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BOW CORRIDOR ECOSYSTEM ADVISORY GROUP

**WILDLIFE CORRIDOR
AND HABITAT PATCH GUIDELINES
FOR THE BOW VALLEY**

MARCH 1998

Town of Canmore
Municipal District of Bighorn
Banff National Park
Environmental Protection
Agriculture, Food and Rural Development

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Copies of this report may be obtained from:

Environmental Services
Environmental Protection
303 – 2938 11 Street NE
Calgary, Alberta
T2E 7L7

Telephone: (403) 297-5959

Town of Canmore
600 – 9th Street
Canmore, Alberta
T1W 2T2

Telephone: (403) 678-1500

Municipal District of Bighorn
P.O. Box 310
No. 2 Heart Mountain Drive
Exshaw, Alberta
T1W 2M4

Telephone: (403) 673-3611

Superintendent
Banff National Park
Box 900
Banff, Alberta
T0L 0C0

Telephone: (403) 762-1500

A copy of this report may be viewed at:

Library
Alberta Environmental Protection
6th Floor, Great West Life Building
9920 – 108 Street
Edmonton, Alberta
T5K 2M4

Telephone: (403) 427-6132

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1.0 BACKGROUND

The Bow River Valley around Canmore has been recognized as a critical component of the Rocky Mountain Ecosystem. The area consists of predominantly montane habitat characteristics that are relatively rare in Alberta and of value for its ability to support a vast diversity of mammal and bird species. Its importance also lies in its value as a vital linkage corridor for large mammals between the Kananaskis Valley, Banff National Park and areas to the north. Maintenance of viable wildlife movement corridors is necessary to mitigate further fragmentation of habitat and populations that if severe could lead to the elimination of the resultant small, genetically isolated, populations. Having functional corridors would also allow individual animals to safely negotiate their way around highly developed areas thereby reducing the likelihood of human/wildlife conflicts.

The Town of Canmore is undergoing rapid population growth with associated residential, commercial, industrial and recreational expansion. Due to the narrow width of the valley, the extent of this development is impacting wildlife habitat and the ability of several species to move across and through the valley. To address this situation the Bow Corridor Ecosystem Advisory Group (BCEAG) have developed wildlife corridor and habitat patch guidelines for the Bow Valley.

2.0 PURPOSE OF THIS DOCUMENT

These Guidelines define a consistent approach which each of the land management jurisdictions in the Bow Valley will implement when handling development applications where there is potential for impacts on wildlife corridors. The Guidelines have the following objectives:

- 1) To ensure the viability of a system of wildlife corridors linking habitat patches within the Bow Valley based on the Map found in Appendix I.
- 2) To establish common ground rules so that development proposals for land in or adjacent to wildlife corridors in the Bow Valley are dealt with in a consistent manner by the respective approval authorities.
- 3) To identify standards for wildlife corridor design, including such things as maximum length, minimum width, topography, and vegetation characteristics.
- 4) To identify standards for local habitat patch design.

- 5) To identify a limited number of uses that may be allowed within wildlife corridors and local habitat patches and any special conditions governing such uses.
- 6). To identify those land uses that are compatible adjacent to wildlife corridors and local habitat patches and define any special conditions governing such uses.
- 7). To identify development guidelines designed to lessen the impacts of approved development projects on the viability of nearby wildlife corridors and local habitat patches.

The Map in Appendix I indicates the area of the Bow Valley covered by these standards and guidelines. The flowchart in Figure 1 illustrates how the standards and guidelines would be integrated into the planning process for applicable projects.

3.0 APPLICABILITY

These Guidelines provide a framework for decision making for all jurisdictions that adopt them. However, they have no statutory authority in any jurisdiction unless adopted under specific legislation. In addition, Guidelines will not apply to projects that have existing commitments and approvals from any of the land management jurisdictions. Specifically the following projects are exempt:

1. projects for which approvals have been granted by the Natural Resources Conservation Board (NRCB);
2. projects that conform to an approved area structure plan, area redevelopment plan, master plan, land use bylaw or subdivision approval;
3. projects that have valid development permits;
4. existing developments that have valid surface or subsurface leases or letters of intent from the Provincial Government and existing developments on private lands.

