Petroleum Industry Activity Guidelines for Wildlife Species at Risk in the Prairie and Northern Region

DRAFT

Canadian Wildlife Service
Environment Canada
Prairie and Northern Region
Edmonton, Alberta

2009

This report should be cited as follows:

Environment Canada. 2009. Petroleum Industry Activity Guidelines for Wildlife Species at Risk in the Prairie and Northern Region. Canadian Wildlife Service, Environment Canada, Prairie and Northern Region, Edmonton Alberta. 64p.

ACKNOWLEDGEMENTS

This document was prepared by Paul Gregoire of the Canadian Wildlife Service. This document is based upon contracted information provided to Environment Canada in 2007 by D.L. Scobie of Avocet Environmental Inc. with the assistance of C.A. Scobie and C.W. Faminow.

DRAFT

TABLE OF CONTENTS

TABLES

APPENDICES

1. INTRODUCTION

Environmental assessment guidelines exist for a variety of wildlife, particularly for species of concern in Prairie Canada. Current guidelines include species of national, provincial and local concern. For each species of sensitive wildlife, guidelines identify restrictions on passive and development activities for industry and other wildlife disturbances. Guidelines typically include setback distances from nests or dens and timing to avoid disturbances.

The guidelines herein are primarily directed towards wildlife species at risk that are currently afforded protection under the federal Species at Risk Act (SARA) in areas of federal jurisdiction in Alberta, Saskatchewan and Manitoba. For migratory birds, this includes any areas in Canada where they may occur. For other wildlife species, these guidelines are primarily directed towards federal lands, including but not limited to, Agriculture and Agri-food Canada (formerly PFRA) community pastures, Department of National Defense training areas, Indian Reserve Lands, and Federally protected areas. Provincial legislation may extend this protection to provincial and private lands. Although these guidelines are primarily intended for areas of federal jurisdiction they are applicable in a broader context.

2. BACKGROUND

In 2000, Environment Canada contracted Avocet Environmental Inc., which produced a working document entitled *Development of Standardized Guidelines for Petroleum Industry Activities that Affect COSEWIC* (Committee on the Status of Endangered Wildlife in Canada) *Prairie and Northern Region Vertebrate Species at Risk* (COSEWIC Guidelines) (Scobie and Faminow 2000). The information for the COSEWIC Guidelines was based on broad consultation, the best available knowledge and existing local management. It reflected the varying degrees of impact that activities associated with the petroleum industry may have on these COSEWIC species.

Avocet Environmental Inc. was again contracted in 2006 to provide Environment Canada with an update to the COSEWIC Guidelines, but this time with a focus on Prairie and Northern Region Vertebrate Species Listed under the Species at Risk Act in Alberta, Saskatchewan and Manitoba. It included: a compilation of the current state of species knowledge; expert opinion as it related to the guidelines; identification of beneficial management practices for each species; and a contact list of experts consulted.

Environment Canada adapted information from both contracts and augmented the literature review and expert consultations through 2009 with the intent to produce a standardized set of guidelines for areas of federal jurisdiction across the species range in Alberta, Saskatchewan and Manitoba that would be defensible to industry.

The development of standardized guidelines for setback distances, timing restrictions, and mitigation strategies is the continuation of a process that must be updated to reflect changes in development practices, species knowledge, existing published research and literature. This is an ongoing process of development, adjustment, and modification as required by new information.

These updated guidelines are not intended to address setbacks or timing restrictions for ñcritical habitatò, as these definitions currently do not exist for most vertebrate SARA listed species. These updated guidelines should be used in conjunction with the ñresidenceò descriptions available on the *SARA* Public Registry website.

3. METHODS

Through the provisions of the contracts, a comprehensive search for literature on this topic was undertaken by searching online databases at the University of Alberta library. The scope of this literature review was limited to direct visual, auditory or kinetic (*e.g.,* seismic) disturbances and their effects on stationary structures/habitats that relate to important aspects of a species life history (*i.e.,* hibernacula,

DRAFT

natal den, nest, breeding pond, migratory staging area). Limitations and assumptions of the review are further discussed within the methodology. Environment Canada augmented this review with a web based search for existing and newly published literature.

Species authorities representing both federal and provincial governments and non-government personnel from the Prairie and Northern Region of Canada were involved in the expert consultation process. Participants were asked to review and provide comment on critical dates and suggested rationale for setbacks from the original document (Scobie and Faminow 2000) in light of recent available knowledge and their own experiences. The results of the literature review and information on petroleum industry activities were provided to these individuals to aid in this assessment. Input was also requested on beneficial management practices and any other relevant literature, which had not been included in the literature review.

The combined results of the literature review and expert consultation resulted in a revised setback distance and critical timing for petroleum industry activities for each species assessed. Such criteria were derived for various levels of disturbance for each species. Matrix values for the level of disturbance of petroleum industry activities that had been developed within the original document (Scobie and Faminow 2000) were reworked and simplified to produce a table of Activities and Associated Level of Disturbance (Table 1). This table was based on the type, magnitude and risk of disturbance due to particular petroleum industry activities and a category between low and high level of disturbance. The reader is referred to the species specific setback distances and critical times (Table 2) to derive the recommended setback or timing information for that level of disturbance.

The setbacks and critical timing are based on a scenario where the area is deemed ñundisturbedò where no previous development or other mitigative circumstances exist in the area. Existing mitigative circumstances (*i.e.,* existing land use, aboveground structures, topography) should be assessed on a case-by-case basis in consultation with the proper authority to determine whether the setback or timing can be relaxed. If an assessment by a qualified professional wildlife biologist is not undertaken, it is suggested that the original setbacks apply.

Beneficial management practices, in terms of timing, setbacks and habitat conservation, were summarized both in general terms and on a per species basis.

3.1. Setback Assessment System

In 2000, representatives from the petroleum industry were consulted in an effort to develop a set of matrix values that would reflect the range of activities that could impact species (Scobie and Faminow 2000). To simplify the current document the matrix was reworked into an Activities and Associated Level of Disturbance Table (Table 1). The Type, Magnitude and Risk associated with a disturbance were utilized to arrive at a ñLEVELò of disturbance (*e.g.,* high, medium, low). This ñLEVELò of disturbance was then utilized to determine the appropriate setback and timing criteria for each species in the assessment (Table 2).

This approach is based on the premise that not all developments are the same in terms of magnitude and risk and thus should warrant different setback distances and timing restrictions. This process is applied equally to all species included in the evaluation, regardless of level of designation.

DRAFT

Table 1
Activities and Associated Level of Disturbance

LEVEL	ACTIVITY
LOW	Surveying Drive by Trails, low use, less than one pass[1] per week Flowline 2ò or less, plowed in
MEDIUM-LOW	*Interpolated* Pipeline 6ò or less, plowed in
MEDIUM	Pipeline 10ò or less, plowed in Pipeline 6ò or less, trenched Seismic, low footprint Trails, less than 50km/hr, all season, one or more passes per day Well servicing 15 minutes to 2hrs, less than 49 decibels
MEDIUM-HIGH	*Interpolated* Shallow gas well: winter construction including associated activities/infrastructure[2], minimal disturbance drilling, remote monitoring/metering, no longterm tanks or shacks. Permanent pig trap, cathodic protection or risers
HIGH	Permanent structures (*e.g.,* roads, buildings, compressor stations, pump stations, oil batteries, straddle plants, power lines, pig stations, riser stations) Oil or gas well (shallow or deep) with associated activities/infrastructure[2] Pipeline 8ò or greater, trenched Well servicing greater than two hours, greater than 49 dBA, summer

[1] Pass means one direction no return. A return trip is equivalent to two passes.

[2] òAssociated activities/infrastructureò refers to the additional well site disturbances that generally accompany drilling and are collectively considered part of the well drilling process. This includes: perforating, fracturing, swabbing, dewatering, finishing, flowline construction, cattle guard construction, fencing, tie-ins, trail construction, installation of tanks, sheds, etc.)

Participants were asked to provide comment on the LOW, MEDIUM and HIGH categories. The MEDIUM-LOW and MEDIUM-HIGH categories were added to offer more flexibility to the Table.

It was emphasized to industry that for many of the species being considered there was a general lack of science to back up the setback distances and that the biological information would be based on a broad consultation process and for many species, anecdotal evidence.

3.2. Literature Review

Scope of the Literature Review

Through the provisions of the contracts an extensive literature search relating to the effects of petroleum development on SARA listed vertebrate species in the Prairie and Northern Region was conducted by searching online databases at the University of Alberta library. Few studies have been performed on this specific topic therefore the search was expanded to find articles relating to the effect of human disturbance on the reproductive success or fitness of individual vertebrate SARA species. The review focused on the effects on stationary structures/habitats that relate to important aspects of a species life history (*i.e.,* hibernacula, natal den, nest, breeding pond, migratory staging area). The scope of this literature search was limited to direct visual, auditory or kinetic (*e.g.,* seismic) disturbances.

Parallel levels of disturbance can be found between petroleum and non-petroleum related activities (*e.g.,* recreational use of off-road vehicles = surveyor use of off-road vehicles). In addition, many of the studies on the effects of anthropogenic disturbances on wildlife have used humans walking towards nest sites as the means of disturbance (this type of disturbance would be considered ñLOW levelò, as noted in Table 1). In instances where there was difficulty in locating articles on a particular species, articles on closely related species with similar reproductive history and habitat preferences were substituted. Only peer reviewed articles and grey literature specifically oriented towards the topic were chosen.

DRAFT

Literature Review Methodology

The methodology used was based on that used by Jalkotzy *et al.* (1997). Search platforms, databases and the range of years searched can be found in Appendix A. Some databases were updated weekly and all searches were completed by December 2006 for the purposes of the contract. (Because more literature on this subject has since become available, Environment Canada continued internet searches and species expert consultations through 2009.)

A Boolean search was performed in each database combining the terms from group 1 and 2 (Appendix A). The list of journals from each database was compared and databases deemed redundant by overlap were not searched. For most databases a search was performed for each species by combining the species name (past and present) in all its forms (common and Latin) with all the terms in group 2 (Appendix A). Some databases had few articles on target species, thus only one or a combination of all of the forms of the species name required searching.

For species with little available literature (*e.g., l*ong-billed curlew), the genus name was included in the search (*e.g.,* ñlong-billed curlewò or ñ*Numenius americanus*ò or *Numenius*), in hope of increasing the results. Other species with more literature written and with more species in the same genus had their search confined to their common name and complete Latin name (*e.g.,* ñferruginous hawkò or ñ*Buteo regalis*ò). Wildcards (*e.g.,* *) and truncation symbols were used in searches where possible to include singular, plural and other forms of the terms (*e.g.,* disturb* = disturb, disturbance, disturbs, disturbances, disturbing, disturbed).

The results of these database searches were exported to the online reference managing program RefWorks. The large number of references resulting from these searches were further searched and sorted in RefWorks, according to the relevancy of the topic. Relevant articles that could not be obtained from online journals, by Internet search or found at the University of Alberta library, were ordered through the interlibrary loan system. Once obtained, all articles were read and included in this report if deemed relevant to the updated guidelines. The Literature Cited section of each applicable article was thoroughly examined for additional references.

3.3. Consultation with Recovery Team Experts and Species Authorities

Recovery Team experts included both federal and provincial representatives. Species-authorities included government and non-government personnel from the Prairie and Northern Region of Canada. They were provided, by email correspondence, with a Portable Document Format (PDF) version of a Power Point presentation summarizing petroleum development activities, the results of the Literature Review and the 2000 COSEWIC Guidelines Timing and Setback table. They were asked to consider the animal living in relative isolation from human disturbance when commenting on updating the critical dates, suggested setbacks, rationale for setbacks, best management practices and any other literature not included in the literature review. No emphasis was given to the *SARA* designation. This process was applied equally to all species included in the evaluation, regardless of level of SARA designation. Species authorities were asked to make recommendations based on the spirit of the prohibitions defined in *SARA*, especially with respect to the damage or destruction of the residence.

The critical dates, suggested setbacks, and rationale for the setback distances were compiled and sent out to the original interviewees as well as to a broader range of species-authorities for final comment.

In discussions with both environmental and industry representatives, it was stressed that this is meant to be a work in progress and that the final document will not be static. The process must be continually updated to reflect changes in development practices and species knowledge. Some species already have existing local management groups and, therefore guidelines were not developed for the woodland caribou and grizzly bear.

DRAFT

3.4. Assumptions in Development/Revision of Setbacks

Based upon the literature review, the distance at which the animal fled or behaviour changed (*e.g.,* alertness, distraction displays) was considered the distance at which the animal was disturbed. The change in behaviour or movement of the individual was deemed to have an adverse effect on reproductive success and the fitness of individuals. There are several factors that could alter the reaction of a species to a disturbance. These factors include habituation, stage of reproduction and intensity of disturbance (low, medium and high). As the updated guidelines are meant to be used prior to new development, it is assumed that the animals will not be habituated and the level of disturbance has already been factored in. It is acknowledged that there are different reactions to disturbances between species and between individuals within a species. For other species, especially those that have large foraging areas or movements, the setbacks were set according to the mortality risk associated with the activity (e.g. amphibians and roads).

4. RESULTS

The results of the literature review, on a per species basis, are provided in Sections 6 through 9 of this report and are grouped by avifauna (birds), mammals, reptiles and amphibians. The Beneficial Management Practices are located immediately following the Literature Review and reflect much of the information found in the Literature Review.

During the Recovery Team Expert and Species Authorities consultation process, a total of 140 species-authorities in British Columbia, Alberta, Saskatchewan, Manitoba and various locations in the United States were contacted. (NOTE: some people have experience with more than one species).

Table 2 contains the compiled listing of Setback Distances, Critical Timing and Rationale that apply to nests and dens, unless otherwise noted. This listing is organized into species groups of avifauna (birds), mammals, reptiles and amphibians.

5. DISCUSSION

The development of standardized guidelines for setback distances, timing restrictions, and mitigation strategies is the continuation of a process that began in Saskatchewan in 1994 and must be updated to reflect changes in development practices, species knowledge, existing research and literature.

As industry practices evolve, adjustments to these guidelines will need to be made. **When planning a project, initially the proponent should attempt to schedule the project to have the least impact on species at risk.** For most species this means construction outside of the breeding season. If avoiding this critical period is not an option, then the guidelines should be applied for planning and operational purposes.

If a company must develop within the critical times, historic species information is available from provincial databases (*i.e.,* Conservation Data Centers [CDC]) that highlight historic ñhot spotsò. If the CDC data is limited for a given area, then it should be determined if the development activity is within the range of a listed species and whether there is suitable habitat present. The onus would then be on the developer to hire qualified wildlife personnel to conduct surveys for all listed species whose ranges occur within the project area to identify current locations of nests or dens. If a den or nest is found within the recommended setback distance, and setback distances cannot be met, existing land use/aboveground structures and topography in the area should be evaluated to determine if the setback can be relaxed. This would be done in consultation with the proper regulating authority.

Industry activity values are based on perceived impacts and will be revised as more knowledge is gained. There was some debate regarding the low weighting given to the *Pipeline* type of disturbance on Table 1. The concern with the low weighting was that pipeline rights-of-way frequently become trails and then

DRAFT

roads**. Should a pipeline right-of-way become a trail or road, then setback distances would increase to reflect the increased level of disturbance, in this instance for example, that of an Access Road.** This principle should apply to any disturbance activity.

Similarly, should multiple activities occur at a location, for example, the construction of a number of wells or a number of roads, then it may be necessary to increase setbacks to reflect a higher level of disturbance. Disturbance tolerances may vary among individuals and among species, though once exceeded, may lead to future habitat avoidance.

Monitoring and follow-up is an important consideration when undertaking activities during the breeding season and when applying setbacks. Insight into the effectiveness of applied timing restrictions and setbacks in avoiding impacts to species at risk can be used to refine practices to minimize effects to species at risk. Monitoring can also provide insight into species threshold level responses to fragmentation types of disturbances.

Listed below are comments that appeared numerous times as suggested **Beneficial Management Practices** that may benefit species and make projects more cost effective. To reduce duplication they have only been appended below and should be considered for each species.

- Developments should occur outside of the breeding season.
- Hire qualified and trained wildlife personnel to conduct pre-development inventories.
- Consider additive or cumulative effects and/or develop threshold limits.
- Create, implement and enforce a traffic control program, as appropriate.
- Once critical habitat is defined, incorporate into setbacks.
- If working within recommended setback distances, conduct a two year post-construction monitoring project in consultation with the appropriate regulatory authority.
- If seeding is required, use native seed common to the area (local provenance).
- Favor multi-pad sites over single well locations.
- Use trails; if ruts get too deep, fill with gravel rather than building a gravel road.
- Maintain noise emissions at less than 49 dBA. Or 10 dBA above ambient in remote areas.

It must be emphasized that species are at risk in Canada for a variety of reasons. The majority of these species rely upon native prairie for a significant portion of their breeding cycle. Though the impact of industrial development on these species cannot be dismissed, it is only one factor at work. Agriculture, urban development, and other types of fragmentation and degradation of habitat, along with natural cycles, must be included in discussions of species recovery efforts.

It is critical that qualified environmental/wildlife professionals are engaged when setting appropriate setback distances. These updated guidelines provide suggestions based on knowledge gained to date. It may be possible to relax the recommended setbacks, should mitigative circumstances be identified (in the opinion of a qualified professional in consultation with regulators). It is also noteworthy, for some species, that the close proximity of existing disturbances should not be used as a reason to automatically relax setbacks, as the effects can be additive (e.g. Sage Grouse). **If a project is planned without a qualified wildlife biologist review, then the maximum setback distances should be applied at all times**.

It is recommended that industry consider the cumulative effects of all projects that involve infilling of existing resource developments. Agencies are encouraged to develop multi-disciplinary studies to investigate effectiveness of setback distances and timing restrictions. Applied research should focus on determining the impacts of development activities on species and their habitats. There is a need to identify disturbance density effects and thresholds for populations.

