TSA portion of the monitoring area. These investigations were conducted to gather supporting information for the development of implementation and effectiveness (see Chapter 6) monitoring specific to grizzly bear habitat and road access-related risk factors, influencing risk of human-caused mortality.

Based on interviews, I classified the status of designated ACPs as

- Implemented, Gate
- Implemented, Road Re-contoured
- Not Yet Required
- Required, Not Implemented

I identified a priority (low or high) for field investigations of each ACP based on my knowledge of the study area, information gathered through interviews, data presented in Wellwood and Pfalz (2009), a literature review and a review of Google Earth satellite imagery (imagery dated 1 January 2006). If available information indicated that an ACP had been implemented and the probability of people accessing the area by any type of motorized vehicle was low or nil then it was given a low priority for field investigation. Alternatively, I gave it a high priority for field investigation if information indicated

- A designated ACP had not been implemented
- An ACP was not located as recommended by biologists for grizzly bears (to support effectiveness monitoring in Chapter 6)
- Unauthorized people riding any type of motorized vehicle could circumvent the ACP (to support effectiveness monitoring in Chapter 6).

Field notes included bear and other wildlife observations and general comments regarding grizzly bear habitat suitability, major food plants observed along road right-of-ways, line-of-sight distances along roads, and condition of gated ACPs. I took photographs and GPS waypoints at key features.

1.5 Babine River Corridor Provincial Park

I used the review of land use planning of relevance to Babine River Corridor Provincial Park (formerly Babine River Wilderness Zone) in Chapter 3 to support implementation monitoring in Chapter 5, Section 2.3.

2 Results and Discussion

2.1 High value Grizzly Bear Habitat

2.1.1 Extent of Mapped Grizzly Bear Habitat With Legal Effect

A summary of high and moderate value grizzly bear habitat polygons with current legal effect delineated in the Bulkley and Kispiox TSA portions of the BWMT area of interest is provided in Table 9. Approximately, 670 km^2 (16%) of the BWMT area of interest was delineated as high value grizzly bear habitat polygons of which 170 km^2 (4%) occurred in the Bulkley TSA portion and 500 km^2 (12%) occurred in the Kispiox TSA portion. Moderate value grizzly bear habitat polygons were only delineated for the Babine LUP area, totaling 267 km^2, or 7% of the BWMT area of interest.

Table 9. Summary of high value and moderate value grizzly bear habitat polygons, delineated through land use planning, Babine Watershed Monitoring Trust area of interest, British Columbia. Analysis completed by J. Pfalz July 2010.

Management Unit	Bulkley TSA			Kispiox TSA	BWMT
	Babine LUP Area (km^2)	Nilkitkwa LUP Area (km^2)	Total LUP Areas (km^2)	Total West Babine SRMP Area (km^2)	Area (%)
Bulkley TSA Portion					
High value	129.3	15.4	144.7	-	3.6
Mixed Forest Management	25.3	0.0	25.3	-	0.6
Total High Value	*154.6*	*15.4*	*170.0*	-	*4.2*
Total Moderate Value	*266.8*	*0.0*	*266.8*	-	*6.6*
Kispiox TSA Portion					
High value	-	-	-	469.1	11.7
Mixed forest Management	-	-	-	30.7	0.8
Total High Value				*499.8*	*12.1*
Total Moderate Value	-	-	-	*0.0*	*0.0*
High Value in BWMT Area = 669.8 km^2					**16.3**
Moderate Value in BWMT Area = 266.8 km^2					**6.6**

2.1.2 2010 Analysis Road Density in Mapped Grizzly Bear Habitat with Legal Effect

As expressed by Simpson (1992), habitats of importance to grizzly bears can only be located with further habitat interpretation (e.g., using orthophotos or satellite imagery) and ground investigations because mapped habitat polygons consisted of complex polygons with up to three habitat types. That is, the locations for important grizzly bear habitat types were not spatially identified. Depending on the plan, management strategies or indicators plus targets for identified important grizzly bear habitat types were applicable to those located within and, for some plans, outside of important grizzly bear

habitat polygons. Forestry-related activities, including road development and forest harvesting, were not precluded in areas (i.e., polygons) delineated as important grizzly bear habitat provided management direction for important habitat types within these areas were applied, as directed. Mountain pine beetle salvage operations have been conducted in this area over the course of land use planning. Thus ground investigations and decision-making specific to mountain pine beetle-specific also need to be considered when monitoring for implementation.

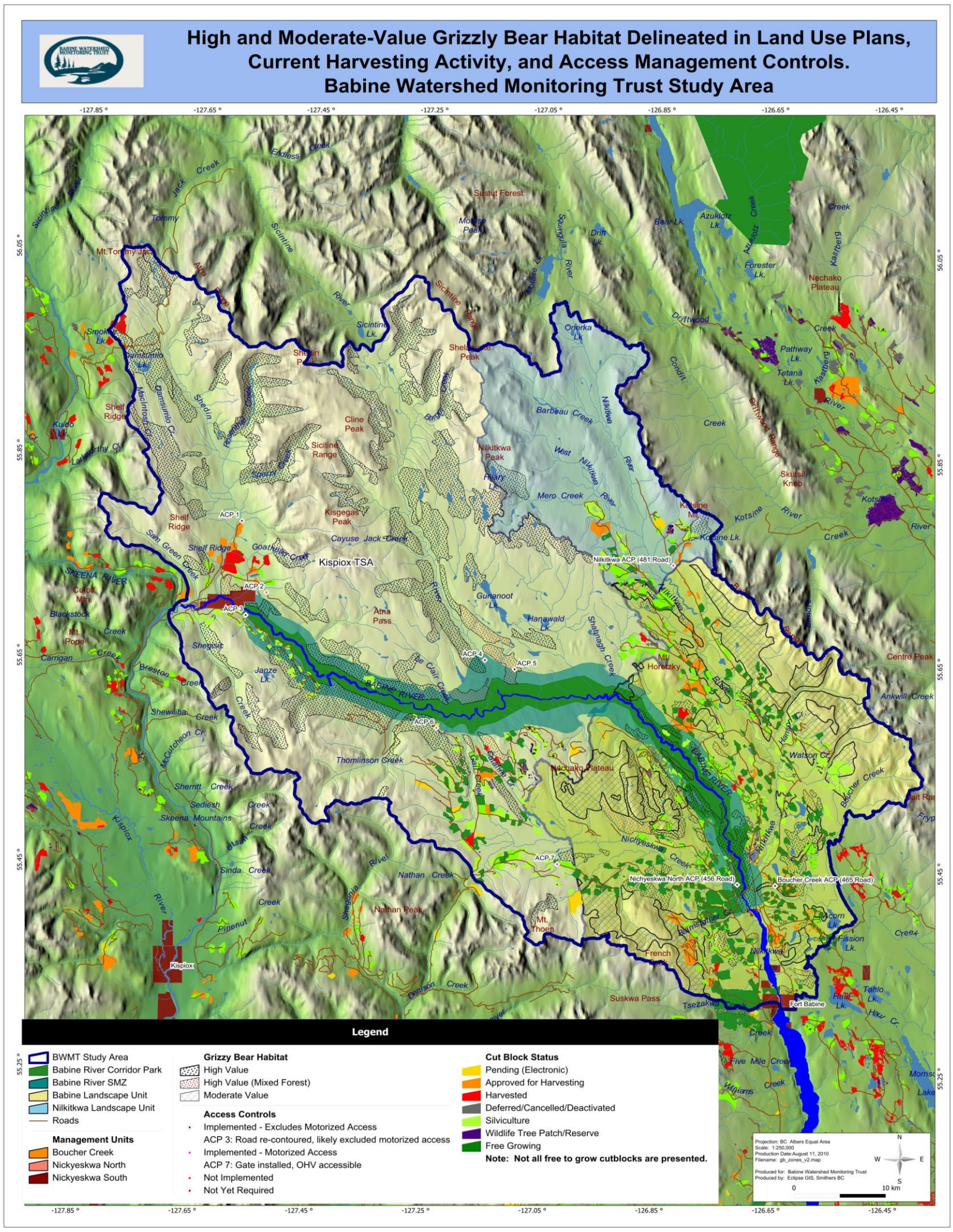
A preliminary analysis for total and active road densities within grizzly bear habitat polygons with legal effect identified as high value (i.e., high value and mixed forest management are presented in Table 10; both TSA portions) and moderate value (Bulkley TSA portion only). A map displaying this information is provided in Figure 5. As previously discussed, no moderate value grizzly bear habitat polygons were delineated for the Nilkitkwa LUP or West Babine SRMP areas.

Important grizzly bear habitat polygons (i.e., high value and mixed forest management) delineated through land use planning contained 105 km of road of which 85 km was classified as active road. This included 38 km total (37 km active) in the Bulkley TSA and 67 km total (49 km active) road in the Kispiox TSA. A total of 140 km (139 km active) of road was documented within moderate value habitat polygons, Babine LUP area. Total road density for high value habitat polygons in the Bulkley TSA portion, Kispiox TSA portion and entire BWMT area of interest was 0.22 km^2, 0.13 km^2 and 0.16 km^2, respectively. Total road density for moderate value habitat in the Babine Landscape Unit was 0.52 km^2.

Table 10. 2010 Road density estimates in high value and moderate value grizzly bear habitat polygons delineated in land use planning with legal effect for the Babine River watershed, Babine Watershed Monitoring Trust area of interest, British Columbia. Analysis completed by J. Pfalz July 2010.

Management Unit	Area (km^2)	Total Active Road Length (km)	Active Road Density (km/km^2)	Total Road Length (km)	Total Road Density (km/km^2)
Bulkley TSA Portion					
High value grizzly bear habitat	144.7	27.3	0.19	28.5	0.20
Mixed forest management	25.3	9.4	0.38	9.4	0.37
Total High Value	*170.0*	*36.7*	*0.22*	*37.9*	*0.22*
Total Moderate Value	*266.8*	*139.2*	*0.52*	*139.8*	*0.52*
Kispiox TSA Portion					
Total High Value	*501.2*	*48.6*	*0.10*	*66.9*	*0.13*
Total High Value	*671.2*	*85.3*	*0.13*	*104.5*	*0.16*
Total Moderate Value	*266.8*	*139.2*	*0.52*	*139.8*	*0.52*

Figure 5. High value, mixed forest management and moderate value grizzly bear habitat polygons delineated in land use plans, harvesting, and access management controls for the Babine Watershed Monitoring Trust area of interest. Note: Some free-to-grow cutblocks were missing from the data set. Map produced by J. Pfalz, August 11, 2010.



2.2 2010 and 2011 Access Control Points

In 2010 and 2011, I conducted field investigations for three ACP locations that were identified in the *Babine LUP* and four of seven ACP locations that were designated through the *West Babine SRMP* (Figure 5). I did not have time to visit the ACP for the Big Slide AMZ, identified as low priority. Two ACP locations did not have road access yet. I also visited some ACP locations that were proposed or recommended but were not carried forward in land use plans.

2.3 Babine River Corridor Provincial Park

Prior to park establishment, direction in the *Options for the Babine River* report to establish a no shooting zone within 3-km of the fish counting fence was implemented, extending from the north end of Nilkitkwa Lake to Nilkitkwa River. This included area outside of the wilderness zone.

In 1999, the park was established as directed in the *Bulkley LRMP* and *Kispiox LRMP*. No plans for park and recreation management have been completed for the park. While an interim human–bear management plan for the southern park entrance area, a small portion of the park, has been prepared, it is not an approved plan (Wellwood 2011); as such, direction to complete human–bear management planning for the park has also not been completed.

2.3.1 Southern Park Entrance Area

A red flag indicating that the objective to minimize human–bear interactions in the BWMT area of interest is compromised is the nature, frequency and intensity of bear incidents that occur in the area around the Babine River bridge and fish counting fence and southern park entrance of Babine River Corridor Provincial Park (Wellwood 2007a, 2008, 2012). This poses a unique, complex, challenging and contentious management problem that has yet to be resolved from grizzly bear conservation and public safety perspectives (also see Ciarniello 2012, Davis and Himmer 2010).

BC Parks has never implemented an area closure to mitigate or respond to bear incidents (see Hopkins et al. 2010), even though bear incidents commonly occur in the southern park entrance area, within and outside of the park. This conflicts with management direction to address bear incidents through area closures provided in *Skeena District Bear–People Conflict Prevention Plan* (BC Parks 2001), *Bear–People Conflict Prevention Plan for Parks and Protected Areas in British Columbia* (Ministry of Water, Land and Air Protection 2002), *Emergency Procedures Manual, Skeena Region* (e.g., Province of B.C. 2006) and *2011 Human-Bear Management Plan for Southern Park Entrance Area* (Wellwood 2011). From a grizzly bear conservation perspective, it also conflicts with the *Management Direction Statement for Babine River Corridor Provincial Park* (MELP 2000a), which states

> "*Notwithstanding the need for further planning, the priority for management is to protect the conservation values, notably the fish and bear populations.*

A second priority is to protect wilderness recreation values in the park and permit wilderness recreation opportunities that are compatible with protecting conservation values. Maintaining, or in the case of overuse, restoring a wilderness experience will be perused in management actions or decisions relating to issues such as access, and permit approvals and renewals" (MELP 2000a).

In 2009, a parking lot was developed in grizzly bear habitat that had been delineated as high habitat suitability in an area that had a trail used by bears and numerous bear beds (Wellwood 2008).

3 Key Findings

3.1 High Value Grizzly Bear Habitat

- With respect to legally binding objectives, the *Bulkley LRMP OSG* (ILMB 2006a) did not provide a list of high value grizzly bear habitat types, thus it was not clear whether habitat-related objectives apply to the entire area within a high value grizzly bear habitat polygon or only the high value habitat types within it.
- The *West Babine SRMP* (ILMB 2004) clearly specified that objectives only apply to the identified critical grizzly bear habitat types within high value grizzly bear habitat polygons.
- No preliminary investigations or conclusions regarding implementation of management direction for important grizzly bear habitat types or grizzly bear habitat polygons can be made based GIS analysis for roads and cutblocks located in delineated high value grizzly bear habitat. Fieldwork is required for all aspects of implementation monitoring for important grizzly bear habitat.

3.2 Access Control Points

Bulkley TSA Access Control Points

- Boucher Gate (1.8 km on 465 Road): Implemented
- South of Nichyeskwa Management Unit: Implemented
- Nichyeskwa North Management Unit (2 km on 456 Road): Implemented
- Nilkitkwa Gate (21 km on 481 Road): Implemented. Land use planning does not specify expectations and direction for this gate.

Kispiox TSA Control Points

- Sperry-Rosenthal (ACP1): Not yet required
- Shenismike West (ACP2): Not implemented
- Big Slide AMZ (ACP3): Implemented
- Shenismike-Shelagyote Access Management Zone (ACP4): Not yet required
- Shelagyote Crossing (ACP 5): Not yet required
- Thomlinson (ACP6): Not implemented. There is a plan to install this gate in 2014 (Vanderstar pers. comm. 2013)
- Nichyeskwa Connector (ACP7): Implemented

Management of Access Control Points

- The MFLNRO has a gate lock procedure providing expectations for gates in the Bulkley TSA that is given to people working in these areas (R. Donnelly pers. comm.).
- I did not determine whether or not rationale has been provided to or by the Province of B.C. for the lack of implementation of designated ACPs in the Kispiox TSA portion.

3.3 Babine River Corridor Provincial Park

- Prior to park establishment, direction in the *Options for the Babine River* report to establish a no shooting zone within 3-km of the fish counting fence (MOF, MOE and Babine TAC 1991) was implemented. An area extending from the north end of Nilkitkwa Lake to Nilkitkwa River was closed. This included area within and outside of the wilderness zone.
- The Wilderness Zone was designated as a Provincial Park.
- Several land use plans directed the completion of a park management plan for Babine River Corridor Provincial Park. The Management Direction Statement for the park directs the completion of recreation management and human–bear management plans, identified as high priorities (MELP 200a). These directions have not been implemented.
- No area closures have been implemented to address serious bear incidents in the southern park entrance area of the park. This conflicts with regional and provincial direction for human–bear management in provincial parks.

4 Project Limitations

- GIS data sets: Some data sets were incomplete or not up-to-date including some roads and cutblocks (e.g., free-to-grow) that were missing from data sets, at the time these GIS analyses were completed. I did not pursue this further.
- GIS analysis: These results were used to support recommendations for implementation monitoring in this report and are considered preliminary.
- Fieldwork: Only four days of fieldwork were conducted for this study. I also used my knowledge of the study area gained through other projects and interviews with persons familiar with this area.

Chapter 6: Effectiveness Monitoring

1 Methods

1.1 Management Direction in Land Use Planning

I conducted an assessment of management direction provided in land-use plans to evaluate the potential effectiveness of planning for achieving the goal to maintain grizzly bears. This included a comprehensive review of objectives, strategies, indicators and targets or thresholds presented in land use plans (Wellwood 2014a).

I asked the question, is the scientific basis and organizational structure of land use planning to avoid, reduce or mitigate potential impacts to grizzly bears conceptually sound given best available knowledge, standards and practices?

I reviewed habitat and cumulative effects modeling and other information applicable to the management of grizzly bear populations in other areas to propose a conceptual framework for grizzly bear conservation in the BWMT area of interest, building on Wellwood and Pfalz (2009). I compared key components of land use planning for grizzly bears in the BWMT area of interest with those identified in the framework to identify gaps in direction and limitations of planning to support discussions regarding next steps for adaptive management.

1.2 Grizzly Bear Habitat

Johanna Pfalz conducted a preliminary analysis of landscape level grizzly bear habitat mapping. This included an examination of the proportion of high- and moderately high value polygons in PHM (Mahon et al. 2003) that was captured within high value polygons in the *Babine River Interim LRUP* (MOF and MELP 1994), and conversely those in the *Babine River Interim LRUP* that were captured within PHM. Because habitat suitability ratings for the PHM were evaluated for spring, summer and fall, three data layers were combined into one to include all polygons rated as high or moderately high, regardless of season. This analysis could only be completed for the Kispiox TSA portion of the study area. This is because the Bulkley TSA portion does not have more reliable map products; maps prepared by Simpson (1992) that could be compared with the *Babine River Interim LRUP* could not be located; and the Nilkitkwa TEM (Oikos Ecological Services 1998, Keystone Wildlife Research 1999b) does not overlap with any other map products. I used this analysis to assess the feasibility of effectiveness monitoring based on existing map products. This can be used to support decisions about how to proceed.

1.3 Access Control Points

I evaluated the potential effectiveness of an ACP for reducing risk of human–bear interactions based on

- Land use planning strategies for preventing spatial and temporal overlap between people and grizzly bears.

- The permeability of an implemented ACP, roughly estimated as the ease of which unauthorized people using any type of motorized vehicle could cross an identified ACP when access control strategies presented in land use planning were in effect.

I conducted a preliminary assessment of effectiveness was based on interviews. This included reports of gates that had been vandalized; gates left open (purposely or inadvertently); or vehicles moved over, under or around them. At each of the implemented ACP visited, I checked gates and locks to confirm that they were in working order. I conducted a ground search in the immediate vicinity of installed gates to look for evidence of motorized vehicles circumventing them. I then classified implemented ACPs as

- Excludes Motorized Access – no evidence that motorized vehicles could drive around the gate
- ORV Accessible – evidence that motorized vehicles could drive around the gate.

As previously stated, I took a GPS waypoint and photographs at each ACP location. I documented evidence of motorized vehicles circumventing gates and other features of interest. As time permitted, I also opportunistically recorded information (i.e., waypoints, photos, field notes) for examples of some of the road-related risk factors for grizzly bears that were previously identified by biologists as issues of concern along with recommendations to address them.