New activities associated with existing surface or subsurface leases, or are on private lands and are within an approved Area Structure Plan, will be exempt from the guidelines provided the activity is consistent with the nature and intent of the guidelines. Each approving jurisdiction will take care to ensure wildlife impacts are considered.

Figure 1: Flow Chart Showing How the Guidelines are Integrated into the Planning Process

4.0 DEFINITIONS

Numbers derived for this document are a product of completed and ongoing research on wildlife movement. These include studies on wildlife movement in Banff National Park, wolf use of the local mountain landscape, cougar use of urban environments in California, grizzly bear use of vegetation cover and land area, and conservation biology theory (see Section 5.1). Definitions and guidelines used in this report are partly based on studies and research in progress and, as a result, the guidelines will be reviewed on a three year basis beginning in the year 2000 (see Section 10.0).

Adjacent – Adjacent is defined as half the wildlife corridor width or half the local habitat patch radius from the corridor or patch edge. The concept addresses and attempts to buffer the effects of human activities along corridor and local habitat patch edges.

For a Primary Wildlife Corridor if a development or activity is located within a perpendicular distance of 175 meters from the edge of the corridor, it is considered to be “adjacent” to the corridor.

For a Secondary Wildlife Corridor if a development or activity is located within a perpendicular distance of 125 meters from the edge of the corridor, it is considered to be “adjacent” to the corridor.

For a Local Habitat Patch if a development or activity is within a perpendicular distance of 250 meters from the edge of the patch, it is considered to be “adjacent” to the patch.

Habitat Patch - Habitat patches are areas of land linked together by wildlife corridors. Habitat patches are generally large in area and meet a wider spectrum of habitat requirements (e.g. feeding, breeding, thermal regulation, security, resting) for species expected to live in the valley. Different species have different habitat requirements. Large species such as bears and elk require much larger areas of habitat than red squirrels and marten. Habitat patches are classified as either “Local” or “Regional”.

Local Habitat Patch - A local habitat patch is meant to meet the food, rest and water needs of an animal for a short period while negotiating a corridor network toward a larger, regional habitat patch at its end. Much of the difference between a local habitat patch and a wildlife corridor depends on shape. Habitat patches need to provide sufficient habitat in their interior for an animal to rest or feed with security from human disturbance. Based on minimum security areas defined for female grizzly bears (Gibeau et al. 1996), minimal habitat patch size is 4.5 km² with a

minimum width of 1.2 km. Narrower blocks of land merely become wildlife corridors.

Regional Habitat Patch - Regional habitat patches are the entities that a network of wildlife corridors and smaller local habitat patches connect for larger species. Regional habitat patches are large enough (>10 km. sq.) to contain adequate resources to sustain large carnivores for short periods of time. It is an order in size that would accommodate the seasonal range of elk, deer or moose (e.g. Wind Valley or the benches of the Fairholme Range in Banff National Park). In the Bow Valley the Regional Habitat Patches are generally incorporated within a protected area designation.

Linear Development - These are human disturbances to the landscape that tend to be long and narrow in terms of the physical area disturbed (e.g. power lines, roadways).

Wildlife Corridor - An area of land designed to provide connectivity among habitat patches. Wildlife corridors are generally not designed to fulfill any of the requirements of habitat patches other than some elements of security without which animals would not use them. The following two types of corridors are recognized in the Bow Valley:

Primary or Multi-species Corridors - These corridors are designed to be used by a wide variety of wildlife species including carnivores (wolves, bears, cougar etc.) that are more wary of human activities and less inclined to venture close to settled areas. These are the main corridors connecting large contiguous habitat areas and also provide the connectivity with other more distant populations in adjacent areas such as Banff National Park or the Kananaskis Valley. Vegetation characteristics must meet security and thermal cover requirements for a wide variety of wildlife species and may provide foraging areas. See next section for minimum widths.

Secondary Corridors - These corridors are believed to be more appropriate for smaller wildlife species or species more readily acclimated to human activities and developments such as elk. As such these corridors tend to be narrower in width and may contain landscape disturbances of a low impact nature such as trails and electric power lines. They should, however, provide enough security to accommodate movement. Similar to primary corridors, secondary corridors provide important links with larger habitat patches. See next section for minimum widths.