DRAFT

Knowledge Gaps

The following are knowledge gaps identified from the literature review:

- Information on the overwintering sites of herptiles and the potential effects of exposing these sites during ground disturbance in winter.
- Effects of human disturbance on reproductive success of individual denning mammals and many bird species.
- Distances of roads from reptile hibernacula that result in lower mortality.
- Effects of petroleum specific disturbances (*e.g.,* seismic testing, trails, pipeline construction, etc.) on reproductive success of species at risk.
- Effects of habitat fragmentation on species at risk.
- Effects of disturbances on species time budgets and individual fitness of species at risk.
- Success or failure of setback distances, timing restrictions and mitigation.
- Effect of seismic activity on Ordôs kangaroo rat.
- Effect of noise (*e.g.,* traffic, compressor stations, etc.) on density and reproductive success of breeding birds.
- Edge effect on nest predation and nest parasitism.

Literature Cited

Jalkotzy, M. G., P. I. Ross, and M. D. Nasserden. 1997. The effects of linear developments on wildlife: A review of selected scientific literature. Prepared for Canadian Association of Petroleum Producers. Arc Wildlife Services Ltd., Calgary, Alberta.

Scobie, D. and C. Faminow. 2000. Development of Standardized Guidelines for Petroleum Industry Activities that Affect COSEWIC Prairie and Northern Region Vertebrate Species at Risk. Prepared for Environment Canada by Avocet Environmental Inc. and Ghostpine Environmental Services Ltd., Alberta. 42p.

DRAFT

Table 2 Setback Distance, Critical Timing and Rationale

BIRDS

TIMING	ACTIVITY	SETBACK (m)	RANGE[1] (m)	RATIONALE
Burrowing Owl: (Nest And Roost)				
April 1 to August 15[2] (nestling, fledgling)	LOW	200	200	will react to disturbance
	MED-LOW	250		
	MED.	300	300-500	noise, people, losing part of home range
	MED-HIGH	400 (roost 300)		
	HIGH	500 (roost 300)	500	90% of owl activity is within 600 m, safety factor, same setback as Furadan
August 16 to October 15[2] (dispersal, pre-migration)	LOW	100	100	will react to disturbance
	MED-LOW	150		
	MED.	200	200-300	may affect future nest site selection
	MED-HIGH	300		
	HIGH	500 (roost 300)	500	90% of owl activity is within 600 m, safety factor, same setback as Furadan
October 16 to March 31[2] (winter)	LOW	100	10-100	avoid destruction of burrow
	MED-LOW	100		
	MED.	200	200	buffer
	MED-HIGH	300		
	HIGH	500 (roost 300)	500	90% of owl activity is within 600 m, safety factor, same setback as Furadan
Ferruginous Hawk: (Nest)				
March 1 to July 15 (nesting)	LOW	250	250-500	female may stress, may decrease nestling fitness with adults spending more time defending nest than feeding
	MED-LOW	350		
	MED.	500	250-750	helicopters and high disturbance activities may affect behaviour.
	MED-HIGH	750		
	HIGH	1000	450-1000	high intensity or prolonged activities may keep hawks at greater distances than other raptors
July 16 to February 28 (dispersal, winter)	LOW	50	50-100	post-fledging, maintain buffer when hawks are not present
	MED-LOW	50		
	MED.	200	50-300	maintain buffer so nesting is not discouraged by new disturbance.
	MED-HIGH	300		
	HIGH	500 (1000)	450-1000	young may be on the ground and unable to fly, maintain buffer (for tall permanent vertical structures)
Least Bittern (Nest)				
May 1 to July 31	LOW	100	100	sensitive to human activity, may disturb calling,
	MED-LOW	150		
	MED.	200	250	avoid all impacts to wetland including siltation and pollution runoff
	MED-HIGH	300		
	HIGH	400	400	noise, light may disturb calling
Loggerhead Shrike: (Nest) Note: Applies to *L. L. Excubitorides and L. L. Migrans* in Manitoba				
May 1 to August 15	LOW	100	100	eliminate nesting attempt, reduce feeding rates and reduce nestling success
	MED-LOW	200		
	MED.	250	250	may lead to predation and abandonment

DRAFT

TIMING	ACTIVITY	SETBACK (m)	RANGE[1] (m)	RATIONALE
	MED-HIGH	300		
	HIGH	400	400	may lead to predation and abandonment
Long-Billed Curlew: (Nest)				
April 15 to July 15	LOW	100	100	aggressive territorial displays
	MED-LOW	100		
	MED.	200	200	avoid nesting disruption
	MED-HIGH	200		
	HIGH	200	200	noise, movement may interfere with nesting
McCown's Longspur: (Nest)				
May 1 to July 31	LOW	25	25	prevent disturbance during nesting
	MED-LOW	50	60-100	
	MED.	100	100-200	maintain integrity of nesting territory, auditory disturbance
	MED-HIGH	150	150-300	
	HIGH	200	200-500	auditory noise
Mountain Plover: (Nest)				
May 1 to July 31	LOW	200	200	avoid nesting disruption
	MED-LOW	300		
	MED.	400	200-500	more buffer, predators, avoid nesting disruption
	MED-HIGH	500		
	HIGH	500	200-750	more buffer; unknown effects of roads, traffic, attract raptors
Peregrine Falcon: (Nest) Note: Applies To *F.P. Anatum* And *F. P. Tundrius*				
April 1 to August 15	LOW	300	100-500	reduce disturbance, female may "throw" eggs or small young
	MED-LOW	400		
	MED.	500	500-2000	lack of incubation, loss of eggs, less feeding, no brooding
	MED-HIGH	750		
	HIGH	1000	500-2000	disruption at nest, desertion, auditory disturbance
Piping Plover: (Nest)				
May 1 to July 31 (nesting, brood rearing) (consideration should be given to year round setbacks where there is site fidelity)	LOW	100	75-200	birds will react at 100-150m
	MED-LOW	100		
	MED.	150	150-200	minimize nest desertion, predation, rare globally
	MED-HIGH	200		
	HIGH	250	200-300	unknown effects of roads, traffic, permanent loss of nest
August 1 to September 1 (dispersal, migration)	LOW	50	50-50	maintain habitat
	MED-LOW	100		
	MED.	100	50-100	concern about permanent habitat loss
	MED-HIGH	200		
	HIGH	200	200-300	concern about permanent habitat loss
Red-Headed Woodpecker: (Nest)				
May 1 to July 31	LOW	50		nest disturbance
	MED-LOW	50		
	MED.	100		avoid desertion
	MED-HIGH	150		
	HIGH	200		noise, avoid desertion
Rusty Blackbird: (Nest)				
May 1 to July 31	LOW	0		
	MED-LOW			
	MED.	50		
	MED-HIGH			

TIMING	ACTIVITY	SETBACK (m)	RANGE[1] (m)	RATIONALE
	HIGH	100		habitat loss, predation
Sage Grouse: (Lek, Nest, Brood Rearing And Winter Habitat)				
March 1 to June 15 (leks)	LOW	1000		concern about disturbing congregating birds
	MED-LOW	2500		
	MEDIUM	3200		may interfere with lek behaviours
	MED-HIGH	3200		
	HIGH	3200		predation, auditory, mortality
June 16 to February 29 (leks)	LOW	100		concern about disturbing congregating birds
	MED-LOW	400		
	MEDIUM	500		may interfere with lek behaviours
	MED-HIGH	3200		
	HIGH	3200		predation, auditory, mortality
November 1 to March 31 (wintering habitat)	LOW	200		
	MED-LOW	200		
	MEDIUM	200		
	MED-HIGH	400		
	HIGH	500		
April 1 to July 31 (nests, brood rearing)	LOW	200		no surface disturbance within setback
	MED-LOW	500		
	MEDIUM	500		no surface disturbance within setback
	MED-HIGH	1000		
	HIGH	1000		predation, auditory, mortality
Sage Thrasher: (Nest)				
May 15 to June 30	LOW	100		minimize disturbance, are somewhat tolerant
	MED-LOW	100		
	MED.	200		concern about habitat integrity and foraging habitat
	MED-HIGH	200		
	HIGH	250		concern about habitat integrity and foraging habitat
Short-Eared Owl: (Nest)				
April 1 to July 31	LOW	100		fairly tolerant, reduce chance of disrupting nesting
	MED-LOW	200		
	MED.	200		minimize nest disturbance, noise and vibration
	MED-HIGH	200		
	HIGH	200		road mortality, protection of nesting areas
Sprague's Pipit: (Nest)				
May 1 to August 31	LOW	50	50	prevent disturbance during nesting
	MED-LOW	100		
	MED.	200	100-300	maintain integrity of nesting territory, auditory disturbance
	MED-HIGH	250	200-350	
	HIGH	350	350-1000	minimize fragmentation, cowbird parasitism, predators, noise
Whooping Crane: (Breeding, Staging Areas)				
May 1 - May 30 June 01 - Nov 01	LOW	500	100-1000	sensitive to visual disturbance
	MED-LOW	1000		
	MED.	1000	1000	shy sensitive birds in only a few areas
	MED-HIGH	1000		
	HIGH	1000	1000	sensitive to visual disturbance, need to build up fat reserves for migration
Yellow Rail: (Nest)				
May 1 - July 15	LOW	100	100	may disturb calling
	MED-LOW	100		

TIMING	ACTIVITY	SETBACK (m)	RANGE[1] (m)	RATIONALE
	MED.	150	150	sound and light may interfere with breeding, avoid all impacts to wetland including siltation and pollution runoff
	MED-HIGH	300		
	HIGH	350	350	sound and light may interfere with breeding, avoid all impacts to wetland including siltation and pollution runoff

MAMMALS

TIMING	ACTIVITY	SETBACK (m)	RANGE (m)	RATIONALE
Black-Tailed Prairie Dog: (Colony)				
Year-round	LOW	0		
	MED-LOW	50		sensitive to visual disturbance
	MED.	100		visual disturbance
	MED-HIGH	150		
	HIGH	200		
Grey Fox: (Den)				
	LOW	0		
	MED-LOW	50		
	MED.	100		
	MED-HIGH	150		
	HIGH	200		susceptible to road mortality
Ord's Kangaroo Rat: (Residence)				
Year-round	LOW	50	---	avoid damage to burrow system, daytime activities only
	MED-LOW	100	---	
	MED.	250	---	concern about abandonment, loss food caches, minimize light
	MED-HIGH	250	---	concern about mortality, predators, parasites
	HIGH	500	---	minimize light to allow foraging, seismic could affect burrows, avoid population sinks
Swift Fox: (Den)				
February 15 to August 31 (breeding, rearing, emergence)	LOW	500	500	correlation between disturbance and lower productivity
	MED-LOW	500		
	MED.	500	500-1000	correlation between disturbance and lower productivity
	MED-HIGH	1000		
	HIGH	2000	2000	respond negatively to edge, fragmentation and roads up to 5,000m away
September 1 to February 14 (winter)	LOW	100	100	
	MED-LOW	250		
	MED.	500	500	may cause premature dispersal and mortality
	MED-HIGH	1000		
	HIGH	2000	2000	respond negatively to edge, homogeneity and road habitats up to 5,000m away

DRAFT

TIMING	ACTIVITY	SETBACK (m)	RANGE (m)	RATIONALE
Western Harvest Mouse (Nest)				
Year-round	LOW	50	---	Vehicle or ATV traffic may destroy nests
	MED-LOW	50	---	
	MED.	100	---	Vegetation clearing may destroy cover; minimize creation of edge habitat; daytime access only to prevent vehicle mortality and minimize interference with nocturnal movement patterns
	MED-HIGH	150	---	Well heads may provide perch for predators
	HIGH	250	---	Long-distance effects of light and noise associated with permanent infrastructure
Wolverine: (Den)				
Year-round	LOW	0	---	
	MED-LOW	100	---	
	MED.	250	---	
	MED-HIGH	250	---	
	HIGH	500	---	will use roads and seismic lines, road mortality
Wood Bison: (Calving, Rut Grounds, Winter Range)				
April 1 to September 1 (calving, rut grounds)	LOW	0	---	
	MED-LOW	0	---	
	MED.	0	---	animals will disperse
	MED-HIGH	500	--	
	HIGH	1000	500-1500	overflights.
March 1 to April 15 (winter range)	LOW	500	---	poor body condition, restricted locomotion
	MED-LOW	500	---	
	MED.	500	---	poor body condition, restricted locomotion
	MED-HIGH	750	---	
	HIGH	1000	500-1500	poor body condition, restricted locomotion, overflights

REPTILES

TIMING	ACTIVITY	SETBACK (m)	RANGE (m)	Rationale
Eastern Yellow-Bellied Racer: (Hibernacula)				
Year-round	LOW	100	---	reduce mortality encounters, no disturbance during critical times
	MED-LOW	150	---	
	MED.	200	---	
	MED-HIGH	500	---	
	HIGH	1000	---	prevent den collapse, reduce road mortality
Greater Short-Horned Lizard: (Suitable Habitat)				
Mar 15 - Nov 15	LOW	50	---	concern about quads and vehicles
	MED-LOW	100	---	
	MED.	200	---	movements beyond rims and ravines
	MED-HIGH	200	---	
	HIGH	200	---	no activity on breeding areas
Northern Prairie Skink: (Burrow)				
Year-round	LOW	50	---	concern about quads and vehicles
	MED-LOW	100	---	
	MED.	100	---	
	MED-HIGH	200	---	
	HIGH	200	---	no activity on breeding areas

DRAFT

AMPHIBIANS

TIMING	ACTIVITY	SETBACK (m)	RANGE (m)	Rationale
Great Plains Toad: (Breeding pond, wintering site)				
Year-round	LOW	50	50	may disturb calling, mortality from vehicles
	MED-LOW	200		
	MED.	200	200-400	sound and light may interfere with breeding, reduce road mortalities
	MED-HIGH	400	400-500	
	HIGH	400	400-500	contamination from runoff, road mortalities, sound and light may interfere with breeding.
Northern Leopard Frog: (Breeding pond, wintering site)				
Year-round	LOW	50	50	calling during day
	MED-LOW	100		
	MED.	200	75-400	activity may cause calling to cease, identify movement corridors
	MED-HIGH	350	350-400	
	HIGH	400	100-500	Dispersal, road mortality, no instream effects that will affect flow needs
Western Toad: (Breeding pond, wintering site)				
Year-round	LOW	50	50	may disturb calling, mortality from vehicles
	MED-LOW	200		
	MED.	200	200-400	sound and light may interfere with breeding, reduce road mortalities
	MED-HIGH	400	400-500	
	HIGH	400	400-500	Seasonal movements, dispersal, contamination from runoff, road mortalities, sound and light may interfere with breeding.

[1]Range in recommended setbacks by respondents and literature.

[2]Setbacks for BUOW apply to burrows and roosts for 2 full years following the last known month of occupation..

DRAFT

6. LITERATURE REVIEW - BIRDS

Avifauna in the prairie portion of the Prairie and Northern Region are more susceptible to disturbance due to the lack of topographical relief and vegetation to conceal nests from anthropomorphic disturbances. The distance at which a nesting bird flushes from a disturbance can be used as a rough measure for establishing setback distances. The literature suggests that an additional 40 m (Rodgers and Smith 1995) or 50 m (Vos *et al.* 1985) be added to the flush distance because the bird was aware of the disturbance and stressed before it flushed.

Disturbances may affect the reproductive success of a nesting bird in the following ways:

- the nest is open to predation when an incubating adult is flushed;
- the disturbance may attract predators via the bird distraction display;
- a predator may be attracted to the scent of feces deposited by a fleeing bird;
- exposure of the eggs or nestlings to the elements when the bird is flushed;
- nest abandonment;
- eggs broken or nestlings accidentally kicked out of the nest by a fleeing bird; or
- young may try to fledge prematurely and are then open to predation.

It is important to note the negative effect of noise from human disturbances on bird occurrence and density. Noise is thought to be the most important reason for the reduction in songbird density near roads (Reijnen *et al.* 1995, Reijnen *et al.* 1996). A reduction in density of all birds combined occurred at a threshold of 47 dBA (Reijnen *et al.* 1996). Sixty percent of the species studied showed a reduction in density, but the distance to which bird density was reduced from roads varied with bird species and amount of traffic (Reijnen *et al.* 1995). Roads with light traffic, namely less than 12 vehicles per day, have also shown effects for grassland birds within 100m (Ingelfinger and Anderson 2004), although habitat fragmentation due to the roads was suggested as a possible cofactor. It is important to recognize the need for species-specific studies, as there exists this variability in responses by different species of birds to different levels of noise. In addition, an important trend to notice for some species is that as traffic increases the distance effect on bird presence and breeding increases (Forman *et al.* 2002). In a study in the Netherlands, approximately 60% of the grassland bird species were reduced by 12-56% within 100 m of roads with traffic of 5,000 cars a day, and the average disturbance distance for birds with reduced densities from traffic noise was 120 m (Reijnen *et al.* 1996). A study on the effect of compressor station noise in the boreal forest found that all passerines combined had a 37% reduction in density near compressor stations (Habib 2006). This effect of reduced density extended out to at least 250 m from the compressor stations (Habib 2006). Estimated noise levels for shallow gas fracturing operations, traditional drill rig operations and typical coil rig operations on grasslands at 250m distances have been estimated at 57 dBA, 55 dBA and 55 dBA, respectively (EnCana 2007). At 500m these were attenuated to 49 dBA, 44 dBA and 44 dBA, respectively. A threshold of 49 dBA was proposed for grassland birds and grouse (Ingelfinger 2001; Nicholoff 2003; Wyoming Game and Fish Dept. 2009) which was deemed an acceptable 10 dBA above natural background noises.

