Application for a Mine Development Certificate

for the

ELKHORN QUARRY EXTENSION

submitted by
Rick Jarrett, Mine Manager

Westroc Industries Limited

P.O. Box 217, Invermere, B.C. VOA 1K0 TEL 604 342,9410 FAX 604 342,6311

May 1995



TABI	E OF	PAGE	
1.0	INTRO	DDUCTION	7
2.0	Exist	ring Environmental and Social Conditions	9
	2.1	Property History and Past Development	
	2.2	Physiography and Geology	
	2.3	Land Tenure	
	2.4	Surface Water	
	2.5	Ground Water	
	2.6	Soils and Surface Geology	
	2.7	Vegetation	
	2.8	Land Capability	
	2.9	Environmental Impact Issues	
	2.10	Socio-Economic Issues	
	2.11	Invitation to the Public	
	2.12	Historic and Archeological Sites	
3.0	THE	ELKHORN EXTENSION	21
	3.1	Exploration	
	3.2	Mine Development	
	3,3	Stockpiles	
	3.4	Product Haulage System and Shipping Facilities	
	3.5	Utilities and On-Site Facilities	
	3.6	Development Schedule	
	3.7	Production Levels and Mine Life	
	3,8	Overburden	
	3.9	Reclamation	
4.0	Арре	INDICES	30
	4.1	Mineral Lease and Mineral Claim	
	4.2	Land Capability Maps	
	4.3	Archeological Assessment References	
	4.4	Elkhorn Quarry Extension Access Road	
	4.5	Overburden Locations and Cross Sections	

LIST OF FIGURES		PAGE
Figure 1.	Location Map	5
Figure 2.	Proposed Extension of the Elkhorn Quarry	11
Figure 3.	Location of Archeological Study Area	1.5
Figure 4.	Proximity of Extension	16
Figure 5.	East Over Proposed Quarry Expansion	17
Figure 6.	The Elkhorn Quarry Extension	21
Figure 7.	Elkhorn Quarry Extension Schematic Plan (A and B)	24
Figure 8.	Haul Road Cross-Section for Haul Trucks	26
Figure 9.	Tons of Gypsum Shipped from Windermere Operations	28
Figure 10.	Overburden Locations	29
Appendices		
Figure 11.	Mining Lease	34
Figure 12.	Survey Plan of Mineral Claim	3.5
Figure 13.	Land Capability for Agriculture	36
Figure 14.	Land Capability for Forestry	3
Figure 15.	Land Capability for Wildlife – Ungulates	38
Figure 16.	Land Capability for Wildlife – Waterfowl	39
Figure 17.	Elkhorn Extension Access Road	4:
Figure 18.	Sections Lines	42
Figure 19.	Sections 2 and 3	4
Figure 20.	Section 4	4
	Sections 5 and 6	4.