1.4 Babine River Corridor Provincial Park

I made a subjective assessment of the risk to conservation objectives for grizzly bears based on my review of the knowledge base (Chapter 2) and land use planning (Chapter 3). I considered types and levels of human activities reported for main areas of overlap among people, bears and salmon. I considered this information within the context of management direction provided in planning.

2 Results and Discussion

2.1 Goal to Maintain Grizzly Bears

The goal to maintain grizzly bears was variably expressed in land use planning for the BWMT area of interest and not expressed or well expressed in most plans. The exception was the *West Babine SRMP*; this plan more clearly described expectations by forecasting population estimates under different management scenarios, anticipating a population decline with implementation of the plan that was estimated to be less than a scenario without a plan (MSRM 2004a). This plan also stated that "the LRUP goal of "maintaining the present grizzly bear population" does not recognize that the range of many of the Babine bears extends beyond the plan boundaries or that integrated development as required in the *Babine River Interim LRUP* and both LRMPs will have an affect on estimates of the bear population" (MSRM 2004a:p. 25).

2.2 Objectives to Maintain Grizzly Bears: A Conceptual Framework

A conceptual framework for grizzly bear conservation was needed to support effectiveness monitoring for grizzly bears. It can be used to consider the potential effectiveness of land

use planning for the BWMT area of interest for achieving the goal of maintaining grizzly bears. I have proposed a framework with conservation objectives, for discussion purposes only, to support BWMT decisions regarding next steps for monitoring. It is a review draft (this section, appendices 2–4). Collaboration with the Province of B.C. and peer review is needed, as considered appropriate, to revise or further adapt it for use in subsequent monitoring initiatives for land use planning, in whole or in part. The following components and objectives are proposed for consideration:

1. Habitat Effectiveness (adapted from USDA Forest Service 1990, MacHutchon 1998a)
   a) Habitat Suitability: Maintain important habitats for all life requisites (e.g., feeding, bedding and resting, travel, denning; RIC 1999), managed at ecologically relevant scales.
   b) Displacement and Disturbance: Minimize displacement of grizzly bears from habitats they are using and disruption of grizzly bear activity, managed at ecologically relevant scales.
2. Human-caused mortality (adapted from USDA Forest Service 1990; MacHutchon 1998a; Safety in Bear Country Society 2001, 2005, 2008)
   a) Minimize developments and human activities in important natural habitats and attractive, human-disturbed habitats.
   b) Maximize knowledge and application of bear awareness and safety to minimize bear incidents.
   c) Minimize bear access to anthropogenic foods, throughout their range.
   d) Limit the rate of human-caused mortality to a scientifically determined sustainable level (Alberta Grizzly Bear Recovery Team 2008), at scales used in grizzly bear harvest management.
3. Anthropogenic Fragmentation (adapted from Weir and Hamilton 1996 *in* MacHutchon 1998a, MacHutchon 1998a; associated with human settlements, vehicle traffic, human-caused mortality, Proctor et al. 2012): Prevent anthropogenic fragmentation and maintain connectivity; managed at region, sub-region and population scales.

Management direction to achieve Objectives 1a, 1b, 2a, 2b and 2c are suitable for consideration from a land-use planning perspective. As most land use planning was largely forestry focused, other types of land and resources uses also need to be considered and managed accordingly to address project and activity specific effects. Strategic planning and interagency and multi-stakeholder collaboration will be required to manage cumulative effects. The Fish and Wildlife Branch is responsible for achieving Objective 2d through management of the grizzly bear harvest (i.e., Wildlife Management Units 6-7 and 6-8 within Babine GBPU). Objective 3 could be achieved with interagency, multi-stakeholder and inter-jurisdictional collaboration to avoid fragmentation and ensure connectivity. Additional details are provided in this report in review draft diagrams for discussion purposes as follows:

- Appendix 2 presents a proposed conceptual framework for thinking about cumulative effects of land and resource development and use on grizzly bears (adapted from USDA 1999, Weir and Hamilton 1996 *in* MacHutchon 1998a, MacHutchon 1998a, RIC 1999; associated with human settlements, vehicle traffic, human-caused mortality, Proctor et al. 2012)

- Appendix 3 presents a proposed conceptual framework for thinking about risk of human-caused grizzly bear mortality to support land use planning decisions (a component of the cumulative effects presented in Appendix 2, adapted from RIC 1999, USDA 1999, MacHutchon 1998a, MacHutchon and Wellwood 2002, Herrero et al. 2005, Sakals et. al 2010).
- Appendix 4 presents a proposed conceptual framework for thinking about grizzly bear conservation to support land use planning decisions (here the cumulative effects model presented in Appendix 3 is placed within the context of planning for land and resource development and use, at various scales, adapted from USDA 1999, Weir and Hamilton 1996 *in* MacHutchon 1998a, MacHutchon 1998a, RIC 1999, Price and Daust 2004).

The following four high-level indicators (adapted from NESERC 2000) are proposed for further discussion to select indicators for monitoring the effectiveness of land use planning

- Habitat effectiveness – that is, the potential of the habitat with consideration for human-caused displacement to estimate the realized habitat value (USDA Forest Service 1990, Gibeau et al. 1996). Habitat effectiveness has been estimated in other study areas based on habitat potential and disturbance sub-model components of the USDA Forest Service CEM (1990).
- Security area – considers the maintenance of areas that females with cubs could forage for 24–48 hour without human disturbance (Mattson 1993, Gibeau 1996)
- Habitat connectivity (Linkage Zones) – considers the ability of grizzly bears to move safely and unimpeded between areas (Servheen and Sandstrom 1993)
- Route density – considers open and closed roads and trails and levels and types of activities (Mace et al. 1996, Summerfield et al. 2004).

In addition, direct human-related effects on grizzly bears need to be managed to ensure that the viability of the population is not compromised. A fifth indicator (adapted from NESERC 2000), is proposed for further discussion

- Total human-associated grizzly bear mortality – considers the human-associated grizzly bears mortality rate that is sustainable including known and an estimate for unknown (i.e., undetected, unreported) grizzly bear mortality.

Additional methodologies also need to be considered for potential application to support management decisions. Nielsen et al. (2006) developed *A Habitat-based Framework for Grizzly Bear Conservation in Alberta.* This framework uses models of grizzly bear occupancy and mortality risk. These are combined for a two-dimensional habitat framework identifying

- Indices of
    - Attractive sinks
    - Safe harbour habitats
- Habitat states
    - Non-critical habitat
    - Secondary habitats (low quality and secure)
    - Primary habitats (high quality and secure)

- Secondary sinks (low quality, but high risk)
- Primary sinks (high-quality and high risk).

They suggest, "A no net loss policy of critical habitats could be used to maintain existing habitat conditions for landscapes threatened by human development. Under such a policy, conversions of primary habitat would require restoration of equivalent amounts of primary sinks through decommissioning of roads". To identify source-sink habitat conditions, Nielsen (2011) developed methodology to identify *Relationships Between Grizzly Bear Source-Sink Habitats and Prioritize Biodiversity Sites in Central British Columbia* with grizzly bear habitat models produced for grizzly bear density, mortality risk and source-sink habitat. Knowledge gained can be used to prioritize maintenance of source-like habitats and restoring sink-like habitats (i.e., through road decommissioning). While data available for analysis limit the use and application of model outputs to coarse level and scale of assessment, Nielsen (2011) identified relatively large areas of sink-like habitat in the BWMT area of interest. This information may be suitable for consideration or reanalysis at the scale of the Babine Grizzly Bear Population Unit to identify priorities for maintaining source-like habitat and restoring sink-like habitat.

Peer review and additional expert input are needed to assess and as appropriate revise the conceptual frameworks. Additionally, these would need to be developed within the context of agency and stakeholder mandates, roles and responsibilities for grizzly bear conservation and management at various scales (e.g., sub-regional, bear management unit, landscape, stand, patch). This would be useful for identifying gaps in management and associated limitations.

For the purposes of this project, I compared land use plan objectives with conservation objectives proposed in the conceptual framework to consider the potential effectiveness of land use planning to support decisions about how to proceed with monitoring. I only did this for the *Babine River Interim LRUP* (MOF and MELP 1994a, Table 11), the original planning direction; and the *Bulkley OSG* (ILMB 2006a, Table 12) and the *West Babine SRMP* (MSRM 2004a, Table 13), the two planning documents with current legal effect. I also identified potential indicators for objectives to maintain grizzly bear habitat and minimize human–bear interactions. The following sections provide a preliminary examination of the effectiveness of land-use planning objectives for achieving the goal of maintaining grizzly bears.

Table 11. A proposed conceptual framework for grizzly bear conservation to support land and resource management and monitoring for grizzly bears with considerations for the potential effectiveness of objectives presented in the Babine River Interim Land and Resource Use Plan for achieving the goal of maintaining the grizzly bear population, Babine Watershed Monitoring Trust area of interest. REVIEW DRAFT FOR DISCUSSION PURPOSES ONLY. Text in *italics* is for direct quotes.

Objective/ Component	Potential Indicators	Babine River Interim LRUP Objective	Considerations for Potential Effectiveness
Maintain effectiveness of important grizzly bear habitat (i.e., realized habitat value). **Habitat Effectiveness can be derived from Habitat and Disturbance Components (sections following)**			
Maintain important grizzly bear habitats for all life requisites (i.e., habitat potential) **Habitat Component**	Percentage of intact important grizzly bear habitat polygons (appropriately reliability) with sufficient buffers for cover and bedding Percentage of intact important grizzly bear habitat types with sufficient forest for cover and bedding	*Long term intent is to have no net loss of important grizzly bear habitat and no displacement of grizzly bears from this drainage* (MOF and MELP 1994a:p. 23)	Gaps in knowledge and limitations of data limit effectiveness. Important habitats were to be identified through airphoto interpretation and ground investigations.
Minimize disturbance (includes displacement) of grizzly bear activity (i.e., a sub-set of human–bear interactions) **Disturbance Component**	• Type, nature, length and intensity of activity • Proportions of Grizzly Bear Management Unit by road density class for open and total routes (roads and trails) • Level of bear awareness and application of knowledge of people working, living and recreating in the area • Other human dimensions (e.g., values, attitudes, opinions)	*Long term intent is to have no net loss of important grizzly bear habitat and no displacement of grizzly bears from this drainage* (MOF and MELP 1994a:p. 23) *…minimize human–bear conflicts and preserve high value grizzly bear habitat* (MOF and MELP 1994a:p.23) High Value: "*Roads should remain 150 metres from* [specified habitat types]…" (MOF and MELP 1994a:p, 23) and specified habitat types were to remain undeveloped. Direction also provided for road and security and cover requisites for high value habitat in complex polygons. Mixed Forest Management: *"Road density will be minimized to reduce interactions with bears*" (MOF and MELP 1994a:p. 25) Moderate Value: *It is anticipated that harvesting within these habitat types [moderate value grizzly bear habitat] will result in an increase in berry shrub production in the short term, thus rendering them attractive to bears during summer and fall. These habitat types include LB, HB and BB. The main objective in these habitat types is to minimize road development and the number and duration of entries* (MOF and MELP 1994a:p. 25)	Access was to be addressed through CAMP but CAMP no longer has legal effect. In addition, objectives for grizzly bears were not provided in the CAMP so intentions were unclear.
Minimize human-associated grizzly bear mortality (i.e., a sub-set of human–bear interactions) **Mortality Risk Component**	• Proportion core secure area by Grizzly Bear Management Unit • Habitat quality (intact and human-disturbed habitats) • Availability of anthropogenic foods • Level of bear awareness and application of knowledge of people working, living and recreating in the area • Levels and types of use • Other human dimensions (e.g., values, attitudes, opinions) • Presence of firearms	• *…minimize human–bear conflicts and preserve high value grizzly bear habitat* (MOF and MELP 1994a:p.23)	▪ This plan provides direction for road development to reduce risks associated with bear–human interactions but has not addressed the many other factors influencing risk, for example: availability of anthropogenic foods; increasing food value of human-altered habitats; presence of firearms; human-factors including knowledge, values, opinions, attitudes, behaviours, barriers to action. ▪ Core secure area not addressed.

Table 11. Continued

Objective/ Component	Potential Indicators	Babine River Interim LRUP Objective	Considerations for Potential Effectiveness
Minimize impediments to grizzly bear movements among areas to allow for continuous distribution of grizzly bears **Fragmentation/Habitat Connectivity Component (e.g., sub-regional-, landscape-levels)**	• Barriers to movement • Mortality hotspots or sinks. **Derived from Compulsory Inspection Forms and Problem Wildlife Occurrence Reports**	None	• Not addressed
Overall risk to grizzly bear population	Consider range of indicators to assess cumulative effects of land and resource use on the Babine Grizzly Bear Population Unit. **To be defined.**	None	• Only addresses limited range of land uses (largely guidance for forestry and range practices) and potential impacts. Does not provide management direction for mineral exploration and mining; oil and gas exploration, development and transport; motorized and non-motorized recreation etc. • BWMT area of interest inappropriate scale to achieve goal. Need to consider a much larger, biologically relevant unit for the population of bears that use this and/or adjacent areas.

Table 12. A proposed conceptual framework for grizzly bear conservation to support land and resource management and monitoring for grizzly bears with considerations for the potential effectiveness of objectives presented in the Bulkley LRMP Objectives Set by Government for achieving the goal of maintaining the grizzly bear population in the Babine Watershed Monitoring Trust monitoring area. REVIEW DRAFT FOR DISCUSSION PURPOSES ONLY. Text in *italics* is for direct quotes.

Objective/ Component	Proposed Indicators	Bulkley Objectives Set by Government	Considerations for Potential Effectiveness
Maintain effectiveness of important grizzly bear habitat (i.e., realized habitat value). **Habitat Effectiveness can be derived from Habitat and Disturbance Components (sections following)**			
Maintain important grizzly bear habitats for all life requisites (i.e., habitat potential) **Habitat Component**	Percentage of intact important grizzly bear habitat polygons (appropriately reliability) with sufficient buffers for cover and bedding Percentage of intact important grizzly bear habitat types with sufficient forest for cover and bedding	*Provide high-value habitat buffered for security and bedding for grizzly bears in the locations identified in Map 5* *Provide diverse understory within high-value, mixed forest habitat identified in Map 5* (ILMB 2006a)	• Only applies to specified important grizzly bear habitat types within areas delineated as important grizzly bear habitat (i.e., high value grizzly bear habitat polygons) • Gaps in information and limitations of data limit effectiveness. • Low reliability (for this purpose) of mapping for important grizzly bear habitat
Minimize disturbance (includes displacement) of grizzly bear activity (a sub-set of human–bear interactions) **Disturbance Component**	• Type, nature, length and intensity of activity • Proportions of Grizzly Bear Management Unit by road density class for open and total routes (roads and trails) • Level of bear awareness and application of knowledge of people working, living and recreating in the area • Other human dimensions (e.g., values, attitudes, opinions)	*Avoid human-bear conflicts in high-value grizzly bear habitat identified in Map 5* *Limit road development and the number and duration of entries within moderate-value grizzly bear habitat identified in Map 5* *Provide opportunities for movement with minimal disturbance from humans between important landscape features in the Boucher Creek Wetlands management unit, the Nichyeskwa South management unit and the Nichyeskwa North management unit (Map 5)* Objective for Wildlife: *Provide for wildlife habitat and populations by implementing and timing road location, development and maintenance activities in a manner that minimizes the effects on these values* (ILMB 2006a)	• Only applies to specified habitat types within areas delineated as important for grizzly bear habitat • Low reliability (for this purpose) of mapping for important grizzly bear habitat • No definition for human–bear conflicts but assume that this includes all negative interactions (e.g., displacement or other disturbance, human-caused grizzly bear mortality). • Negative human–bear interactions (e.g., those associated with human-disturbed habitat and anthropogenic food sources) need to be avoided and prevented throughout the plan area, not just important grizzly bear habitats • A strategy specific to road development is provided for moderate value habitat but it is not clear what the objective is • Term 'provide' is inappropriate because, for example, it is possible to 'provide' high value grizzly bear habitat (from a foraging perspective), at least for a period, in human altered habitats (e.g., road-right-of-ways, cutblocks) • It is not clear what important landscape features are being referred to for the specified management units • Core secure not addressed.
Minimize human-associated grizzly bear mortality (a sub-set of human–bear interactions) **Mortality Risk Component**	• Proportion core secure area by Grizzly Bear Management Unit • Habitat quality (intact and human-disturbed habitats) • Availability of anthropogenic food • Level of bear awareness and application of knowledge of people working, living and recreating in the area • Levels and types of use • Other human dimensions (e.g., values, attitudes, opinions) • Presence of firearms		

Table 12. Continued

Objective/ Component	Proposed Indicators	Bulkley Objectives Set by Government	Considerations for Potential Effectiveness
Maintain movement corridors to allow for grizzly bear movements at a population scale and landscape scale. **Fragmentation Component (sub-regional-, landscape-levels)**	• Barriers to movement • Mortality hotspots or sinks. **Derived from Compulsory Inspection Forms and Problem Wildlife Occurrence Reports**	None	Not addressed
Overall risk to grizzly bear population	Consider range of indicators to assess cumulative effects of land and resource use on the Babine Grizzly Bear Population Unit. **To be defined.**	None	• Only addresses limited range of land uses (largely guidance for forestry and range practices) and potential impacts. Does not provide manage direction needed for mineral exploration and mining; oil and gas exploration, development, and transport; motorized and non-motorized recreational use etc. • BWMT area of interest inappropriate scale to achieve goal. Need to consider a much larger, biologically relevant unit for the population of bears that use this and /or adjacent areas.

Table 13. A proposed conceptual framework for grizzly bear conservation to support land and resource management and monitoring for grizzly bears with considerations for the potential effectiveness of objectives presented in the West Babine Sustainable Resource Management Plan (SRMP) for achieving the goal of maintaining the grizzly bear population in the Babine Watershed Monitoring Trust area of interest. REVIEW DRAFT FOR DISCUSSION PURPOSES ONLY. Text in *italics* is for direct quotes.

Objective/ Component	Proposed Indicators	West Babine SRMP Objective	Considerations for Potential Effectiveness
Maintain effectiveness of important grizzly bear habitat (i.e., realized habitat value). **Habitat Effectiveness can be derived from Habitat and Disturbance Components (sections following)**			
Maintain important grizzly bear habitats for all life requisites (i.e., habitat potential) **Habitat Component**	Percentage of intact important grizzly bear habitat polygons (appropriately reliability) with sufficient buffers for cover and bedding	*To maintain the integrity of and linkage amongst grizzly bear habitats* (MSRM 2004a:p. 29)	• Only applies to specified important grizzly bear habitat types within areas delineated as important grizzly bear habitat (i.e., high value grizzly bear habitat polygons) • Low reliability for mapping of important grizzly bear habitat • Best available grizzly bear habitat mapping was not presented or referenced • Some important grizzly bear habitat types identified in the Babine River Interim LRUP were omitted from this plan, notably some forested habitat types that were considered important to grizzly bears • "distance of roads from critical habitats" indicator could also be linked to human–bear interactions
	Percentage of intact important grizzly bear habitat types with sufficient forest for cover and bedding	*To provide forest cover adjacent to non-critical habitats in order to provide visual (security) and resting (bedding) cover* (MSRM 2004a:p. 29)	
Minimize disturbance of grizzly bear activity (a sub-set of bear–human interactions) **Disturbance Component**	• Type, nature, length and intensity of activity • Proportions of Grizzly Bear Management Unit by road density class for open and total routes (roads and trails) • Level of bear awareness and application of knowledge of people working, living and recreating in the area • Other human dimensions (e.g., values, attitudes, opinions)	*To minimize the impact of road building and forest harvesting activities on critical habitat* (MSRM 2004a:p. 29)	
		To reduce number of human bear interactions (MSRM 2004a:p. 26)	Applies to entire plan area. Indicators only applied to "roads open for timber harvesting at any one time", pubic bear awareness and level of tourism use. Many important indicators of bear–human interactions not captured. Term 'open' is not defined. However, "*deactivated roads will not contribute to the road density target*" and are defined as "*roads which effectively prevent four wheel drive access*". Human disturbance need to be anticipated and managed for in these areas.
		Objectives to minimize disruption to bear use, bear movement and risk of bear–human interactions or grizzly bear-related conservation values for: Big Slide AMZ, along Shenismike Creek, Sperry/Rosenthal AMZ, north of Babine River and east of Shenismike Creek and Shenismike West AMZ (MSRM 2004a: pp.27 & 28)	Specified areas only. Definitions for mortality and displacement are provided [1, 2,]but it is unclear why variations in human–bear interaction-related terms used for each area. If these areas are considered important to grizzly bears then the objective for all should be to minimize risk of bear–human interactions and then specific components of this risk could be highlighted, if/as considered appropriate.