There are however, some species such as the horned lark that increase near roads (Inglefinger 2001, Ingelfinger and Anderson 2004). The Tennessee and yellow warbler seem attracted to compressor stations (Habib 2006) and others, such as the Lapland longspur, seem not to be affected by roads (Male and Nol 2005). Waterfowl are also known to nest in roadside ditches. For birds that nest in noisy areas, there also exists a cost of increased energy expenditure, as it was found that birds may increase their vocal amplitude (Brumm 2004) or frequency (Habib 2006) when singing in noisy environments.

The following cases of direct mortality of birds from petroleum development should not be ignored. In the United States, from 1992 to 2005, the bird remains from petroleum waste fluids stored in exposed pits or open topped tanks were analyzed and of the 2060 birds collected, 3 were burrowing owls, 25 were sage thrashers, 8 were loggerhead shrikes and one was a short-eared owl (Trail 2006).

Literature Cited

Brumm, H. 2004. The impact of environmental noise on song amplitude in a territorial bird. The Journal of Animal Ecology 73(3): 434-440.

EnCana. 2007. Environmental Impact Statement for the EnCana Shallow Gas Infill Development in the CFB Suffield National Wildlife Area: Volume 1, Project Description. EnCana Corporation. Calgary, Alberta, Canada. 535p.

Forman, Richard T. T., B. Reineking, and A. M. Hersperger. 2002. Road traffic and nearby grassland bird patterns in a suburbanizing landscape. Environmental Management 29(6): 782-800.

Habib, L. D. 2006. Effects of chronic industrial noise disturbance on boreal forest songbirds. M.S. Thesis, University of Alberta, Edmonton, Alberta, Canada.

Ingelfinger, F., and S. Anderson. 2004. Passerine response to roads associated with natural gas extraction in a sagebrush steppe habitat. Western North American Naturalist 64: 385-395.

Ingelfinger, F. M. 2001. The effects of natural gas development on sagebrush steppe passerines in Sublette County, Wyoming. M.S. Thesis, University of Wyoming, Laramie, Wyoming.

Male, S. K., and E. Nol. 2005. Impacts of roads associated with the Ekati Diamond MineÊ , Northwest Territories, Canada, on reproductive success and breeding habitat of lapland longspurs. Canadian Journal of Zoology 83(10): 1286-1296.

Nicholoff, S.H. 2003. Wyoming Bird conservation Plan, Version 2. Wyoming Partners in Flight. Wyoming Game and Fish Department, Lander, Wyoming.

Reijnen, R., R. Foppen, C. T. Braak, and J. Thissen. 1995. The effects of car traffic on breeding bird populations in woodland. III. Reduction of density in relation to the proximity of main roads. Journal of Applied Ecology 32(1): 187-202.

Reijnen, R., R. Foppen, and H. Meeuwsen. 1996. The effects of traffic on the density of breeding birds in Dutch agricultural grasslands. Biological Conservation 75: 255-260.

Rodgers, J. A., Jr., and H. T. Smith. 1995. Set-back distances to protect nesting bird colonies from human disturbance in Florida. Conservation Biology 9: 89-99.

Trail, P. W. 2006. Avian mortality at oil pits in the United States: A review of the problem and efforts for its solution. Environmental Management 38(4): 532-544.

Vos, D. K., R. A. Ryder, and W. D. Grand. 1985. Response of breeding great blue herons to human disturbance in northcentral Colorado. Colonial Waterbirds 8: 13-22.

Wyoming Game and Fish Dept. 2009. Recommendations for development of oil and gas resources within important wildlife habitats. Wyoming Game and Fish Department. Cheyenne, Wyoming, USA. 242p.

DRAFT

6.1 Burrowing Owl (*Athene cunicularia*)

Status	Endangered, *SARA* Schedule1
Status Last Reviewed	April 2006
Provincial Range	BC, AB, SK, MB

Table 3
Provincial Setback Distances for Burrowing Owl Nest Burrows

Level of Disturbance	Alberta			Saskatchewan		
	April 1st – Aug. 15th	Aug. 16th – Oct. 15th	Oct. 16th – March 31st	April 1st – July 15th	July 16th – Oct. 15th	Oct. 16th – March 31st
Low	200 m	200 m	50 m	200 m	100 m	10 m
Medium	500 m	200 m	100 m	300 m	200 m	200 m
High	500 m	500 m	500 m	500 m	500 m	500 m

Alberta Fish and Wildlife Division (2001) and Saskatchewan Environment (2003) recommend buffers between disturbances and burrowing owl nest burrows (Table 3). On repeated approaches to burrowing owl nests, Fisher *et al.* (2004) found that on average, the observer was allowed to approach within 69 m of the nest burrow prior to the eggs hatching, 50 m in the first week after hatch and 49 m in third week after hatch, before an adult flushed. The California Burrowing Owl Consortium (1997) recommends a 50 m buffer from disturbances for occupied burrowing owl burrows outside the breeding season (September 1 to January 31) and 75 m during the breeding season (February 1 to August 31). Year-round it is also suggested that a 100 m foraging radius (2.63 ha) be maintained around burrows of burrowing owls (or single resident owl) (California Burrowing Owl Consortium 1997). Anecdotally, Lehman *et al.* (1999) documented the failure of a nest that was within 100 m of a tank maneuver area while other burrowing owl pairs nested successfully at 600 m and further from tank ranges.

Literature Cited

Alberta Fish and Wildlife Division. 2001. Recommended land use guidelines for protection of selected wildlife species and habitat within grassland and parkland natural regions of Alberta. [Online: http://www.srd.gov.ab.ca/fw/landuse/pdf/grasslandparkland.pdf].

California Burrowing Owl Consortium. 1997. Burrowing owl survey protocol and mitigation guidelines. Journal of Raptor Research 9: 171-177.

Fisher, R. J., R. G. Poulin, L. D. Todd, and R. M. Brigham. 2004. Nest stage, wind speed and air temperature affect the nest defence behaviours of burrowing owls. Canadian Journal of Zoology 82(5): 707-713.

Lehman, R. N., K. Steenhof, M. N. Kochert, and L. B. Carpenter. 1999. Effects of military training activities on shrub-steppe raptors in southwestern Idaho, USA. Environmental Management 23(3): 409-417.

Saskatchewan Environment. 2003. Saskatchewan activity restriction guidelines for sensitive species in natural habitats. [Online: http://www.biodiversity.sk.ca/Docs/SKactivityrestrictions.pdf].

Beneficial Management Practices

- Avoid activities in areas while birds are present, approximately April 1 to October 15.
- Create, implement and enforce a traffic control program with maximum 50 km/hr speed zones during day and night within 1,600 m of nest/roosts sites.
- Do not create predator perching opportunities.

DRAFT

- Avoid development in low-lying areas and ephemeral wetlands (foraging areas).
- Avoid use of pesticides within 500m of burrows.
- Maintain grazed areas and minimize conversion to hay.
- Keep activities confined to daylight hours.
- Keep noise emissions within ambient levels.

DRAFT

6.2 Ferruginous Hawk (*Buteo regalis*)

Status	Special Concern, *SARA* Schedule 3
Status Last Reviewed	April 2008
Provincial Range	AB, SK, MB

Table 4
Provincial Setback Distances for Ferruginous Hawk Nests

Level of Disturbance	Alberta		Saskatchewan
	Mar. 15 – July 15	Jul. 16 – Mar. 14	Mar. 15 - July 15
Low	1,000 m	50 m	500 m
Medium	1,000 m	50 m	750 m
High	1,000 m	1,000 m	1,000 m

Deschant *et a*l 2003 provides a summary of the extensive literature on disturbance effects on ferruginous hawks, a number of which are referred to in the discussion below. Alberta Fish and Wildlife Division (2001) and Saskatchewan Environment (2003) recommend buffers between disturbances and ferruginous hawk nests (Table 4). Wyoming Game and Fish Department (2004) suggests reducing noise levels to 49 dBA or less at the nest sites of at risk raptor species to minimize the effects of continuous noise on raptors that are sensitive to human disturbance during the breeding season. The maximum distance at which wintering ferruginous hawks flushed in response to humans walking and driving a vehicle were 165 m and 280 m respectively (Knight *et al.* 1993). The maximum and average flush distances of nesting ferruginous hawks to a human intruder on foot was found to be 500 m and 100 m respectively (Hansen 1994). After observing the post-fledging behaviour of ferruginous hawks, Konrad and Gilmer (1986) recommended delaying any energy development near active nests until 45 days after fledging to avoid disrupting post-fledging activities.

While studying ferruginous hawks in Montana, Ensign (1983) observed incubating hawks crouch in the nest when he approached to about 450 m on foot. Ensign (1983) noted incubating ferruginous hawks flushed from the nest when an intruder on foot, on a motorcycle and in a truck was within 170 m, 95 m and 75 - 200 m, respectively. No apparent adverse reactions were observed from incubating adults when a helicopter approached as close as 30 m from the nest (Ensign 1983). Ensign (1983) recommends that human activities within 450 m of active ferruginous hawk nests should be restricted as that is the distance at which hawks first elicited a response to nest approaches. Both Keeley (2009) and Holmes (1994) observed a mean flushing distance of 380m for ferruginous hawks and recommended a 640m buffer during the nestling phase. Olendorff (1993) suggested buffer zones of 0.25 km for brief disturbances, 0.5 km for intermittent activities, 0.8 km for prolonged activities, and Ó1.0 km for construction or similar activities.

A study on the ferruginous hawk in South Dakota found that fewer nests were successful when located closer to human activity (Blair 1978). There was an 11.4% greater probability of fledging from a nest that was far from occupied dwellings than a nest that was near occupied dwellings (Blair 1978). Hanson (1994) suggested that the cause of failure for seven ferruginous hawk nests was an increase in human disturbance during the nest initiation and incubation period. Hansen (1994) recommends a 500 m buffer around nest sites, as that was the minimum distance observed for a successful nest from a disturbance.

A study designed to simulate the effects of low-level human activity on nesting ferruginous hawks found that the disturbed nests fledged less than half the number of young compared to undisturbed nests (White and Thurow 1985). The furthest distance an incubating hawk flushed when approached on foot was 400 m, and 500 m when approached by vehicle (White and Thurow 1985). White and Thurow (1985) suggest a buffer of 250 m for low-level human activities during incubation, as 90% of adults did not flush when human activity was confined to distances of 250 m or more. Keeley (2009) noted that an abundance of prey species may contribute to hawks being in better physiological condition and better able to cope

DRAFT

with stress due to disturbance, whereas in areas (or years) of low prey abundance, hawks may be in poor physiological condition and more susceptible to disturbance.

In a two year study on the reproductive and behavioural responses of ferruginous hawks to human activity, the reproductive success of ferruginous hawks in areas disturbed by petroleum development was lower than in the reference area, though not significantly (P=0.17) (Van Horn 1993). During the study, he determined that ferruginous hawks flushed 95% of the time when a human intruder approached to within 532 m, and recommend a buffer zone of 500 m as sufficient for preventing the induction of most nest defence behaviour. In a study by White and Thurow (1985) only 52% of the territories that contained human disturbed nests were occupied the following year, compared to 93% of territories containing control nests. Van Horn (1993) noticed that 75% of ferruginous hawks choose nest sites that were greater than 1.9 km from active oil wells and, as a result, suggested that oilfield expansion be limited to areas greater than 1.9 km from known nesting sites. Smith *et al* (2007) found that ferruginous hawk nest use and activity was greater in areas with reduced oil and gas development within an 800m radius. In North Dakota, Ferruginous Hawks avoided cropland and nesting within 0.7 km of occupied buildings (Gaines 1985). In Alberta, Ferruginous Hawks rarely nested within 0.5 km of farmyards (Schmutz 1984). Gilmer and Stewart (1983) found that pairs nesting within 500 m of interstates or well-traveled roads acclimated to activity on the roads and exhibited similar rates of nest success to other pairs. Nesting has also been observed near active railroads and gravel roads (Gilmer and Stewart 1983, MacLaren et al. 1988).

A combined buffer zone was recommended by Suter and Joness (1981) for Golden Eagle, Ferruginous Hawk and Prairie falcon, on the basis of a survey of raptor field researchers. To avoid thermal stress to eggs or young, they proposed that disturbances by a few individuals performing tasks such as geological, biological or soil surveys should be kept a minimum of 500 m from active nests or limited to short periods and during times of moderate temperature (Suter and Joness 1981). During periods of construction and other extended noisy activities, they recommended a buffer of 1 km from active nest sites to avoid nest abandonment (Suter and Joness 1981). Literature cited in the Suter and Joness (1981) article was weighted towards golden eagles. Suter and Joness (1981) also suggested that longer distances would reduce visibility and hence persecution from shooting.

Anecdotally, Lehman *et al.* (1999) noted a ferruginous hawk nest failure that was within 1,000 m of a tank range during military training activities. Eggs were observed before the training activities began and one dead nestling was in the nest when the activities were completed (Lehman *et al.* 1999). Several studies have attributed nest abandonment to the sensitivity of ferruginous hawks to disturbance and observer intrusion at the nest site during incubation (Fitzner *et al.* 1977, Ensign 1983, Gilmer and Stewart 1983).

Literature Cited

Alberta Fish and Wildlife Division. 2001. Recommended land use guidelines for protection of selected wildlife species and habitat within grassland and parkland natural regions of Alberta. [Online: http://www.srd.gov.ab.ca/fw/landuse/pdf/grasslandparkland.pdf].

Blair, C. L. 1978. Breeding biology and prey selection of ferruginous hawks in northwestern South Dakota. M.S. Thesis, South Dakota State University, Brookings, South Dakota, USA.

Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, A. L. Zimmerman, and B. R. Euliss. 2003. Effects of management practices on grassland birds: Ferruginous Hawk. Northern Prairie Wildlife Research Center, Jamestown, ND. Northern Prairie Wildlife Research Center Online. http://www.npwrc.usgs.gov/resource/literatr/grasbird/feha/feha.htm

Ensign, J. T. 1983. Nest Site Selection, Productivity, and Food Habits of Ferruginous Hawks in Southeastern Montana. M.S. Thesis, Montana State University, Bozeman, Montana, USA.

Fitzner, R. E., D. Berry, L. L. Boyd, and C. A. Reick. 1977. Nesting of ferruginous hawks (Buteo regalis) in Washington, 1974-75. Condor 79: 245-249.

Gaines, R. C. 1985. Nest site selection, habitat utilization, and breeding biology of the Ferruginous Hawk in central North Dakota. M.S. thesis. North Dakota State University, Fargo, North Dakota. 32 pages.

Gilmer, D. S., and R. E. Stewart. 1983. Ferruginous hawk populations and habitat use in North Dakota. Journal of Wildlife Management 47: 146-157.

Hansen, R. W. 1994. Raptor use of the Idaho National Engineering Laboratory. M.S. Thesis, South Dakota State University, Brookings, South Dakota, USA.

Holmes, T.L. 1994. Behavioral responses of grassland raptors to human disturbance. M.S.Thesis. Colo. State Univ., Fort Collins. 84pp.

Keeley, W.H. 2009. Diet and Behavior of Ferruginous Hawks Nesting in Two Grasslands in New Mexico with Differing Anthropogenic Alteration. M.S. Thesis Boise State University, Idaho.

Knight, R. L., G. R. Craig, T. L. Holmes, and L. Stegall. 1993. Responses of wintering grassland raptors to human disturbance. Wildlife Society Bulletin 21(4): 461-468.

Konrad, P. M., and D. S. Gilmer. 1986. Post fledging behavior of ferruginous hawks in North Dakota. Raptor Research 20: 35-39.

Lehman, R. N., K. Steenhof, M. N. Kochert, and L. B. Carpenter. 1999. Effects of military training activities on shrub-steppe raptors in southwestern Idaho, USA. Environmental Management 23(3): 409-417.

MacLaren, P. A., S. H. Anderson, and D. E. Runde. 1988. Food habits and nest characteristics of breeding raptors in southwestern Wyoming. Great Basin Naturalist 48:548-553.

Olendorff, R. R. 1993. Status, biology, and management of Ferruginous Hawks: a review. Raptor Research and Technical Assistance Center, Special Report. U.S. Department of the Interior, Bureau of Land Management, Boise, Idaho. 84 pages.

Saskatchewan Environment. 2003. Saskatchewan activity restriction guidelines for sensitive species in natural habitats. [Online: http://www.biodiversity.sk.ca/Docs/SKactivityrestrictions.pdf].

Schmutz, J. K. 1984. Ferruginous and Swainson's hawk abundance and distribution in relation to land use in southeastern Alberta. Journal of Wildlife Management 48:1180-1187

Smith, J.P., S.J. Slater, and M.P. Neal. 2007. An Assessment of the Effects of Oil and Gas Field Activities on Nesting Raptors in the Rawlins, Wyoming and Price, Utah Field Offices of the Bureau of Land Management. HawkWatch International, Inc. Salt Lake City, UT.

Suter, G. W., I.I., and J. L. Joness. 1981. Criteria for golden eagle, ferruginous hawk, and prairie falcon nest site protection. Raptor Research 15(1): 12-18.

Van Horn, R. C. 1993. Ferruginous hawk and prairie falcon reproductive and behavioural responses to human activity near the Kevin Rim, Montana. M.S. Thesis, Montana State University, Bozeman, Montana.

White, C. M., and T. L. Thurow. 1985. Reproduction of ferruginous hawks exposed to controlled disturbance. The Condor 87: 14-22.

Wyoming Game and Fish Department. 2004. Minimum recommendations for development of oil and gas resources within crucial and important wildlife habitats on BLM lands. [Online: http://gf.state.wy.us/downloads/pdf/og.pdf].

DRAFT

Beneficial Management Practices

- Avoid activities in areas while birds are present, approximately March 1 to July 15.
- Studies have shown that setback distances should not be relaxed during the breeding season.
- Do not cut or disturb trees, where possible.

- Create, implement and enforce a traffic control program with maximum 50 km/hr speed zones day and night within 1,000 m of nest sites.
- Maintain a 100 m no-activity buffer from edge of coulees.
- If working within recommended setback distances, conduct a two year post-construction monitoring project in consultation with the appropriate regulatory authority.
- No activity for 45 days after young have hatched.
- Keep oil and gas developments 500m from important prey concentrations.
- Protect nesting trees from cattle rubbing.