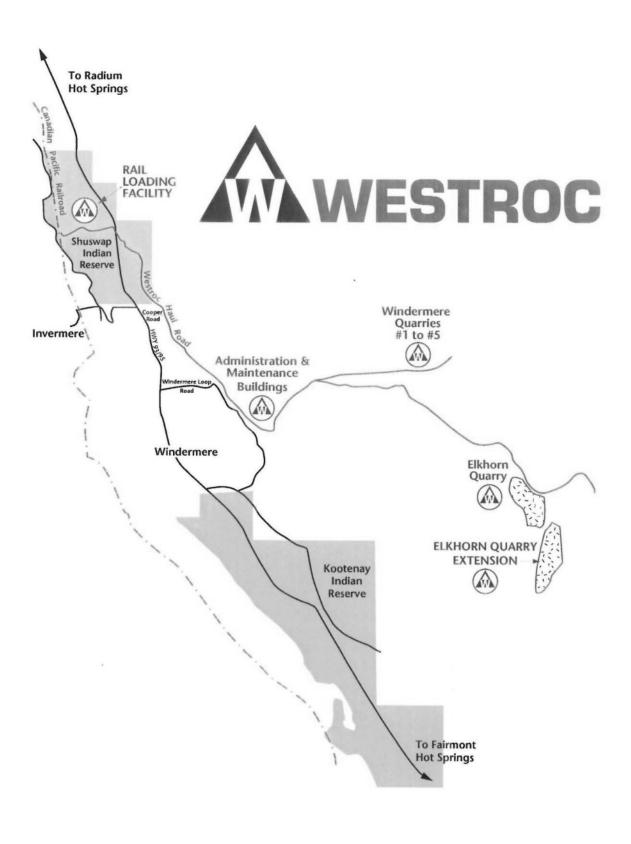


FIGURE 1. LOCATION MAP

1.0 Introduction

Westroc Industries Limited has operated gypsum quarries on Windermere Creek, near Invermere, B.C. since 1957. The reserves of the Elkhorn Quarry are nearing depletion and Westroc has conducted extensive exploration to locate the additional adjacent reserves known as the Elkhorn Quarry Extension.

The feasibility of proceeding with the Elkhorn Quarry Extension is largely a function of four factors:

- market opportunities
- · production economics
- · environmental responsibility
- reliable and stable work force

Fortunately all of these factors have come together to create an opportunity for continued prosperity in the Columbia Valley communities by developing Westroc's Elkhorn Quarry Extension. Environmental and social impacts are minimal.

As the mine is in close proximity to the Columbia Valley, all Westroc employees and their families live nearby. They contribute economically and socially to the infrastructure of the greater Rocky Mountain Trench communities.

A highly trained and competent work force of twenty-one residents of the Columbia Valley are employed year-round at the Elkhorn Quarry with a payroll of approximately 1 million dollars. Purchases of about 2 million dollars in local materials and services along with spin-off employment of an estimated 100 jobs has made Westroc Industries Limited a long-term, highly significant and stable contributor to the local valley economy.

In 1993 and 1994, Westroc's Windermere operations had no lost time accidents. Westroc's employees have an excellent long-term safety record.

The Minister of Energy, Mines and Petroleum Resources supports a joint initiative with the B.C. Trade Development Corporation to accelerate the development of industrial minerals through the development of new markets. A recent report titled *Economic Development in the Columbia-Kootenay-Boundary Area* (Fall, 1994), prepared by the ARA Consulting Group Inc. and hosted by the Ministry of Small Business, Tourism and Culture stated that industrial mineral developments are "...less prone to the cyclical swings and instability of base metal operations, they offer a more stable long-term economic base for individual communities."

The proposed method of mining would be similar to that employed in the existing quarry and will utilize existing crushing/stockpiling and transport infrastructures. Any soil or glacial till will be bulldozed into stockpiles for reclamation. The gypsum will then be drilled and blasted. The fragmented ore will be loaded into 30 ton 6 wheel drive Caterpillar D-300D articulated haul trucks and carried to the primary crusher. From there the ore will be

conveyed to a secondary crusher and stockpiled. Haulage trucks are loaded by front end loader, weighed, and the transport of gypsum to the marketplace begins. Reclamation takes place as depleted areas are deserted.

To maintain continuity of production, pre-stripping of the Elkhorn Quarry Extension must commence in the spring of 1995. This document is designed to satisfy the application requirements of the Mine Development Assessment Act. Given Westroc's long history of good mining practices and progressive reclamation, this 25 hectare extension does not appear to raise any significant issues to delay the permitting process.

2.0 Existing Environmental and Social Conditions

2.1 Property History and Past Development

Westroc's Windermere Mining Operations, located 10 km east of Lake Windermere, have been in continuous operation since 1950 with a peak annual production in 1980 of 870,000 tons. It is the longest continuously operating open pit mining operation in British Columbia. This mine has provided a stable and well paid workplace for local residents for as many years and is a long-term contributor to the local service economy.