Table 13. Continued

Objective/ Component	Proposed Indicators	West Babine SRMP Objective	Considerations for Potential Effectiveness
Minimize human-associated grizzly bear mortality (a sub-set of human–bear interactions) **Mortality Component**	• Proportion core secure area by Grizzly Bear Management Unit • Habitat quality (intact and human-disturbed habitats) • Availability of anthropogenic foods • Level of bear awareness and application of knowledge of people working, living and recreating in the area • Levels and types of use • Other human dimensions (e.g., values, attitudes, opinions) • Presence of firearms	*To reduce number of human bear interactions* (MSRM 2004a:p. 26)	• Applies to entire plan area. This plan acknowledges that effect of human-caused mortality will be much greater than the effect of habitat displacement but strategies to reduce risk of grizzly bear mortality are considered insufficient. Reduction of major risk factors should also include, but not be limited to: bear awareness education for workers and residents (i.e., permanent and seasonal) and bear awareness education for hunters, anglers and various recreationist that can be anticipated to interact with bears; removing and securing anthropogenic foods and other attractants; closing roads to all exclude all types of motorized vehicles; minimizing access to important grizzly bear habitat; and/or minimizing increases in habitat value associated with the development (e.g., road right-of-ways, cutblocks) in areas used by people. • Road density targets only provided for Shedin and Hanawald watersheds. Term 'open' is not defined. However, it states "*deactivated roads will not contribute to the road density target*" and are defined as "*roads which effectively prevent four wheel drive access*". Human use (motorized/non-motorized) can be anticipated for these areas.
		Objective to minimize risk of bear–human interactions specifically referred to for Shenismike West AMZ	Specified area only. Unclear why this is the only AMZ with this all-encompassing objective that is needed to effectively manage human–bear interactions. Secure area not explicitly addressed.
Maintain movement corridors to allow for grizzly bear movements at a population scale and landscape scale. **Fragmentation Component (sub-regional-, landscape-levels)**	• Barriers to movement • Mortality hotspots or sinks. **Derived from Compulsory Inspection Forms and Problem Wildlife Occurrence Reports**	*To maintain the integrity of and linkage amongst critical grizzly bear habitats* (MSRM 2004a:p. 29)	• No indicators are provided to maintain linkage at a regional or sub-regional scale. Plan does not provide direction to reduce population fragmentation or physical barriers to movements. • Only applies to the identified important habitat types within polygons delineated as important grizzly bear habitat (see habitat considerations above). At a landscape scale, the only indicator is the "amount of alteration of critical habitats" (p.29), which does not address fragmentation.
Overall risk to grizzly bear population	Consider range of indicators to assess cumulative effects of land and resource use on the Babine Grizzly Bear Population Uni. **To be defined.**	No objectives	• Only addresses limited range of land uses (largely guidance for forestry and range practices) and potential impacts. Does not provide management direction needed for mineral exploration and mining; oil and gas exploration development, and transportation; motorized and non-motorized recreation etc. • BWMT area of interest inappropriate scale to achieve goal. Need to consider a much larger, biologically relevant unit for the population of bears that use this and /or adjacent areas.

[1] "potential for increased risk of *bear mortality* due to human-grizzly bear interactions e.g., negative habituation, bears being shot in defense of life and property, illegal kills" (MSRM 2004a:p. 22)

[2] "potential for increased risk of *displacement* of grizzly bears from their preferred habitats, primarily due to disruption (noise, human activity)" (MSRM 2004a:p. 22)

2.3 Objective to Maintain Important Grizzly Bear Habitat: Land Use Planning

For a benchmark, I adapted an objective for grizzly bear habitat provided in the *Identified Wildlife Management Strategy* (MWALP 2004a), as a proposed grizzly bear conservation objective for land use planning. For the purpose of this review, it is recognized that land-use planning objectives for grizzly bears were developed with consideration for other values and interests. I assessed each of the land-use objectives relevant to important grizzly bear habitat for risk to the goal of maintaining the grizzly bear population using clarity of intent and validity (scientific and technical) as indicators and as compared to the proposed conservation objective (Table 14).

I found that several of the land-use objectives, including some in the legally enforceable *Bulkley OSG* (ILMB 2006a) and the *West Babine SRMP* (MSRM 2004a), were mixed with strategies. That is, objectives were constrained to the specified habitat types or mapped areas. Whereas, guidance provided in *Writing Resource Objectives and Strategies, a Guide to Preparing Effective Resource Management Plans* suggests

> *"As a general rule, mixing objectives with strategies in a statement that will become legally enforceable land use objective should be limited to situations where the strategy is:*
>
> - *technically sound*
> - *achievable*
> - *the best way to achieve the objective*
> - *not likely to be amended in the foreseeable future*
> - *certainty of outcome is important"* (MSRM 2004a:p. 25).

Table 14. Risk to the goal of maintaining the grizzly bear population for grizzly bear habitat-specific objectives in land use plans for the BWMT monitoring area. Text in *italics* is for direct quotes.

Document	Objective	Risk to Goal	Comments
Adapted from Identified Wildlife Management Strategy (MWLAP 2004a)	Example of a best standards-based conservation objective*:* Maintain the ecological integrity and effectiveness of seasonally (i.e., spring, summer, fall, denning) important habitats for life requisites for food, security and thermal cover and hibernation (see p. 16).	Low	Intent clearly defined and considered valid based on best available knowledge, standards and practices. Objective does not include strategies, indicators or targets.
Babine River Interim LRUP (MOF and MELP 1994a)	Land-use objectives Long-term intent "*no net loss of important grizzly bear habitat"*. Primary objectives: "*minimize bear-human conflicts and preserve high-value habitat"* (p. 23).	High	Long-term intent broadly defined. High value habitat objective combines strategy by providing direction for specified habitat types (within and outside of mapped areas), provisionally estimated as low reliability. No limitations of data or gaps in information identified in plan.
Bulkley LRMP (BVCRIPT 1998)	Land-use and habitat specific objectives Upper Nilkitkwa, Barbeau Creek (SM1): *To manage a watershed in a primitive state, while permitting sensitive mineral exploration and development. Water quality, goat and grizzly bear habitat, and wilderness recreation opportunities are all to be maintained* with direction to maintain grizzly bear habitat (p. 53). Upper Nilkitkwa, Nilkitkwa River (IRM); no objective for grizzly bears or their habitat (p. 54). Babine River Corridor (P): *To maintain the wilderness quality of the high-value grizzly bear habitat located in close proximity to the river through designation and management as a protected area. To manage according to guidelines set out in the Babine River Interim Local Resource Use Plan (LRUP)* (p. 57). Babine River (SM2): *To protect and buffer the river-based resource values within the protected corridor* (Sub-unit 2-1). *To follow the guidelines set out in the Babine River Interim Local Resource Use Plan (LRUP)* (p. 58). Babine (IRM): *To manage for a variety of values and activities in an integrated and compatible manner. Follow the guidelines set out in the Babine River Interim Local Resource Use Plan (LRUP) and Coordinated Access Management Plan (CAMP)* (p. 60).	High	Intent for grizzly bear habitat not clearly defined. Assumption Babine River Interim LRUP objectives apply because this plan defers to Babine River Interim LRUP for direction for specified management zones and provides direction to coordinate management of Barbeau Creek unit with the other planning units.

Table 14. Continued

Document	Objective	Risk to Goal	Comments
Bulkley LRMP Objective Set by Government (ILMB 2006a)	Land-use objectives *Provide high-value habitat buffered for security and bedding for grizzly bears in the locations identified in Map 5* (p. 9). *Provide diverse understory within high-value, mixed forest habitat identified in Map 5* (p. 9).	High	Combines high-risk strategy (i.e., constraining habitat objective to mapped locations with low reliability for that purpose) with objective.
Kispiox LRMP	Land-use objectives *To maintain natural ecosystems and habitat to sustain viable populations of all native wildlife within their natural ranges* (p. 45).	Low	Intent relatively clear (covers all wildlife species)
West Babine SRMP (MSRM 2004a)	Land-use objectives *Within high-value habitat:* *To maintain the integrity of and linkage amongst critical grizzly bear habitats* [as listed in plan]. *To provide forest cover adjacent to non-forested critical in order to provide visual (security) and resting (bedding) cover.* *To minimize the impact of road building and forest harvesting activities on critical habitat* (p. 29).	High	Combines high risk strategy (i.e., constraining habitat objective to mapped locations with low reliability for that purpose) with objective.
BWMT Knowledge Base	Summary of land-use objectives Maintain high-value habitat	High	Based on plan summary, this objective is combined with a high risk strategy (i.e., constraining habitat objective to mapped location with low reliability with low reliability for that purpose)

2.4 Strategies to Maintain Important Grizzly Bear Habitat

To support effectiveness monitoring, I used the following indicator as an interim measure: Percentage of intact important grizzly bear habitat with sufficient forest for cover and bedding (revised from Price and Daust 2005b).

Important grizzly bear habitat is defined as high (Class 1) and moderately high (Class 2) for habitat suitability as determined by a qualified professional based on their knowledge and experience and best available information.

A summary of interpretations for mapped grizzly bear habitat and estimated reliability is provided in Table 15.

Table 15. Key considerations for assessing reliability of interpretations for mapped grizzly bear habitat in the BWMT area of interest.

Key Considerations	Babine River Interim LRUP Treatment Units	GB Habitat Suitability/Capability Upper Nilkitkwa	Babine LRUP Treatment Unit Mapping Extension, Kispiox Forest District	Kispiox PHM Version 3	Best Standards for Landscape-level Planning[1]
Grizzly bear habitat polygons based on	Biophysical mapping – precursor to Terrestrial Ecosystem Mapping, pre-Resource Inventory Committee Standards	Terrestrial Ecosystem Mapping – based on RIC (1996) standards	Habitat suitability mapping (version 1): Precursor to Predictive Habitat Mapping	More refined Predictive Habitat Mapping	Delineate potentially important grizzly bear habitat based on distinct ecosystem units or complexes (2 or 3) of ecosystem units on large scale airphotos or orthophotos (preferable) (MacHutchon 2007)
Knowledge base	Poor understanding of this grizzly bear ecotype(s). Based on limited area specific information and some studies of grizzly bears conducted in different biogeoclimatic zones	Poor understanding of this grizzly bear ecotype(s). Based on limited area specific information and some studies of grizzly bears conducted in different biogeoclimatic zones.	Fair understanding of this grizzly bear ecotype(s). Knowledge improving overtime with biologists conducting more fieldwork in the area. Based on more area specific information and studies of grizzly bears conducted in different biogeoclimatic zones. Knowledge also improving provincially as more studies accumulate.	Good understanding of this grizzly bear ecotype based extensive area specific information from predictive habitat mapping, a comprehensive understanding of grizzly bear food habits and habitat use in other areas of B.C. and a prematurely ended study of radio-collared grizzly bears conducted in the study area. Additional input from grizzly bear biologist with extensive expertise in grizzly bear habitat gained from a wide range of habitat relevant studies.	Excellent understanding of ecotype based knowledge gained through studies of radio-collared grizzly bears in the study area or the same biogeoclimatic zones.
Map Scale	1:50,000	1:20,000	1:20,000	1:20,000	1:20,000
Biogeoclimatic zones	Did not map parkland and alpine tundra subzones	Entire area	Entire area?	Entire area	Entire area

Table 15. Continued

Key Considerations	Babine River Interim LRUP Treatment Units	GB Habitat Suitability/Capability Upper Nilkitkwa	Babine LRUP Treatment Unit Mapping Extension, Kispiox Forest District	Kispiox PHM Version 3	Best Standards for Landscape-level Planning[1]
Habitat Rating	Ratings for grizzly bear habitat suitability and capability. List of food plants considered not provided. Those plant species referenced do not comprehensively cover known or probable food plants used by grizzly bears in this area.	Ratings for grizzly bear habitat suitability and capability. List of food plants considered not provided. Those plant species referenced do not comprehensively cover known or probable food plants used by grizzly bears in this area.	Ratings for grizzly bear habitat suitability. List of food plants considered not provided. Those plant species referenced did not comprehensively cover known or probable food plants used by grizzly bears in this area.	Ratings for grizzly bear habitat suitability. Comprehensive list of known and probable food plants provided.	Considers habitat suitability based on food plants and cover by ecosystem unit or habitat type. Collective contribution of each habitat type or ecosystem unit within polygon. As feasible, also considers other factors (e.g., landscape position, proximity of polygons, animal foods, intra and inter specific competition, local human influences) (MacHutchon 2007)
Buffer for travel and security and thermal habitat	Did not map buffer	Not determined	Did not map buffer	Did not map buffer	Flagged in mapping for landscape-level planning to be refined through groundwork during development planning. Width of buffer will be variable depending on site-specific conditions (MacHutchon 2007)
Method for delineating polygons	Polygon boundaries on air photos, transferred by hand before being digitized	TEM methods. I could only locate a few project details.	Polygon boundaries digitally generated based on predictive habitat model with some testing	Polygon boundaries digitally generated based on predictive habitat model with more extensive testing	Geometrically corrected airphotos transferred to TRIM and then into GIS (or directly to GIS) Orthophotos digitized directly into GIS (MacHutchon 2007)
Method for delineating important grizzly bear habitats	Based on biophysical map units	Based on ecosystem map units generated to assess habitat for multiple species	Based on ecosystem map units generated specifically for grizzly bear habitat	Based on ecosystem map units generated specifically for grizzly bear habitat	Polygons delineated specifically for grizzly bear habitat
Field verification - polygon line-work	Unknown	Not determined	Not determined	Ground work	Ground work

Table 15. Continued

Key Considerations	Babine River Interim LRUP Treatment Units	GB Habitat Suitability/Capability Upper Nilkitkwa	Babine LRUP Treatment Unit Mapping Extension, Kispiox Forest District	Kispiox PHM Version 3	Best Standards for Landscape-level Planning[1]
Field verification – ecosystem unit classification	Unknown	Not determined	Relatively little	Not specified. Considerably more than other mapping for this area.	Recommend minimum of 5-10% ground assessment and 20-25% air assessment of total polygons. Considers surveyor experience with grizzly bear habitat (MacHutchon 2007)
Field verification - habitat suitability ratings	Low level	Low level	Low level	Not specified – moderate or high	Recommend minimum of 5-10% ground assessment and 20-25% air assessment of total polygons. Considers surveyor experience with grizzly bear habitat (MacHutchon 2007)
Reliability	Lowest	Lowest	Low – report confidence between predicted and actual habitat classification using 3-class (low, moderate or high) rating	Highest for project area but probably not as good as best mapping products for coast	High

[1] Adapted from RIC 1998a and MacHutchon 2007.

2.5 GIS Analysis for Grizzly Bear Habitat

Johanna Pfalz conducted a preliminary GIS analysis for grizzly bear habitat early in the development of this project in July 2010. No further analysis was completed due to budget constraints and time that was needed to gather additional information to determine how effectiveness monitoring for grizzly bear habitat might be conducted.

The *West Babine SRMP* delineated 499.8 km^2 as important grizzly bear habitat (i.e., high value and mixed forest management polygons), covering 21.1% of the total area (Table 16). This included habitat polygons derived from the *Babine River Interim LRUP* (MOF and MELP 1994a) and an early version of PHM used to delineate treatment units for the Babine LRUP Treatment Unit Mapping Extension (Mahon and Marsland 2001). Based on the most recent version of the PHM completed by Mahon et al. (2004), 30.5% of the West Babine SRMP area was mapped as high suitability (Class 1) and moderately high (Class 2, Table 17).

Table 16. Overview of high value and mixed forest management polygons delineated in the West Babine SRMP (MSRM 2004), Kispiox TSA portion of the Babine Watershed Monitoring Trust area of interest, British Columbia. GIS analysis completed by J. Pfalz, July 2010.

West Babine SRMP Area	Area (km^2)	West Babine SRMP Area (%)
High Value Habitat	469.1	19.8
Mixed Forest Management Habitat	30.7	1.3
Total	**499.8**	**21.1**

Table 17. Overview of high (Class 1) and moderately high (Class 2) habitat suitability polygons delineated through PHM (Mahon et al. 2004), Kispiox TSA portion of the Babine Watershed Monitoring Trust area of interest, British Columbia. GIS analysis completed by J. Pfalz, July 2010.

PHM Important Grizzly Bear Habitat Polygons	Area PHM Important Grizzly Bear Habitat Polygons (km^2)	West Babine SRMP Area (%)
Class 1 (High Suitability)	346.0	14.6
Class 2 (Moderately High Suitability)	375.5	15.9
Total	721.4	30.5

Table 18 provides a preliminary analysis examining extent of important grizzly bear habitat polygons delineated in PHM (Mahon et al. 2004) captured within important grizzly bear habitats delineated in the West Babine SRMP (MSRM 2004). Thirty six percent of Class 1 (high suitability) and Class 2 (moderately high suitability) habitat delineated in PHM was

captured within high value polygons delineated in the West Babine SRMP. As previously stated, the West Babine SRMP high value grizzly bear polygons were derived from two different map products (i.e., Babine River Interim LRUP Treatment Units, MOF and MELP 1994a; Babine LRUP Treatment Unit Mapping Extension, Mahon and Marsland 2001). Some important grizzly bear habitat delineated through PHM also falls within other West Babine SRMP management units and zones, which provide varying levels of protection of relevance to maintaining grizzly bear habitat. As such, this analysis is considered incomplete but I did not explore this further due to limited funding.

Table 19 provides a preliminary analysis examining the percentage of important grizzly bear habitat polygons in the West Babine SRMP (MSRM 2004) that was rated as important grizzly bear habitat in the PHM (Mahon et al. 2004). Fifty two percent of the total area delineated as high value grizzly bear habitat polygons in the West Babine SRMP was rated as Class 1 or Class 2 in PHM.

Table 18. Preliminary analysis examining extent of important grizzly bear habitat polygons delineated in Predictive Habitat Mapping (Mahon et al. 2004) captured within important grizzly bear habitats delineated in the West Babine Sustainable Resource Management Plan (MSRM 2004). GIS analysis completed by J. Pfalz, July 2010.

PHM Important Grizzly Bear Habitat Polygons[1]	Area (km^2)	Area of PHM Important Habitat Captured in West Babine SRMP Important Habitat (km^2)[2]	% PHM Important Habitat Captured in West Babine SRMP Important Habitat
Class 1	346.0	120.3	34.8
Class 2	375.5	138.8	37.0
Total Class 1 and Class 2	721.4	259.1	35.9

[1] Important grizzly bear habitat polygons in PHM include Class 1 (high) and Class 2 (moderately high) habitat suitability.