5.0 STANDARDS FOR THE DESIGN OF WILDLIFE CORRIDOR AND LOCAL HABITAT PATCH NETWORKS

5.1 Introduction

This Section describes the process for determining the standards for the design of wildlife corridor and local habitat patch networks. First two possible layouts for a corridor network are assessed. This is followed by a series of steps toward a final calculation for sufficient corridor width and local habitat patch size. The calculation is based on the stepwise assessment of corridor length, patch and corridor shape, and the topography and vegetative cover in and beside the corridor and habitat patch networks. The end result is a set of numbers that can be used by developers and planners to determine the minimum acceptable standards for wildlife corridor and habitat patch design in the Bow Valley.

The following standards build on known information about wildlife corridors and reserve network design currently available. Information about the subject is limited but increasing. As new information becomes available, these guidelines will be adjusted accordingly (see Section 10.0)

These guidelines were derived from a number of information sources. Harrison (1992) and Noss (1992) discuss the concepts of corridor and reserve (patch) networks. Beier and Loe (1992) and Beier (1995) discuss the specific attributes of wildlife corridors and attempt to assign minimal widths for cougar corridors. Herrero and Hamer (1983), Matson (1993) and Gibeau et al. (1996) address the issue of habitat patches in the form of "core security areas".

The role of vegetative cover for the security of large carnivores from human disturbance is well documented by McLellan and Shackleton (1989). Vegetation requirements for functional corridors are derived from unpublished data from ongoing wildlife corridor surveys in Banff National Park (Heuer, 1995, Stevens et al. 1996, Stevens and Qwchar 1997, Heuer et al. 1998, Heuer in progress).

Maximum slope measurements for corridor function are derived from a ten-year wolf location database from the Central Rockies (Callaghan, in progress) and wildlife corridor studies in Banff National Park (Heuer in progress). Maximum corridor lengths, corridor widths and desirable attributes for surrounding topography are inferred from Heuer (in progress) and wildlife corridor studies in northern Canmore (McCallum and Paquet 1992) and southern California (Beier 1995).

5.2 Wildlife Corridor Network Design

Wildlife corridors and local habitat patches marked on the Map (Appendix I) are, in many instances, a product of "what is left". All existing corridor networks do not necessarily meet the minimum requirements of these standards. While intended for future development proposals, the standards do highlight a number of existing and approved developments that likely compromise wildlife movement.

The distance over which human development may constrict wildlife to a corridor or system of corridors between two regional habitat patches should not exceed 8 km. The distance between two regional habitat patches (e.g. Canmore Flats and Banff National Park) can be linked by a single long, wide corridor or via a system of shorter, narrow corridors connecting local habitat patches. (Figure 2).

Of the above choices, a single and wide corridor is preferable. Wildlife will more easily follow a single, very wide corridor that offers fewer cul-de-sacs, peninsulas and doglegs that could trap, disorient and lead animals into conflict with humans. Unfortunately, many situations already exist in the valley which preclude the possibility of long, wide continuous corridors. The large widths of undisturbed land needed for 8 km long corridors no longer exist between many developments and the steep slopes and cliffs of surrounding mountains. Such a situation demands that standards be set for both wildlife corridors and local habitat patches.

A system of regional and local habitat patches and linking wildlife corridors are identified on the Wildlife Corridor/Habitat Patch Map (Appendix I). Locations were derived from a combination of empirical evidence, best professional judgment (McCallum and Paquet 1992), wildlife/vehicle collision mortality data and a simple delineation of remaining contiguous natural lands. Wildlife corridor and local habitat patch locations on the Map (Appendix I) and adjacent areas (see Section 4), are meant to alert developers and planners to areas where these standards are to apply.

1) BEST DESIGN

- Long, wide corridor (see Figure 3)

2) INFERIOR NETWORK DESIGN

Fig. 2 Two Corridor Network Designs to Link Regional Habitat Patches

5.3 Wildlife Corridor and Local Habitat Patch Design - the Starting Model

Certain minimum standards have been identified for wildlife corridors and local habitat patches (Table 1) and can be used as starting points in the assessment of acceptable dimensions (Figure 3). These starting points have incorporated baseline variables such as corridor length, topography and vegetation adjacent to and within corridors. Deviation from the baseline values in any of the variables will affect the dimensions of the wildlife corridor.