The Windermere gypsum deposits were first discovered by trapper/prospector s.22 s.22 of Invermere. While prospecting Windermere Creek, he noticed a large sinkhole in the landscape and wondered what caused it. He rightly surmised that the underground gypsum deposits had been dissolved by water and caused the formation of a cavern into which the ground collapsed. After some digging, he discovered the Windermere gypsum deposits.

s.22 staked

eight claims in 1947 under the name of the Blue Goose Group. In 1948, Columbia Gypsum Products Inc. commenced development of the property and by 1950 the mine was in production. It recorded production of 48,000 tons in 1953.

In 1955, the company was purchased by a Vancouver group and renamed the Columbia Gypsum Co. Ltd. They operated the quarry for 2 years and then sold the operation and claims to the present owners, Western Gypsum Products Ltd. of Winnipeg, Manitoba. The parent company is BPB Industries plc of England. The name of the Canadian company has since been changed to Westroc Industries Limited with its head office at Mississauga, Ontario.

Windermere No. 1 Quarry was depleted in 1958, followed by No. 2 in 1963. The Lower No. 3 Quarry still contains 400,000 tons suitable for the cement industry. No. 4 was depleted in 1982. The Elkhorn Quarry was opened in 1983 and with the extension the Windermere/Elkhorn quarries will have an additional 17 year life beyond 1995.

Most of the past production of gypsum has been for wallboard, about 9 million tons, with about 3 million tons going to cement production. Total production to date for the Windermere mine is 12,000,000 short tons.

2.2 Physiography and Geology

Thick sedimentary beds of gypsum were deposited as mineral rich waters evaporated during the Devonian Age. Buried deep under a sequence of limestone and mudstone, the gypsum layer was subsequently folded and uplifted as the chain of Rocky Mountains was built. Gypsum is found in abundance in the Stanford Range of the Rocky Mountains and purity ranges up to 94% CaS04 • 2H20.

The gypsum deposits within which the Windermere group is included are distributed over a distance of 120 miles from the south boundary of Kootenay National Park along the Rocky Mountain Trench to the U.S. border.

The Windermere Creek area has been subject to prolonged glaciation and is dissected by many gullies which carry runoff to Windermere Creek. Windermere Creek flows to Lake Windermere which is of the chain of lakes in the Columbia Valley that form part of the Columbia River system.

The proposed extension to the Elkhorn Quarry lies slightly above and adjacent to the eastern side of the present operations (see Figure 2). This proposed quarry is located on the north flank of Four Points Mountain near Invermere, B.C., at an elevation of about 1,400 meters. It is about 525 meters from the valley bottom to the top of the mountain. This low peak is a part of the front ranges of the Stanford Range of mountains and is located immediately to the east of the Rocky Mountain Trench.

2.3 Land Tenure

Westroc Industries Ltd. holds a Mineral Lease on the proposed Elkhorn Quarry Extension lands. This 30 year mine lease No. 319259 was approved on August 18th, 1994. This Crown land lies within the Regional District of the East Kootenay. See Appendix 4.1.

