

etc. We don't want cars or trains keeping us awake at nights and now we could lose this to the coal mining exploration.

I would like my grand children to have some of the things that I have had when they grow up. When someone says to them, your Grandad used to outfit bighorn sheep hunters in the mountains, they may say what is a bighorn and further what is a mountain.

So ladies and gentlemen, lets all try and keep this Willmore Wilderness as it is. Thank you.

PROTECTION AND RECLAMATION OF BIGHORN SHEEP
RANGE IN THE FOOTHILLS OF ALBERTA

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Winter Range Ecology

Just as winter often restricts man's movements on the ground, big game animals find themselves confined to rather small portions of their habitat where protection, forage and snow depths are to their advantage. In the foothills of Alberta, this winter range is shared at various times by bighorn sheep, elk, mule deer and perhaps moose, horses or other livestock; it is mainly composed of openings and southerly facing, grassy slopes, bordered by open mixedwood or coniferous forests. The climax grass species in many of these open areas in southern Alberta is Festuca scabrella.

Several ecological factors combine to make winter range quality of great importance for the maintenance of bighorn sheep herds. First, if winter range becomes restricted or deteriorated, malnutrition will occur at a time when climatic factors are the most severe. Secondly, poor winter forage may increase the incidence of lungworm disease and lamb mortality, or cause late breeding by ewes. Thirdly, sheep often have to compete with other grazing animals that use the same range at various times during the year. And, fourthly, these same areas are the first to green up in the spring and thus provide for the recovery of animals from poor winter forage conditions. These ecological relationships combine to determine the carrying capacity of winter ranges, which is a key factor in the management and conservation of wild sheep herds.

Range Protection

The federal government does not have a historical mandate for the protection of wildlife species and habitats outside the National Parks and the Territories, although the proposed Canada Wildlife Act would allow for the designation and protection of rare and endangered animals, and in cooperation with provincial governments, the Act would allow for the federal government to acquire, control and manage lands for conservation and study of wildlife resources. Habitat protection through land-use management is in most cases a provincial responsibility. The two main threats to sheep winter range in Alberta are overgrazing by sheep or competing animals, and

encroachment by forests or man into grassy cover types. Sheep, elk and deer can be hunted, horses can be fenced, and trees can be cut or burned; but man's presence in this ecosystem is not so easily dealt with. If our goal is to protect the range, then man must either be excluded from it, or made to act in a manner that is non-destructive to its critical elements.

Impact of Mining

One of man's activities that can completely destroy winter range is surface mining, since all original wildlife, vegetation and soil is lost where open pits, overburden dumps, processing plants and haul roads are located. If surface mining is allowed in areas that are presently used by sheep as winter range, we can expect some effects upon sheep populations for the term of the disturbance and until the habitat is restored. The first effect will be that the animals must move to other locations. If this secondary range is as accessible and as able to support grazing animals as the disturbed land did, then there should be no decrease in sheep numbers. However, if the new range can not support as high animal densities, or greater competition is encountered, then sheep numbers will fall to the new carrying capacity of the range. Rapid reclamation and evacuation of mined land will minimize the impact of these activities on grazing animals by allowing them to return to their original range as quickly as possible, bearing in mind, that if the carrying capacity of the secondary range is too low, there may be no sheep to return.

Reclamation

Our next consideration must be the quality of the original range after mining and reclamation are completed. Methods of reclamation are not known to me that can reproduce the mosaic of topography and native vegetation that we know as high quality wild sheep habitat. Reclamationists who want to restore winter range must be made aware of the intricacy of the habitat that was destroyed.