CORRIDOR

LOCAL HABITAT PATCH

Fig. 3 Starting Point for Discussion of Wildlife Corridor and Local Habitat Patch Design

Table 1: Starting point values for wildlife corridor and local habitat patch design

	Primary Corridor	Secondary Corridor	Local Habitat Patch
Minimum Width (corridor) or Size (patch)	350 m	250 m	4.5 km²
Length	1 km	1 km	Surface/Perimeter Ratio > 0.45
Topography	Flat	Flat	Flat
Vegetation Cover	> 40%	> 40%	> 40%

* See Appendix II for methods of measuring vegetation cover.

5.4 Interacting Variables that Change Local Habitat Patch and Corridor Design

The variables in Table 1 interact together to produce an acceptable wildlife corridor or local habitat patch design. However, an increase in corridor length will necessitate an increase in corridor width. Similarly, less vegetative hiding cover will need to be balanced by a wider corridor or larger local habitat patch. Conversely, shorter distances between patches, less developed edges and certain types of topography will serve to decrease the required corridor width and local habitat patch size.

5.4.1 Stepwise Approach to Determine Shape, Width and Size of Wildlife Corridors and Local Habitat Patches

The determination of corridor width and local habitat patch sizes are often the most commonly questioned values in corridor network design. While corridor widths and local habitat patch sizes have been discussed in the past, the resulting values have often neglected the presence or absence of sufficient hiding cover, the nature of the local topography and their length or shape.

The following stepwise approach addresses the interaction of all these variables and provides actual numbers that developers, planners and land use managers can apply on the ground. The approach is illustrated in flowchart format in Figure 4. Determining corridor width and local habitat patch size (Steps 1-4) is described in detail below with reference to a series of figures that depict the relationship of width and size with other variables.

Lakes and rivers have not been included in the calculation of corridor widths and local habitat patch size because they often act as barriers to large mammal movement.

Figure 4: Flowchart outlining Stepwise Approach for Determining Minimum Wildlife Corridor Width

Step 1 Shape

Human development along the edge of a local habitat patch or wildlife corridor should form as straight an edge as possible (Figure 3). Peninsulas, doglegs and cul-de-sacs have the potential to trap animals or direct them out of the corridor network and into development areas where conflict with humans may result. (Figure 5)

Figure 5: Wildlife Corridor and Local Habitat Patch Shapes - Staying Away From Peninsulas and Doglegs

Furthermore, a disadvantage of long or convoluted patches of habitat over their square or circular counterparts is that disturbance such as light, noise and smell infiltrate more of the interior and thus increase the area of impact.

A good measurement of this interior to edge relationship for habitat patches is the ratio of surface area to perimeter (SA/P) (Table 2). To limit 'edge effects', the minimum suggested value of the SA/P ratio is 0.45. Where the patch shape is rectangular, this equates to a minimum patch width of 1.2 km. Lesser widths lack sufficient interior habitat for rest and feeding and become, by definition, corridors.

Table 2: Examples of surface area/perimeter ratios for local habitat patches

Shape	Dimensions	Surface Area	Perimeter (P)	SA/P Ratio	Acceptable
Circle	R= 1.2 km	4.5 km ²	7.54 km	0.59	Yes
Square	2.12 km X 2.12 km	4.5 km ²	8.48 km	0.53	Yes
Rectangle	3.75 km X 1.2 km	4.5 km ²	9.9 km	0.45	Just
Rectangle	4.5 km X 1 km	4.5 km ²	11 km	0.41	No

Step 2: The Interaction of Corridor Length and Width

Long corridors potentially expose animals to unfavorable conditions for longer periods of time and increase the potential for an animal to leave the corridor to conflict with humans. Longer times required to traverse a corridor require food, water and adequate security for an animal to rest. Larger widths inevitably satisfy these requirements (Figure 6). In effect, longer and wider corridors make the distinction between corridors and habitat patches less obvious.

As stated in Section 5.2, the maximum allowable distance between two regional habitat patches is 8 km. Unless sufficient corridor width (1.25 km) can be accommodated along its length, a network of shorter, narrower corridors linking local habitat patches is necessary (Figure 2).