DRAFT

6.3 Least Bittern (*Ixobrychus exilis*)

Status	Threatened, *SARA* Schedule 1
Status Last Reviewed	April 2009
Provincial Range	MB, ON, QC, NB, NS

Anecdotally, it was observed over a 2-month period during the summer, that 12 and 4 least bitterns had been killed by highway traffic and by a fence, respectively, both adjacent to a wetland (Guillory 1973). The author suggested that the limited binocular vision and a habit of flying low and slowly over marsh vegetation made this species susceptible to these types of mortality (Guillory 1973).

Literature Cited

Guillory, H. D. 1973. Motor vehicles and barbed wire fences as major mortality factors for the least bittern in southwest Louisiana. Inland Bird Banding News 45: 176-177.

Beneficial Management Practices

- Prevent loss, drainage, channelization and degradation of wetlands (e.g. pollution and siltation runoff).
- Maintain a minimum 100 m buffer from wetlands especially for larger freshwater wetlands (greater than 5 hectares) that are dominated by dense tall emergent vegetation, typically cattail (*Typha* spp.), and containing deeper open water areas.
- Avoid activities in areas while birds are present, approximately May 1 to July 31.
- Create, implement and enforce a traffic control program with maximum 50 km/hr speed zones day and night within 100 m of wetlands with least bitterns.
- Avoid installing new fences in vicinity of wetlands.

DRAFT

6.4 Loggerhead Shrike migrans subspecies (*Lanius ludovicianus migrans*)

Status	Endangered, *SARA* Schedule 1
Status Last Reviewed	November 2000
Provincial Range	MB, ON, QC

Loggerhead Shrike excubitorides subspecies (*Lanius ludovicianus excubitorides*)

Status	Threatened, *SARA* Schedule 1
Status Last Reviewed	May 2004
Provincial Range	AB, SK, MB

The recommended distances in Saskatchewan between human disturbances and nest sites of loggerhead shrikes, from May 1 to August 15, are 50 m, 250 m and 400 m for low, medium and high levels of disturbance, respectively (Saskatchewan Environment 2003). Alberta Sustainable Resource Development (2002) states that ñTo preserve existing breeding sites, land within 400 m of an active nest should be restored to the natural grassland/shrubland habitat upon which these birds rely. Furthermore, although shrikes are tolerant of some human activity, human disturbance within 100 m of a nest should be minimized during the mid-May to mid-August breeding season.ò In a study by Collister and Wilson (2007) researchers were able to approach within 50-100m of nests to observe birds without altering behaviour, but recommended a 250m buffer around nests to minimize the potential for territory abandonment. The Wyoming Game and Fish Department (2004) suggest, from April 1 through June 30, that noise levels be reduced to 49 dBA or less within the breeding habitat of listed songbird species to minimize the effects of continuous noise on species that rely upon aural cues for successful breeding.

Literature Cited

Alberta Sustainable Resource Development. 2002. Loggerhead Shrike (Species At Risk Profile). URL http://www.srd.gov.ab.ca/fishwildlife/speciesatrisk/selectedprofiles/loggerheadshrike.aspx (June 2009). Government of Alberta.

Collister, D.M. and S. Wilson. 2007. Territory Size and Foraging Habitat of Loggerhead Shrikes (*Lanius Ludovicianus*) in Southeastern Alberta. Journal of Raptor Research 41(2) 130-138.

Saskatchewan Environment. 2003. Saskatchewan activity restriction guidelines for sensitive species in natural habitats. [Online: http://www.biodiversity.sk.ca/Docs/SKactivityrestrictions.pdf].

Wyoming Game and Fish Department. 2004. Minimum recommendations for development of oil and gas resources within crucial and important wildlife habitats on BLM lands. [Online: http://gf.state.wy.us/downloads/pdf/og.pdf].

Beneficial Management Practices

- Avoid activities in areas while birds are present, approximately May 1 to August 15.
- Do not cut or disturb trees and shrubs.
- Minimize disturbance of native grassland within 400m of nests. Avoid fragmentation of habitat patches.
- Implement a traffic control program within 300 m of nest sites.
- Restore marginal agricultural land to native grassland.
- Avoid spraying of habitat with pesticides.

DRAFT

- Moderate grazing is beneficial. Patches of both short and tall grass is ideal with an average height of at least 15- to 20-cm. Heavy grazing can be detrimental.
- Scattered woody and dense vegetation along fence-lines and shelterbelts and in pastures and riparian areas (potential nesting substrate and foraging areas) should be conserved and protected from rubbing and trampling by cattle.
- Maintain noise emissions at less than 49 dBA. Or 10 dBA above ambient in remote areas.

DRAFT

6.5 Long-billed Curlew (*Numenius americanus*)

Status	Special Concern, *SARA* Schedule 1
Status Last Reviewed	November 2002
Provincial Range	BC, AB, SK

Table 5
Provincial Setback Distances for Active Long-Billed Curlew Nests

Level of Disturbance	Alberta	Saskatchewan
	April 15th – July 15th	April 15th – July 15th
Low	100 m	100 m
Medium	100 m	200 m
High	200 m	200 m

Alberta Fish and Wildlife Division (2001) and Saskatchewan Environment (2003) recommend buffers between development and long-billed curlew nests (Table 5). Several studies showed that incubating long-billed curlews often do not flush from the nest until approached closer than 2 m (Wolfe 1931, Sugden 1933, Graul 1971, Allen 1980), but also note that the distraction displays by both adults is quite aggressive (Wolfe 1931, Sugden 1933, Graul 1971, Allen 1980). An energy expenditure as expensive as that of the long-billed curlewôs distraction display may have an effect on individual fitness. Sadler and Maher (1976) reported the nest failure of a long billed curlew soon after the hatch of the first egg, and attributed the abandonment to the presence of a fencing crew near the nest.

Literature Cited

Alberta Fish and Wildlife Division. 2001. Recommended land use guidelines for protection of selected wildlife species and habitat within grassland and parkland natural regions of Alberta. [Online: http://www.srd.gov.ab.ca/fw/landuse/pdf/grasslandparkland.pdf].

Allen, J. N. 1980. The ecology and behavior of the long-billed curlew in southeastern Washington. Wildlife Monographs 73: 1-67.

Graul, W. D. 1971. Observations at a long-billed curlew nest. Auk (88): 182-184.

Sadler, D. A. R., and W. J. Maher. 1976. Notes on the long-billed curlew in Saskatchewan. Auk 93(2): 382-384.

Saskatchewan Environment. 2003. Saskatchewan activity restriction guidelines for sensitive species in natural habitats. [Online: http://www.biodiversity.sk.ca/Docs/SKactivityrestrictions.pdf].

Sugden, J. W. 1933. Range restriction of the long-billed curlew. Condor 35: 3-9.

Wolfe, L. R. 1931. The breeding limicolae of Utah. Condor 33: 49-59.

Beneficial Management Practices

- Avoid activities in areas while birds are present, approximately May 1 to August 15.
- Include fall sewn crops and irrigated hay land in search areas.
- If birds are exhibiting territorial displays, consider there is a nest nearby and apply setbacks; searching for a nest site may cause nest failure.
- Create, implement and enforce a traffic control program with maximum 50 km/hr speed zones (day only) within 400 m of nest sites.
- If working within recommended setback distances, conduct a two year post-construction monitoring project in consultation with the appropriate regulatory authority.

DRAFT

- Avoid spraying of pesticides.
- Minimize use of off-road vehicles.

DRAFT

6.6 McCown’s Longspur (*Calcarius mccownii*)

Status	Special Concern COSEWIC status assessment not yet forwarded to the Minister
Status Last Reviewed	April 2006
Provincial Range	AB, SK

Wyoming Game and Fish Department (2004) suggest that from April 1 to June 30 noise levels be reduced to 49 dBA or less within the breeding habitat of listed songbird species to minimize the effects of continuous noise on species that rely on aural cues for successful breeding. In several studies it was observed that incubating female McCownøs longspurs often did not flush until the observer was very close to the nest (DuBois 1937, Mickey 1943) but one sensitive female left the nest whenever the observer came closer than 10 feet (Mickey 1943). Mickey (1943) thought that the adults from one nest prematurely ejected their nestlings out of the nest because they were disturbed by his daily visits. An observation of foraging individuals found that some McCownøs longspurs flushed when the observer was as far as 25 m while most others flew when the observer was 5 to 10 m away (With 1994). One study found that a significant portion of pre-natal mortality was desertion of eggs and it was thought that regular daily visits and intensive observer activity around the nest may have contributed to this egg desertion (Felske 1971). Territory size is approximately one hectare (With 1994).

Literature Cited

DuBois, A. D. 1937. The McCown longspurs of a Montana prairie. The Condor 39(6): 233-238.

Felske, B. E. 1971. The population dynamics and productivity of McCownøs Longspur at Matador, Saskatchewan. M.S. Thesis, University of Saskatchewan, Saskatoon, Saskatchewan.

Mickey, F. W. 1943. Breeding habits of McCown's lonspur. The Auk 60: 181-209.

With, K. A. 1994. McCownøs longspur (Calcarius mccownii). in Poole A. and Gill, F., editor. The Birds of North America, No. 96. The Academy of Natural Sciences, Philadelphia, Pennsylvania; The American Ornithologistsø Union, Washington D.C.

Wyoming Game and Fish Department. 2004. Minimum recommendations for development of oil and gas resources within crucial and important wildlife habitats on BLM lands. [Online: http://gf.state.wy.us/downloads/pdf/og.pdf].

Beneficial Management Practices

- Species responds to heavier or season-long grazing, however do not overgraze.
- Do not encourage fire suppression.
- Avoid use of pesticides.

DRAFT

6.7 Mountain Plover (*Charadrius montanus*)

Status	Endangered, *SARA* Schedule 1
Status Last Reviewed	November 2000
Provincial Range	AB, SK

During the nesting period (May 1 to July 31), Saskatchewan Environment (2003) recommends a buffer of 200 m, 400 m and 500 m between mountain plover nests and low, medium and high levels of human disturbance, respectively. While studying the breeding biology of the mountain plover, Graul (1975) observed that the incubating adult will frequently quietly leave the nest while the intruder is still 50-100 m away, but occasionally will not flush until the intruder is near the nest. The effect of foot traffic on another upland nesting plover, the Eurasian golden plover (*Pluvialis apricaria*), showed that when people stayed on the designated trail, plovers avoided areas within 50 m of the trail during the chick-rearing period (Finney *et al.* 2005).

Literature Cited

Finney, S. K., J. W. Pearce-Higgins, and D. W. Yalden. 2005. The effect of recreational disturbance on an upland breeding bird, the golden plover Pluvialis apricaria. Biological Conservation 121(1): 53-63.

Graul, W. D. 1975. Breeding biology of the mountain plover. The Wilson Bulletin 87(1): 6-31.

Saskatchewan Environment. 2003. Saskatchewan activity restriction guidelines for sensitive species in natural habitats. [Online: http://www.biodiversity.sk.ca/Docs/SKactivityrestrictions.pdf].

Beneficial Management Practices

- Avoid activities in areas while birds are present, approximately May 1 to July 31.
- Create, implement and enforce a traffic control program with maximum 50 km/hr speed zones day and night within 500 m of nest sites.
- If working within recommended setback distances, conduct a two year post-construction monitoring project in consultation with the appropriate regulatory authority.
- Delay mowing (*e.g.,* rights-of-way, lease sites, etc.) until after July 31.
- Route and place disturbances away from suitable nesting habitat.

DRAFT

6.8 Peregrine Falcon anatum subspecies (*Falco peregrinus anatum*)

Status	Threatened, *SARA* Schedule 1
Status Last Reviewed	April 2007
Provincial Range	YT, NT, NU, BC, AB, SK, MB, ON, QC, NB, NS, NL

Peregrine Falcon tundrius subspecies (*Falco peregrinus tundrius*)

Status	Special Concern, *SARA* Schedule 3
Status Last Reviewed	April 2007
Provincial Range	YT, NT, NU, QC, NL

Table 6
Provincial Setback Distances for Peregrine Falcon Nests

Level of Disturbance	Alberta		Saskatchewan
	April 1 – July 31	Aug. 1 – March 31	April 1 - Aug. 15
Low	500 m	50 m	300 m
Medium	1,000 m	100 m	500 m
High	1,000 m	1,000 m	1,000 m

Alberta Fish and Wildlife Division (2001) and Saskatchewan Environment (2003) recommend buffers between development and peregrine falcon nests (Table 6). Erickson (1988) recommends where possible, a 1,000 m no-disturbance area around peregrine falcon nest sites from April 15 to September 1. While studying the impacts of nature tourism on peregrine falcons, Kurvits (1989) noted that incubating falcons became agitated when approached on foot and recommends a buffer zone of 200 m for one person visiting two times a week on foot. Windsor (1977) tested the response of peregrine falcons to aircraft overpasses and hikers. He observed that the incubating falcons first exhibited stressful behaviour when the hiker was as far as 1,500 m away. Windsor (1977) recommends that hiking trails be kept at least 1,500 m from a peregrine falcon nest if visible from the trail, and no closer than 800 m if not visible.

During a study on the response of nesting peregrine falcons to various stimuli, Johnson (1988) observed that thresholds of 3,200 m, 1,600 m, 800 m and 500 m existed before the incubating falcon responded. Johnson (1988) recommended the following management areas at various levels of topographical screening (Table 7). Human activities in the core area will likely have an adverse effect on falcons and activities in the review area should be examined by a qualified biologist to assess the possibility of disturbance and the need for mitigation (Johnson 1988).

Table 7
Current Management Areas Around Peregrine Falcon Nests

Management Area	Topographic Screening		
	None	Gentle[1]	Steep[2]
Core Area	3400 m	2300 m	1,600 m
Review Area	900 m	600 m	400 m

[1] < 40º angle obstructing view of nest.
[2] > 40º angle obstructing view of nest.

Wyoming Game and Fish Department (2004) suggests reducing noise levels to 49 dBA or less at the nest sites of at risk raptor species to minimize the effects of continuous noise on raptors that are sensitive to human disturbance during the breeding season. Anecdotally, Bond (1946) observed that at least three nest sites were abandoned after roads were built below them and Hickey (1942) noted that frequent or prolonged visits by humans to the top of an escarpment or cut-bank may bring about interruptions in the breeding cycle, and in some cases desertion of the nest.

DRAFT

Literature Cited

Alberta Fish and Wildlife Division. 2001. Recommended land use guidelines for protection of selected wildlife species and habitat within grassland and parkland natural regions of Alberta. [Online: http://www.srd.gov.ab.ca/fw/landuse/pdf/grasslandparkland.pdf].

Bond, R. M. 1946. The peregrine populations of western North America. Condor 48: 101-116.

Erickson, G., R. Fyfe, R. Bromley, G. L. Holroyd, D. Mossop, B. Munro, R. Nero, C. Shank, and T. Wiens. 1988. Anatum peregrine falcon recovery plan. Canadian Wildlife Service, Ottawa, Ontario.

Hickey, J. J. 1942. Eastern population of the duck hawk. Auk (59): 176-204.

Johnson, T. H. 1988. Responses of breeding peregrine falcons to human stimuli. Pages 301-305 in Glinski, R. L. and *et al.* (editors), Proceedings of the Southwest raptor management symposium and workshop. National Wildlife Federation Scientific and Technical Series No. 11. National Wildlife Federation, Washington, D.C.

Kurvits, A. K. 1989. The impacts of nature tourism on wildlife: A case study of the peregrine falcon in the Northwest Territories. M.E.S. Thesis, York University, Toronto, Ontario.

Saskatchewan Environment. 2003. Saskatchewan activity restriction guidelines for sensitive species in natural habitats. [Online: http://www.biodiversity.sk.ca/Docs/SKactivityrestrictions.pdf].

Windsor, J. 1977. The response of Peregrine Falcons (Falco peregrinus) to aircraft and human disturbance. Mackenzie Valley Pipeline Investigations. Canadian Wildlife Service, Ottawa, Ontario.

Wyoming Game and Fish Department. 2004. Minimum recommendations for development of oil and gas resources within crucial and important wildlife habitats on BLM lands. [Online: http://gf.state.wy.us/downloads/pdf/og.pdf].

Beneficial Management Practices

- Avoid activities in areas while birds are present, approximately April 1 to August 15.
- Route access roads no closer than 800 m from nest if nest is not visible and 1,500 m if nest is visible.
- Create, implement and enforce a traffic control program with maximum 50 km/hr speed zones day and night within 1,000 m of nest sites.
- Maintain noise emissions at less than 49 dBA. Or 10 dBA above ambient in remote areas.

DRAFT

6.9 Piping Plover circumcinctus subspecies (*Charadrius melodus circumcinctus*)

Status	Endangered, *SARA* Schedule 1
Status Last Reviewed	May 2001
Provincial Range	AB, SK, MB, ON

Table 8
Provincial Setback Distances for Bodies of Water Where Piping Plovers are Known to Breed (High Water Mark)

Level of Disturbance	Alberta		Saskatchewan	
	May 1 – July 31	Aug. 1 – April 30	May 1 – July 31	Aug. 1 – Sept. 30
Low	200 m	50 m	200 m	100 m
Medium	200 m	50 m	400 m	200 m
High	200 m	200 m	600 m	600 m

Alberta Fish and Wildlife Division (2001) and Saskatchewan Environment (2003) recommend buffers between development and the high water mark of piping plover breeding water bodies (Table 8). When approached by a human on foot, piping plovers have been observed flushing from the nest at 20-30 m (Burger 1987) and flushing from the nest or brood at distances as far as 210 m (Flemming *et al.* 1988). Flemming (1988) also noted that chick behaviour appeared unchanged until approaching humans were approximately 160 m from chicks and adult behaviour was not altered by vehicles. Goldin (1993) observed that adult and juvenile piping plovers did not flush until pedestrians, joggers and off-road vehicles were within 18.7 m, 19.5 m and 20.4 m on average, respectively. The average flush distance of chicks in the Goldin (1993) study was found to be 20.7 m, 32.3 m and 19.3 m from pedestrians, joggers and off-road vehicles, respectively. Several studies showed that human disturbances did negatively affect piping plovers, as reproductive success was suppressed in areas with higher levels of disturbance (Cairns 1982, Flemming *et al.* 1988, Strauss 1990). Human disturbance decreased the amount of time piping plovers spent foraging and increased the amount of time they spent reacting to disturbances (Burger 1991, Goldin 1993, Goldin and Regosin 1998) and may have had a negative effect on chick survival and adult maintenance (Burger 1991). More specifically, Burger (1994) found that the amount of time spent foraging decreased as the number of people within 100 m increased. Strauss (1990) also found that plovers spent less time feeding when pedestrians and moving vehicles were less than 100 m than when undisturbed.