Hopefully we will be able to restore or duplicate some parts of the range. To attempt this, we start with a list of the preferred foods of bighorn sheep and certain other wild ungulates (Table 1). Grasses, sedges and legumes constitute 80 - 90 per cent of the sheep's diet; and the sheep's closest competitors are probably elk and horses or other livestock. Of the 16 genera listed in Table 1 only 3 are given at the species level. This reflects both a degree of flexibility by sheep within most genera, and our lack of specific knowledge of preferred species. Even if we do designate individual species, there are at least 20 species of Poa and Carex and 10 legumes that occur naturally in the foothills, none of which are commercially available or which have been grown on disturbed land. We can take two approaches to this situation. Either substitute species that are commercially available, or start a native plant collection and propagation program. The latter option is expensive and usually fraught with technical difficulties. A compromise between these two approaches has led to the list of species in Table 2 which we are now studying in hydroseeding trials at Luscar, Alberta. Additions and deletions in this list may be necessary, and plants in genera such as Salix and Populus which are more easily planted

than seeded, will be considered separately in our experiments. Initial results indicate that several of the plants in the Luscar trials will prove useful for the revegetation of mined land for winter range. However, it will take some time to get the sheep's opinion of this list of candidate species.

Assuming that available species will satisfy wildlife forage requirements, the next step is establishing them on disturbed land in a pattern that will be useful, for example, grasses and forbs on south facing slopes and shrubs and trees on north facing slopes. If the soil mantle that was on these areas can be replaced prior to seeding or planting, then the job of revegetation is within the realm of possibility; however, if the s-o-i-l must be spelled s-p-o-i-l, then the time required to produce a productive range will be decades, perhaps centuries. Since south facing slopes have a potential for use by animals and a risk of drought, limited soil supplies should be placed on these slopes first and immediately stabilized with vegetation during reclamation. Some grass will also be needed on north facing slopes to control erosion. If choices must be made as to the steepness and stability of slopes, the most stable 20 - 40 per cent slopes should be south facing. Hydroseeding techniques, in which a slurry of water, organic mulch, fertilizer, adhesive and seeds are sprayed onto rough ground, appear to be well suited to these revegetation jobs. Certain species will require other planting methods. The main information we lack is the ability of these plants to produce high quality forage and to support wildlife populations.

Conclusion

In conclusion, a conscientious, cooperative effort by mining companies and environmental agencies, will be necessary to apply and refine these basic methods of winter range protection and reclamation, and to assure our continued enjoyment of wild sheep in Alberta. Also, we will have to keep a close watch on the health and distribution of bighorn sheep herds in the coming years to make sure that we are in fact not destroying this unique natural resource.

TABLE 1. PREFERRED FOODS OF HIGHORN SHEEP AS COMPARED TO ELK, MULE DEER
AND MOOSE ON FOOTHILLS RANGE IN ALBERTA ^{a, b}

Plants Eaten	Bighorn Sheep	Elk	Mule Deer	Moose
Grasses				
<u>Agropyron spp.</u>	H	H	L	M
<u>Koeleria cristata</u>	H	M	L	L
<u>Festuca spp.</u>	M	M	H	L
<u>Poa spp.</u>	M	H	H	M
<u>Bromus spp.</u>	L	H	M	L
Sedges				
<u>Carex spp.</u>	H	M	M	M
Forbs				
<u>Astragalus spp.</u>	H	L	L	L
<u>Oxytropis spp.</u>	H	L	L	L
<u>Hedysarum spp.</u>	M	L	L	L
<u>Delphinium spp.</u>	M	L	L	L
<u>Cirsium spp.</u>	M	M	L	L
Shrubs and Trees				
<u>Salix spp.</u>	H	H	H	H
<u>Populus tremuloides</u>	H	H	M	H
<u>Ribes spp.</u>	H	L	L	L
<u>Picea gluca</u>	M	L	L	L
<u>Rosa spp.</u>	L	M	M	L

^aH, M and L represent high, medium, and little or no utilization of the plant listed.

^bSources: W.D. Wishart 1958. The bighorn sheep of the Sheep River Valley. M.Sc. Thesis, Univ. of Alberta, Edmonton; and private communication by Bill Wishart, Wildlife Research Biologist, Fish and Wildlife Div., Alberta Dept. of Lands and Forests, Edmonton.