Step 3: The Interaction of Topography with Corridor Width and Local Habitat Patch Size

The relief of a ridge, elevated bench or sunken gully can insulate a wildlife corridor from the intrusion of noise, light and other human disturbances (Figure 7). The greater security afforded by the topography alleviates some of the need for larger corridor widths (Figure 8) and more dense vegetative cover (Figure 9). All these types of topography also act to channel animal movement in the appropriate direction, parallel to the edge of human development. A ridge or gully can be defined as such if it attenuates noise and light from an adjacent source by 60%.

Conversely, topography that slopes up and away from human development will allow noise, light, smells and other disturbances to permeate deeper into the corridor or habitat patch (Figure 7). Corridors and local habitat patches composed of such topography require larger widths and sizes (Figure 8).

[Assumes corridor with flat topography, vegetative cover > 40%, urban development on one side only, and no human use inside the corridor.]

Fig. 6 Widths for Different Wildlife Corridor Lengths

Topography

Note: A ridge or ravine attenuates at least 60% of light and sound.
Slopes > 25° are inadequate for corridor function.
(Heuer in progress, Callaghan in progress)

Fig. 7 Influence of Topography on Wildlife Corridor Width and Local Habitat Patch Size

Wildlife Corridor Width and Local Habitat Patch Size

[Assumes corridor length of 1km, > 40% vegetative cover, urban development on 50% of boundaries, and no human use in corridor or local habitat patch.]

Fig. 8 Corridor Widths and Local Habitat Patch Size for Different Types of Topography

* see Appendix 11 for methods to measure vegetative cover

[Assumes corridor length of 1km, flat topography, urban development on 50% of boundaries and no human use in corridor or local habitat patch.]

Fig. 9 Wildlife Corridor Widths and Local Habitat Patch Size for Different Vegetative Cover Values

Step 4: The Interaction of Vegetative Hiding Cover with Corridor Width and Local Habitat Patch Size

Like topography, vegetative cover acts to buffer auditory, visual and olfactory stimuli of human activity from penetrating deep into the corridor and patch interiors and provides animals with enough hiding cover to feel secure in their ability to elude predators or aggressors. For purposes of these guidelines, the baseline optimal average vegetative hiding cover for corridors and local habitat patches is greater than 40%. Less hiding cover will necessitate larger corridor widths and local habitat patch sizes (Figure 9).

Detailed methods for the measurement of vegetative hiding cover values are included in Appendix II.

5.4.2: Example Calculation for Corridor Width using the Stepwise Approach

The Scenario (see Figure 4)

Land above and immediately adjacent to a proposed development is labeled as a wildlife corridor. If the developer builds to full capacity, only a 700m wide swath of land will remain between the houses and mountain slopes which are greater than 25°. Half of the swath consists of mature forest that averages 40% hiding cover value and half consists of open forest slopes that average 25% hiding cover value. The proposed corridor will constrict to 700m for a 2 km length, connecting two large areas of critical winter habitat for deer and elk (i.e. regional habitat patches). Forty percent of the corridor area consists of a flat bench that sits above and below two 200m-long 20° slopes that comprise the remaining 60% of the corridor area. The developer plans to impose and enforce restrictions on human access into the corridor using fencing with signs. The developer has adjusted the proposal to meet the specified land use setback from the corridor boundary.

Based on the above guidelines, is the proposed corridor wide enough to accommodate large carnivores and other large mammals (i.e. a primary corridor)?

Table 3: Sample calculation for corridor width – addition and subtraction of maximum and minimum corridor widths, respectively.

	Calculated Value	Relevant Figure
Starting Width	350 m	Fig 3
Corridor Length = 2 km	+ 100 m	Fig. 6
Topography - 40 % bench	0.40 (-50 m) -20 m	Fig. 8
- 60 % 20 ° Slope	0.60 (100 m) +60 m	
Vegetation – half 40 % cover	0.50 (0) 0 m	Fig. 9
- half 25 % cover	0.50 (200) +100 m	

The starting point value for width of a primary corridor is 350m. The maximum addition to this width from the figures above is 100m (Table 3). The maximum subtraction is 20m (Table 3). Therefore, the required corridor width is:
 $350\text{m} + 100\text{m} - 20\text{m} = 430\text{m}$ wide.

(Primary corridor width)+(Max addition)-(Max subtraction)=(Min. width)

Therefore, the proposed 700m alignment is more than adequate given the constraints of the local landscape and vegetation inside corridor boundaries. Excess width could be used to buffer against unexpected human use inside the corridor.