Literature Cited

Alberta Fish and Wildlife Division. 2001. Recommended land use guidelines for protection of selected wildlife species and habitat within grassland and parkland natural regions of Alberta. [Online: http://www.srd.gov.ab.ca/fw/landuse/pdf/grasslandparkland.pdf].

Burger, J. 1987. Physical and social determinants of nest-site selection in piping plover in New Jersey. The Condor 89: 811-818.

Burger, J. 1991. Foraging behavior and the effect of human disturbance on the piping plover (Charadrius melodus). Journal of Coastal Research 7(1): 39-52.

Burger, J. 1994. The effect of human disturbance on foraging behavior and habitat use in piping plover (Charadrius melodus). Estuaries 17(3): 695-701.

Cairns, W. E. 1982. Biology and behavior of breeding piping plovers. Wilson Bulletin 94(4): 531-545.

Flemming, S. P., R. D. Chiasson, P. C. Smith, P. J. Austin Smith, and R. P. Bancroft. 1988. Piping plover status in Nova Scotia related to its reproductive and behavioral responses to human disturbance. Journal of Field Ornithology 59(4): 321-330.

DRAFT

Goldin, M. R., and J. V. Regosin. 1998. Chick behavior, habitat use, and reproductive success of piping plovers at Goosewing Beach, Rhode Island. Journal of Field Ornithology 69: 228-234.

Goldin, M. R. 1993. Effects of human disturbance and off-road vehicles on piping plover reproductive success and behavior at breezy point, Gateway National Recreation Area, New York. M.S. Thesis, University of Massachusetts, Amherst, Massachusetts.

Saskatchewan Environment. 2003. Saskatchewan activity restriction guidelines for sensitive species in natural habitats. [Online: http://www.biodiversity.sk.ca/Docs/SKactivityrestrictions.pdf].

Strauss, E. G. 1990. Reproductive success, life history patterns, and behavioral variation in a population of piping plovers subjected to human disturbance. Ph.D. Thesis, Tufts University, Medford, Massachusetts, USA.

Beneficial Management Practices

- Avoid development on nesting beaches (*e.g.,* sand, gravel, alkali).
- Avoid traffic (e.g. vehicles, ATVôs, motorcycles) on nesting beaches.
- Avoid activities in areas while birds are present, approximately May 1 to September 1.
- Create, implement and enforce a traffic control program with maximum 50 km/hr speed zones day and night in suitable habitat within 300 m of nest sites.

DRAFT

6.10 Red-headed Woodpecker (*Melanerpes erythrocephalus*)

Status	Threatened, *SARA* Schedule 1
Status Last Reviewed	April 2007
Provincial Range	SK, MB, ON, QC

Saskatchewan Environment (2003) recommends a buffer between human disturbance and a red-headed woodpecker nest of 100 m from medium and high levels of disturbance during the breeding season (April 15 to June 30). No buffer was recommended for low levels of disturbance. Jackson (1976) noted the red-headed woodpeckerôs sensitivity to disturbance as he observed an incubating male red-headed woodpecker hurriedly leave the eggs and scramble to the entrance 12 times in 157 minutes in response to ten vehicles and a boy on a horse passing along a gravel road 7 m from the nest, as well as an airplane flying approximately 1 km away.

Literature Cited

Jackson, J. A. 1976. A comparison of some aspects of the breeding ecology of red-headed and red-bellied woodpeckers in Kansas USA. Condor 78(1): 67-76.

Saskatchewan Environment. 2003. Saskatchewan activity restriction guidelines for sensitive species in natural habitats. [Online: http://www.biodiversity.sk.ca/Docs/SKactivityrestrictions.pdf].

Beneficial Management Practices

- Avoid areas with snags.
- Avoid activities in areas while birds are present, approximately May 1 to July 31.
- Create, implement and enforce a traffic control program with maximum 50 km/hr speed zones day and night within 100 m of nest sites.
- Maintain noise emissions at less than 49 dBA. Or 10 dBA above ambient in remote areas.
- Limit destruction of suitable nesting habitat. Snags should be retained in groups where possible.

DRAFT

6.11 Greater Sage Grouse urophasianus subspecies (*Centrocercus urophasianus urophasianus*)

Status	Endangered, *SARA* Schedule 1
Status Last Reviewed	April 2008
Provincial Range	AB, SK

Table 9
Provincial Setback Distances for Greater Sage Grouse Leks and Nest Sites

Level of Disturbance	Alberta		Saskatchewan		
	Lek		Lek		Nest
	March 1 – June 15	June 16 – Feb. 29	March 1 – July 15	July 16 – Feb. 29	April 15 – June 15
Low	500 m	100 m	500 m	100 m	200 m
Medium	500 m	100 m	1,000 m	1,000 m	300 m
High	1,000 m	1,000 m	1,000 m	1,000 m	500 m

Alberta Fish and Wildlife Division (2001) recommends buffers between development and sage grouse leks, and Saskatchewan Environment (2003) recommends buffers between leks and nest sites (Table 9). It is thought that sage grouse avoid areas within 0.8 km of power lines because raptors use power lines as perches (Alberta Sage Grouse Recovery Action Group 2005). Wyoming Game and Fish Department (2004) suggests avoidance of surface disturbing activities within 400 m of the perimeter of occupied sage grouse leks (occupied is defined as active at least one breeding season in the last ten years). It is also recommended that human and vehicular activity be avoided from 8pm to 8am from March 1 to May 15 within 400 m of the perimeter of occupied sage grouse leks (Wyoming Game and Fish Department 2004). Also during these dates, it is advised that no anthropogenic sources of noise should exceed 10 dBA above natural ambient noise measured at the perimeter of any occupied lek at any time of the day (Wyoming Game and Fish Department 2004), and no noise should reach a lek one hour before sunrise and two hours after sunrise.

Holloran (2005) looked at the response of sage grouse populations to natural gas field development in Wyoming and found that sage grouse were sensitive to industrial disturbances. The number of males attending leks declined relative to controls within 3 km of producing wells and main haul roads, and appeared to decline within 5 km of drilling rigs (Holloran 2005). As traffic increased, male attendance on leks decreased, and this effect was intensified when traffic increased within 1.3 km of leks during strutting periods (Holloran 2005). Increased noise intensity was attributed as the primary cause of declined male lek attendance near main haul roads and drilling rigs (Holloran 2005). Well densities exceeding one well per 283 ha within 3 km of leks, negatively influenced male lek attendance, and rates of decline increased as leks became surrounded by the developing gas field (*i.e.,* producing wells in three directions of lek) (Holloran 2005). Nesting females avoided areas of high well densities and successful nests were in areas of lower well densities, compared to unsuccessful nests (Holloran 2005). Based on the results of his study, Holloran (2005) recommends the following to reduce the negative impact of gas field development on sage grouse:

- Maintain well density of less than or equal to one well per 283 ha (approx. one well/section) within 3 km of leks.
- Sound-muffling of noisy gas field structures within 5 km of leks.
- Reduce overall traffic volumes (*i.e.,* car pooling) and isolate traffic disturbances (*i.e.,* use one main road to and from the gas field).
- Enforce daily traffic timing restrictions (*i.e.,* avoid strutting periods).
- Protect an area of at least 5 km from development that contains the breeding habitat shrub requirements outlined in the sage grouse habitat management guidelines (Connelly *et al.* 2000).

DRAFT

Observations on the impacts of gas development on sage grouse nest initiation and movement revealed that hens from disturbed leks had lower nest initiation and nested approximately twice as far from the leks they were captured on than did hens from undisturbed leks (Lyon 2000, Lyon and Anderson 2003). The type of disturbance in this study was a main haul road with 1-12 vehicles per day of traffic that was near three leks where all males from these three disturbed leks danced on or within 15 m of the road (Lyon and Anderson 2003). The disturbance affected the grouse, despite the imposition of restrictions on activities between 12am and 9am during the breeding season.

Based on their findings, Holloran and Anderson (2005) recommended a buffer of 5 km from sage grouse leks in contiguous sagebrush habitats and the minimization or halting of activities that negatively affect sage grouse nesting habitat within 5 km of leks. They also recommend that all potential nesting areas be protected regardless of their proximity to leks (Holloran and Anderson 2005).

Aldridge (2005) noted that sage grouse chick failure increased and broods avoided areas with a greater density of visible well sites within 1 km. Lek male attendance and lek persistence decreased within 3.2 km of coal-bed natural gas development in Montana and Wyoming (Walker *et al* 2007). Connelly *et al.* (2000) recommended that energy-related facilities be greater than 3.2 km from active leks whenever possible, and human activities in sight of or within 500 m of a lek be minimized during the early morning and late evening when grouse are on or around the leks. Anecdotal observations in Alberta by Aldridge (1998), noted that four of six leks that had been disturbed by oil and gas activity were no longer active. Also in Alberta, the development of roads and wells within approximately 200 m of three different sage grouse leks between 1983 and 1985 coincided with the abandonment of these leks (Braun *et al.* 2002). Aldridge (2007) suggested that nest and brood source habitats may be on average 6 to 10 km from leks.

A study on the effects of various disturbances at the lek of a similar species (sharp-tailed grouse) found that females were affected in some way by all disturbances and it is suggested that reproduction of grouse at those leks did not occur (Baydack and Hein 1987).

Literature Cited

Alberta Fish and Wildlife Division. 2001. Recommended land use guidelines for protection of selected wildlife species and habitat within grassland and parkland natural regions of Alberta. [Online: http://www.srd.gov.ab.ca/fw/landuse/pdf/grasslandparkland.pdf].

Alberta Sage Grouse Recovery Action Group. 2005. Alberta Greater Sage-Grouse Recovery. Alberta Species at Risk Recovery Plan No. 8. Alberta Sustainable Resource Development, Fish and Wildlife Division, Edmonton, Alberta.

Aldridge, C. L. and M. S. Boyce. 2007. Linking occurrence and fitness to persistence: Habitat-based approach for endangered Greater Sage-Grouse. Ecological Applications, 17(2). Pp. 508-526.

Aldridge, C. L. 1998. Status of the sage grouse (Centrocercus urophasianus urophasianus) in Alberta. Wildlife Status Report No. 13. Alberta Environmental Protection, Wildlife Management Division, and Alberta Conservation Association, Edmonton, Alberta.

Aldridge, C. L. 2005. Identifying habitats for persistence of greater sage-grouse (Centrocercus urophasianus) in Alberta, Canada. Ph.D. Thesis, University of Alberta, Edmonton, Alberta, Canada.

Baydack, R. K., and D. A. Hein. 1987. Tolerance of sharp-tailed grouse to lek disturbance. Wildlife Society Bulletin 15(4): 535-539.

Braun, C. E., O. O. Oedekoven, and C. L. Aldridge. 2002. Oil and gas development in western North America: effects on sagebrush steppe avifauna with particular emphasis on sage grouse. Pages 337-349 Proceedings of the Transactions of the 67th North American Wildlife and Natural Resources Conference.

Connelly, J. W., M. A. Schroeder, A. R. Sands, and C. E. Braun. 2000. Guidelines to manage sage grouse

DRAFT

populations and their habitats. Wildlife Society Bulletin 28: 1-19.

Holloran, M. J. 2005. Greater sage-grouse (Centrocercus urophasianus) response to natural gas field development in western Wyoming. Ph.D. Thesis, University of Wyoming, Laramie, Wyoming, USA.

Holloran, M. J., and S. H. Anderson. 2005. Spatial distribution of greater sage-grouse nests in relatively contiguous sagebrush habitats. The Condor 107(4): 742-752.

Lyon, A. G., and S. H. Anderson. 2003. Potential gas development impacts on sage grouse nest initiation and movement. Wildlife Society Bulletin 31(2): 486-491.

Lyon, A. G. 2000. The potential effects of natural gas development on Sage Grouse near Pinedale, Wyoming. M.S. Thesis, University of Wyoming, Laramie, Wyoming, USA.

Saskatchewan Environment. 2003. Saskatchewan activity restriction guidelines for sensitive species in natural habitats. [Online: http://www.biodiversity.sk.ca/Docs/SKactivityrestrictions.pdf].

Walker, B., D. Naugle and K. Doherty. 2007. Greater Sage-Grouse population response to energy developmet and habitat loss. Journal of Wildlife Management 71(8) pp2644-2654.

Wyoming Game and Fish Department. 2004. Minimum recommendations for development of oil and gas resources within crucial and important wildlife habitats on BLM lands. [Online: http://gf.state.wy.us/downloads/pdf/og.pdf].

Beneficial Management Practices

- Route and place development and disturbances away from suitable nesting habitat (*e.g.,* tall grass, ephemeral edges).
- No activity within recommended setback distances from leks between one hour before sunrise until two hours after sunrise.
- Create, implement and enforce a traffic control program with maximum 50 km/hr speed zones day and night within 5 km of leks.
- Delay mowing (rights-of-way, lease sites, etc.) until after July 31.
- Complete a cumulative effects assessment if well density exceeds more than one well per 283 ha (approx. one well/section) within 3 km of a lek.
- Reduce traffic volumes.
- Maintain noise emissions at less than 10 dBA within 5 km of a lek.
- If working within recommended setback distances, conduct a two year post-construction monitoring project in consultation with the appropriate regulatory authority.
- Favor multi-pad sites over single well locations.
- Once cumulative effects modeling is complete, incorporate into all development activities.

6.12 Rusty Blackbird (*Euphagus carolinus*)

Status	Special Concern, *SARA* Schedule 1
Status Last Reviewed	April 2006
Provincial Range	YT, NT, NU, BC, AB, SK, MB, ON, QC, NB, PE, NS, NL

In the boreal forest the rusty blackbird favours wetlands such as slow-moving streams, peat bogs, marshes, swamps, beaver ponds and pasture edges. Home ranges averaged 15.2ha and 71.1ha, respectively, for solitary and semi colonial birds (Powell *et al* (in prep.). Tassone (1981) noted that a number of species of birds that have strong affinities for riparian buffer strips will not inhabit strips narrower than 50 m. In the Canadian boreal forest, Darveau et al. (1995) compared bird abundance and species composition in riparian forest strips of varying widths and found that riparian strips of at least 60 m were needed to support forest dwelling birds including riparian species. Powell *et al* (in prep.) recommended that foresters maintain at least a 75 m buffer around wetlands suitable for or occupied by rusty blackbirds to minimize rusty blackbird nesting in or near regenerating clear cuts, which are susceptible to higher predation. To reduce edge effect predation on nests in natural habitats, Powell (2008) recommended that forest practitioners maintain a minimum 100m buffer from wetlands.

Literature Cited

Darveau, M., P. Beauchesne, L. Belanger, J. Huot, and P. LaRue. 1995. Riparian forest strips as habitat for breeding birds in boreal forest. Journal of Wildlife Management 59:67ï 78.

Powell, L. L. 2008. Habitat occupancy, status, and reproductive ecology of Rusty Blackbirds in New England. MS Thesis, University of Maine.

Powell, L., T. Hodgman, and W. Glanz, . In prep. Home Range and Spatial use of Wetlands by Rusty Blackbirds Breeding in Northern Maine. The Condor.

Tassone, J. F. 1981. Utility of hardwood leave strips for breeding birds in Virginia's central Piedmont. Thesis, Virginia Polytechnic Institute and State University, Blacksburg, USA.

Beneficial Management Practices

- Minimize wetland destruction, peat harvest, and beaver eradication.
- Minimize clear cutting near forested wetlands, beaver ponds and streams.

DRAFT

6.13 Sage Thrasher (*Oreoscoptes montanus*)

Status	Endangered, *SARA* Schedule 1
Status Last Reviewed	November 2000
Provincial Range	BC, AB, SK

Table 10
Provincial Setback Distances for Sage Thrasher Nests

Level of Disturbance	Alberta		Saskatchewan
	May 15 - June 30	July 1 - May 14	May 15 - June 30
Low	100 m	50 m	100 m
Medium	200 m	50 m	200 m
High	200 m	200 m	200 m

Alberta Fish and Wildlife Division (2001) and Saskatchewan Environment (2003) recommend buffers between development and sage thrasher nests (Table 10). Wyoming Game and Fish Department (2004) suggest that from April 1 to June 30, noise levels be reduced to 49 dBA or less within the breeding habitat of listed songbird species to minimize the effects of continuous noise on species that rely on aural cues for successful breeding. Several studies have shown that the density of sagebrush obligate passerines (sage sparrows, brewers sparrows and sage thrashers) decline within 100 m of roads used for natural gas extraction, with the passage of as few as 12 vehicles per day (Inglefinger 2001, Ingelfinger and Anderson 2004).

Literature Cited

Alberta Fish and Wildlife Division. 2001. Recommended land use guidelines for protection of selected wildlife species and habitat within grassland and parkland natural regions of Alberta. [Online: http://www.srd.gov.ab.ca/fw/landuse/pdf/grasslandparkland.pdf].