[2] Important grizzly bear habitat polygons in West Babine SRMP include high value and mixed forest management polygons that were derived from MOF and MELP (1994a) for the Babine River Interim LRUP area and Mahon and Marsland (2001) for the Babine LRUP Treatment Unit Mapping Extension area.

Table 19. Preliminary analysis examining percentage of important grizzly bear habitat polygons in West Babine Sustainable Resource Management Plan (MSRM 2004) rated as important grizzly bear habitat in PHM (Mahon et al. 2004). GIS analysis completed by J. Pfalz, July 2010.

West Babine SRMP Grizzly Bear Habitat Polygons[1]	Area (km^2)	Area of West Babine Important Habitat Polygons Rated as PHM Important Habitat (km^2)[2]	% West Babine Important Habitat Polygons Rated as PHM Important Habitat
High Value	469.1	244.7	52.1
Mixed Forest Management	30.7	14.4	45.6
Total Important Polygons	499.8	259.1	51.8

[1] Important grizzly bear habitat polygons in West Babine SRMP include high value and mixed forest management polygons that were derived from MOF and MELP (1994a) for the Babine River Interim LRUP area and Mahon and Marsland (2001) for the Babine LRUP Treatment Unit Mapping Extension area.
[2] Important grizzly bear habitat polygons in PHM include Class 1 (high) and Class 2 (moderately high) habitat suitability.

2.6 Objectives to Minimize Human–Bear Interactions: Land Use Planning

Minimizing grizzly human–bear interactions includes minimizing human-associated disruption (i.e., temporary disturbance, may result in temporal or spatial avoidance), displacement (i.e., habitat avoidance reducing habitat effectiveness) and mortality. These can be considered sub-sets of the main objective.

2.7 Strategies to Minimize Human–Bear Interactions

For the objective to minimize bear-human interactions, I propose the indicators presented in Table 20 for further consideration to develop an effectiveness monitoring program. I have presented proposed indicators with indicators derived from a review of land use plans completed by Price and Daust (2005) for reference purposes. I provide comments for consideration.

Table 20. Indicators for monitoring land use plans derived from a review of land use plans completed by Price and Daust (2005) with indicators proposed in this project for further consideration to develop an effectiveness monitoring program for the Babine Watershed Monitoring Trust area of interest.

Indicators in Land Use Plans (Price and Daust 2005)	Indicator Human/bear Interaction (includes mortality and displacement)	Indicator Disruption of Bear Activity	Risk Considerations	Proposed Indicators For Further Consideration	Indicator Risk of Human-Caused Mortality	Indicator Displacement	Indicator Disruption	Comments
Risk Curve: Open road density per watershed or habitat unit	√		Risk to grizzly bear mortality versus road density (0.6 km/km² estimated as moderate risk). Consider effectiveness of deactivations and gates.	**Primary: Proportions of Grizzly Bear Management Unit by road density class for open and total routes (i.e., roads and trails)**	?	√		• Open road density, total road density and core secure area need to be considered together. • Open road density and total road density influence risk to objective for displacement. Also influences risk of human-caused mortality but needs additional consideration (e.g., literature review, expert input).
Risk Curve: Open road density in specified areas		√	Risk to grizzly bear disruption versus amount of motorized use in active seasons					
				Primary: Proportion core secure area by watershed or grizzly bear management unit	√	√	√	• Open road density, total road density and core secure area need to be considered together. • Core secure area estimated as low or nil risk of human-caused mortality and displacement
Risk Curve: Investment in education programs	√		Risk to grizzly bear mortality versus investment in education programs	**Primary: Initiation and effectiveness of education programs for avoiding, preventing and responding to bear incidents**	√			
				Primary: Initiation and effectiveness of hunter education programs	√			

Indicators in Land Use Plans (Price and Daust 2005)	Indicator Human/bear Interaction (includes mortality and displacement)	Indicator Disruption of Bear Activity	Risk Considerations	Proposed Indicators For Further Consideration	Indicator Risk of Human-Caused Mortality	Indicator Displacement	Indicator Disruption	Comments
Length of road in high value habitat	√		Risk of grizzly bear mortality versus road density					Not appropriate indicator.
Length of road <150 m from critical habitat	√		Risk of grizzly bear mortality versus road density	Secondary: Proportion of open routes (roads and trails) <150 m from important grizzly bear habitat types	√	√		Needs ground investigation. Distance arbitrary.
				Secondary: Proportion of important grizzly bear habitat patches with sufficient habitat for thermal and security cover and travel	√	√		Needs ground investigation.
% of road through listed areas and habitats with screening	√		Risk of grizzly bear mortality versus road density	Secondary: Proportion of open roads without screening	√			Habitat disturbance creates attractive habitats.
Percent of road with >300 m sight distance in Babine River SMZ and SM2	√		Risk of grizzly bear mortality versus road density	Secondary: Proportion of road with > 300 m sight line distance	√			Interviews indicate this may not be practicable
Seeded forage along open roads	√		Risk of grizzly bear mortality versus road density	Secondary: Proportion of open routes (roads and trails) through human-disturbed habitats that have high value for foraging for food plants	√			Consider all food types that increase food value along roads including early seral species, introduced species, increased berry productivity
Food availability	√		Risk of grizzly bear mortality versus road density	Secondary: Availability of anthropogenic food	√			Consider location, attractant value, abundance
				Secondary: Presence of people with firearms	√			Firearms not restricted from any area, provided within legal requirements

Indicators in Land Use Plans (Price and Daust 2005)	Indicator Human/bear Interaction (includes mortality and displacement)	Indicator Disruption of Bear Activity	Risk Considerations	Proposed Indicators For Further Consideration	Indicator Risk of Human-Caused Mortality	Indicator Displacement	Indicator Disruption	Comments
Proportion of time with harvesting activity		√	Risk to grizzly bear disruption versus harvesting activity during active season	To be considered				Important consideration but not covered in this project
Length of time between passes in years		√	Risk to grizzly bear disruption versus duration of inactive period between passes	To be considered				Important consideration but not covered in this project

No land use plans highlight the importance of core secure area in management to conserve grizzly bear populations. The *West Babine SMRP* (MSRM 2004a) was the only land use plan that provided management direction specific to road density as specified in the following

Objective: "*To reduce the number of human bear interactions".*

- Indicator a: *"Density of roads by mid-sized watersheds (see Map 5, page 70) open to timber harvesting activity at one time".*
- Target/Measure a: "*80% of Shedin and Hanawald watersheds <0.6 km/km²".*
- Management Considerations: "*These thresholds should be monitored and re-evaluated in conjunction with the watershed assessments. Initial report should be completed in 10-15 years. Deactivated roads* [defined as roads which prevent four wheel drive access] *will not contribute towards road density target. Minimize number of road networks open at any one time. Mortality risk to bears within the plan area will be reduced by:*
    - *Harvesting in winter;*
    - *Deactivating or blocking temporary roads and secondary roads after operations are completed"* (West Babine SRMP 2004a:p. 26).

Direction provided in the *West Babine SRMP* does not effectively address the need for core secure area to achieve the goal to maintain grizzly bears because core secure area was not specifically identified in this plan and overall plan direction for control of motorized access lacks rigor and in some cases specific directions were inconsistent.

A risk assessment tool was created to report on grizzly bear habitat conditions to consider potential development scenarios in the *West Babine SRMP Technical Report* (MSRM 2004b). In this document, "a core secure area is any patch of ground that does not contain an open road (any existing roads must be in an *inaccessible condition*) or the influence of a road and where the impact of roads on grizzly bear mortality is minimized." There is little direction in the *West Babine SRMP* to ensure that roads are appropriately closed (i.e., inaccessible to all types of motorized vehicles).

The strongest statement regarding access in the *West Babine SRMP* is as follows: "*In addition to the above access control points, secondary and tertiary roads throughout the plan area should be decommissioned following the completion of planting, to the extent that motorized traffic is not practical or is prohibited"* (West Babine SRMP 2004a: p. 62). Unfortunately, this statement is the summary of access management and comparable statements are not within the main sections providing management direction, most of which explicitly or implicitly do not provide direction to exclude all types of motorized access.

The *Interim Babine River CAMP, Bulkley Portion* (MELP and MOF 1994b) provided management direction regarding road density for the Bulkley TSA as follows:

> *Guidelines for active primary road densities are 25 km of road per 100 km2* (sic).

> *Guidelines for active secondary road densities are 50 km of road per 100 km2* (sic).
> *Roads are not active when access is no longer possible with a four wheel drive pickup* (MOF and MOE 1994b:p. 18).

These guidelines also do not address the need for core secure area to achieve the goal to maintain grizzly bears.

2.8 Management Direction for Babine River Corridor Provincial Park

BC Parks does not have a park management plan, recreation management plan or human–bear interaction management plan in place for management of Babine River Corridor Provincial Park. These are needed to effectively address the goal to maintain grizzly bears.

Wellwood (2012) highlights grizzly bear conservation and public safety issues and one bear expert's perspective regarding the limited effectiveness of efforts to-date to address human–bear management in the southern park entrance area. Numerous people have worked hard to find better ways of moving forward to address public safety and grizzly bear conservation issues in this area, yet arguably most of the important risk factors remain unaddressed.

2.9 Other Monitoring and Grizzly Bear-Related Initiatives

Specific to management direction for grizzly bears, some site-specific and broadly applicable problems of relevance to monitoring *Babine River Interim LRUP* and *Interim Babine CAMP, Bulkley Portion* direction for grizzly bear habitat and access have been previously reported

- Monitoring for the Babine River Interim LRUP (Laing and McCulloch 1994, Hillcrest Consulting 1995, Saimoto and Rysavy 1996) provides some anecdotal information specific to harvesting and road development investigations in high value grizzly bear habitat.
- Other studies point to some broader concerns including
  - Easy access into important grizzly bear habitats (Hatler 1998, MacHutchon and Mahon 2003, D. Wellwood pers. obs.)
  - Long line-of-sight distances (MacHutchon and Mahon 2003, D. Wellwood pers. obs.)
  - Attractive forage along road right-of-ways or landings, or both (MacHutchon and Mahon 2003, Wellwood 2003). Notably, clover was considered a major problem.

Several other reports reviewed for this project identified a wide range of issues of concern specific to grizzly bears.

From other monitoring perspectives, exemplary report cards have been given for overall forestry practices (e.g. FPB 2009, 2010) and for bear-related indicators examined in the State of the Forest Reports (Ministry of Forests and Range [MOFR] 2004a, 200b).

3 Key Findings

3.1 Overall Management Direction in Land Use Planning

- The *Babine River Interim LRUP* was divided into two planning areas for the Kispiox and Bulkley LRMP processes, each of which was expanded to include the Babine LRUP Treatment Unit Extension area for Kispiox portion and the Upper Nilkitkwa Planning Unit for the Bulkley portion. This resulted in planning history that was a disjointed and challenging to track.
- Planning has a minimum of five very different outcomes for the 1) Babine River Corridor Provincial Park, 2) Babine Planning Unit, 3) Upper Nilkitkwa Planning Unit, 4) West Babine SRMP, Babine River Interim LRUP portion, and 5) West Babine SRMP, Babine LRUP Treatment Unit Mapping Extension portion.
- The BWMT area of interest is too small to support a goal of maintaining or conserving grizzly bears. Management and associated effectiveness monitoring needs to be conducted over a much larger area that considers the ecology, behaviour and demographics of grizzly bears; and Province of B.C. management of the grizzly bear population including hunter harvest.
- While grizzly bears figured prominently throughout land use planning, priorities for their conservation appear to have diminished over time, based on changes made in management direction.
- Some key limiting factors for maintaining grizzly bears appear to be insufficient understanding or application of scientific knowledge about them and their needs for conservation; gaps in roles, responsibilities and resources to address some important management issues including cumulative effects of land and resource use at sub-regional and landscape-levels; and diminishing resources and capacity for action.
- Many recommendations made by biologists and expressed intentions presented in planning have not come to fruition.
- The *Bulkley LRMP* largely focused on the Babine and Upper Nilkitkwa planning units for grizzly bear habitat. Some additional direction was provided for grizzly bear habitat for a narrow corridor along the Telkwa River and for the Serb Creek watershed. Grizzly bear habitat mapping was never completed for these areas.
- The *Kispiox LRMP* provided more direction for grizzly bears in areas outside of the BWMT area of interest. These have major relevance to potential outcomes for grizzly bears in the project area. I did not review these in detail.
- The Fort St. James and Morice LRMP areas also border the BWMT area of interest. These have major relevance to potential outcomes for grizzly bears in the project area. I did not review these in detail.
- A conceptual framework for grizzly bear conservation is needed for discussion purposes, to identify gaps in and limitations of land use planning for achieving grizzly bear conservation and management goals; and to support adaptive management for grizzly bears and their habitat, and human–bear interactions. Peer review and expert input can be used to revise or adapt a draft framework that I have proposed here, as considered appropriate. Notably, additional expert input is needed to select, refine or adapt objectives and indicators and estimate appropriate

targets or thresholds for landscape conditions, at appropriate scales. This should be done in collaboration with the Province of B.C. with consideration for other grizzly bear initiatives in progress, as considered appropriate.

3.2 Objectives to Maintain Important Grizzly Bear Habitat

- A conservation objective is needed for grizzly bear habitat. None of the land use plans clearly and comprehensively identify and describe important grizzly bear habitat, as currently described based on best available standards.
- Constraints on legal objectives to mapped grizzly bear habitat polygons severely reduce the potential effectiveness of habitat management for grizzly bears. Confining the objectives to mapped habitats may be a reasonable option if map products are highly reliable, they are completed at an appropriate scale for their intended application, risk and associated uncertainty are considered, long-term habitat supply is considered, and effectiveness monitoring can be conducted to detect and address potential issues that may need to be addressed.

3.3 Strategies to Maintain Grizzly Bear Habitat

- Terminology and standards used to describe ecosystems or grizzly bear habitat types and associated value interpretations were highly variable throughout the knowledge acquisition and land-use planning processes.
- Inaccurate or inconsistent use of terminology, differences in methods, and limited rationale for changes to strategies for grizzly bear habitat may contribute to variable use of information resources and their interpretations and, I suspect, frustration for some of those trying to manage resources, particularly at the operations and site-level of planning and development.
- Interpretive mapping for grizzly bear habitat provides tools to highlight areas estimated as having greater concentrations of important grizzly bear habitat and support landscape level decisions. Their reliability varies depending on the product used and for what purposes.
- Not all important grizzly bear habitats delineated by researchers were identified as such in land use planning. Other treatment units and management zones overlap some important habitat polygons. For example, the “best of the best” grizzly bear habitat in the *West Babine SRMP* Babine LRUP Treatment Unit Extension area was mapped as Core Ecosystem (Treatment Unit 2, T. Mahon pers. comm.). Its importance to grizzly bears was identified in the treatment unit mapping report but not in the *West Babine SRMP*.
- Map products were largely based on estimated habitat value for food plants. Thus there are major gaps in available information and direction to maintain habitats to fulfill other life requisites such as food animals (e.g., salmon, small mammals, ungulates, insects), denning, and travel; and probably to some extent thermal and security cover. Additionally, habitats with lower food value may be important for females with young cubs that are less tolerant of human activities, as needed to fulfill security requirements. These also need to be considered.
- Other concerns reducing potential effectiveness of grizzly bear habitat management include

- No wildlife habitat areas have been designated for grizzly bears. A proposal for a Wildlife Habitat Area for Shenismike West, adjacent to Grizzly Drop on the Babine River, has been presented and discussed over numerous years.
- Grizzly bear habitat polygons have not been delineated in land use planning for parkland and alpine areas in the Bulkley TSA portion and the portion of the Kispiox TSA that was originally mapped in the Babine River Interim LRUP and subsequent plans derived from this map.
- Landscape and sub-regional level planning direction is needed to address affects on grizzly bear habitat of forest harvesting associated with mountain pine beetle and non-forestry land and resource developments and uses including commercial recreation, mineral exploration and development, linear corridor development (e.g., pipelines, transmission lines, transportation routes), and others; and ensure sufficient habitat supply over the long term.

3.4 Objectives to Minimize Human–Bear Interactions

Land use planning does not provide a conceptually sound foundation to manage human–bear interactions. The set of conservation objectives is needed to support effectiveness monitoring because it would more explicitly and appropriately define human–bear management, from the perspective of maintaining the grizzly bear population for the long term; some of these will fall outside of the mandate of land use planning and others may have multiple parties with mandates relevant them. By providing a comprehensive set of conservation objectives, decision-makers and others will have a better understanding of the overall management context to better support their decisions.

3.5 Strategies to Minimize Human–Bear Interaction

- Most notably, there was no management direction to maintain secure areas for grizzly bears (i.e., areas providing important grizzly bear habitats with low risk of human-caused mortality).
- Land use planning did not identify or address several major access-related risk factors in areas where bears and people overlap.
- Implemented strategies controlling access (e.g. road deactivation, gates) prevent people in some types of motorized vehicles (e.g., cars, 2 and 4 wheel drive trucks) from driving in some areas for some or all of the period bears are active. However, effectiveness has been compromised because little direction was provided to explicitly exclude all types of motorized vehicles (e.g., All Terrain Vehicles [ATV], other Off Road Vehicles [ORV]).
- The effectiveness of some gates may have been further compromised because designated closure periods were shorter than that recommended by biologists, and even these time periods probably would not provide an appropriate measure of security for the entire season that bears are probably active, at least in some years. In addition, the active period for bears can be anticipated to increase over time as climate changes.
- The issue of motorized access has apparently only been explicitly directed to ensure effectiveness for

  - Big Slide Access Management Zone in the Kispiox TSA (MSRM 2004a). Major re-contouring has been completed along the roadbed (R. Donnelley pers. comm.)
  - All secondary and tertiary roads south of the mainline in the Shenismike-West access management zone (MSRM 2004a)
  - A short spur road leading to the Babine River in the Bulkley TSA. Major re-contouring was completed along the roadbed (R. Donnelly pers. comm.).
- Interviews indicate that some roads in the Bulkley TSA portion probably warrant closed status (i.e., not accessible by any type of motorized vehicle). This may also be the case for the Kispiox TSA portion. More detailed interviews and field investigations are needed to determine accessibility status for roads.
- Efforts to prevent people in highway-class vehicles from driving circle routes through the plan area appear to have been relatively effective. However, people on ORVs could easily drive around the gate installed for the Nichyeskwa Connector.
- Several trade-off based decisions, reducing the effectiveness of access control, appear to have been made in selecting the designated locations of ACPs in the Kispiox TSA portion. This reduced the amount of area with restricted access and potential effectiveness, as compared to locations recommended by biologists. A risk assessment tool was developed to assess risk to grizzly bear under a variety of access scenarios (MSRM 2004b). However, I did not find reporting for rationale supporting final decisions for gate locations.
- Some concerns compromising effectiveness of management to address human–bear interactions include
  - Gaps in direction to identify important grizzly bear habitat.
  - Gaps in direction to avoid, prevent or mitigate negative effects associated with attractive human-disturbed habitats. Many road right-of-ways and cutblocks that were developed in less important grizzly bear habitats subsequently produce attractive forage for grizzly bears for varying extents of time following disturbance. For example, non-native white clover (*Trifolium repens*) and red clover (*T. pratense*), major attractants for bears, are wide spread along roadsides and landings. The planting of clover to stabilize roadsides has long been a concern expressed by biologists involved in bear-related work in this area.
  - Gaps in direction to avoid, prevent or mitigate negative effects on bears associated with anthropogenic food sources.
  - Uncertain status and prospects for deterring motorized travel on circle routes linking adjacent plan areas. Some general areas of potential concern include the Nichyeskwa Connector, Acorn and Fusion lakes area, Kotsine Pass, and Tommy Jack Pass (e.g., the Sloan Connector was proposed to complete a 230 km road between Stewart and Kemess Mine).
  - Gaps in direction to address negative effects of human–bear interactions stemming from non-forestry related land and resource development.
  - Gaps in direction to address risk factors associated with access (e.g., air and ground, motorized and non-motorized, on and off roads).