TABLE 2. PLANTS UNDER STUDY IN HYDROSEEDING TRIALS ON MINED-LAND AT
LUSCAR, ALBERTA

Plants Seeded	Seed Source	Seedlot Quality and Germination ^a
Grasses		
<u>Agropyron cristatum</u>	Commercial	H
<u>Agropyron latiglume</u>	Collected in Alberta	M
<u>Agropyron riparium</u>	Commercial	H
<u>Agropyron trichophorum</u>	Commercial	H
<u>Agrostis alba</u>	Commercial	H
<u>Bromus inermis</u>	Commercial	H
<u>Dactylis glomerata</u>	Commercial	H
<u>Elymus junceus</u>	Commercial	H
<u>Festuca rubra</u>	Commercial	H
<u>Koeleria cristata</u>	Collected in Alberta	M
<u>Phleum pratense</u>	Commercial	H
<u>Poa pratensis</u>	Commercial	M
Forbs		
<u>Medicago sativa</u>	Commercial	H
<u>Melilotus alba</u>	Commercial	H
<u>Lupinus sp. (Russel)</u>	Commercial	M
<u>Vicia americana</u>	Collected in Alberta	L
<u>Epilobium angustifolium</u>	Collected in Alberta	M
<u>Phacelia sericea</u>	Collected in Alberta	M
<u>Linaria dalmatica</u>	Collected in Alberta	L
<u>Aster alpinus</u>	Commercial	L
Shrubs and trees		
<u>Amelanchier alnifolia</u>	Commercial	S
<u>Prunus virginiana</u>	Commercial	S
<u>Rosa woodsii</u>	Collected in Alberta	S
<u>Caragana arborescens</u>	Commercial	S
<u>Elaeagnus commutata</u>	Commercial	M
<u>Lonicera tatarica</u>	Commercial	H
<u>Picea engelmanni</u>	Alberta Forest Service	M
<u>Picea glauca</u>	Alberta Forest Service	M
<u>Pinus contorta</u> var. latifolia	Alberta Forest Service	H

^aH, M and L indicate high, medium and low quality and germination are characteristic of most seedlots; S indicates special germination requirements such as stratification are common.