Ingelfinger, F., and S. Anderson. 2004. Passerine response to roads associated with natural gas extraction in a sagebrush steppe habitat. Western North American Naturalist 64: 385-395.

Inglefinger, F. M. 2001. The effects of natural gas development on sagebrush steppe passerines in Sublette County, Wyoming. M.S. Thesis, University of Wyoming, Laramie, Wyoming.

Saskatchewan Environment. 2003. Saskatchewan activity restriction guidelines for sensitive species in natural habitats. [Online: http://www.biodiversity.sk.ca/Docs/SKactivityrestrictions.pdf].

Wyoming Game and Fish Department. 2004. Minimum recommendations for development of oil and gas resources within crucial and important wildlife habitats on BLM lands. [Online: http://gf.state.wy.us/downloads/pdf/og.pdf].

Beneficial Management Practices

- Avoid activities in areas where birds are present, approximately May 15 to June 30.
- Route and place disturbances away from suitable nesting habitat (*i.e.,* sage brush prairie).
- Maintain noise emissions at less than 49 dBA. Or 10 dBA above ambient in remote areas.
- Minimize habitat fragmentation.
- Delay mowing (rights-of-way, lease sites, etc.) until after July 31.

DRAFT

6.14 Short-eared Owl (*Asio flammeus*)

Status	Special Concern, *SARA* Schedule 3
Status Last Reviewed	April 2008
Provincial Range	YT, NT, NU, BC, AB, SK, MB, ON, QC, NB, PE, NS, NL

Table 11
Provincial Setback Distances for Short-Eared Owl Nests

Level of Disturbance	Alberta	Saskatchewan
	April 1 – July 31	March 25 – Aug. 1
Low	200 m	100 m
Medium	200 m	300 m
High	400 m	500 m

Alberta Fish and Wildlife Division (2001) and Saskatchewan Environment (2003) recommend buffers between development and short-eared owl nests (Table 11). Incubating female short-eared owls have been observed to flush from a human intruder when they were about to be stepped on (Urner 1923, Urner 1925, Clark 1975), when 2 m away (Lewis 1925), up to 7.5 m away (Kitchin 1919), and for a particularly sensitive individual when the intruders were as far as 10 m away (Leasure and Holt 1991). In a project to capture and band short-eared owls it was possible for two individuals to approach on opposite sides of 20 incubating female owls on nests to a distance of 6 m without the female flushing (Leasure and Holt 1991). Holt (1992) suggests that disturbance during nest construction may affect nest site selection, as three out of four females that were flushed from nest scrapes, before eggs were laid, moved to new locations nearby to nest.

Literature Cited

Alberta Fish and Wildlife Division. 2001. Recommended land use guidelines for protection of selected wildlife species and habitat within grassland and parkland natural regions of Alberta. [Online: http://www.srd.gov.ab.ca/fw/landuse/pdf/grasslandparkland.pdf].

Clark, R. J. 1975. A field study of the short-eared owl, Asio flammeus (Pontoppidan) in North America. Wildlife Monographs 47: 1-67.

Holt, D. W. 1992. Notes on short-eared owl, Asio flammeus, nest sites, reproduction, and territory sizes in coastal Massachusetts. Canadian Field Naturalist 106(3): 352-356.

Kitchin, E. A. 1919. Nesting of the short-eared owl in western Washington. The Condor 21: 21-25.

Leasure, S. M., and D. W. Holt. 1991. Techniques for locating and capturing nesting female short-eared owls (Asio flammeus). North American Bird Bander 16(2): 32-33.

Lewis, H. F. 1925. Notes on birds of the Labrador Peninsula in 1924. Auk 42(2): 278-281.

Saskatchewan Environment. 2003. Saskatchewan activity restriction guidelines for sensitive species in natural habitats. [Online: http://www.biodiversity.sk.ca/Docs/SKactivityrestrictions.pdf].

Urner, C. A. 1923. Notes on the short-eared owl. Auk 40(1): 30-36.

Urner, C. A. 1925. Notes on two ground-nesting birds of prey. Auk 42(1): 31-41.

Beneficial Management Practices

- Avoid activities in areas while birds are present, approximately April 1 to July 31.
- Create, implement and enforce a traffic control program with maximum 50 km/hr speed zones day and night within 200 m of nest sites.

- Delay mowing (rights-of-way, lease sites, etc.) until after July 31.
- Route and place disturbances away from suitable nesting habitat.

DRAFT

6.15 Sprague's Pipit (*Anthus spragueii*)

Status	Threatened, *SARA* Schedule 1
Status Last Reviewed	May 2000
Provincial Range	AB, SK, MB

Table 12
Provincial Setback Distances for Sprague's Pipit Nests

Level of Disturbance	Alberta	Saskatchewan
	April 15 – July 15	April 21 – Aug. 31
Low	100 m	50 m
Medium	100 m	200 m
High	100 m	250 m

Alberta Fish and Wildlife Division (2001) and Saskatchewan Environment (2003) recommend buffers between development and Spragueôs pipit nests (Table 12). Wyoming Game and Fish Department (2004) suggest that from April 1 to June 30, noise levels be reduced to 49 dBA or less within the breeding habitat of listed songbird species to minimize the effects of continuous noise on species that rely on aural cues for successful breeding.

Linnen 2006 and 2008 found reduced bird densities up to a minimum of 300 m from wells or associated trails/ roads. The response was similar for both shallow gas and oil activities. Because winter construction of roads, trails and wells does not mitigate for this effect, consideration should be given to year round setbacks in high quality habitat.

Literature Cited

Alberta Fish and Wildlife Division. 2001. Recommended land use guidelines for protection of selected wildlife species and habitat within grassland and parkland natural regions of Alberta. [Online: http://www.srd.gov.ab.ca/fw/landuse/pdf/grasslandparkland.pdf].

Linnen. C. 2006. The effects of minimal disturbance shallow gas activity on grassland birds. Prepared for Petroleum Technology Alliance Canada. 17 pp.

Linnen. C. G. 2008. Effects of oil and gas development on grassland birds. Prepared for Petroleum Technology Alliance Canada. Calgary Alberta. 25pp.

Saskatchewan Environment. 2003. Saskatchewan activity restriction guidelines for sensitive species in natural habitats. [Online: http://www.biodiversity.sk.ca/Docs/SKactivityrestrictions.pdf].

Wyoming Game and Fish Department. 2004. Minimum recommendations for development of oil and gas resources within crucial and important wildlife habitats on BLM lands. [Online: http://gf.state.wy.us/downloads/pdf/og.pdf].

Beneficial Management Practices

- Avoid activities in areas while birds are present, approximately May 1 to August 31.
- Nests are difficult to find, therefore if male birds are heard singing within 100 m consider there is a nest and apply setbacks. Searching for nest site may cause nest failure.
- Route and place disturbances away from suitable nesting habitat (*e.g.,* grass of moderate height, mixed grass prairie with good litter cover, ephemeral edges). Consider year round setbacks in habitat that consistently provides high quality nesting cover.
- Delay mowing (rights-of-way, lease sites, etc.).

DRAFT

6.16 Whooping Crane (*Grus americana*)

Status	Endangered, SARA Schedule 1
Status Last Reviewed	November 2000
Provincial Range	NT, AB

Due to the existing protection of the Whooping crane nesting areas in Wood Buffalo National Park, literature concerning the effects of disturbance on the staging areas of the Whooping crane is the focus of the literature review for this species.

The type of disturbance and distance from cranes was found to be more important than frequency of disturbance in eliciting a response from whooping cranes on their wintering grounds (Lewis and Slack 1992). When a disturbance, such as helicopters, airboats and tour boats was less than 1,000 m away, whooping cranes reacted most strongly and flushing rates were 50%, 38% and 24%, respectively (Lewis and Slack 1992). A study on the flushing distance of wintering whooping cranes in Texas found the maximum flushing distances to be 275 m, 550 m and 1,100 m from airboats, airboats with a hunter and power boats with a hunter, respectively (Mabie *et al.* 1989). Burger and Gochfeld (2001) investigated the reactions of sandhill cranes to a vehicle stopped perpendicular to feeding flocks, at an important crane staging area near the Nebraska Platte River. Many cranes within 300 m of the vehicle flew or walked away while few cranes beyond 300 m flew but several stopped feeding to watch the vehicle (Burger and Gochfeld 2001). Lewis and Slack (1992) suggest that disturbance may severely impact maintenance of optimal energy budgets or cause injury to whooping cranes.

Literature Cited

Burger, J., and M. Gochfeld. 2001. Effect of human presence on foraging behavior of sandhill cranes (Grus canadensis) in Nebraska. Bird Behavior 14(2): 81-87.

Lewis, T. E., and D. R. Slack. 1992. Whooping crane response to disturbances at the Aransas National Wildlife Refuge. Pages 176-176 in Stahlecker, D. W. and R. P. Urbanek (editors), Proceedings of the Sixth North American crane workshop. North American Crane Working Group, Grand Island, Nebraska.

Mabie, D. W., L. A. Johnson, B. C. Thompson, J. C. Barron, and R. B. Taylor. 1989. Responses of wintering whooping cranes to airboat and hunting activities on the Texas coast USA. Wildlife Society Bulletin 17(3): 249-253.

Beneficial Management Practices

- Avoid activities in areas while birds are present, approximately May 1 to November 1.
- Always view cranes from vehicle at least 500 m away, do not approach on foot.
- Avoid placing transmission lines near staging areas.
- Implement a traffic control program with maximum 50 km/hr speed zones day and night within 1,000 m of staging areas.
- Implement measures to discourage birds from landing in sumps or tailings ponds.

DRAFT

6.17 Yellow Rail (*Coturnicops noveboracensis*)

Status	Special Concern, SARA Schedule 1
Status Last Reviewed	November 2001
Provincial Range	NT, BC, AB, SK, MB, ON, QC, NB

Saskatchewan Environment (2003) recommends that during the breeding season (April 15 to June 30) a buffer of 100 m, 150 m and 350 m from low, medium and high levels of disturbance, respectively, be kept between human disturbance and yellow rail nests. Yellow rails are secretive birds that are restricted to the dense low vegetation of very shallow wetlands. They feed during the daytime and primarily call at night (Alvo and Robert 1999). Prescott *et al* (2001) reported that detection of yellow rails using playback calls improved with darkness and suggested that time of night and lunar phase were factors in detection.

Literature Cited

Alvo, R. and M. Robert. 1999. COSEWIC status report on the yellow rail *Coturnicops noveboracensis* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 1-62 pp.

Prescott, D., M. Norton, and I. Michaud. 2001. A survey of Yellow and Virginia rails in Alberta using nocturnal call playbacks. Alberta Conservation Association. Edmonton, Alberta. 20p.

Saskatchewan Environment. 2003. Saskatchewan activity restriction guidelines for sensitive species in natural habitats. [Online: http://www.biodiversity.sk.ca/Docs/SKactivityrestrictions.pdf].

Beneficial Management Practices

- Avoid activities in areas while birds are present, approximately May 1 to November 1 (They are late fall migrants).
- Prevent loss, drainage, channelization and degradation of wetlands, especially wet meadows and peatlands (e.g. siltation and pollution runoff)
- Maintain year-round 100 m no-activity buffer from seasonal wetlands including wet meadows, bogs and fens that may provide suitable habitat.
- No mowing of seasonal wetland areas when dry.
- Avoid nighttime activities (light and noise) near breeding wetlands.

DRAFT

7. LITERATURE REVIEW - MAMMALS

7.1 Black-tailed Prairie Dog (*Cynomys ludovicianus*)

Status	Special Concern, *SARA* Schedule 1
Status Last Reviewed	November 2000
Provincial Range	SK

Saskatchewan Environment (2003) does not recommend a setback distance from black-tailed prairie dog colonies for low-level disturbances, but suggests a 250 m and 500 m buffer between medium and high levels of disturbance, respectively. A study on the responses of non-habituated black-tailed prairie dogs to human intrusion found that the furthest distance that triggered a vocal response from a prairie dog was 60 m and the furthest distance that caused a movement response (escape into the burrow) was triggered at 43 m (Adams *et al.* 1987). A similar study by Magle (2005) found that non-habituated prairie dogs barked in response to human presence when they were as far as 43 m away and went into the burrow when the observer was as far as 29 m.

Literature Cited

Adams, R. A., B. J. Lengas, and M. Bekoff. 1987. Variations in avoidance responses to humans by black-tailed prairie dogs (*Cynomys ludovicianus*). Journal of Mammalogy 68: 686-689.

Magle, S., J. Zhu, and K. R. Crooks. 2005. Behavioral responses to repeated human intrusion by black-tailed prairie dogs (*Cynomys ludovicianus*). Journal of Mammalogy 86(3): 524-530.

Saskatchewan Environment. 2003. Saskatchewan activity restriction guidelines for sensitive species in natural habitats. [Online: http://www.biodiversity.sk.ca/Docs/SKactivityrestrictions.pdf].

Beneficial Management Practices

- Maintain a 200 m buffer year-round from suitable habitat and colonies.
- Create, implement and enforce a traffic control program with maximum 50 km/hr speed zones within 200 m of suitable habitat and colonies.
- Do not create predator perching opportunities, where possible.

DRAFT

7.2 Grey Fox (*Urocyon cinereoargenteus*)

Status	Threatened, *SARA* Schedule 1
Status Last Reviewed	May 2002
Provincial Range	MB, ON

The grey fox is considered extremely rare in Manitoba and only as an accidental. The grey foxôs distribution is closely associated with deciduous or mixed wood forests. This fox can readily climb trees. Dens are generally located in dense brush in forested areas and in proximity to wetlands. The home range is estimated between 30 and 1000 hectares (Judge and Haviernick 2002).

Literature Cited

Judge, K.A., Haviernick, M. 2002. Update COSEWIC status report on the grey fox Urocyon cinereoargenteus in Canada, in COSEWIC assessment and update status report on the grey fox Urocyon cinereoargenteus interior in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 1-32 pp.

Beneficial Management Practices

- Avoid roads within 200m of dens.

DRAFT

7.3 Ord's Kangaroo Rat (*Dipodomys ordii*)

SARA Schedule	Endangered, *SARA* Schedule 1 .
Status Last Reviewed	2006
Provincial Range	AB, SK

Table 13
Provincial Setback Distances for Ord's Kangaroo Rat Burrows

Level of Disturbance	Alberta Year-Round	Saskatchewan Year-Round
Low	50 m	50 m
Medium	100 m	250 m
High	250 m	500 m

Kissner (2009) and Saskatchewan Environment (2003) recommend buffers between development and Ordôs kangaroo rat dens throughout the year (Table 13). Increased nighttime illumination and noise near dens and in home ranges may alter behaviour and potentially decrease survival or reproduction. Kangaroo rats are known to change their foraging behaviour in response to nighttime light conditions (Tappe 1941, Justice 1960, Schwab 1966, Lockard and Owings 1974a, Lockard and Owings 1974b, O'Farrell 1974, Lockard 1975, Kaufman and Kaufman 1982, Kotler 1983, Kotler 1984, Price *et al.* 1984, Bowers 1988, Brown *et al.* 1988, Daly *et al.* 1992). The hearing of the kangaroo rat is sensitive to low frequency sound, as specialized auditory structures in the skull enable them to hear predators more efficiently (Webster 1962), and excess noise during active periods may hinder the ability to detect predators. In an experiment by Brattstrom and Michael (1983), it took 21 days before the normal range of hearing returned to kangaroo rats exposed to sounds at 95 dBA at close range, decreasing the ability to detect predators such as owls and snakes. Brattstrom and Michael (1983) suggested that kangaroo rat ears may be particularly sensitive to sounds with high concentrations of energy in the area of 1.0 to 3.0 kHz. Their sensitivity to foot drumming, an anti-predator behaviour kangaroo rats use against snakes (Randall and Stevens 1987), may be affected by seismic activity.

Human activities limited to diurnal hours near kangaroo rat dens may still affect behaviour as Gummer and Robertson (2003) found that kangaroo rats with burrows near the construction site of a pipeline had a contraction of their home ranges and suggested a decrease in foraging opportunities. The reduction in foraging opportunities was suggested as the reason why kangaroo rats near the pipeline entered hibernation less frequently than the control group (Gummer and Robertson 2003). For this pipeline, special mitigation measures were put in place which prevented direct mortalities of kangaroo rats at the pipeline site. The mitigation strategy employed included: conducting specialized surveys to identify den sites for kangaroo rats; marking of burrows and instructing operators to avoid these sites; restricting trucks and large vehicles from accessing areas where kangaroo rats occurred; and prohibiting nighttime construction activities or lighting.

DRAFT

Literature Cited

Bowers, M. A. 1988. Seed removal experiments on desert rodents: The microhabitat by moonlight effect. Journal of Mammalogy 69: 201-204.

Brattstrom, B. H., and C. B. Michael. 1983. Effects of off-road vehicle noise on desert vertebrates. Pages 192-206 in R. H. Webb and H. G. Wilshire, editors. Environmental effects of off-road vehicles: Impacts and management in arid regions. Springer-Verlag, New York.

Brown, J. S., B. P. Kotler, R. J. Smith, and W. O. Wirtz. 1988. The effects of owl predation on the foraging behavior of heteromyid rodents. Oecologia 76: 408-415.

Daly, M., P. R. Behrends, M. I. Wilson, and L. F. Jacobs. 1992. Behavioural modulation of predation

DRAFT

risk: Moonlight avoidance and crepuscular compensation in a nocturnal desert rodent, Dipodomys merriami. Animal Behaviour 44(1): 1-9.

Gummer, D., and S. Robertson. 2003. Evaluation of activities and survival of Ord's kangaroo rats during and post-construction of the North Suffield pipeline. Final Report for Encana. Provincial Museum of Alberta, Edmonton, Alberta. [Online: http://www.royalalbertamuseum.ca/natural/mammals/pubs/_pdfs/encan-lo.pdf].