2.4 Surface Water

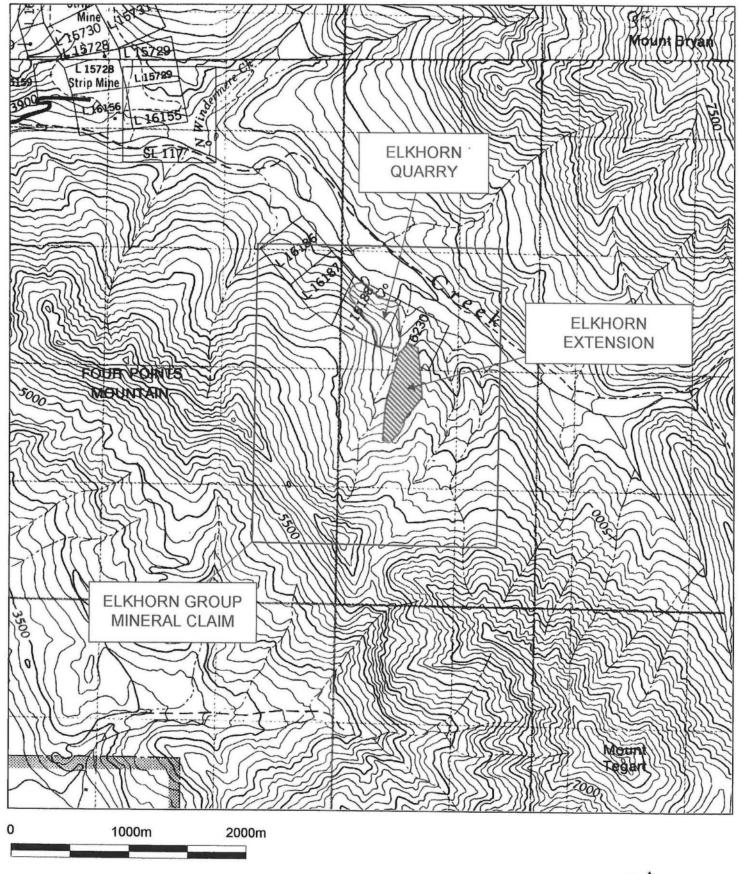
The proposed extension area lies above and to the southeast of the present mining site (see Figure 2). A dry gully running along the western side of the extension abuts the present mining operations. Any surface water runoff will be controlled and will dissipate into the overburden along side the excavation site.

Gypsum is a substance which occurs naturally in the area. There are no processing changes to the mineral which occur at the mine site. The small amounts of powdered gypsum or chalk which might find its way into the watershed streams have virtually no known effect on water quality or habitat. In the past, any runoff has been fed into a settling pond before the water is allowed to enter the watershed or Windermere Creek.

Although there is little anticipated runoff from the extension, a contingency plan is in place for the creation of an additional settling pond should it become necessary. Any water that is collected in the pit area and which must be disposed of will be directed to settling ponds already in place at the Elkhorn Quarry.

There are no waste dumps beyond areas for overburden at the Elkhorn Quarry nor are any proposed for the extension.

FIGURE 2. PROPOSED EXTENSION OF THE ELKHORN QUARRY



2.5 Ground Water

Exploration drilling to date, has indicated that no ground water will be encountered by quarrying operations. This reinforces the experience at the existing Elkhorn operations and at the quarries across the valley.

2.6 Soils and Surface Geology

The soils in the area are essentially glacial till with a poorly developed A and B horizon, they are typical of a Montane Forest. Thickness of the till varies from 0 to 1 meter in depth. Generally, it is about .5 of a meter thick. Underlying the till is weathered bedrock which consists of limestone or gypsum. Bedrock is exposed in some areas of the extension.

2.7 Vegetation

The principle vegetation in the area is Lodgepole Pine. Douglas Fir, Willow, Spruce and Aspen do occur along the valley floor, however this area will not be effected by the extension. All of the extension area has been logged and there is no merchantable timber on the property.

2.8 Land Capability

The Canada Land Inventory, as published by the Queen's Printer for Canada, 1970, showing Soil Capability for Agriculture; Land Capability for Forestry; Land Capability for Wildlife – Ungulates; and Land Capability for Wildlife – Waterfowl were consulted, and are reproduced and shown as Figures 13 to 16 respectively in Appendix 4.2.

2.9 Environmental Impact Issues

The surface area for the proposed extension was intensively logged some years ago and there is no merchantable timber on the lands. Serviceable roads already exist to access the site.

The extension to the Eikhorn Quarry is unique in that much of the gypsum deposit lies very near the surface and therefore extensive overburden stripping will not be required. The overburden materials to be removed are made up of thin glacial till. This overburden will eventually be reclaimed for wildlife habitat through a progressive reclamation program.

The extension area is a more complex mining task than the present mine site. This means that some of the limestone waste material within the deposit will also be removed as mining proceeds.

The extension is situated southeast and from 0 to 300 meters above the existing quarry. This means that much of the overburden and waste materials will be placed on top of, or adjacent to the existing waste area. This should streamline reclamation work.