3.6 Effectiveness Monitoring for Grizzly Bear Habitat

- Bulkley TSA Portion: Analysis to determine effectiveness of maintaining grizzly bear habitat is not feasible, given relatively low reliability of habitat mapping for identifying the locations of grizzly bear habitat on the ground, gaps in information and limitations of data; and direction provided in land use planning. Extensive fieldwork required.
- Kispiox TSA Portion: More reliable habitat mapping is available to support more GIS analysis to examine potential effectiveness of land use planning for maintaining grizzly bear habitat. This could include a more comprehensive comparison of best available interpretive mapping with mapping used and direction provided in land use planning.
- For the Kispiox TSA portion, further GIS analysis could be conducted to determine
    - Proportion of Class 1 and 2 grizzly bear habitat polygons delineated in the final version of PHM (Mahon et al. 2004) located in areas delineated in the West Babine SRMP (MSRM 2004a) as 1) high value grizzly bear habitat polygons, 2) Atna-Shelagyote SMZ, 3) Babine River Corridor Provincial Park, 4) Shenismike Corridor, 5) Core Ecosystem polygons, 6) Landscape Corridor polygons, and 7) in areas outside of these units and zones (i.e., points 1 to 6). Consideration will be needed for each unit to determine the level and extent of habitat protection potentially afforded given the management direction for each type of unit or zone. Perhaps an easier and more informative step would be to first look at Mahon et al. (2004) important grizzly bear habitat polygons that occur within areas that do not have some measure of habitat protection to support the habitat objective for grizzly bear conservation.
    - As two different map products formed the basis of treatment unit mapping for the Babine River Interim LRUP area and Babine River Interim LRUP extension area, each area would need to be analyzed separately and they cannot be directly compared. Gaps in information and limitations of data need to be considered for each.

  This type of analysis cannot be completed for the Bulkley TSA portion of the BWMT area of interest because more reliable grizzly bear habitat mapping (e.g., Mahon et al. 2004) is not available for this area.
- Decisions about if and how to proceed with effectiveness monitoring for grizzly bear habitat should consider gaps in and limitations of the knowledge-base and planning; historically limited resources for grizzly bear-related initiatives; and more immediate priorities such as determining core secure area or source-like habitats; for example, an examination of core secure area, open road density and total road density using roving window analysis (e.g., Summerfield et al. 2004; as recommended in Wellwood and Pfalz 2009). Alternatively or complimentary to, the potential use and application of methods developed by Nielsen (2011) should also be considered, perhaps as a review of his analysis at the scale of Babine GBPU, as a preliminary step to support decisions and prioritize efforts.

3.7 Effectiveness Monitoring for Access Control Points

3.7.1 2010 Survey Bulkley TSA Portion

- Boucher Gate (1.8 km on 465 Road): Gate appeared to exclude most types of motorized vehicles.
- South of Nichyeskwa Management Unit: No access control was specified for this management unit. This gate is on Kispiox TSA side. It was installed to control access for a circle route, as directed through the *Bulkley LRMP*. See Section 3.7.2.
- Nichyeskwa North Management Unit (2 km on 456 Road): Gate appeared to exclude most types of motorized vehicles.
- Nilkitkwa Gate (21 km on 481 Road): The gate location is only mapped in the *Nilkitkwa LUP* (MOF 1999b) and no land use plans provided management direction specific to it. People could easily drive ORVs around this gate.
- Nilkitkwa Bridge: An ACP (e.g., through bridge removal) was initially recommended for the Nilkitkwa Bridge (Nilkitkwa FSR) in the *Options for the Babine River* report and deferred by the *Babine River Interim LRUP* to the *Interim Babine River CAMP, Bulkley Portion* for management direction. It was not subsequently designated in land-use plans. The largest hot spot identified based on grizzly bear reports (i.e., Compulsory Inspections for dead bears, Problem Wildlife Occurrence Reports for bears, and relocated or translocated bears; 1990–2011) was in the Nilkitkwa–Babine confluence area (Ciarniello et al. 2012). This area could have been made inaccessible or less accessible for motorized access had effective access control been implemented as recommended in early planning.

3.7.2 2010 Survey Kispiox TSA Portion

- Big Slide AMZ: Appears to effectively exclude all motorized access. One major deactivation was implemented for the Big Slide AMZ with interviewees reporting that the major re-contouring of the road bed and other strategies have apparently been successful for excluding all types of motorized vehicles. I did not visit to verify this. This type of strategy appears to provide the most effective means for achieving road closure to exclude all types of motorized (land) vehicles.
- Nichyeskwa Connector ACP: Ineffective for excluding ORV access. A gate has been installed at the Nichyeskwa Connector. People riding ORVs could, and based on anecdotal reports apparently frequently did, drive around this gate.
- Sperry-Rosenthal ACP: The road ends at the specified ACP location and was thus not yet required. This ACP location was established well beyond the Shedin Creek location recommended for access control by Province of B.C. and consulting biologists.
- Thomlinson ACP: Ineffective. A sign specifying road closure was moved to the roadside when I visited. Recreationists use this road to access the Babine River, via a short hike through a cutblock. As previously stated, there is a plan to install this gate in 2014 (Vanderstar pers. comm. 2013)
- Shenismike West: Ineffective. A trail that appeared to be well used by people traveling on ORVs was cleared from the end of the Sperry Road. Reports indicate a well-established trail was being used to access a cabin in the subalpine (de Groot

2011). I did not investigate further. The ACP location for the Shenismike West AMZ is well beyond the Shedin Creek location recommended by biologists.

- Tommy Jack Pass: Biologists strongly recommended an ACP for this area. No direction was provided for access control in land-use planning.

3.7.3 Both Areas

- With the exception of the Big Slide Access Management Zone, ACP measures rely on voluntary compliance by members of the public, disregarded by some and possibly overlooked by others (e.g., Tomlinson).
- All gates: Reports indicate periodic problems with vandalism (e.g., gate destroyed, lock destroyed), gates being left open during closure periods, and people using portable ramps (or possibly other means) to off-load ORVs over gates. Incidents of people driving ORVs around the Nilkitkwa and North Nichyeskwa gates were also reported and evidence for this was observed during field investigations.

3.8 Effectiveness Monitoring for Babine River Corridor Provincial Park

- Lack of appropriately detailed plans (i.e., park management plan, recreation management plan and human–bear management plan) for Babine River Corridor Provincial Park is a major concern for the goal to maintain grizzly bears. Comprehensive area-specific planning is also needed to address human–bear interactions in the area of major overlap between people and bears that includes the southern park entrance and area outside of BC Parks' jurisdiction (i.e., DFO Lease Lot, Forest Service Road and Babine River bridge and right-of-way, Crown Land).
- Grizzly bears were not considered in the Skeena Quality Waters Strategy, a process involving decisions regarding angler use on the Babine and other rivers (MOE 2010). It is not clear how decisions made might affect potential options to address human–bear management issues on the Babine River, most notably the area around the southern park entrance and Babine River bridge and weir.
- A recommendation to conduct a risk assessment for human–bear interactions, within the context of planning for human–bear management, to support decisions about if and how to proceed with development was not completed for a parking lot built in 2009. The rationale for not doing so was not determined.

3.9 Other Monitoring Initiatives

Findings in this report and the occurrence of multiple parties conducting monitoring for a variety of land use and natural resource management related values point to a need and potential opportunity for collaboration. Efforts to solicit interest and establish common agreement and standards and guidelines for monitoring could provide much needed support. Universal or compatible and complimentary implementation monitoring would probably better utilize resources and could build on previous studies to support more rigorous effectiveness monitoring and reporting on successes and challenges of major relevance to grizzly bears and their habitat.

4 Project Limitations

Limitations for the reviews and assessments for effectiveness monitoring included

- *Missing information*: Some areas delineated as important grizzly bear habitat polygons in interpretive mapping were lost or buried under other management zones or units delineated in land use planning for Bulkley TSA portion.
- *Incomplete survey for important grizzly bear habitats*: Important habitats for grizzly bears for feeding, security and thermal cover, denning and travel, can be expected to occur throughout much of the study area, at sites, in patches and linearly (e.g., well-used trails). Due to the gaps in information and limitations of polygons delineated in land use planning and the limited resources available for this project, I only investigated land use planning objectives and strategies specific to identified important grizzly bear habitat types and polygons. Those were primarily focused on feeding for food plants.
- *Incomplete survey for important planning units*: Several land use planning management units that are also considered relevant to monitoring for grizzly bear habitat that were not explored in this project include, but are not limited to
    - Babine River Corridor Provincial Park
    - Landscape corridors which were formerly riparian ecosystems, upland buffers, potential movement corridors in the Babine River Interim LRUP
    - Landscape corridors which were formerly conservation zones associated with lakes and linkage areas in the Babine River Interim LRUP
    - Core ecosystems some of which were formerly forest ecosystem networks in the Babine River Interim LRUP.
- *Non-spatial aspects not surveyed*: Land use planning related to non-spatial aspects that were not specific to grizzly bear habitat that are know or may potentially be important to maintaining grizzly bear habitat include, but are not limited to, elements of planning specific to maintaining biodiversity.
- *Mapping constraints*: As an example, area originally mapped in *Babine River Interim LRUP* did not include parkland and alpine areas.
- *Non-spatial constraints*: Human–bear interactions posing a threat to grizzly bears can occur anywhere in the project area. For example, they may be attracted to anthropogenic foods in habitats considered unimportant to grizzly bears, as such their risk of human-caused mortality in these areas increases.

Chapter 7: Conclusions, Management Implications, and Recommendations

1 Conclusions

On Challenges of Grizzly Bear Management

"*B.C. faces significant challenges in managing grizzly bears because of the way responsibilities are separately allocated to the MWLAP and the Ministry of Forests. The ability of the MWLAP to accomplish its mission with respect to grizzly bears and other wildlife species requires the active cooperation of the Ministry of Forests and Ministry of Sustainable Resource Management. This is because decisions on whether and how habitat modifications occur are not under MWLAP control. The mission of the MWLAP will not and cannot be accomplished unless these other ministries are active participants in managing the habitat in ways that address the requirements of grizzly bears. If the agency managing the habitat looks at its mission as one of maximizing the production of wood products without regard to the habitats wildlife require on the same landscapes, these landscapes will cease to be areas where wildlife can survive in viable numbers. The format for this collaboration is beyond the scope of this Panel; however, the Panel would be remiss in its obligation under our terms of reference not to identify it as an issue in need of solutions to avoid conflicting missions by different ministries. Based on past history on both sides of the border, such a conflict in missions, if not addressed explicitly, is unlikely to be resolved in ways that benefit grizzly bears*." (Peek et al. 2003:p. 69; Management of Grizzly Bears in British Columbia: a review by an independent scientific panel)

To-date, BWMT grizzly bear-specific projects have explored road density (Wellwood and Pfalz 2009) and reported grizzly bear incidents and human-caused mortality (Ciarniello et al. 2012), as indicators for the objective to reduce human–bear interactions; and development in delineated high value grizzly bear habitat, as an indicator for the objective to maintain important grizzly bear habitat; and ACPs as an indicator for the objective to reduce human–bear interactions (this report). Additionally, this report examined the implementation and effectiveness of planning for achieving the goal to maintain grizzly bears. Collectively, this information can be used to support decisions for monitoring of land use planning to maintain grizzly bears.

1.1 Knowledge Base

In general, attempts to conduct grizzly bear research appear to have been fraught with the challenge of securing adequate funding and other resources. More reliable grizzly bear habitat mapping has not been completed for the Bulkley TSA portion of the study area as originally intended. Attempts to conduct studies of radio-collared grizzly bears ended prematurely (e.g. 1996 project initiated on upper Babine, MacHutchon and Mahon 2003).

Developed as an interim measure until more resources were available and more rigorous scientific methods could be developed, monitoring for grizzly bears in the Babine River Interim LRUP area was inconclusive; probably requiring a major decrease in population before more defensible conclusions could be made (Wellwood 2005). While collectively these studies provide a valuable resource to support decision-making, more rigorous studies are needed to better understand area-specific aspects of grizzly bear ecology, behaviour and demographics; and determine population trend and status. In the interim, a large body of scientific evidence from other areas indicates application of the precautionary principle would be prudent and provides scientifically sound concepts and principles for moving forward to achieve goals and objectives for grizzly bears.

This study identified major gaps in knowledge about the ecology of grizzly bears in the study area and the limitations of data that have been used describe and locate important habitat for grizzly bears in land use planning. Planning direction for important grizzly bear habitat in the *West Babine SRMP* could be improved by applying best available information that has been gathered for the Kispiox TSA portion of the study area. As grizzly bears have not been well studied in areas that are ecologically similar to the Bulkley TSA, careful consideration will be needed in decisions about if and how information from other areas might be extrapolated. While many generalities can be applied, it seems probable that some major differences in ecological, behavioural and demographic characteristics of grizzly bears probably exist in the monitoring area as compared to other areas where they have been extensively studied. As an example, the Parsnip Grizzly Bear Study found that the ecology and movements of grizzly bears utilizing the Arctic watershed of B.C. were much different from grizzly bears in coastal and southern parts of the province (Ciarniello 2006). Such findings serve as reminders to consider the possibility that grizzly bears using the BWMT area of interest demonstrate as yet unidentified combinations of life strategies and adaptations that enable them to interact more efficiently and effectively in this particular environment. This is a coastal–interior transition area that is relatively easily travelled. It has spatially variable diversity and distribution of major food sources (by elevation, east to west, north to south). There are important foods plants indicative of coastal and interior ecosystems and multiple major protein sources, notably moose and salmon. A humble and adaptive approach to management of grizzly bear habitat is needed.

The MacHutchon and Mahon (2003) study provides many valuable insights regarding grizzly bear food habits and habitat use in the study area, in particular for Kispiox TSA portion of the study area. A longer-term radio telemetry study would fill gaps in knowledge to support planning for land and resource management. Short of this, expert-driven habitat assessment that utilizes existing knowledge, formulates assumptions, clearly identifies uncertainties and can be improved over time, as additional information becomes available, would provide a stronger foundation to support management and monitoring decisions regarding land-use in the study area. Ideally, such an endeavour would utilize the knowledge, expertise and skills of multiple bear experts and incorporate local and traditional knowledge.

In the absence of strong evidence from the monitoring area or a reasonably similar area, it was necessary to generate assumptions based on more reliable knowledge about ecology

and behaviour (e.g., habitat use, movement, home range, social behaviour) and demographics (e.g., survival, growth, reproduction) gained through studies (e.g., radio telemetry, genetic sampling) conducted in other areas. By considering area-specific information within the context of stronger evidence from other areas, I believe this project's conclusions are conceptually defensible. A scientific review panel could be used to assess these conclusions. Long-term radio telemetry and genetic sampling population studies of local grizzly bears would be invaluable for increasing area-specific knowledge and decreasing uncertainty.

1.2 Land Use Planning in General

In general, attempts to plan for grizzly bears also appear to have been fraught with challenges securing adequate funding and other resources. Major changes in overall land use planning direction coincide with changes in management regime (i.e., Forest Practices Code, results-based professional reliance). Land use planning has not progressed through the adaptive management process that was originally intended.

The grizzly bear population that utilizes the BWMT area of interest is clearly regionally significant from a land use planning perspective, ecologically, socially and economically. For more than two decades, many people have dedicated considerable time and effort through various land use planning processes to address the challenges and complexities of conserving grizzly bears and other values in a landscape designated for multiple land uses.

The Lake Babine and Gitxsan nations have expressed an interest in grizzly bears and to varying extents have participated in some aspects of planning. However, because they did not directly participate in decisions made at planning tables, these were not fully collaborative processes, an important point in considering next steps.

Land use planning provided little direction to address non-forestry related land and resources use and development to achieve the goal to maintain grizzly bears. This report provides information of relevance to other natural resource sectors.

The results-based, professional reliance management regime provides little assurance for achieving the goal of maintaining grizzly bears, in part because higher level, interdisciplinary and inter-jurisdictional supports for comprehensive and collaborative landscape and sub-regional management of risk factors are limited. Gaps in important land use planning mandates, roles and responsibilities that were formerly filled or committed to by government do not appear to have been filled or have only been partially filled by others.

1.3 Land Use Planning for Specific Objectives

Land use planning direction provided for grizzly bear habitat and gated ACPs indicate potentially high risk for achieving conservation objectives to maintain grizzly bear habitat and minimize human–bear interactions, respectively. While many uncertainties remain, this assessment has been made with considerable attention to available information and placed within the context of principles, concepts, standards and practices in bear management and human–bear interaction management so that decision makers and others

can consider how best to proceed in resolving the problem of conserving grizzly bears in this area. Conclusions here contrast with the relative level of emphasis that has been afforded to a single species in land use planning. They were one of several major values that motivated the initiation of a collaborative decision making process about if and how forestry development would occur in the Babine River watershed and they have consistently been identified as one of several key values throughout the planning history. In all of this, habitat management and access control have been major areas of focus in land use planning for grizzly bears; thus, these are key areas of focus for implementation and effectiveness monitoring.

1.3.1 Important Grizzly Bear Habitat

Some preliminary conclusions for important habitat

- Land use planning constrained to specified habitat types within delineated high value grizzly bear habitat polygons to maintain grizzly bear habitat provides direction with a relatively high risk for achieving a conservation objective to maintain important grizzly bear habitats, undisturbed by humans.
- Forestry development has probably resulted in an overall reduction in area of intact (or undisturbed) important habitats for grizzly bears.
    - Probable losses related to habitat types that were not identified in habitat studies used in land use planning; habitat types that were dropped in various land use planning processes; and for later years when objectives were constrained to mapped habitat, in habitat patches outside of mapped planning units and special management zones (providing varying levels of protection) that can only be identified through airphoto interpretation and field investigations.
    - Other habitat types have probably been better maintained; notably, those that were more readily identifiable given existing knowledge and mapping, particularly non-forested habitat types (e.g., avalanche chutes) and those that are more closely associated with other treatment units (e.g., core ecosystems, landscape corridors) or zones (e.g., Babine River Corridor Provincial Park, Atna-Shelagyote Special Management Zone, Barbeau Special Management Zone).
- Forestry might be inappropriately constrained, specific to grizzly bears, in some areas. Some habitat types that were identified as important to grizzly bears in early studies and carried through to land use planning may be of relatively low value to them. Specifically, some nutrient poor wetland habitat types in the SBSmc2 appear to have relatively low value for food plants; although values for other life requisites or foraging for animal species (e.g., microtines, ungulates) may be greater (D. Wellwood pers. obs.). The contribution of these habitat types to other wildlife species and conservation of biodiversity would also need to be considered. Achieving biodiversity targets was a consideration when Simpson (1992) completed his work, which may have also influenced his decision regarding sensitivity for development of wetland complexes. More information is needed.
- Forestry development has probably resulted in a major increase in the area of human-disturbed habitat (e.g., road right-of-ways, cutblocks) that is high quality for

grizzly bear foraging on food plants (i.e., attractive habitat), an issue of concern from a risk of human-caused mortality perspective.

- As forested human-disturbed habitats reach mid-seral stages, habitat value will probably decline in some areas; the location, duration and extent of which will be influenced by the biogeoclimatic subzone and variant, habitat type, site preparation, silviculture practices, and subsequent development-, natural-, or climate change-related disturbance events.