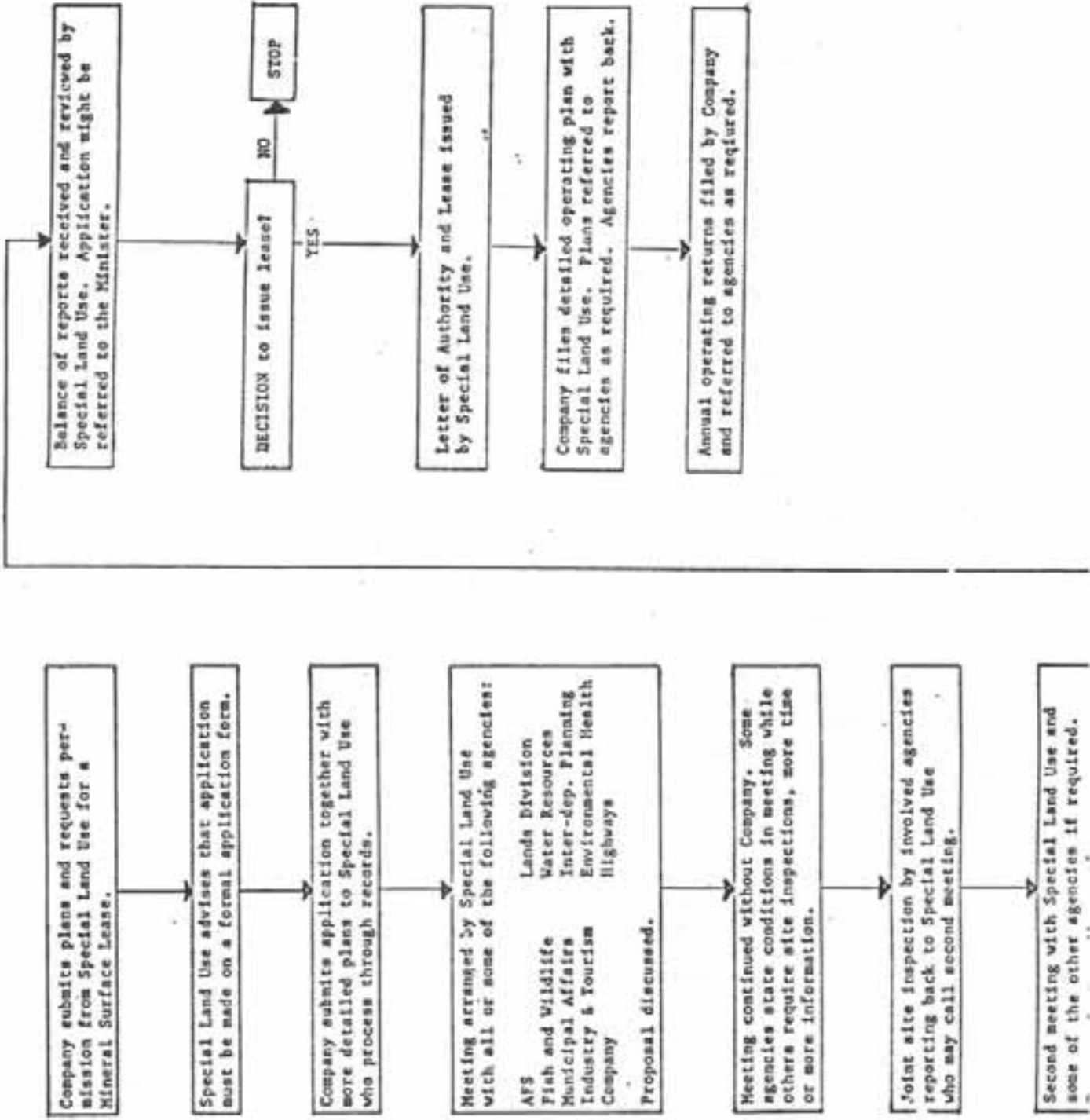
APPENDIX A - Coal Mining

Before approval is given to the mining operation, the department requires:

1. Assurance that no failures occur in the foundation area on which the spoil material is placed and that no failures occur in the spoil material itself.
2. Sufficient detail of operations to assess the intervening impact as well as the ultimate result on the watershed characteristics with respect to groundwater and overland flow, water quality and quantity, sediment transport, flow diversion, methods of diversion and monitoring and other corrective actions to maintain provincially imposed pollution control standards.
3. Details of your access road location on your own as well as public lands.
4. We require plans submitted under the signature and seal of a professional engineer and in preparing your mining plan, the following should be considered:
 - (a) Temporary spoil piles shall not be permitted in a location which would result in siltation of any drainage course.
 - (b) The slopes and location of the spoil material must be such that no failures will occur in either its foundation upon which the spoil material has been placed or the spoil material itself.
 - (c) Backfilling shall be carried out progressively and shall not be left as the final operation.
 - (d) The entire mined area is to be backfilled.
 - (e) No permanent spoil pikes will be permitted.
 - (f) The surface non-toxic material shall be piled separately to be used as a top layer in completing the reclamation program.
 - (g) Drainage ditches shall be constructed above and below the spoil and strip areas in order to prevent any surface runoff water from entering the areas disturbed in the mining operation.
 - (h) Sedimentation ponds may be required and it may be necessary to have the sedimentation ponds operative until revegetation has been totally accomplished.
 - (i) The area shall be contoured in order that the disturbed areas blend in with the natural areas and that no slope shall exceed $25^{\circ} 30'$.

We will require a reclamation deposit of \$500.00 per acre for the area which will be disturbed. The reclamation deposit will be increased as additional areas are approved. This reclamation deposit or portion thereof will be held until vegetation has been re-established and siltation in runoff has been eliminated.

PROCESS SCHEMATIC OF COALMINING SURFACE RIGHTS APPLICATIONS



APPENDIX C - Geophysical Conditions for Seismic
Exploratory & Coal Permit Exploratory Work

1. It is the responsibility of the company to determine the ownership or other interests in the land designated in the sketch attached to the request.

2. Access trails shall not exceed sixteen (16) feet in width and shall be constructed with a minimum of surface disturbance. Existing trails shall be utilized wherever possible. New trails must be flagged by the company and their location approved by an officer of the Minister before clearing commences.

3. All necessary precautions to be taken while trails are under construction to prevent the inception of soil erosion and sedimentation to streams. Trails shall be constructed in such a manner that inside ditches are not required unless otherwise directed.