The extension area has no potential as arable agricultural land. Once mining has taken place, it is unlikely that a commercial stand of timber will occur. However, reclaimed mine sites have excellent potential as wildlife range for ungulates and other animals typical of the area. Reclaimed sites at depleted quarries in the Windermere area have proven to be excellent habitat for sheep, deer, elk, moose and their predators.

As the gypsum deposits lie close to the surface and in concentrated areas, the overall impact on the Windermere watershed is not great. In the long run, what will be left are some cliffs and high quality wildlife range land.

2.10 Socio-Economic Issues

The extension of the Elkhorn Quarry is critical to the well-being of many families in the Columbia Valley communities. It is an important source of prosperity for the entire area.

The extension will guarantee steady employment for Westroc employees for at least another 17 years. This opportunity comes at a time when many area workers in industries like Forestry are facing difficult transitions.

As employees and families of the Windermere operation are long time integral members of the greater Columbia Valley, it is very important to the stability of these communities that job continuity and security be provided by the Elkhorn Quarry Extension.

Many suppliers of materials and services in East Kootenay also depend on the Westroc mine to provide income security for the next two decades.

2.11 Invitation to the Public

An invitation will be extended to the general public at the end of May, 1995 to attend the Westroc Open House and Orientation to the Elkhorn Quarry Extension.

Information regarding the mining process, the economic impacts of the Elkhorn Quarry Extension, and the contribution to the general social stability of the Columbia Valley communities will be available. Those who may wish to visit the Extension are invited to accompany our personnel on a site tour that can be arranged through our administration office.

Copies of the Elkhorn Quarry Extension Application for a Mine Development Certificate will be placed in the local library and at the Government Agent's office in Invermere. The Application is available for public viewing.

2.12 Historic and Archeological Sites

The following independent archeological impact assessment was prepared by Wayne T. Choquette, Resource Protection Advisor, Department of Land and Resources, Ktunaxa/Kinbasket Tribal Council.

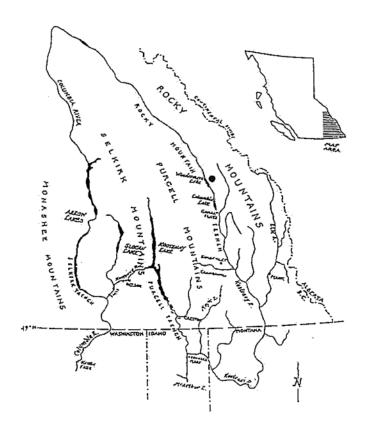


FIGURE 3. LOCATION OF ARCHEOLOGICAL STUDY AREA

Background

Westroc industries Ltd. proposes to expand their Elkhorn Quarry to an unnamed tributary of Windermere Creek (Figures 3 and 4). The 22 hectare expansion will involve removal of part of the east wall of the small valley. Prior to logging which took place about 1970, the northwest facing slope supported Douglas fir and spruce closed canopy forest.

The Windermere Valley is within the traditional territory of the Ktunaxa, a culturally and linguistically unique people who have inhabited the region that now bears their anglicized name since early post-glacial time. At the time of European contact, they comprised four geographically and linguistically distinct subdivisions centered on the Kootenay River, extending north and eastward onto the Great Plains and southward into what is now the United States. A band of the Upper Ktunaxa

wintered at the Columbia's headwaters and traveled seasonally both westward and eastward through the adjacent mountains. One of the latter routes ascended Windermere Creek. The major ethnographic works on the Ktunaxa are Schaeffer (1940) and Turney-High (1941). Smith (1984) has compiled a recent synthesis. Although the archeological record of the Columbia headwaters locality is not well known, there is evidence back to early post-glacial time as well as many millennia of travel between the Rocky Mountain Trench and the Bow

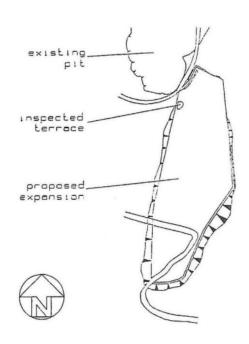


FIGURE 4. PROXIMITY OF EXTENSION

and Kananaskis drainages east of the Continental Divide. More detailed discussion of the archeology of the area are provided in Choquette 1991 and 1993.