1.3.2 Access Control Points

Some preliminary conclusions for ACPs

- Although highlighted in recommendations made by Simpson (1990, 1992) and MacHutchon and Mahon (2003), land use planning for access control did not consider issues associated with human-disturbances that increase food availability for bears. When and where people and grizzly bears overlap in use, risk of human-caused mortality will be greater.
- Risk of human-cause mortality associated with road access appears to be among the most challenging and contentious issues to address, as indicated by the histories of coordinated access management planning and recreation access management planning for this area.

Linking these conclusions to the objective to minimize human–bear interactions, I strongly suspect that forestry development has resulted in a major increase in the area of attractive sink-like habitat (i.e., high quality habitat with high mortality risk). This is largely due to an increase in roads that provide access into important grizzly bear habitats that have not been captured in planning direction and forestry-related disturbances (e.g., cutblocks, roads) that improve habitat quality in some habitat types. Nielsen (2011) and Ciarniello (2012) also provide evidence that mortality issues need to be addressed.

1.3.3 Babine River Corridor Provincial Park

Although largely anecdotal, there is strong evidence that the frequency and nature of human–bear interactions occurring in the area around the southern park entrance to Babine River Corridor Provincial Park, the Babine River Bridge, and the DFO fish counting fence poses major threats to grizzly bears and people. The area of greatest concern includes land within and outside of B.C. Parks' jurisdiction. Perhaps because the road was already there, early land-use planning did not specifically consider this area; but as one of two major routes to areas north of the Babine River, a major amount of industrial and recreational activity is funneled through this area. Additionally, there are many other land and resource interests and uses in this area, which collectively and in the absence of a comprehensive and collaborative human–bear management program, developed within the context of a park management plan and recreation management plan, are at odds with a goal to maintain grizzly bears.

The DFO has attempted to address the problem within their area of responsibility for their worker safety (Shelton 2000). Several BC Parks personnel and others have made concerted attempts to motivate the completion and approval of recreation, human–bear management and park management plans. Interagency attempts at problem solving have also been

made. With more than 15 years and multiple attempts to address bear–human interactions, decisions that could be made to better manage this area for grizzly bear conservation and public safety have largely been deferred as levels and types of human use increase. Resources for the management of this area are insufficient (Davis and Himmer 2010). If considered within a landscape level context of land and resource use, this is one area where dedicated resources and innovation in problem solving could conceivably make a major contribution to better outcomes for grizzly bears.

1.4 Effectiveness of Land Use Planning

This project gathered much information to support an estimation of the overall effectiveness of land use planning for achieving the goal of maintaining grizzly bears. However, no conclusions can be made regarding status and trend of the Babine GBPU over the course of land use planning in the BWMT area of interest. No hair-snag/DNA sampling studies have been conducted to inventory and monitor the Babine GBPU (Apps 2011a). In a *Grizzly Bear Population Inventory and Monitoring Across the Skeena Region of British Columbia: Need Assessment and Design Recommendation* (Apps 2011b), the Babine Grizzly Bear Population Unit ranked among the highest in priority to determine absolute abundance, distribution and connectivity, and population trend monitoring. Unreported and otherwise undetected mortality has not been determined for this area nor has it been determined in other areas in similar situation and context. Considering advances in ORV, Google Earth and GPS technology, I speculate that factors influencing unreported mortality and associated spatial patterns have probably resulted from major changes in the types, levels and distribution of human use that occurs in more remote and backcountry areas. As an interim measure, given limited area-specific scientific information, well-informed assumptions about the potential effectiveness of land use planning for grizzly bears can be made. This project has identified gaps in and limitations of planning by comparing land use planning to maintain grizzly bears with best available knowledge, principles, concepts, standards, and practices for grizzly bear conservation and management in other areas.

Based on the findings in this project, Wellwood and Pfalz (2009) and Ciarniello et al. (2012), grizzly bears that utilize the BWMT area of interest appear to be increasingly exposed to human-related hazards and for those that are exposed their vulnerability may be relatively high. A major concern is that important principles and concepts of human–bear management (e.g., Wellwood and MacHutchon 2002, Hopkins et al. 2010) have not been specified in planning. Evidence points to a need to address issues associated with attractive sinks (Nielsen 2011, Ciarniello et al. 2012, this report). Some of these can be anticipated to be associated with natural habitats providing high quality foods (e.g. sections of the Babine River and tributaries providing access to salmon) that have high-risk of human caused mortality. Others are associated with human-disturbed habitats including cutblocks, road right-of-ways and landings that provide attractive forage, such as clover, horsetail and a range of berry producing species. Focused efforts are needed to mitigate risk of human-caused mortality in areas that are used by grizzly bears and readily accessible to people.

For a period, forest harvesting may have some positive effects; for example, some types of bear foods may increase in occurrence (Roever et al. 2008), which may influence

reproductive output. However, as regeneration progresses to mid-seral stages food supply will decrease to some extent, particularly if site preparation and silviculture or other disturbances do not support ongoing maintenance of food plants for bears. There may also be other negative effects; for example, by creating conditions that support competitive exclusion by black bears, in response to changing landscape conditions (see Mattson 2005).

Research is needed determine the effects and management implications of land use and human activities on grizzly bears in this area.

What is certain is that a major portion of the BWMT area of interest is now readily accessible to people that was not accessible in 1992. A substantial body of scientific evidence from other areas strongly supports assumptions that when people and bears overlap spatially and temporally most grizzly bear mortalities will be human-caused and occur within relatively short distances of roads or trails (e.g., Ciarniello et al. 2007, Nielsen et al. 2004), exceptions include areas where human–bear interactions can be appropriately and adaptively managed (see Hopkins et al. 2010). The availability, distribution and long-term status of potential source areas that may help to mitigate decline of grizzly bears in areas that are not secure (e.g., through dispersal) have not been examined. However, it is reasonable to assume suitably large protected areas that could potentially buffer some of the undesirable effects of land use and human activities are probably not within home range of most grizzly bears using this area.

Land-use plans were largely direct forestry development and activities. Other uses or potential uses also need to be considered including recreation (motorized, non-motorized types); oil, gas and mineral exploration and development; and development of transportation, utility and pipeline corridors. Based on proposed and completed environmental assessments, interests in other types of natural resource development activities are increasing in the region (Project Information Centre 2013). Focused efforts will be needed to fill major gaps in management direction provided in land use planning. Ultimately, the effectiveness of land use planning for achieving the goal of maintain grizzly bears is inextricably tied with those grizzly bear-related objectives and associated strategies that fall outside of the mandate of land use planning and overall cumulative effects of land and resources development on grizzly bears.

1.5 Framework for Grizzly Bear Conservation

The proposed framework for grizzly bear conservation supported assumptions made in this project and provide a basis to support discussions about how to proceed for next steps. With input from additional qualified biologists, peer-review and collaboration with the Province of B.C. and others, the framework could potentially be applied, in whole or in part, for research and management purposes beyond the scope of this project.

1.6 Problem Orientation

In this partial problem analysis, I determined how the knowledge base was developed and then used in the land and resource use planning processes with the expressed intent of maintaining grizzly bears. Then I focused on select strategies for implementation within the context of a conceptual framework for grizzly bear conservation and management to

consider potential effectiveness of land use planning decisions. In general, I was able to extract much useful information through detailed reviews of grizzly bear-related research and monitoring reports. By summarizing early recommendations for grizzly bear habitat and access management and direction provided in land use planning and then listing management direction at subsequent stages, I documented numerous changes that occurred over time. For the majority, changes moved further from conservation objectives but rationales were rarely reported. Reports forming the knowledge base provide important information regarding gaps in knowledge, limitations of data, and recommendations relevant to grizzly bear management and conservation to support informed decisions regarding land use planning.

For most of the 1990s, planning for the BWMT area of interest was done on a reconnaissance level, interim basis with a vision of gathering more information. For a short period in the early 2000s, an increased level of expert support and resources allowed for a couple or few years of relatively rigorous research and planning initiatives in the Kispiox portion of the BWMT area of interest, benefiting from biologists and others contributing a diversity of knowledge and skill sets. Although short in duration, scientific information gathered in this period remains the best available landscape-level information for the area. In addition, in the 1990s, consultants with grizzly bear habitat assessment expertise produced several detailed road development and site-level reports. The last reporting that I found specific to grizzly bears associated with operational-level forestry development was completed in 2001. More recently, BC Parks contracted more detailed, site-level investigations of grizzly bear habitat and human–bear interactions to support human–bear management planning for the area around the southern park entrance area of Babine River Corridor Provincial Park, in the Bulkley TSA portion. Limitations of the knowledge base are highlighted by numerous grizzly bear-related initiatives that fell short of fulfilling expressed intentions, needs or recommendations. Renewed support for grizzly bear-related research to support decision-making is needed.

The *Babine River Interim LRUP* and the *Bulkley LRMP* planning processes were among the earliest land and resource use planning processes in the province, lack of or simultaneous development of standards and guidelines for land use and resource use planning probably influenced the lesser clarity of these plans, as compared to the *West Babine SRMP*. This project presents in detail the variability in outcomes for planning direction within the BWMT area of interest.

For the Babine Planning Unit, some limiting factors for a conservation objective to maintain grizzly bear habitat are planning direction was not well designed to support monitoring and *interim* direction was based on reconnaissance level information that was intended to be revisited and updated. In 2000, the *Bulkley LRMP HLPO* constrained objectives to mapped grizzly bear habitat, effectively eliminating management direction for important grizzly bear habitat in areas outside of mapped polygons in the Babine Planning Unit.

By contrast the *West Babine SRMP* (MSRM 2004a) expressed intent more clearly and explicitly. Some limiting factors with a probable effect on outcomes for a conservation objective to maintain grizzly bear habitat were as follows:

- Best available information for grizzly bear habitat not presented or otherwise referenced in the plan
- Legal objectives constrained to specified habitat types within mapped grizzly bear habitat polygons
- Loss of management direction for important grizzly bear habitats in other areas
- Loss of management direction for moderate value habitat
- Loss of management direction for some identified important habitats types (e.g., forest types with devil's club and horsetail) identified by Simpson (1990, 1992) and listed in the *Babine River Interim LRUP* (MOF and MELP 1994a)
- Some planning direction was also based on reconnaissance level information that was intended to be revisited and updated.

For the Nilkitkwa Planning Unit, the knowledge base summarized in this report was not used in land use planning and very little direction was provided to support an objective of maintaining grizzly bear habitat.

None of the plans were particularly effective for addressing risk to grizzly bears associated with human–bear interactions; that is, much more could be done to improve prospects for grizzly bear conservation over the long term.

1.7 Problem Solving: Where to from Here?

On Challenges of Grizzly Bear Conservation

"*If engagement through collaboration is the best model for complex decision making, then the fundamental question becomes what is the problem to solve. Problems are rarely as they first appear. In natural resources management, the traditional view has been that problems can be viewed as objective realities to be solved by actions. However, problems usually are based on particular world views and values of the people who perceive them. People do not act in response to objective problems; rather, they are part of them. Further investigation of the context of a problem at the beginning of any collaborative problem-solving effort often reveals deep-seated issues, such as lack of trust and other obstacles to collaborative relationships.*

Typically the obvious or trivial issue is the spark to the debate. More hidden from view and rarely discussed is who has the authority to decide on the outcome…" (Edwards and Gibeau 2013:p. 239).

This partial problem analysis underscores a need for more comprehensive and collaborative problem solving for grizzly bear conservation. Edwards and Gibeau (2013:p. 240) state "decades have been spent improving biological and other scientific skills, but little attention has been paid to social problem-solving and decision-making skills". Findings in this study indicate that decades have been spent on gathering limited amounts of information about grizzly bears and a series of planning processes that incrementally

transformed management direction as human uses and developments in this area have expanded, the combined outcome of which, at least conceptually, moves further from a conservation goal of maintaining grizzly bears. Without scientifically rigorous population studies, uncertainties about status (viable, threatened) and trend (stable, increasing, decreasing) are considerable, particularly given limited scientific understanding about the specific ecology, behaviours (e.g., intra- and inter-specific interactions) and demographics of this sub-population: however, Wellwood and Pfalz (2009), Ciarniello et al. (2012) and this report have identified numerous red flags for a variety of major risk factors potentially compromising prospects for their conservation. The findings in this study indicate effective problem solving appears to be limited by

- Challenges gathering sufficient resources to support grizzly bear conservation in an area designated for integrated resource management
- Divergences from best available scientific knowledge, expertise and recommendations
- Inaccurate or inappropriate information, or both, about grizzly bears, their life requisites, and threats to their conservation expressed in land use planning
- Multiple small planning units with major variation in planning direction and, overall, insufficient area with planning direction for grizzly bears
- Insufficient structure, processes and resources for monitoring
- Unfulfilled intentions for adaptive management.

This project highlights a need for more effective problem solving for grizzly bear conservation, a conclusion that has also been reached in other areas of North America (e.g., Mattson et al. 1996, Clark et al. 2005, Clark and Slocombe 2010).

The Policy Sciences approach to problem solving provides a framework for respectful dialogue and situation- and context-specific innovation for resolving complex and challenging problems in natural resource management (Clark 2002). It includes problem orientation and examination of social and decision-making processes to find more productive ways of moving forward to achieve the expressed goal of maintaining grizzly bears. An overview of this framework is presented in Appendix 5.

People can participate and contribute to this open and adaptive learning process by

- Reflecting on their stand point in the problem solving process
- Applying multiple methods for problem solving
- Aiming to secure common interests
- Framing problems using multi-dimensional and interdisciplinary approach (Clark 2002).

This report proposes a comprehensive, conceptual framework to support an understanding of and further considerations for exploring the big picture of grizzly bear conservation and management.

In *Making Sense of the Policy Process for Carnivore Conservation*, Primm and Clark (1996:p. 1036) discuss the role of scientists in large carnivore conservation

> *Because the challenge of conserving* [large carnivores] *extends beyond biological issues, it is necessary to involve other relevant disciplines and perspectives in understanding and solving the problem. Our examination of the context, content, and process of large carnivore conservation policies suggests more effective and active roles for scientists in designing solutions to the problem of landscape-level carnivore conservation. Scientists must develop an understanding of the range of participants in the policy process and the ways in which these participants receive and utilize information. This knowledge of the policy process could help scientists to better understand their roles in framing and clarifying policy questions, projecting the consequences of various alternatives, and presenting policy information in appropriate fora.*

In this way, scientists working on grizzly bear-related issues in the BWMT area of interest could learn better ways of contributing to the problem solving process. In particular, focused effort is needed to more effectively present scientific information, opinions and recommendations to people representing a diverse range of roles and responsibilities, disciplines and stakeholder interests. If this information can be presented in a way that is respectful and engaging, and it is relevant to peoples' situations and secures common interests then hopefully prospects for grizzly bear conservation can be improved.

Problem analyses of grizzly bear management and conservation initiatives in other region of North America have identified conventional approaches fraught by challenges and controversy (e.g., Mattson et al. 1996, Clark et al. 2005, Clark and Slocombe 2010). Natural resource professionals involved in research, management, planning and policy aimed at the complex problems of managing and conserving grizzly bears in rapidly changing environments may be able to shift this trend by using policy-oriented professional approaches and practices (see Clark 2002, Gibeau 2012). Reporting on successes and challenges provide a basis for learning to find better ways of moving forward to maintain grizzly bear populations in areas where human developments and use are expanding and secure areas for grizzly bears are diminishing.

This report provides a broad spectrum of information highlighting the successes, challenges and limitations of land use planning for supporting a goal to maintain grizzly bear populations for the long term. I do not propose definitive solutions because problem solving for grizzly bear conservation will probably be much more effective if alternative options for achieving desired goals can be identified, innovated and explored; and acceptable solutions can be selected to protect public interests. There is a need to revitalize and expand discussions about how best to move forward to achieve grizzly bear conservation.

1.8 Problem Solving: Some Specific Considerations

The Policy Sciences process, in whole or in part, can be used at multiple scales for problem solving but the following stand out as important for specific consideration.

From a holistic perspective, a major gap in process is that the Gitxsan and Nat'oot'en first nations were not full partners in land use planning. They are affected by land and resource

use and development decisions; their input, support, and full partnership in problem solving will be important for clarifying and achieving goals and objectives.

More specifically, two of the most contentious and hotly debated land use issues for stakeholders and managers responsible for land-use decisions for the BWMT area of interest have major relevance to long term prospects for maintaining grizzly bears. At a landscape level, land-use planning has not sufficiently identified and addressed the risk that open road- and trail-related factors, notably motorized access of any type, pose to the grizzly bear population. Over the entire BWMT area of interest, a primary issue is relatively little management direction to effectively exclude motorized vehicles, regardless of type. In the Kispiox TSA, another primary issue is ACPs not implemented. Efforts are underway to address this problem. In a site-specific example, land-use planning has not addressed risks associated with human–bear interactions in the area around the Babine River fish counting fence, bridge and southern entrance to Babine River Corridor Provincial Park. Overall, these two clearly contentious issues have received relatively little emphasis in land-use plans and have largely been deferred to planning processes that were not fully realized. Failures to effectively address these issues in planning, from a grizzly bear conservation perspective, or other means (e.g. regulatory processes), as required to effectively mitigate risk of human-caused grizzly bear mortality, are major concerns that that are worthy of more comprehensive problem analysis to identify alterative options more compatible with goals and objectives for grizzly bears.

Many changes of relevance to deciding how to proceed have occurred over the course of land use planning for this area, particularly within the last decade. Changes have been made to the regulatory framework for forestry through the transition from the Forest Practices Code (i.e., government-led, largely prescriptive) to the Forest and Range Practices Act (i.e., legal objective-focus, results-based and professional reliance). Government no longer monitors land use planning and resources to support others, such as the BWMT, are severely limited. Forest companies have been faced with a prolonged economic downturn (FPB 2010, FPB 2012). Government ministries responsible for the management of natural resources in the BWMT area of interest underwent budget cuts, downsizing, and several major reorganizations. Concurrently, provincial supports for a range of grizzly bear research, management and education initiatives were discontinued or reduced. Momentum to resolve challenging and complex issues most relevant to grizzly bear conservation in the BWMT area of interest stalled. Locally established intuitions (e.g., BWMT, Babine River Foundation, Bulkley Valley Community Resources Board, Bulkley Valley Research Centre) might provide additional or alternative supports to government to restore and build community relationships to address these and other issues. Renewed, collaborative or alternative means of filling gaps in grizzly bear and human–bear management will be needed to achieve long term goals and objectives for grizzly bears.

1.9 Problem Solving: Babine Watershed Monitoring Trust

Despite severely limited budgets for grizzly bear-related monitoring, the locally led and largely volunteer supported BWMT has been able to provide useful knowledge in a range of key areas. Challenges that remain are to complete the monitoring cycle and use the knowledge to find ways of improving management to achieve the goal of maintaining

grizzly bears in a landscape designated for integrated land use. As critical steps to success are outside of the BWMT impartial monitoring mandate, others will be needed to carry this work forward.

The BWMT framework provided a solid foundation to

- Examine the limitations, benefits and challenges of developing affordable and effective methods for monitoring land use planning for grizzly bears
- Quantitatively and qualitatively evaluate a diverse range of risk factors and associated uncertainties
- Present a more compelling argument for management action to address important risk factors
- More constructively communicate this information to others involved in the complex challenge of land use planning for this area
- Set the stage to find better ways of moving forward in problem solving to maintain grizzly bears
- Make it easier for others to participate and collaborate in learning how to sustain a grizzly bear population in this and other areas.