5.5 Number of Corridors Needed

It is prudent for land managers to plan for multiple corridor networks to link the same regional habitat patches. Natural and man-made disturbances that could render a corridor dysfunctional are often unpredictable (e.g. fire or forest disease). Maintaining existing corridors is much less expensive than restoring ones that have been destroyed or blocked.

In terms of regional planning for a corridor system around a town, at least two functional primary corridors and 1 system of secondary corridors are recommended to link habitat to either side of the municipality (along valley movements). Movement from one side of the valley to the other must also be accommodated. Minimal cross-valley corridor systems are outlined for each municipality on the Map found in Appendix I.

6.0 COMPATIBLE USES WITHIN CORRIDORS AND LOCAL HABITAT PATCHES

With increased development pressures in the Bow Valley in recent years, the area is in a very unique situation with respect to wildlife movement corridors and local habitat patches. Remaining undeveloped areas may be all that are left in the Bow Valley and it will be necessary to protect them to the extent possible. In view of this, the BCEAG agencies feel it may be necessary to take steps to

manage human use impacts on corridors and local habitat patches. BCEAG is recommending that only the following types of land uses be permitted within wildlife corridors and local habitat patches:

- Scientific research
- Designated perpendicular trails within wildlife corridors
- Perpendicular crossings of linear developments within wildlife corridors (e.g. power lines, roads, sewage and water pipelines)
- Vegetation management for fire, disease and weed control
- Wildlife habitat management
- Education

In addition to restrictions on the types of uses within corridors and local habitat patches the following approaches should be incorporated into the management of human activities:

- Consolidation of Trails - The existing trail network that runs through wildlife corridors should be consolidated into a series of single perpendicular trails with approximately 1 km spacing. All surplus trails should be permanently closed. Trails within wildlife corridors that run parallel to the corridor should be eliminated. If a road or emergency access crosses a wildlife corridor, trails should be incorporated into the design.
- Seasonal Trail Closures - Where required, trails should be closed during seasons when wildlife are most sensitive to human disturbance.
- Temporal Trail Closures - Where required, trails should be closed during certain times of the day when wildlife are most sensitive to human disturbance.
- Human Use Monitoring - In order to reduce the impact of human use on wildlife corridors, trail use should be monitored.
- Dogs - All dogs should be kept on a leash at all times and remain on designated trails.
- Signage - All trails that bisect wildlife corridors should have signage that explains the importance of wildlife corridors and the use restrictions that apply.

7.0 ADJACENT USES TO CORRIDORS AND LOCAL HABITAT PATCHES

7.1 Definition of Adjacent

Adjacent is defined in terms of a distance of 175 and 125 meters from a primary and secondary wildlife corridor respectively and 250 meters from a local habitat patch. (Section 4.0)

7.2 Land Use Setbacks from Corridors and Local Habitat Patches

The nature and extent of human activity on either side of a wildlife corridor or along the edges of a local habitat patch will also affect the nature and extent to which visual, auditory and olfactory disturbances intrude. To mitigate these

effects the setbacks noted in Table 4, or as subsequently defined as a result of a Wildlife Impact Assessment, must be maintained between the corridor/local habitat patch edge and the nearest “active” area of property development. The following guidelines may be used in reviewing development applications with respect to potential impacts on wildlife corridors and local habitat patches:

- **Lighting** - Street and residential lighting adjacent to a wildlife corridor shall be designed or screened to prevent illumination of any portion of the wildlife corridor.
- **Passive Restrictions on Trail Use** – Trail head parking lots should be built to encourage use of designated trails located away from wildlife corridors and habitat patches.

Table 4: Human Impact Assessment of Land Uses not requiring a WIA and their Setbacks from Corridors or Local Habitat Patches.

Activity	Setback (m)¹ (left in a natural state)
Single Family Residential to Four Unit Residential	20
Local Commercial (commercial uses that serve the needs of a local neighborhood and generate only a limited amount of traffic)	40

8.0 APPROVAL REQUIREMENTS

8.1 Delineation of Corridor/Local Habitat Patch

Where a private sector, government or nonprofit proponent wishes to undertake a development project in or adjacent to a wildlife corridor or local habitat patch shown on the Map in Appendix I, the proponent will be required to delineate the wildlife corridor or local habitat patch according to the design standards in Section 5. The development proponent must show that the development proposal has accommodated the corridor or local habitat patch and the applicable land use setbacks in Section 7.