FIGURE 5. EAST OVER THE PROPOSED QUARRY EXPANSION.
THE INSPECTED TERRACE IS AT BOTTOM CENTRE.

Westroc's Elkhorn Quarry is distinguished by having the longest continuous span of operation of any open pit mine in B.C. (Westroc n.d.). The deposit was originally discovered by s.22 The Blue Goose Group of claims were first staked in 1947 and the mine began operations in 1950. Westroc (then known as Western Gypsum Products Ltd.) purchased the operation in 1957.

Study Methodology

Field investigation took place on December 20, 1995. The property was viewed via vehicle reconnaissance and was evaluated as having low archaeological potential because of its steep slope and northerly exposure. Disturbance by clearcut logging was extensive (Figure 5).

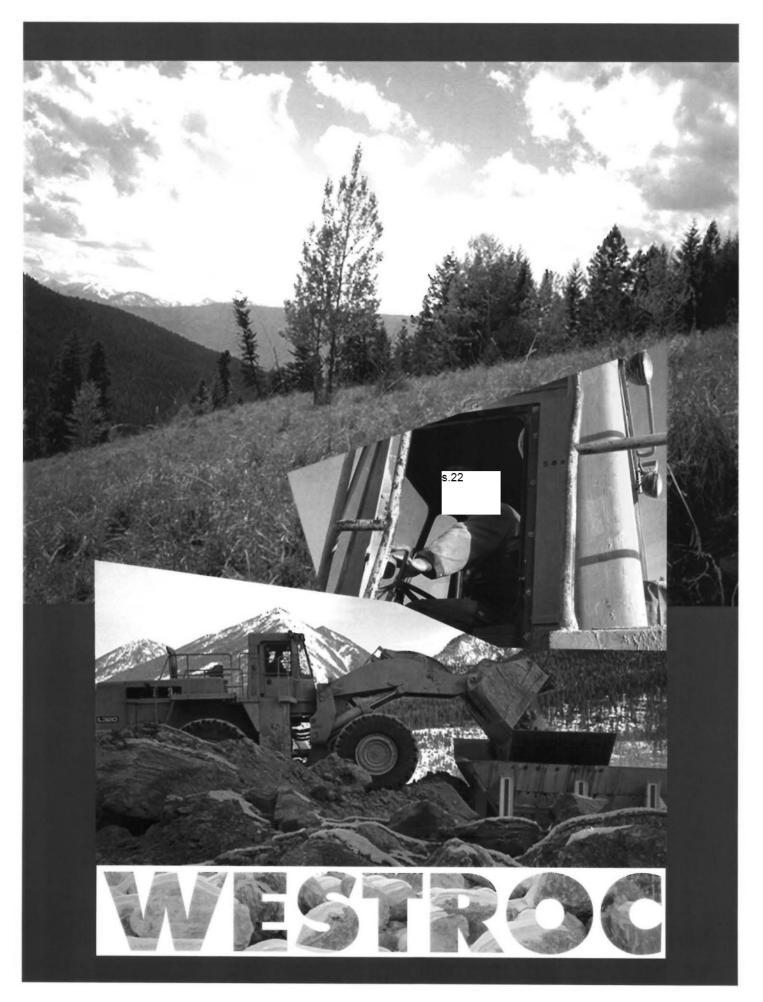
One location was examined more closely. It consisted of a small, nearly level terrace at the base of the slope (Figures 4 and 5). A section of the terrace sediment was exposed in a road cut, revealing a weakly developed forest soil in colluvium. No cultural deposits were found.

Conclusion and Recommendation

In view of the property's low archaeological potential, the disturbance by logging, and the negative results of the field inspection, it is concluded that the proposed quarry extension poses no threat to heritage resources.

References

See Appendix 4.3.