To the best of my knowledge, this is the first comprehensive attempt to initiate monitoring for effectiveness of land use planning for grizzly bears in B.C. The BWMT Framework proved to be an innovated and helpful guide to support a much-needed transition from "learning to monitor" to "monitoring to learn" (Price and Daust 2009). Any successful endeavors will probably need to find ways of extending well beyond the constraints and limitations of conventional approaches to problem solving to maintain grizzly bears. The BWMT provided a large part of the foundation to do this.

2 Management Implications

Salmon As a Food Resource: Potential for Hidden Costs

"*The presence of bison, salmon, or piñon pines in 1850 was associated with accelerated loss of grizzly bear range in 1850–1920. These effects probably had as much do with interactions between humans and grizzly bears as with nutrition. Some foods more than others predictably brought grizzly bears into more frequent, lethal, contact with Europeans by concentrating bears at predictable times and places at lower elevations nearer humans. Salmon, rather than contributing to persistence, likely hastened the demise of grizzly bears by luring them into harm's way*" (Merrill et al.1999 in Mattson and Merrill 2002, Extirpations of Grizzly Bears in the Contiguous United States, 1850—2000).

2.1 For the Babine Watershed Monitoring Trust

A comprehensive review of the history of grizzly bear research and management in the BWMT area of interest was essential for the completion of this monitoring project. In

general, there is relatively little in the structure of land use planning for grizzly bears that can be used to support a scientifically rigorous monitoring program. Any on-the-ground effectiveness monitoring to rigorously quantify maintenance of important grizzly bear habitat or prevention and mitigation of human-caused grizzly bear mortality will be expensive, particularly relative to available budget for monitoring to-date. Costs of additional monitoring of land use planning for grizzly bears, in addition to what has been completed (Wellwood and Pfalz 2009, Ciarniello 2012; this report), should probably be weighed against more defensible and perhaps more compelling means of garnering support for finding better ways of moving forward such as

- Carrying the results of this partial problem analysis forward to complete a full problem analysis including problem orientation, social process and decision making process (see Clark 2002)
- Grizzly bear inventory and monitoring using hair snares and DNA analysis to determine whether or not major interventions are required. Findings to-date indicate that major interventions probably would be prudent.
- Radio-collared study to determine population demographics, food habits, habitat use and implications of natural resource development.

All of these would require guidance and support from the Province of B.C. and support from others, as considered appropriate.

Efficacy of monitoring could be improved with greater intergovernmental, interagency and stakeholder collaboration to find better ways of moving forward to achieve goals and objectives for grizzly bears; easier access to information (information gathered for this report should help subsequent efforts); dedicated and sufficient resources for a monitoring program; and a process for fulfilling the adaptive management cycle.

2.2 For Government and Proponents

There are insufficient resources, institutional structures and processes to coordinate and support the level of comprehensive and collaborative governance that will be needed to achieve land use planning and conservation goals and objectives for grizzly bears in the BWMT area of interest. Any assurance of achieving desired results for grizzly bears over the long-term will require commitment to and innovation in problem solving.

2.3 For Biologists

Based on the findings in this study, it is not clear how important scientific information and expert opinions and recommendations made by biologists working on grizzly bear-related projects in this area are being considered in the decision-making process. In some cases, some information and advice may not be reaching those with the authority to make decisions; and in others, they not might not be considered due to insufficient resources, other priorities, trade-offs made, or for some other reason. More effort is needed find better ways of engaging decision-makers, stakeholders and others in the importance of science in decision-making, and linking science to policy and other decision-making processes in order to achieve conservation objectives for grizzly bears. Other forms of knowledge (e.g., local, traditional) could also be integrated into the knowledge base, as appropriate to support better-informed decisions (see Section 1.4).

2.4 For Mangers and Other Decision Makers

Mangers and other decision makers that are responsible for land and resource use decisions affecting grizzly bears within and adjacent to the BWMT area of interest are faced with making increasingly risky decisions as land uses and human activities expand into previously undeveloped areas. Notably, the goal to maintain grizzly bears is incrementally undermined by initiatives that do not effectively maintain important grizzly bear habitats and address issues associated with the following: bears gaining access to anthropogenic foods; attractive human-disturbed habitats; lethality of interactions with people; and loss of core secure areas.

More effort is needed to link decision-making to knowledge in a way that allows biologists, stakeholders, the public and others to understand considerations, trade-offs made and rationale for them, so that decisions can be re-evaluated or re-visited, as required, to achieve goals and objectives for grizzly bears (see Section 1.2).

2.5 For Planners

Land use planning direction for grizzly bears in the BWMT area of interest changed considerably over the coarse of planning for this area. Ministries and agencies responsible for planning and their mandates have also undergone major changes over the planning period. While some argued that early objectives for grizzly bears were not achievable given other values and interests in this area, I did not determine rationales for many changes. The overall probability of successfully achieving the goal of maintaining grizzly bears appears to have decreased over time, considering principles and concepts for adaptive bear management and human–bear management (e.g. Hopkins et al. 2010). Within the context of the conceptual framework for grizzly bear conservation proposed here, objectives expressed in land use planning do not completely address habitat requirements and human-caused mortality risk factors. Some additional planning components are needed and while other management needs are not within the scope of planning (e.g., grizzly bear harvest, planning in adjacent areas), they could be provided for context.

If land use planning could be anchored within the context of a conceptual framework for grizzly bear conservation and management, then land use plan goals and objectives for them can be expressed, discussed, debated, planned and monitored more meaningfully. A means of tracking land use planning decisions could provide subsequent decision-makers and others with a better understanding of the history, rationales for trade-offs made to address other values, and a means transparent reevaluation; as required, to maintain public interests. Most importantly, all factors influencing prospects for achieving goals for grizzly bears (however this is defined) can be considered to support a fully informed exploration of options and innovation in the planning component of problem solving.

2.6 Overall Implications

Innovation in problem solving is needed. This could potentially be achieved by exploring alternative options for management of limited entry hunting, restoration of core secure areas, or stimulation of a cultural shift that supports a more peaceful coexistence between people and bears, or probably more appropriately, a combination thereof. The later would take focused efforts to increase appreciation, knowledge and understanding about bears

and prevention of bear incidents; and build willingness and capacity to act to prevent bear incidents.

Considerations for research and management to support the goal of maintaining grizzly bears need to extend to areas beyond and be linked back to the BWMT area of interest. This area does not match the Grizzly Bear Management Units and Wildlife Management Units that are used provincially and regionally for grizzly bear harvest management. Planning and monitoring for grizzly bears that use the BWMT area of interest also need to be considered within the context of more ecologically relevant spatial boundaries.

Qualified professional biologists with relevant grizzly bear expertise will be needed to fulfill professional reliance responsibilities and achieve desired results.

Additional and more reliable commitments are needed to fulfill grizzly bear research and management, human–bear management, and bear awareness and safety education needs, and most importantly, to learn how to solve complex and challenging problems, such as grizzly bear conservation, more efficiently and effectively.

3 Recommendations

This section provides recommendations to improve the foundation for monitoring land use planning for grizzly bears through updates to information in the BWMT Land Use Plan Summary and Knowledge Base (Price and Daust 2005). These are aimed at identifying and filling gaps in information and establishing a better understanding about uncertainties that exist in assessing risk to the goal and associated objectives for grizzly bears. These are followed by recommendations specific to grizzly bear habitat and access for implementation monitoring (i.e., collecting indicator data) and effectiveness monitoring (i.e., detecting consequences). Recommendations are directed to the BWMT. I have also provided some considerations that the BWMT can pass on to government, stakeholders, and others that might be able to provide support, as considered appropriate and acceptable by the Province of B.C.

3.1 Improving the Foundation for Problem Solving

Osborn (2009) states the monitoring framework

> "*...compiles the necessary information and assesses the relevant factors to identify where monitoring matters most: where there's the least certainty about meeting objectives; where there's the greatest risk that objectives won't be met; and where there's simply not enough information to know the risks. Overall, the Monitoring Framework focuses on identifying the monitoring activities that can provide the results most essential for assessing how well the Babine Watershed's land use plans are working*."

3.1.1 General Considerations to Forward to Government and Others

The following stand out as priorities for consideration

- Maintain and restore secure or source-like habitat. Identify secure areas (or source-like habitats) and mortality hot spots (or sink-like habitats), at a scale relevant to achieving goals for grizzly bears. Gather appropriately qualified expertise to support decisions regarding methodology. This type of information is needed to assess and manage cumulative effects of land and resource development and use.
- Address serious human–grizzly bear interaction issues associated with the management, and gaps in and limitations thereof, of the area around the southern park entrance of Babine River Corridor Provincial Park (BC Parks jurisdiction), including fish counting fence and lease lot (DFO jurisdiction), and Forest Service Road bridge and road right-of-way (MFLNRO jurisdiction), and Crown Land.
- Address mortality hotspots identified by Ciarniello (2012). For example, the *Options for Babine River Area* report provided direction for removal of the Nilkitkwa Bridge. Access control at this location might be an option to address risk of human-caused mortality, in part. There may also be alternative strategies or a combination of strategies for effectively reducing mortality risk in this area.

3.1.1.1 Recommendations to BWMT: Knowledge Base

- Obtain peer-review for the proposed conceptual framework for grizzly bear conservation (review drafts, appendices 2-4) to decide if and how to move forward on it as a foundation to support monitoring needs. Government input is needed.
- Update the annotated bibliography and collection of digital files for these resources completed by de Groot (2004) to include additional information gathered in this project.
- Revise and update the Knowledge Base to better support management to maintain grizzly bears.
- Uncouple land use objectives provided in the Land-use Planning Summary from the Knowledge Base.
- Add an explicit link between the goal to maintain grizzly bears and associated conservation objectives to achieve the goal.

3.1.1.2 Recommendations to BWMT: Land Use Plan Summary

- Add the *Babine River Interim LRUP* (MOF and MELP 1994a) and *Interim Babine River CAMP, Bulkley Portion* (MOF and MELP 1994b) to the Land-use Plan Summary.

3.1.2 Some Considerations for Government and Others

3.1.2.1 Problem Solving

- Conduct a policy process problem analysis (see Clark 2002) to provide comprehensive support for decisions about how to proceed.
- Identify ecologically sound conservation goal and objectives and clarify management goal and objectives so that empirically conclusive monitoring can be conducted. Collaborate so that goals and objectives are applicable at an ecologically relevant scale.
- Find or innovate more effective ways of problems solving.

3.1.2.2 Professional Reliance

- Gather interdisciplinary expertise to support an open learning problem solving process. Innovative solutions are needed.
- Retain qualified professionals with relevant expertise in grizzly bear research and management and human–bear management to support problem solving.

3.1.2.3 Risk Management

- Conduct population inventory and monitoring studies, using hair-snag/DNA sampling methods DNA-analysis (see Apps 2011b for needs assessment and design recommendations).

3.1.2.4 Planning

- Anchor planning in a conceptual framework for grizzly bear conservation.
- Ensure other planning processes (e.g., RAMP, Skeena Quality Waters Strategy, Mountain Pine Beetle planning) and forestry and other land and resource uses (e.g., mineral exploration and mining, commercial recreation, pipelines, air and off-trail access) of relevance to grizzly bears in this area are appropriately integrated into planning and other elements of decision-making.
- Assess and manage cumulative effects.

3.1.2.5 Collaboration

- Promote and support collaborative and interdisciplinary innovations, such as the BWMT and BWMT Framework, to foster a culture of learning and adaptive management.
- Support a comprehensive data- and knowledge-sharing network (BWMT and others in progress).

3.2 Improving Habitat-Specific Problem Solving

3.2.1 Recommendations for BWMT

3.2.1.1 Knowledge Base

- Revise terms and definitions used to describe important grizzly bear habitats to be managed.
- Revise habitat-related objectives.
- Revise indicators used in the hypothetical cause-effect curves for risk to achieving objective.

3.2.1.2 Land Use Plan Summary

- Provide direction for how to address variability and inconsistencies in the use of and definitions and intent for habitat-related terms among various plans and the BWMT Framework.
- Provide direction for how to address major divergences from original intent in Babine River Interim LRUP and that of some subsequent plans for grizzly bear habitat.

3.2.2 Some Considerations for Government and Others

3.2.2.1 Knowledge Base

- Compile best available species information so that it is readily available and utilized, as appropriate.
- For the Bulkley TSA portion: update grizzly bear species accounts, habitat suitability models, ratings tables, and habitat mapping.
- Delineate important habitats at appropriate scales (e.g., patch, stand, landscape, GBPU).
- Provide information in reporting and on maps regarding intended purpose, reliability and accuracy of ecosystem mapping, and reliability of interpretations for grizzly bears. Government no longer provides the levels of corporate knowledge, advice, and other supports needed to ensure these resources are used appropriately.
- Gaps could be filled and uncertainty reduced by conducting a radiotelemetry study of grizzly bears to determine food habits, seasonal habitat use, and movements of grizzly bears; and implications of natural resource development and recreation activities on grizzly bears.

3.2.2.2 Landscape-Level Planning & Monitoring

- Review and amend legal objectives for grizzly bear habitat to maintain sufficient supply of important grizzly bear habitats for the long term.
- Ensure best available knowledge and map products are utilized appropriately given management context (e.g., intended purpose, reliability and accuracy of mapping, reliability of interpretations for grizzly bear habitat, gaps in information, limitations of data).
- Identify and address important life requisites and habitat types that have not been captured in habitat-related studies and planning to date. Some gaps in direction include some important habitat types, microhabitats or patches of important habitat, and habitat features (e.g., mark trees, mark trails, dens).
- Support the development and refinement of scientifically defensible indicators and threshold or targets for grizzly bear habitat.

3.2.2.3 Site-level Planning, Development and Monitoring

- Work with professional organizations or others (e.g., Forrex) to develop professional guidelines and training for grizzly bear habitat assessment and management to maintain grizzly bear habitat.
- Use airphoto or orthophoto interpretation or other scientifically sound method to identify potentially important grizzly bear habitat on the ground. Ground investigations enable verification of ecosystem mapping and interpretations for grizzly bear habitat and identification and delineation of important grizzly bear habitats that are not detectable in existing map products. Ground investigations will be required to avoid, minimize or mitigate negative effects to important grizzly bear habitat.
- Use silviculture, stand management and other techniques to mitigate negative effects of land and resource use on important grizzly bear habitat to maintain

sufficient habitat supply for the long-term. Risk of human-caused mortality will need to be addressed.

3.3 Improving Access-Specific Problem Solving

3.3.1 Recommendations to BWMT

3.3.1.1 Knowledge Base

- Revise the objective for human–bear interactions to be more specific. This might include objectives or sub-objectives specific to displacement (and perhaps disturbance), human-caused mortality and anthropogenic fragmentation (see USDA 1990, MacHutchon 1998a, Proctor et al. 2012).
- Revise indicators used in the hypothetical cause-effect curves for risk to achieving objectives.

3.3.1.2 Land Use Plan Summary

Provide direction for if and how to deal with major divergences from early intentions to manage access and that of subsequent means for managing access; for example, consider *Options for the Babine River* (MOF, MOE and Babine TAC 1991), *Interim Babine River CAMP, Bulkley Portion* (MOF and MELP 1994b), and *Forest Practices Code Act* (Province of B.C. 1996), as compared to later initiatives.

3.3.2 Some Considerations for Government and Others

3.3.2.1 Planning & Monitoring

- Review and address major divergences from early intentions to manage access and that of subsequent initiatives for managing access to improve prospects for achieving the goal to maintain grizzly bears.
- Delineate Bear Management Units (BMU). These have been defined, but not presented in land use planning, for the Kispiox TSA portion. Review these to update, if and as appropriate. Bear Management Units have not been defined for the Bulkley TSA portion.
- Support the development and refinement of scientifically defensible indicators and associated thresholds or targets for access management to support effectiveness monitoring at appropriate scales (e.g., landscape and sub-regional levels, GBPU). Some methods for consideration include analyses for open motorized road or route density, total road or route density and core secure area by BMU; or source-sink habitat analysis.

3.3.2.2 Management

- Identify, secure and (if necessary) restore secure core areas or source-like habitats for grizzly bears to more effectively mitigate risk of human-caused mortality.

3.4 Implementation Monitoring–Collecting Indicator Data

Have strategies to maintain important grizzly bear habitat and reduce human–bear interactions been implemented?

To monitor implementation over the entire period of planning for this area, monitoring methods will need to consider time period of interest and the relevant plan direction for that period. This adds a major layer of complexity because many changes have been made in management direction over time. Determining habitat types after harvest will also be challenging and perhaps, at least in part, not feasible.

General Recommendations to BWMT

- Identify appropriate indicators and targets or thresholds and promote their use in implementation monitoring conducted by government, industry and other monitoring- and certification-focused organizations. Work with Province of B.C and others to do this.
- Develop an implementation monitoring program.
- Build capacity to monitor implementation for grizzly bear habitat and access management. If this can be achieved then the following are also recommended:

Recommendations to BWMT for Grizzly Bear Habitat

- Review Babine River Interim LRUP treatment unit mapping for Bulkley TSA to assess accuracy of line-work.
- Consult with a vegetation ecologist, preferably with local knowledge, to assess the feasibility and reliability of identifying each of the identified habitat types, post-road and -cutblock development. My cursory discussions with a vegetation ecologist and my experience indicate that problems can be anticipated with this approach. It will probably be more appropriate for some habitat types and seral stages than others.
- Interview forestry practitioners that have had longer-term involvement in management and development decisions regarding grizzly bear habitat in the monitoring area to support decisions for implementation monitoring for grizzly bear habitat. Based on information provided in this report and experiences of others, decide if and how to proceed with implementation monitoring for important grizzly bear habitat.
- Conduct implementation monitoring for grizzly bear habitat as frequently as required allow for monitoring in the operations phases (e.g., layout, pre-harvest). More frequent monitoring is needed so that important habitat features and habitat types can be more reliably identified.

Access

Have access-related strategies to reduce bear-human interactions been implemented?

Lack of support and/or opposition to implementing designated access controls appears to be a factor in failure to install some gates (or another means of achieving objective) at designated ACPs.

Recommendations to BWMT

- Contact Province of B.C. for a problem definition to better understand and discuss the problem of controlling access to reduce risk of human-caused grizzly bear

mortality and identify barriers to lack of implementation of designated ACPs in Kispiox TSA portion of study area. A better understanding of the problem is needed to support decisions about how to proceed. Plans were underway to install the Tomlinson gate (L. Vanderstar pers. comm.).
- Develop an implementation-monitoring program that includes frequent investigations to determine gate status. This should be done during closure periods as specified, and where explicit direction was provide for no motorized vehicle use (only two locations) to look for evidence of motorized vehicles circumventing ACPs. Obliterated (e.g., re-contoured) roads could eliminate or at least greatly reduce the need for costly monitoring.

3.5 Effectiveness Monitoring–Detecting Consequences

Have strategies to maintain important grizzly bear habitat and reduce human–bear interactions been effective?

General Recommendations to BWMT
- Solicit input from other bear experts to gather a range of opinions, experiences and expertise to debate and determine the most defensible means of monitoring access related risk factors associated with human–bear interactions. Multiple viewpoints would probably produce the best solutions and be more broadly accepted; and potentially be considered suitable for context specific application at a regional scale or sub-regional scale.
- Identify appropriate indicators and targets or thresholds and promote their use in implementation monitoring conducted by government, industry and other monitoring- and certification-focused organizations. Work with Province of B.C and others to do this.
- Develop an effectiveness monitoring program.
- Build capacity to monitor effectiveness for grizzly bear habitat and access management. If this can be achieved then the following are also recommended:

Recommendations to BWMT for Grizzly Bear Habitat
- Conduct reconnaissance level effectiveness monitoring for important grizzly bear habitat in the Kispiox TSA for the treatment unit mapping extension to the Babine River Interim LRUP (where more reliable information was used in planning).
- Consult with forestry practitioners to find out if and how Mahon et al. (2004) or other more reliable products might have been used in combination with grizzly bear habitat mapping provided in land use planning.