4. All backfilled areas and other areas of bare soil must be reseeded to a suitable mixture and vegetative growth re-established to the satisfaction of an officer of the Minister.

5. Stream crossings shall be kept to a minimum and only one crossing is permitted at any intersection of a trail and stream. Trails shall cross streams at right angles to the stream channel and where necessary, diversion trenches shall be constructed on approaches to streams to prevent siltation.

6. No debris, soil or overburden shall be deposited or allowed to enter any watercourse and the stream courses shall not be diverted or altered in any way. Stream flow shall not be carried in road or trail ditches.

7. Except for crossings, no trail shall be constructed within 150 feet of the banks of any watercourse unless necessitated by the terrain, in which case the requirement may be waived by an officer of the Minister.

8. Drill hole locations shall be approved by an officer of the Minister and shall not be located less than 150 feet from the high water mark of any stream.

9. No campsite may be established without approval of an officer of the Minister.

10. Cleanup of debris shall be conducted to the satisfaction of an officer of the Minister and to be in accordance with The Public Lands Act, and The Forest Protection Regulations.

11. Cleanup and reclamation shall be conducted in progress with the program.

12. The company shall conduct the operation in a manner that will preserve the aesthetic quality of the area and in this regard shall carry out as little clearing as possible.

13. Revisions of the program requiring additional trails, drill holes or substantial changes in location must be resubmitted and approved before construction. Minor changes may be made in the field if approved by an officer of the Minister.

14. Wherever possible, or upon request, berms of debris and soil along trails are to be removed to allow for proper drainage. Unstable areas such as seeps and slump topography shall be avoided. Trails shall be located on ridge tops where possible to avoid heavy cuts.

15. A copy of the monthly plans presently being submitted to the Director of Minerals, should be forwarded to the Director of Lands and the Forest Superintendent of the Forest wherein the program is being conducted.

16. Before a drilling rig is moved away from a drill hole, a tag indicating the company name and drill hole location to be placed facing and in close proximity to the hole but in no case more than thirty (30) feet from the hole location.

17. Total disposal of debris must be carried out for a distance of 300 feet from the high water mark of all rivers and for a distance of 150 feet from high water mark of secondary streams.

18. All vertical cuts made along slopes that are deeper than two feet in depth are to be backsloped to a minimum 1 1/2:1 slope ratio.

19. Continuous liaison shall be maintained with the officer designated by Forest Superintendent _____ of the _____ Forest, and these officers will oversee your program.

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In preparing this short talk, I assumed the group would be primarily interested in surface disturbance as it relates to coal exploration and surface mining. I will therefore give a general run down of present governmental procedures and policies with reference to this activity.

In brief, if a company proposed to mine coal, it would normally follow this procedure:

1. request the minerals be offered for sale.
2. obtain an exploration permit to determine location and extent of minerals.
3. once minerals established, obtain a mining permit and a mineral surface lease to mine.
4. after completion of mining and reclamation, obtain a reclamation certificate.

(1) To go into each of these stages more fully therefore, and the various environmental protection measures being utilized, let us consider first Stage 1 - sale or lease of minerals. (Here it should be pointed out that in foothills and mountain areas where coal is likely to occur a large proportion of the minerals have already been disposed of). Where they have not been disposed of, a mineral application or request is referred to the Mineral Referral Review Committee. The committee has representatives from the various resource disciplines as well as the Department of Mines and Minerals. Once a request for mineral sale is received, the committee makes recommendations to the Deputy Minister of the Environment as to advisability of sale, of all or part of the area and/or environmental protection conditions which should be attached if sale is approved.

(2) If the mineral sale is approved, the next stage, Stage 2 is normally exploratory. Authority to explore for coal or any other purpose entailing more surface damage than a purely geophysical operation for oil and gas is issued pursuant to the Public Lands Act. Once an application is made, it is submitted to an interdepartmental committee (commonly known as the coal committee), consisting of a Biologist, Agrologist and a Forestry representative. Recommendations of approving the project as a whole or in part plus any special reclamation or land use conditions, which should apply are made to the Deputy Minister of Lands and Forests. The Minister