3.0 THE ELKHORN QUARRY EXTENSION

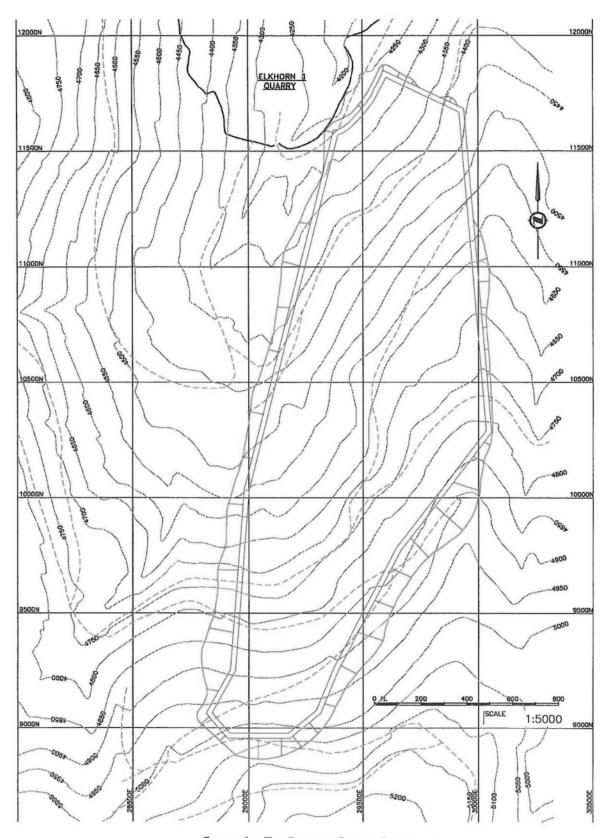


FIGURE 6. THE ELKHORN QUARRY EXTENSION

3.1 Exploration

In 1980, Westroc Industries diamond drilled some 60 one inch core holes in the extension area. About half of the 9,000 feet of hole was drilled vertically and the other half at a right angle to the face. This exploration drilling delineated the extent of the extension reserves and determined the quality of the gypsum. This reconnaissance drilling in the Elkhorn Quarry Extension revealed a highly marketable grade (over 85%) of nearly 5 million tons of gypsum.

3.2 Mine Development

The initial development of the Elkhorn Quarry Extension will take place at the top of the mine. Wherever practical, the soil and glacial till will be removed by a bulldozer and stockpiled for future reclamation work.

A conventional open pit method will be utilized in the mining of this steep hillside deposit. The gypsum, once exposed, will be drilled and blasted. Benches will be established at 45 foot intervals and drilled using 4" holes at 60 degrees. The final highwall slope will be about 70 degrees. Blasting will utilize ANFO initiated with a Pentex #8 charge.

It is expected that some limestone material will be encountered as mining progresses. This material will either be left in place or removed to overburden areas.

The broken rock will be loaded onto 30 ton trucks by a front end loader and transported to the primary crusher already set up in the Elkhorn Quarry (see Figures 7a and 7b).

The primary crusher, a 42" x 48" jaw crusher will reduce all of the rock to less than 6". From there it will be transported on the present conveyor system to the secondary crusher. At the secondary crusher the ore is further reduced to -5 inch and screened providing our two products: "Run of Mine" (-5" to dust) and "Screened Rock" (-2" to 3/4"). The products are then stockpiled with stacking conveyors. From these stockpiles the rock is loaded into trucks with a front end loader for shipment.