Access
Have access-related strategies limited undesirable human–bear interactions?

The relationship between source-like and sink-link habitats, determined by varying levels of population density and mortality risk, is linked to risk of grizzly bear population decline (Nielsen 2011). The road density indicator was selected for use in other areas to examine

potential effects of displacement. An indicator and target or threshold for secure area or source-like habitat is needed to support management to maintain or restore areas with lower risk of human-caused mortality. Additional expert input is needed to determine whether or not it would be appropriate to use existing mapping for grizzly bear habitat and road databases to examine the relationship between source-sink habitats. Findings in this report and (Wellwood and Pfalz 2009) indicate that the level of uncertainty would be high and that additional information will be needed.

Recommendations to BWMT for Access

- Until better information is available, assume all roads are open, until information has been gathered to confirm they are closed (e.g., Big Slide road deactivation) so that no motorized vehicles can gain access.
- For preliminary evaluations of risk to grizzly bears associated with human–bear interactions, assume all roads are located in important grizzly bear habitat or attractive human-disturbed habitat until better information has been gathered. Research (MacHutchon and Mahon 2003) and anecdotal observations (D. Wellwood pers. obs.) indicate attractive habitats for grizzly bears are common within cutblocks and along road right-of-ways.
- Further analysis might include reanalyzing data presented in Wellwood and Pfalz (2009) that were based on length of road per area (km/km^2) to determine open road density, total road density and core secure area using roving window analysis (e.g., Summerfield 2004) or further examination of source-sink habitats (i.e., Nielsen 2011). Additional expert input is needed to determine most appropriate methods including indicators and targets or thresholds. GIS layers for roads will need to be up to date to do this.
- Expand monitoring area and conduct analyses at scientifically relevant scales (e.g. BMU, Babine River watershed, Babine GBPU).

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Appendix 1. List of Acronyms

ACP – Access Control Point

AMZ – Access Management Zone

ATV – All Terrain Vehicle

BCCDC – B.C. Conservation Data Centre

BCTS – B.C. Timber Sales

BMU – Bear Management Unit

BSC – Babine Steering Committee BTAC – Babine Technical Advisory Committee

BTAC – Babine Technical Advisory Committee

BVCRB – Bulkley Valley Community Resources Board

BVCRBIPT – Bulkley Valley Community Resources Board Interagency Planning

BWMT – Babine Watershed Monitoring Trust

CAMP – Coordinated Access Management Plan

DFO – Department of Fisheries and Oceans

FPB – Forest Practices Board

FSP – Forest Stewardship Plan

GBPU – Grizzly Bear Population Unit

GIS – Geographic Information System

CORE – Commission on Resources and Environment

HLPO – Higher Level Plan Order

ILMB – Integrated Land Management Bureau

IWMS – Identified Wildlife Management Strategy

KFDAMPTG – Access Management Direction for the Babine Watershed Kispiox Forest District

KLRMPT – Kispiox Land and Resource Management Plan TeamLRMP – Land and Resource Management Plan

LRUP – Local Resource Use Plan

LRUPMC - Local Resource Use Plan Monitoring Committee

LUP – Landscape Unit Plan

MELP – Ministry of Environment, Lands and Parks

MOF – Ministry of Forests

MOFR – Ministry of Forests and Range

MSRM – Ministry of Sustainable Resource Management

MWLAP – Ministry of Water, Land and Air Protection

NESERC – North East Slopes Environmental Resources Committee

ORV – Off Road Vehicle

OSG – Objectives Set by Government

PEM – Predictive Ecosystem Mapping

PIR – Pacific Inland Resources Division

PHM – Predictive Habitat Mapping

RAMP – Recreation(al) Access Management Plan

RIC – Resources Inventory Committee

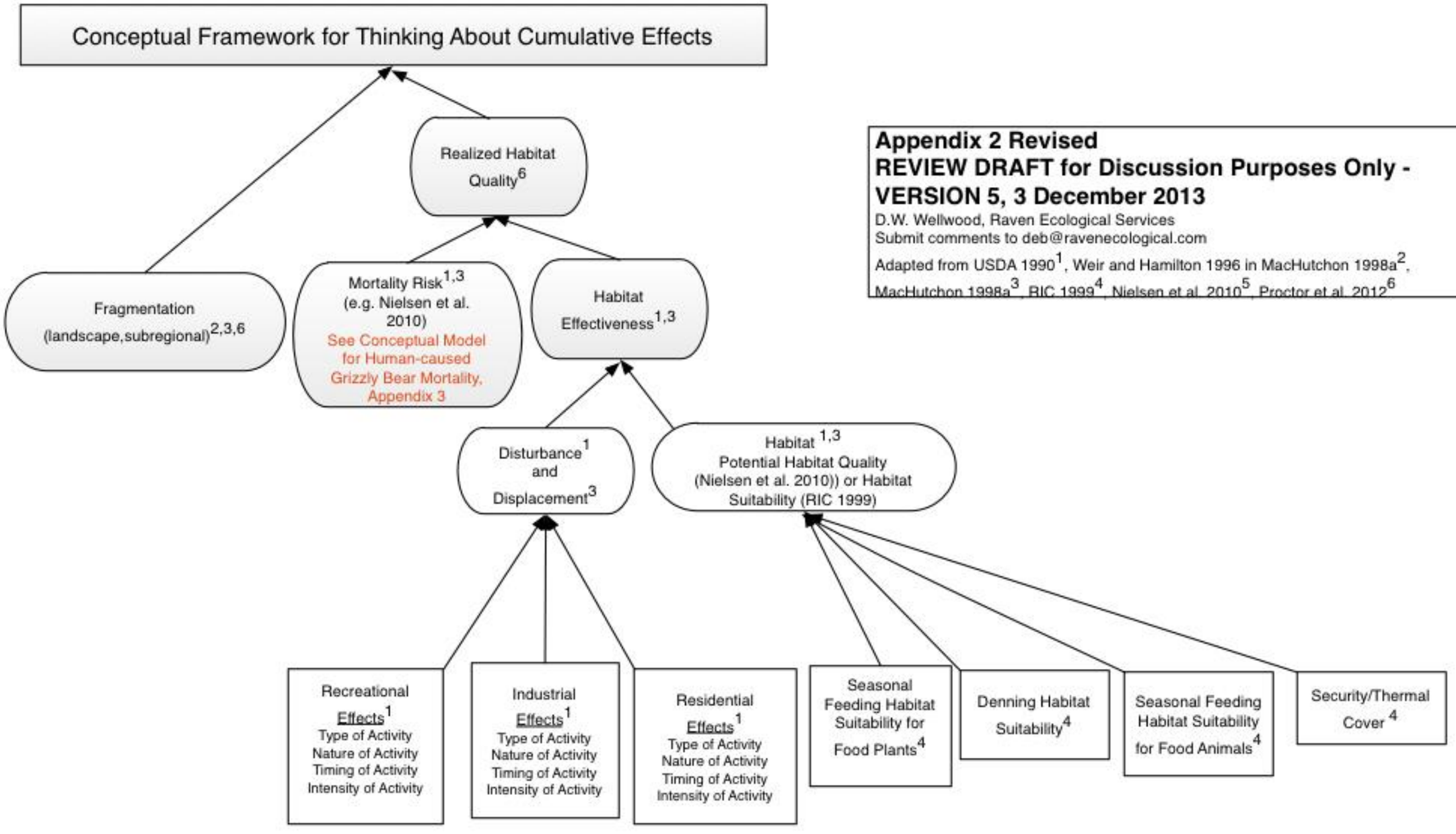
TEM – Terrestrial Ecosystem Mapping

TSA – Timber Supply Area

USDA – U.S. Department of Agriculture

WHA – Wildlife Habitat Area

Appendix 2. Proposed Conceptual Framework for Thinking About Cumulative Effects of Land and Resource Development and Use on Grizzly Bears in the Babine Watershed Monitoring Trust Area of Interest. Review Draft for Discussion Purposes Only.

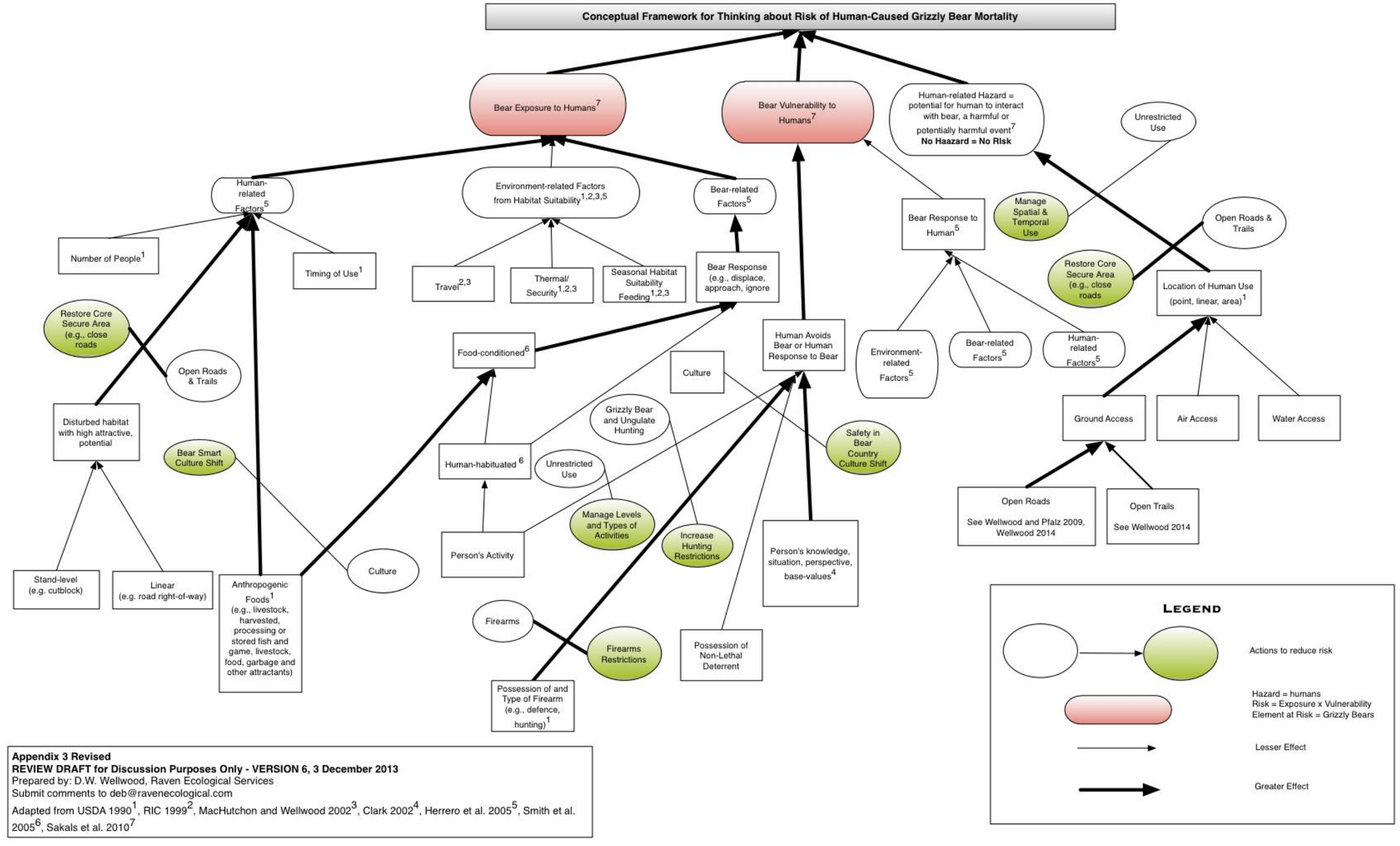


Appendix 2 Revised
REVIEW DRAFT for Discussion Purposes Only - VERSION 5, 3 December 2013

D.W. Wellwood, Raven Ecological Services
Submit comments to deb@ravenecological.com

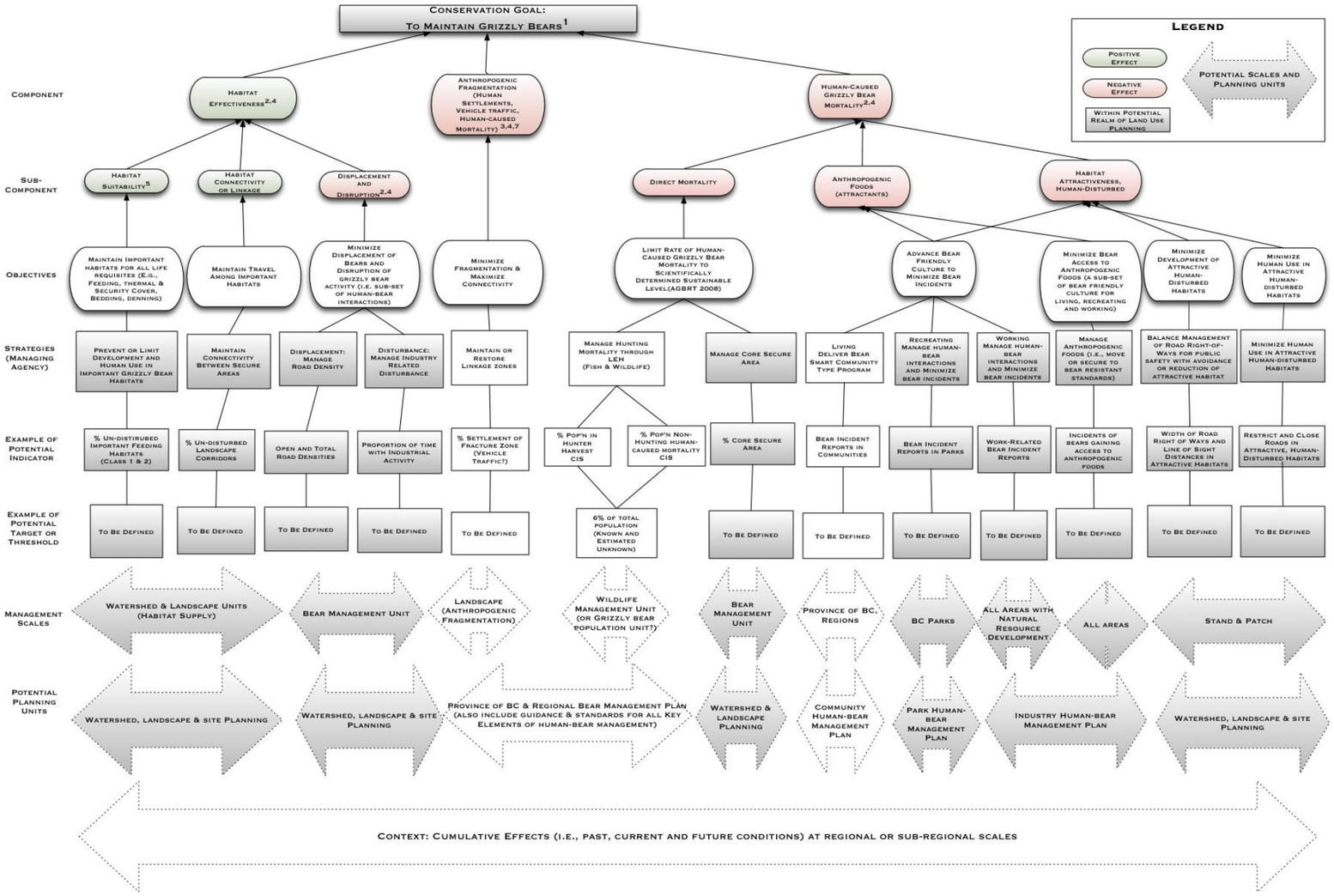
Adapted from USDA 1990[1], Weir and Hamilton 1996 in MacHutchon 1998a[2], MacHutchon 1998a[3], RIC 1999[4], Nielsen et al. 2010[5], Proctor et al. 2012[6]

Appendix 3. Proposed Conceptual Framework to Consider Risk of Human-Caused Grizzly Bear Mortality to Support Land Use Planning Decisions, Babine Watershed Monitoring Trust Area of Interest. Review Draft for Discussion Purposes Only.



Appendix 3 Revised
REVIEW DRAFT for Discussion Purposes Only - VERSION 6, 3 December 2013
Prepared by: D.W. Wellwood, Raven Ecological Services
Submit comments to deb@ravenecological.com
Adapted from USDA 1990[1], RIC 1999[2], MacHutchon and Wellwood 2002[3], Clark 2002[4], Herrero et al. 2005[5], Smith et al. 2005[6], Sakals et al. 2010[7]

Appendix 4. Proposed Conceptual Framework for Grizzly Bear Conservation and Management to Support Land Use Planning Decisions for Grizzly Bears in the Babine Watershed Monitoring Trust Area of Interest. Review Draft for Discussion Purposes Only.



Appendix 4. A proposed conceptual framework for grizzly bear conservation to support discussions regarding adaptive management to maintain grizzly bears in the BWMT area of interest.

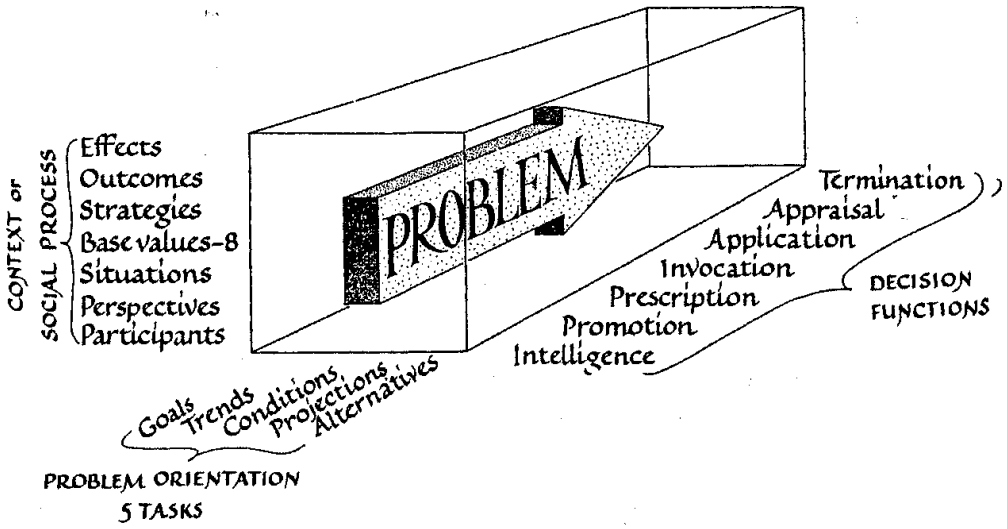
[1]Goal to be refined based on additional expert input

Framework adapted from USDA 1990[2], Weir and Hamilton 1998 in MacHutchon 1998a[3], MacHutchon 1998a[4], RIC 1999[5], Price and Daust 2005[6], Proctor et al. 2012[7]

Prepared by D.W. Wellwood, Raven Ecological Services. Please submit any questions or comments to deb@ravenecological.com

REVIEW DRAFT for Discussion Purposes Only, Version 5, 13 January 2014

Appendix 5. Putting it all together: multi-dimensional, interdisciplinary problem solving using the natural resource management and policy process. Taken with permission from Clark (2002:p. 176).



Appendix Fig. 1. A simplified illustration of the natural resource management and policy process. The three axes show the three key dimensions of interdisciplinary problem solving—problem orientation, context or social process mapping, and decision process analysis.