8.2 Wildlife Impact Assessment

The wildlife impact assessment is intended to be undertaken for proposed projects that are likely to have adverse effects on wildlife corridors or local habitat patches. This might be due to the size of the project or to its location relative to the corridor or patch. A wildlife impact assessment

¹ The setback shall be measured from the closest activity area (e.g. building, parking lot, loading/unloading area, patio, and entrance/exit to property, garbage container, etc.)

would be tailored to the specifics of the proposal and its location. A generic terms of reference for a wildlife impact assessment is attached in Appendix III. The local authority would approve the terms of reference, tailored to the specifics of the proposal and its location.

A development proponent will need to undertake a wildlife impact assessment to define the probable impacts of the proposed development on a wildlife corridor or local habitat patch in any of the following situations:

- The development is for an activity other than single family residential (up to 4 units) or local commercial (see Table 4). Wildlife Impact Assessments would therefore be mandatory for such activities as multifamily residential, resort commercial, general commercial, industrial and recreational land uses adjacent to wildlife corridors and local habitat patches.
- The proponent for a single family residential or local commercial use wishes to adjust the land use setbacks specified in Table 4;

The Wildlife Impact Assessment will recommend the land use setback for the proposed development as well as any mitigation and monitoring requirements.

8.3 Mapping

There is a clear need to create a consistent format for mapping of wildlife information in the Bow Valley. The initial mapping at 1:20,000 is acceptable for general corridor location purposes. Future mapping may be undertaken with the following characteristics:

- Scale - 1:5000 or less
- Contours - 5 m intervals or less
- Vegetation cover type based on the Alberta Vegetation Inventory classification system.
- Hydrology
- Existing developments

8.4 Other Approval Requirements

It should be noted that there are other issues besides wildlife impacts that are assessed by respective approving authorities, and which may make the proposal suitable or unsuitable. This document only addresses the requirements for wildlife corridors and local habitat patches.

9.0 WILDLIFE USE MONITORING

For development proposals that are required to conduct a wildlife impact assessment, wildlife use monitoring will be required. The responsibility for monitoring of wildlife use within the designated wildlife corridors will fall upon the developer. As part of the wildlife impact assessment, wildlife studies may be required prior to approval of the project to develop baseline data, during construction, and potentially for three years after all construction related to the project is completed. The developer would be required to provide and implement a mitigation plan to overcome any negative impacts that are found during the monitoring phase.

10.0 IMPLEMENTATION

It will be necessary to ensure that these guidelines are implemented consistently by each approving authority. A consistent approach to conducting Wildlife Impact Assessments across the Bow Valley is considered to be particularly important. To address this, BCEAG proposes the establishment of a sub-committee, with representation from each of the member agencies, to monitor implementation of the guidelines and to report as needed. The guidelines would be reviewed on a three-year basis, beginning in the year 2000. BCEAG will accept and compile written comments on the contents of these guidelines at any time, and will review all comments. BCEAG reserves the option to initiate review and amendment of the guidelines at any time. Amendments to the guidelines would become effective as they are accepted by BCEAG and adopted by member agencies.

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APPENDIX I

MAP OF WILDLIFE HABITAT PATCHES AND REQUIREMENTS FOR CONNECTING MOVEMENT CORRIDORS IN THE BOW VALLEY - 1998

MAP LEGEND

This Map was developed by the Bow Corridor Ecosystem Advisory Group (BCEAG) to be used in conjunction with the document *Wildlife Corridor and Habitat Patch Guidelines for the Bow Valley*. The membership of BCEAG includes the Town of Canmore, MD of Bighorn, Department of Environmental Protection, Department of Agriculture, Food and Rural Development and Parks Canada. Information on wildlife corridors was incorporated from the mapping done by the Wildlife Corridor Technical Committee in 1995 and updated to reflect recent land use decisions. Several areas of critical winter range for bighorn sheep exist along Highway 1A between Burnco and the Kananaskis Settlement. For clarity purposes these have not been illustrated on this map.