Justice, K. E. 1960. Nocturnalism in three species of desert rodents. Ph.D. Thesis, University of Arizona, Tucson, Arizona, USA.

Kaufman, D. W., and G. A. Kaufman. 1982. Effect of moon light on activity and micro habitat use by Ord's kangaroo rat Dipodomys ordii. Journal of mammalogy 63(2): 309-312.

Kissner, K.J. 2009. Beneficial Management Practices for Ordôs Kangaroo Rat in Alberta. Alberta Sustainable Resource Development. Alberta Species At Risk Report. No. 125. 42p.

Kotler, B. P. 1983. Determinants of community structure in desert rodents: risk, resources, and foraging behavior. Ph.D. Thesis, University of Arizona, Tucson, Arizona, USA.

Kotler, B. P. 1984. Risk of predation and the structure of desert rodent communities. Ecology 65: 689-701.

Lockard, R. B. 1975. Experimental inhibition of activity of kangaroo rats in the natural habitat by an artificial moon. Journal of Comparative and Physiological Psychology 89: 263-266.

Lockard, R. B., and D. H. Owings. 1974a. Moon related surface activity of bannertail (Dipodomys spectabilis) and Fresno (D. nitratoides) kangaroo rats. Animal Behaviour 22: 262-273.

Lockard, R. B., and D. H. Owings. 1974b. Seasonal variation in moonlight avoidance by bannertail kangaroo rats. Journal of Mammalogy 55: 189-193.

O'Farrell, M. J. 1974. Seasonal activity patterns of rodents in a sagebrush community. Journal of Mammalogy 55(4): 809-823.

Price, M. V., N. M. Waser, and T. A. Bass. 1984. Effects of moonlight on microhabitat use by desert rodents. Journal of Mammalogy 65: 353-356.

Randall, J. A., and C. M. Stevens. 1987. Footdrumming and other anti-predator responses in the bannertail kangaroo rat (Dipodomys spectabilis). Behavioral Ecology and Sociobiology 20: 187-194.

Saskatchewan Environment. 2003. Saskatchewan activity restriction guidelines for sensitive species in natural habitats. [Online: http://www.biodiversity.sk.ca/Docs/SKactivityrestrictions.pdf].

Schwab, R. G. 1966. Environmental Factors Affecting Surface Activity of the Kangaroo Rat (Dipodomys merriami). Ph.D. Thesis, University of Arizona, Tuscon, Arizona, USA.

Tappe, D. T. 1941. Natural history of the Tulare kangaroo rat. Journal of Mammalogy 22(2): 117-148.

Webster, D. B. 1962. A function of the enlarged middle ear cavities of the kangaroo rat, Dipodomys. Physiological Zoology 35: 248-255.

Beneficial Management Practices

- Prevent lights from vehicles and equipment from illuminating the surrounding landscape at night.
- Maintain a 500 m buffer year-round from occupied or suitable habitat.
- Create, implement and enforce a traffic control program with maximum 50 km/hr speed zones day and night within 500 m of occupied or suitable habitat.
- Conduct activities only during frozen conditions; subject to pre-winter surveys showing that no kangaroo rats are present within the required setback distance.

- Do not leave trenches open or create open patches of sand, as this may attract kangaroo rats.
- If seeding is required, use native seed common to the area. Consider Indian rice grass, spear grass, Scurf pea, annual sunflower, narrowleaved puccoon, northern wheat grass, prickly pear, western bluebur, and sand dropseed but only in areas that will be fully reclaimed and away from potential population sinks (e.g. roads, trails), as these represent large components of the natural diet.
- Favor multi-pad sites over single well locations.
- Minimize low frequency sound and excess noise during periods kangaroo rats are active.

DRAFT

7.4 Swift Fox (*Vulpes velox*)

Status	Endangered, *SARA* Schedule 1
Status Last Reviewed	May 2000
Provincial Range	AB, SK

Table 14
Provincial Setback Distances for Swift Fox Dens

Level of Disturbance	Alberta		Saskatchewan	
	Feb. 15 – July 31	**Aug. 1 – Feb. 14**	**Feb. 15 – Aug. 31**	**Sept. 1 – Feb. 14**
Low	500 m	50 m	500 m	100 m
Medium	500 m	100 m	500 m	500 m
High	500 m	500 m	2000 m	2000 m

Alberta Fish and Wildlife Division (2001) and Saskatchewan Environment (2003) recommend buffers between development and swift fox dens (Table 14). The effect of pipeline construction on swift fox was investigated by Moehrenschlager (2000). The study concluded that pre-construction activities (surveys of pipeline area by individuals on foot, in trucks and on all-terrain vehicles) during the spring and summer months, less than or equal to 500 m from swift fox dens, reduced reproductive success. It was also concluded that road mortality was highest between August and October when young foxes became more mobile (Moehrenschlager 2000). A close relative, the San Joaquin kit fox (*Vulpes macrotis mutica*) has shown higher road mortality in areas developed for petroleum extraction compared to undeveloped areas (O'Farrell 1984). The swift fox has been shown to locate natal dens close to roads (Hines and Ronald 1991, Pruss 1999).

Literature Cited

Alberta Fish and Wildlife Division. 2001. Recommended land use guidelines for protection of selected wildlife species and habitat within grassland and parkland natural regions of Alberta. [Online: http://www.srd.gov.ab.ca/fw/landuse/pdf/grasslandparkland.pdf].

Hines, T. D., and Ronald M. Case. 1991. Diet, home range, movements, and activity periods of swift fox in Nebraska. The Prairie Naturalist 23(3): 131-138.

Moehrenschlager, A. 2000. Effects of ecological and human factors on the behaviour and population dynamics of reintroduced Canadian swift foxes (Vulpes velox). Ph.D. Thesis, University of Oxford, Oxford, England.

O'Farrell, T. P. 1984. Conservation of the endangered San Joaquin kit fox Vulpes macrotis mutica on the naval petroleum reserves, California. Acta Zoologica Fennica 172: 207-208.

Pruss, S. D. 1999. Selection of natal dens by the swift fox (Vulpes velox) on the Canadian prairies. Canadian journal of zoology 77(4): 646-652.

Saskatchewan Environment. 2003. Saskatchewan activity restriction guidelines for sensitive species in natural habitats. [Online: http://www.biodiversity.sk.ca/Docs/SKactivityrestrictions.pdf].

Beneficial Management Practices

- Avoid activities in areas while foxes are breeding, approximately February 15 to August 31.
- Create, implement and enforce a traffic control program with maximum 50 km/hr speed zones day and night within 2,000 m of den sites.
- Do not mow rights-of-way or leases, as this will create homogenous areas not favoured by foxes.
- Consider cumulative effects and/or development threshold limits.

DRAFT

- Favor multi-pad sites over single well locations.

DRAFT

7.5 Western Harvest Mouse (*Rheithrodontomys megalotis dychei*)

Status	Endangered, *SARA* Schedule 1.
Status Last Reviewed	April 2007
Provincial Range	AB

The western harvest mouse is a nocturnal, non-fossorial mammal active year round but known to enter a brief period of torpor (COSEWIC 2007). The western harvest mouse builds grass nests above ground in dense grass or in low shrubs. The prairie population of the western harvest mouse is poorly studied, but in other parts of its range the species is known to be more active on moonless nights, therefore increased nighttime illumination and noise near nests and on home ranges may affect behaviour and survival or reproduction. Because this species is active above ground year round, individuals are sensitive to activities that impact the nest. Dispersal distance is generally less than 300m and home range has been cited as generally between one half to one hectare (COSEWIC 2007).

Literature Cited

COSEWIC 2007. COSEWIC assessment and update status report on the Western harvest mouse Reithrodontomys in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 27 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

Beneficial Management Practices

- Encourage light grazing. Discourage moderate to heavy grazing.
- Restrict vehicle and all terrain vehicle (ATV) use in areas where harvest mice are present.
- Limit night time activities and lighting.
- Susceptible to temporary habitat loss due to fire. Keep vehicles on trails, and do not park in shrubs or taller grass.

DRAFT

7.6 Wolverine (*Gulo gulo*) – Western population

Status	No status, *SARA* No Schedule
Status Last Reviewed	May 2003
Provincial Range	YT, NT, NU, BC, AB, SK, MB, ON

Several studies have shown that human disturbance, including researchers, near natal or maternal wolverine dens often causes den abandonment (Pulliainen 1968, Copeland 1996, Magoun and Copeland 1998). Wolverines have extensive home ranges that extend from 100sq km to over 900sq km (Bianci 1994). Females with young have home ranges generally between 50 km and 100 km (Bianci 1994).

Literature Cited

Banci, V. 1994. Wolverine. In: Ruggiero L.F., K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski, tech eds. The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the western United States. U.S. Dept. of Agriculture, Forest Service, Gen. Tech. Rep. RM-254. Pg 99-127.

Copeland, J. P. 1996. Biology of the wolverine in central Idaho. M.S. Thesis, University of Idaho, Moscow, Idaho.

Magoun, A. J., and J. P. Copeland. 1998. Characteristics of wolverine reproductive den sites. Journal of Wildlife Management 62(4): 1313-1320.

Pulliainen, E. 1968. Breeding biology of the wolverine (Gulo gulo) in Finland. Annales Zoologici Fennici 5: 338-344.

Beneficial Management Practices

- Maintain a 500 m buffer year-round from dens.
- Create, implement and enforce a traffic control program with maximum 50 km/hr speed zones day and night within 500 m of dens.
- Minimize habitat fragmentation.
- Discourage human access to remote areas with wolverines.
- Favour multi-pad sites.

DRAFT

7.7 Wood Bison (*Bison bison athabascae*)

Status	Threatened, *SARA* Schedule 1
Status Last Reviewed	May 2000
Provincial Range	YT, NT, BC, AB, MB

Fortin and Andruskiw (2003) investigated the response of free-ranging bison to human disturbance. The most significant observation was that the probability of a herd of bison with young running from a snowmobile increased as the distance to the herd decreased. With logistic regression, they determined that at a distance of 257 m, a herd of bison with young would flee from a snowmobile 50% of the time (Fortin and Andruskiw 2003). Human disturbance resulted in the distance traveled by bison to increase by 30%, but did not have a major impact on resource use (Fortin and Andruskiw 2003). A flight response was also more common for bison that encountered a truck than for bison that encountered a hiker (Fortin and Andruskiw 2003). A response of alertness occurred when a hiker and cyclist were on average a distance of 175 m and 149 m respectively from a bison (Taylor and Knight 2003). In the same study a flight response occurred when a hiker or cyclist was on average, 94 m from the bison (Taylor and Knight 2003). To minimize disturbance, Fortin and Andruskiw (2003) recommended remaining greater than 260 m from bison herds.

Literature Cited

Fortin, D., and M. Andruskiw. 2003. Behavioral response of free-ranging bison to human disturbance. Wildlife Society Bulletin 31: 804-813.

Taylor, A. R., and R. L. Knight. 2003. Wildlife responses to recreation and associated visitor perceptions. Ecological Applications 13(4): 951-963.

Beneficial Management Practices

- Maintain a 500 m buffer from winter range, calving and rutting grounds (1000 m for over flights).
- Create, implement and enforce a traffic control program with maximum 50 km/hr speed zones day and night within 1,000 m of key areas.
- Favor multi-pad sites over single well locations.

DRAFT

8. *LITERATURE REVIEW - REPTILES*

8.1 Eastern Yellow-bellied Racer (*Coluber constrictor flaviventris*)

Status	Threatened, *SARA* Schedule 1
Status Last Reviewed	November 2004
Provincial Range	SK

Saskatchewan Environment (2003) recommends buffer zones of 100 m, 200 m and 1,000 m at low, medium and high levels of disturbance, respectively, year-round between human disturbance and eastern yellow-bellied racer hibernacula. Hartline (1971) states that three families of snakes, including Colubridae, are extremely sensitive to vibrations, indicating the need for further study on the effects of seismic and other vibrational activities on snakes. Studies on its cousin , the Western Yellow-bellied Racer, showed an average dispersal distance from denning sites in Utah of 781 m for males and 663 m for females, although daily movements were generally less than 200m (COSEWIC 2004). Poulin and Didiuk (2008) estimated that two radio-tracked Eastern racers traveled up to 2000m from their hibernacula, putting them at risk to road mortality, farm equipment and persecution.

Literature Cited

COSEWIC 2004. COSEWIC assessment and update status report on the Eastern and Western Yellow-bellied Racers, Coluber constrictor flaviventris and Coluber constrictor mormon in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 35 pp.

Poulin, R. and A. Didiuk. 2008. Survey for Eastern Yellow-bellied Racers on AAFC-PFRA Pastures. Final Report to the Interdepartmental Recovery Fund, Government of Canada. 40 pp.

Hartline, P. H. 1971. Physiological basis for detection of sound and vibration in snakes. Journal of Experimental Biology 54: 349-371.

Saskatchewan Environment. 2003. Saskatchewan activity restriction guidelines for sensitive species in natural habitats. [Online: http://www.biodiversity.sk.ca/Docs/SKactivityrestrictions.pdf].

Beneficial Management Practices

- Maintain a 1,000 m buffer year-round from hibernacula.
- Create, implement and enforce a daytime traffic control program with maximum 50 km/hr speed zones within 1,000 m of hibernacula from April 15 to October 15.
- Maintain continuous vigilance for snakes sunning on roads or trails.

DRAFT

8.2 Greater Short-horned Lizard (*Phrynosoma hernandesi*)

Status	Endangered, *SARA* Schedule 1
Status Last Reviewed	April 2007
Provincial Range	AB, SK

Table 15
Provincial Setback Distances for Short-Horned Lizard Habitat

Level of Disturbance	Alberta	Saskatchewan
	Year-Round	March 15 – Nov. 15
Low	100 m	50 m
Medium	100 m	200 m
High	100 m	200 m

Alberta Fish and Wildlife Division (2001) and Saskatchewan Environment (2003) recommend buffers between development and suitable habitat for short-horned lizards (Table 15). Based on the specificity of habitat requirements for the greater short-horned lizard James (2002) recommends that any activity should occur at least 20 m from coulee rims in areas populated by this species. The inability of this lizard to move long distances makes relocation of individuals 100 m from an activity a feasible mitigation technique, if found in or around an area of human disturbance (James 2002). Although temporary home ranges can be quite small, total home ranges can be up to $4000m^2$ and some individuals have been observed moving 100m in one week (James 2004).

Literature Cited

Alberta Fish and Wildlife Division. 2001. Recommended land use guidelines for protection of selected wildlife species and habitat within grassland and parkland natural regions of Alberta. [Online: http://www.srd.gov.ab.ca/fw/landuse/pdf/grasslandparkland.pdf].

James, J.D. 2004. Status of the short-horned lizard (*Phrynosoma hernandesi*) in Alberta: update 2004. Prepared for Alberta Sustainable Resource Development, Fish and Wildlife Division, and Alberta Conservation Association. Wildlife Status Report No. 5, Edmonton, AB. 27 pp.

James, J. D. 2002. A survey of short-horned (Phrynosoma hernandesi hernandesi) lizard populations in Alberta. Alberta Species at Risk Report No. 29. Alberta Sustainable Resource Development, Fish and Wildlife Division, Edmonton, Alberta.

Saskatchewan Environment. 2003. Saskatchewan activity restriction guidelines for sensitive species in natural habitats. [Online: http://www.biodiversity.sk.ca/Docs/SKactivityrestrictions.pdf].

Beneficial Management Practices

- Avoid disturbing south, southeast and east facing slopes that have short or sparse vegetation.
- Avoid grazing near known hibernacula in spring and fall.
- Place salt blocks 200m away from coulee edges, ravines or south facing slopes.
- Maintain sagebrush patches.

DRAFT

8.3 Prairie Skink (*Eumeces septentrionalis*)

Status	Endangered, *SARA* Schedule 1
Status Last Reviewed	May 2004
Provincial Range	MB

The prairie skink has been known to hibernate between 66 cm (Nelson 1963) and 137 cm (Scott and Sheldahl 1937) below the surface, to frequently return to the same site year after year (COSEWIC 2004), and is estimated to spend 9.75 months below ground each year (Nelson 1963) making this species difficult to find and vulnerable to ground disturbance in suitable habitat. Fitch (1954) studied the Canadian five-lined skink (*Eumeces fasciatus*) and observed that females during nest excavation and brooding were prone to nest desertion when disturbed. Nelson (1963) also noted the abandonment of several nests after disturbances at the nest site. Home ranges rarely exceed 100m (COSEWIC 2004). Hibernation sites are generally not within the summer home range, but up to 25 m from the summer home range (COSEWIC 2004).

Literature Cited

COSEWIC. 2004. COSEWIC assessment and update status report on the prairie skink Eumeces septentrionalis in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, Ontario. [Online: http://www.sararegistry.gc.ca/status/status_e.cfm].

Fitch, H. S. 1954. Life history and ecology of the five-lined skink, Eumeces faciatus. University of Kansas Publications, Museum of Natural History 8(1): 1-156.

Nelson, W. F. 1963. Natural history of the northern prairie skink, Eumeces septentrionalis septentrionalis (Baird). Ph.D. Thesis, University of Minnesota.

Scott, T. G., and R. B. Sheldahl. 1937. Black-banded skink in Iowa. Copeia 1937(3): 192.

Beneficial Management Practices

- Avoid sandy areas associated with mixed-grass prairie where the species may be present.