REGIONAL HABITAT PATCHES:

These are relatively larger patches of habitat (>10 km. sq.) that constitute destination areas for a network of wildlife corridors. They are diverse and large enough to meet the year round habitat requirements (food, thermal and hiding cover) for many species including carnivores. They are of regional significance in that they provide habitat on a seasonal basis for many wildlife species that are linked to populations other than those in the Bow Valley.

LOCAL HABITAT PATCHES:

These are smaller patches of habitat that likely meet the food, rest, security and water needs of species for short periods of time while negotiating the corridor network toward larger, regional habitat patches. They provide destination points at either end of movement corridors and need to provide sufficient habitat in their interior for an animal to rest or feed with security from human disturbance.

WILDLIFE MOVEMENT CORRIDOR:

Suggested land base requirements for wildlife movement between habitat patches in the Bow Valley.

AREAS UNDER REVIEW:

AREAS 1 AND 2

Areas that represent constraints on wildlife utilization and movement or areas where wildlife use is suspected but detailed information on which to better delineate exact boundaries is lacking. Site-specific research will be required to identify and delineate the habitat patch/wildlife corridor boundaries.

AREA 3

Area that represent constraints on wildlife utilization and movement but on which detailed information to better delineate exact boundaries is lacking. Final delineation of wildlife corridor/habitat patch boundaries will occur after completion of site-specific research, EIA studies and associated development review processes.

AREA 4

Area which provides a critical link for wildlife moving between the Kananaskis Valley and Banff National Park. More detailed information will be required to delineate specific wildlife corridor and highway crossing locations.

APPENDIX II

MEASURING HORIZONTAL HIDING COVER AS A FUNCTION OF VEGETATION

This method is simple and, in contrast to conventional measurements of the overhead canopy cover, considers horizontal cover as perceived between an animal and its predator, or an animal and a person. The method is currently in use for the Eastern Slopes Grizzly Bear Project (J. Kansas, pers. comm.).

Description

A narrow board or cloth 2.5 m high and 30 cm wide is subdivided into a vertical stack of boxes 25 cm high and 30 cm wide (Figure A.1). The cloth or board is held or placed vertically at the point to be sampled while another worker travels in a straight line to a point 15m away. The percent obscured for each square is recorded from the observer's standing position. The method is repeated four times at each site, once in each direction of the four cardinal points of the compass.

Rough cover maps for a proposed corridor will be constructed by sampling vegetative cover systematically at 100m intervals along transects that bisect the anticipated direction of animal movement in the corridor. A system of parallel transects spaced 100m apart will run the length of the corridor (Figure A.2), sampling vegetative cover once every 100m² and the results entered on a data sheet (Figure A-3).

Figure A-1 The Cover Cloth Used to Measure Horizontal Hiding Cover

Fig. A-2 Example of Grid of Points to Sample for Measurement of Corridor Vegetation

DATA SHEET

Observer: _____

Transect #: _____

Date: _____

Site #: _____

Height	% Cover – North	% Cover – West	% Cover – South	% Cover – East	Average
2.25 -2.5m	65	48	26	38	44
2.0-2.25m	54				
1.75-2.0m	30				
1.5-1.75m	55				
1.25-1.5m	10				
1.0-1.25m	0				
0.75-1.0m	68				
0.5-0.75m					
0.25-0.5m					
0-0.25m					

Figure A-3: Sample Data Sheet for Measuring Corridor Vegetation

APPENDIX III

WILDLIFE IMPACT ASSESSMENT

Terms of Reference

- 1) Description of proposed development.
- 2) Description of existing baseline information related to the location of the wildlife corridor or local habitat patch.
- 3) Description of impacts of the proposed development on the wildlife corridor or local habitat patch including but not limited to: increased human use in and adjacent to the corridor or local habitat patch, habitat alienation, reduction of thermal and hiding cover, increased sensory disturbance due to noise and light, alteration of species composition, microclimate, and hydrology.
- 4) Analysis of the significance of the impacts described in 3) above.
- 5) Description of mitigative measures to be used to address the impacts of the proposed development. Identification of the appropriate land use setbacks from the wildlife corridor/local habitat patch.
- 6) Description of the proposed implementation plan for the mitigative measures.
- 7) Description of the proposed monitoring plans to assess the effectiveness of the mitigative measures.

APPENDIX IV

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