DRAFT

9. LITERATURE REVIEW - AMPHIBIANS

Noise from vehicles can change amphibian call behaviour (Barrass 1985, Sun and Narins 2005) and curtail mating (Barrass 1985). Increased traffic has been shown to increase frog and toad mortality and reduce frog and toad populations (Fahrig *et al.* 1995). It has also been shown that toads and frogs depend upon a specific range of illumination for cues to perform activities relating to vision, such as foraging (Jaeger and Hailman 1981, Hailman 1984, Buchanan 1993) and possibly mating, therefore excess illumination or noise at breeding ponds may impact amphibian reproductive success. Water from oil sands reclaimed wetlands has been shown to negatively affect the development and growth of amphibians and their populations (Pollet and Bendell-Young 2000; Hersikorn 2009; Gupta 2009). A literature review of the terrestrial habitats used by 19 frog species in the United States found that the average minimum and maximum core terrestrial habitats extended out to 205 m and 368 m, respectively, from their aquatic habitat edge (Semlitsch and Bodie 2003). Semlitsch and Bodie (2003) recommended that an additional 50 m buffer of terrestrial habitat be added to the core terrestrial habitat. Gibbs et al (2007) recommended a 300m buffer for roads from wetlands in New York State.

Literature Cited

Barrass, A. N. 1985. The effects of highway traffic noise on the phonotactic and associated reproductive behavior of selected anurans. Ph.D. Thesis, Vanderbilt University, Nashville, Tennessee.

Buchanan, B. W. 1993. Effects of enhanced lighting on the behaviour of nocturnal frogs. Animal Behaviour 45: 893-899.

Fahrig, L., J. H. Pedlar, S. E. Pope, P. D. Taylor, and J. F. Wegner. 1995. Effect of road traffic on amphibian density. Biological Conservation 73: 177-182.

Gibbs, J.P., A.R. Breisch, P.K. Ducey, G. Johnson, J.L. Behler, and R.C. Bothner. 2007. The amphibians and reptiles of New York State. Oxford University Press, NY.

Gupta, N. 2009. Effects of Oil Sands Process-Affected Water and Substrates onWood Frog (Rana sylvatica) Eggs and Tadpoles. MSc. Thesis. University of Saskatchewan, Saskatoon Saskatchewan. 100pp.

Hailman, J. P. 1984. Bimodal nocturnal activity of the western toad (Bufo boreas) in relation to ambient illumination. Copeia (2): 283-290.

Hersikorn, B. D. 2009 In Situ Caged Wood Frog (Rana Sylvatica) Survival And Development In Wetlands Formed From Oil Sands Process-Affected Materials (OSPM). MSc. Thesis. University of Saskatchewan, Saskatoon Saskatchewan.

Jaeger, R. G., and J. P. Hailman. 1981. Activity of neotropical frogs in relation to ambient light. Biotropica 13: 59-65.

Pollet, I., and L. I. Bendell-Young. 2000. Amphibians as indicators of wetland quality in wetlands formed from oil sands effluent. Environmental Toxicology and Chemistry 19(10): 2589-2597.

Semlitsch, R. D., and J. R. Bodie. 2003. Biological criteria for buffer zones around wetlands and riparian habitats for amphibians and reptiles. Conservation Biology 17(5): 1219-1228.

Sun, J. W. C., and P. M. Narins. 2005. Anthropogenic sounds differentially affect amphibian call rate. Biological Conservation 121: 419-427.

DRAFT

9.1 Great Plains Toad (*Bufo cognatus*)

Status	Special Concern, *SARA* Schedule 1
Status Last Reviewed	May 2002
Provincial Range	AB, SK, MB

Table 16
Provincial Setback Distances for Great Plains Toad Ponds

Level of Disturbance	Alberta	Saskatchewan
	Year-Round	**Year-Round**
Low	50 m	10 m
Medium	50 m	400 m
High	100 m	500 m

Alberta Fish and Wildlife Division (2001) and Saskatchewan Environment (2003) recommend buffers between development and ponds used by Great Plains toads in all parts of their life cycle (Table 16). Large numbers of Great Plains toads may be killed upon paved and unpaved roads (Didiuk 1999), especially if these roads are near breeding wetlands and if they have high traffic. While monitoring the mortality of common toads on a road near a breeding pond, Cooke (1995) observed less road mortality on sections of the road furthest from the ponds. Gas well caissons and pipeline trenches may trap individuals (Didiuk 1999).

Literature Cited

Alberta Fish and Wildlife Division. 2001. Recommended land use guidelines for protection of selected wildlife species and habitat within grassland and parkland natural regions of Alberta. [Online: http://www.srd.gov.ab.ca/fw/landuse/pdf/grasslandparkland.pdf].

Cooke, A. S. 1995. Road mortality of common toads (Bufo bufo) near a breeding site, 1974-1994. Amphibia-Reptilia 16: 87-90.

Didiuk, A.B. 1999. COSEWIC status report on the Great Plains toad *Bufo cognatus* in Canada in COSEWIC assessment and status report on the great plains toad *Bufo cognatus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 1-46 pp.

Saskatchewan Environment. 2003. Saskatchewan activity restriction guidelines for sensitive species in natural habitats. [Online: http://www.biodiversity.sk.ca/Docs/SKactivityrestrictions.pdf].

Beneficial Management Practices

- Maintain surrounding uplands.
- Avoid wintering sites.
- Do not create barriers to movement.
- Maintain habitat connectivity between wetlands.
- Leave logs, snags and other woody debris.
- Avoid mowing when toads are active or mow with care.

9.2 Northern Leopard Frog (*Rana pipiens*) - Western Boreal/Prairie populations

Status	Special Concern, *SARA* Schedule 1
Status Last Reviewed	April 2009
Provincial Range	NT, AB, SK, MB

Table 17
Provincial Setback Distances for Northern Leopard Frog Ponds

Level of Disturbance	Alberta	Saskatchewan
	Year-Round	Year-Round
Low	50 m	10 m
Medium	50 m	200 m
High	100 m	500 m

Alberta Fish and Wildlife Division (2001) and Saskatchewan Environment (2003) recommend buffers between development and ponds used by northern leopard frogs in all parts of their life cycle (Table 17). While monitoring the mortality of vertebrate species on the Long Point Causeway at Lake Erie, Ontario, Ashley (1996) noticed that leopard frog mortality decreased when habitat adjacent to the causeway was altered to make it unsuitable for leopard frogs. During leopard frog migration, road mortality can be high when roads with traffic intersect these migrations (Palis 1994, Linck 2000). A study in Ontario cited the leopard frog as being a more vagile species and found that traffic density within 1.5km of ponds had a significant negative effect on abundance (Carr and Fahrig 2001). Similarly, Eigenbrod *et al* (2009) observed a significant positive relationship with leopard frog abundance and increasing distance from a major highway: this relationship extended beyond 1000m.

Literature Cited

Alberta Fish and Wildlife Division. 2001. Recommended land use guidelines for protection of selected wildlife species and habitat within grassland and parkland natural regions of Alberta. [Online: http://www.srd.gov.ab.ca/fw/landuse/pdf/grasslandparkland.pdf].

Ashley, E. P., and J. T. Robinson. 1996. Road mortality of amphibians, reptiles and other wildlife on the long point causeway, Lake Erie, Ontario. Canadian Field-Naturalist 110(3): 403-412.

Carr, L. W. and L. Fahrig. 2001. Effect of road traffic on two amphibian species of differing vagility. Conservation Biology 15(4): 1071-1078.

Eigenbrod, F., S. J. Hecnar, and L. Fahrig. 2009. Quantifying the road-effect zone: threshold effects of a motorway on anuran populations in Ontario, Canada. *Ecology and Society* **14**(1): 24.

Linck, M. H. 2000. Reduction in road mortality in a northern leopard frog population. Journal of the Iowa Academy of Science 107(3): 209-211.

Palis, J. G. 1994. Anura: Rana utricularia (southern leopard frog): Road mortality. Herpetological Review 25(3): 119.

Saskatchewan Environment. 2003. Saskatchewan activity restriction guidelines for sensitive species in natural habitats. [Online: http://www.biodiversity.sk.ca/Docs/SKactivityrestrictions.pdf].

Beneficial Management Practices

- Maintain a 400 m buffer year-round from seasonal wet areas that have suitable breeding habitat for frogs.

DRAFT

- Maintain a 400 m buffer around wetlands known to provide wintering sites for the period of September through May to protect frogs moving to and from wintering sites, and during hibernation at these sites.
- Do not create barriers to movement.
- Maintain habitat connectivity between wetlands.
- Maintain natural patterns of water level fluctuations (to discourage fish).
- Do not stock fish.
- Leave logs, snags and other woody debris.
- Do not mow when frogs are active or mow with care.

DRAFT

9.3 Western Toad (*Bufo boreas*)

Status	Special Concern, SARA Schedule 1
Status Last Reviewed	November 2002
Provincial Range	YT, NT, BC, AB

While monitoring the mortality of toads on a road near a breeding pond, Cooke (1995) observed less road mortality on the sections of road furthest from ponds. Eigenbrod et al (2009) observed decreased American Toad abundance for a distance of 200 and 300 m from a major highway, in 2007 and 2006 respectively. In Colorado, boreal toads (*Bufo boreas boreas*) were observed to move 900 m (with evidence that they may move further) from their summer habitat to an area with 5 hibernacula, that was shared by 30 toads over the winter months (Campbell 1970). Browne and Symes (2007) observed that radio-tracked western toads in the boreal region of Alberta moved significantly farther to reach hibernation sites from their breeding ponds than those in the parkland region, averaging 1042 m and 381 m, respectively. Browne and Symes (2007) also observed that at least 68 percent of the hibernation sites were communal and Western toads used cavities in peat hummocks, red squirrel middens, natural dry wetland crevasses, decayed root channels, cavities under spruce trees, abandoned beaver lodges, and muskrat tunnels. To reduce disturbance during hibernation, western toad hibernacula should be searched for and avoided.

Literature Cited

Browne, C. and S. Symes. 2007. The first Canadian records of western toad hibernation sites. Unpublished Report. Department of Biological Sciences, University of Alberta, Edmonton, AB.

Campbell, J. B. 1970. Hibernacula of a population of Bufo boreas boreas in the Colorado front range. Herpetologica 26(2): 278-282.

Cooke, A. S. 1995. Road mortality of common toads (Bufo bufo) near a breeding site, 1974-1994. Amphibia-Reptilia 16: 87-90.

Eigenbrod, F., S. J. Hecnar, and L. Fahrig. 2009. Quantifying the road-effect zone: threshold effects of a motorway on anuran populations in Ontario, Canada. *Ecology and Society* **14**(1): 24.

Beneficial Management Practices

- Maintain a 400 m buffer year-round from seasonal wet areas that have suitable habitat for toads.
- Minimize the development of dugouts in suitable toad breeding habitat.
- Do not mow areas with suitable toad habitat.
- Maintain surrounding uplands.
- Avoid wintering sites.
- Do not create barriers to movement.
- Maintain habitat connectivity between wetlands.
- Leave logs, snags and other woody debris.

DRAFT

Appendix A

Search Platforms, Databases and Range of Years Searched Online at the University of Alberta Library and Associated Search Terms

SEARCH PLATFORM	DATABASE(S)	DATES
CSA Illumina	Water resources abstracts	1967-2006 (December)
	Pollution abstracts	1981-2006 (December)
	Biology Digest	1989-2006 (December)
	Agricultural and Environmental Biotechnology Abstracts	1993-2006 (December)
	Animal behaviour abstracts	1982-2006 (December)
	ASFA1: Biological Sciences and Living Resources	1971-2006 (December)
	Ecology abstracts	1982-2006 (December)
	BioOne abstracts and Indexes	1998-2006 (December)
	Conference papers index	1982-2006 (December)
	Environmental Engineering abstracts	1990-2006 (December)
Ovid technologies - WebSPIRS 5.12	Agricola	1970-2006 (December)
	Applied Science and Technology	1983-2006 (December)
	Biological and agricultural Index (plus)	1983-2006 (December)
	CAB abstracts	1973-2006 (December)
	General science abstracts	1984-2006 (December)
	Zoological Record	1978-2006 (December)
Arctic and Antarctic regions	Arctic Science and Technology Information system (ASTIS)	1974-2006 (December)
	CASP Bibliography of Arctic and Russian Geology	1984-2006 (December)
	Arctic Bibliography	early 1970's
	Cold Regions Bibliography	
	Centre for Cold Ocean Resources Engineering (C-CORE)	
	World Data Center A for Glaciology [Snow & Ice]	
	Scott Polar Research Institute (SPRI)	
	USBGN Antarctic Place Names	
	Canadian Circumpolar Library - Boreal	
	Canadian Circumpolar Library - Boreal Northern titles	
	Canadian Circumpolar Library - Yukon Bibliography	
	Department of Indian and Northern Affairs, Northern Development, Canada (INAC)	
ProQuest dissertations and theses database: full text		1861-2006 (December)
OCLC First Search	PapersFirst	1993-2006 (December)
EBSCO Host Research Databases	Wildlife and ecology studies worldwide	1838-2006 (December)
Lexis Nexis	Environmental Abstracts	1975-2006 (December)
Scopus		1966-2006 (December)
ISI Web of Knowledge	BIOSIS previews	1926-2006 (November)

DRAFT

Terms Used for Searching Online Databases

(*=wildcard)

GROUP ONE TERMS			
Black-tailed prairie dog	prairie dog	*Cynomys*	*Cynomys ludovicianus*
burrowing owl	*Athene cunicularia*	*Athene*	*Speotyto cunicularia*
Speotyto	Eastern yellow-bellied racer	yellow-bellied racer	*Coluber constrictor*
Coluber	ferruginous hawk	*Buteo regalis*	*Buteo*
great plains toad	*Bufo cognatus*	*Bufo*	greater short-horned lizard
mountain short-horned lizard	short-horned lizard	*Phrynosoma douglassii*	*Phrynosoma douglassii brevirostre*
Phrynosoma hernandesi	*Phrynosoma*	grey fox	gray fox
Urocyon cinereoargenteus	*Urocyon*		
	least bittern	*Ixobrychus exilis*	*Ixobrychus*
loggerhead shrike	*Lanus ludovicianus excubitorides*	*Lanus ludovicianus migrans*	*Lanus ludovicianus*
Lanus	long-billed curlew	curlew	*Numenius americanus*
Numenius	mountain plover	*Charadrius montanus*	*Charadrius*
northern leopard frog	leopard frog	*Rana pipens*	northern prairie skink
prairie skink	*Eumeces septentrionalis*	*Eumeces*	Ordôs kangaroo rat
kangaroo rat	*Dipodomys ordii*	*Dipodomys*	*peregrine falcon anatum*
peregrine falcon tundrius	peregrine falcon	*Falco peregrine*	
Falco peregrine anatum	*Falco peregrine*	piping plover circumcinctus	piping plover
Charadrius melodus circumcinctus	*Charadrius melodus*	red-headed woodpecker	*Melanerpes erythrocephalus*
Melanerpes			
greater sage grouse	sage grouse	*Centrocercus urophasianus urophasianus*	*Centrocercus urophasianus*
Centrocercus	sage thrasher	*Oreoscoptes montanus*	*Oreoscoptes*
short-eared owl	*Asio flammeus*	*Asio*	Spragueôs pipit
Anthus spragueii	*Anthus*	swift fox	*Vulpes velox*
Vulpes	Western toad	boreal toad	*Bufo boreas*
Bufo	Whooping crane	*Grus americana*	*Grus*
Wolverine	*Gulo gulo*	*Gulo*	wood bison
Bison bison athabascae	*Bison bison*	Bison	yellow rail
Coturnicops noveboracensis	*Coturnicops*		

GROUP TWO TERMS			
petroleum	oil	gas	natural gas
sweet gas	sour gas	crude oil	pipeline
access road	lease	right-of-way	oil sand
compressor station	trench	traffic	seismic
minimal disturbance	exploration	road	aircraft
airplane	helicopter	coal bed methane	CBM
facility	construct*	heavy equipment	equipment
oil battery	battery	straddle plant	plant*
pigging station	pig trap	riser	tank farm
camp*	condensate	drilling rig	rig*
completion	completion rig	surface rig	steam assisted gravity drainage
SAGD	chainsaw	multipad	pad site
flare stack	flare	power line	ditch*
gas plant	pump jack	screw jack	well density
refinery	produced water	sodic water	production
drill*	drilling mud	bleed*	frac crew
develop*	cold flow	stripped lease	oil shale
petrochemical	oil refinery	gas refinery	pumping
tar sand	oil field	seismic exploration	compressor
directional drilling	deviate drilling	fracturing	fracing
hydrocarbons	hydrogen sulphide	multiple entry	service rig
straddle extraction plant	wildcat	wellhead	volatile organic compounds
VOC	vibroseis	surface casing	secondary recovery
tertiary recovery	steam injection	bitumen	surface mining

DRAFT

GROUP TWO TERMS			
open-pit mining	cyclic steam stimulation	CSS	vapor extraction process
VAPEX	toe to heal air injection	THAI	strip mining
clear cut	deforest*	linear disturbance	cut line
footprint	road building	earth moving equipment	human disturbance
harass*	abandon*	disturb*	mortality
productivity	alarm	bother	destroy
desert	damage	agitate	upset
interrupt	demolish	destruct	kill
death	direct mortality	indirect mortality	habitat loss
abandon*	reproductive success	litter success	nest failure
nest success	loss of habitat	polar environment*	prairie
tundra	arctic	grasslands	endangered species
threatened species	species of special concern	rare species	home range
breeding period	fecundity	clutch	brood
litter	young	natal burrow	pups
nestling	juvenile	egg	tadpoles
egg mass	toadlet	egg string	breeding season
gestation	den area	kits	dispersal
suitable habitat	hunting area	calving	calving area
altricial	precocious	cavity nest	stick nest
ground nest	cliff nest	tree nest	nest
den	roost	hibernacula	foraging area
water body	wetland	natal den	home range
fidelity	territory	habitat*	critical habitat
lek	nesting colony	rookery	marsh
breeding site	conserv*	management	environment* monitoring
environment* impact	environment* impact assessment	EIA	environment* degradation
environment* quality	environment* sciences	environment* assessment	environment* survey
wildlife survey	wildlife management	sustainable development	biodiversity
environment* ethic*	mitigate*	timing restrictions	setback distance
forest manage*	cumulative effect	remediation	reclamation
reclaim			

DRAFT