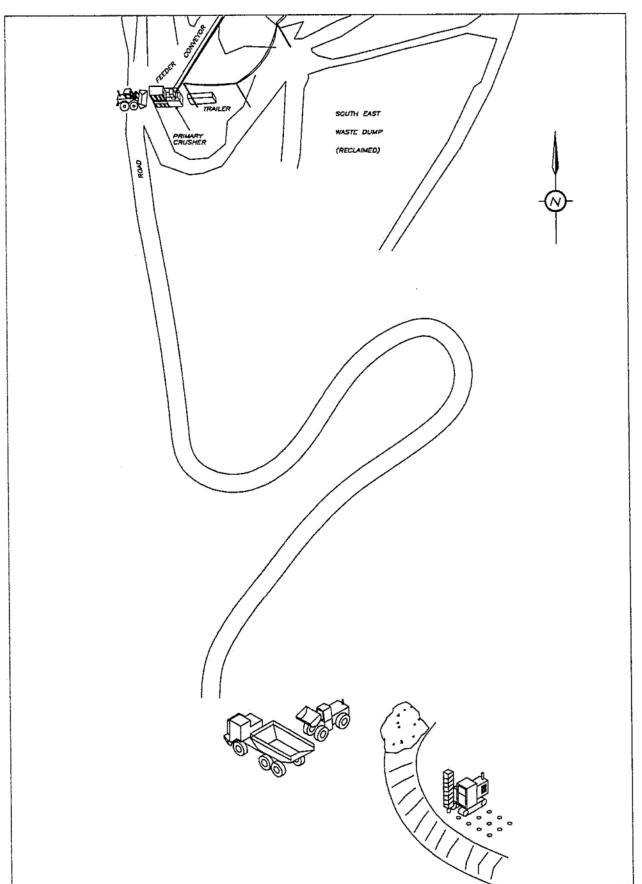


FIGURE 7A. ELKHORN QUARRY EXTENSION SCHEMATIC PLAN

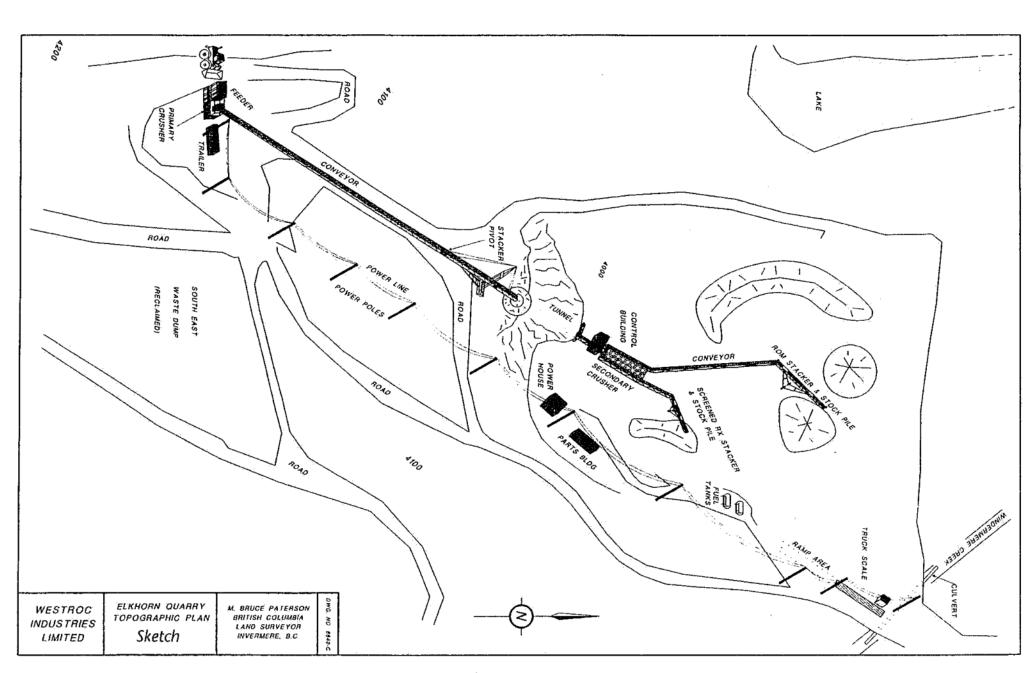


FIGURE 7B. ELKHORN QUARRY EXTENSION SCHEMATIC PLAN

The roadway between the Elkhorn Quarry Extension and the primary crusher will be radio controlled. All vehicles traveling the roadway will be equipped with 2-way V.H.F. radios operating on a dedicated radio frequency of 164.700 MHz. The roadway will be single lane with passing points and runaway ramps provided (see Figure 8 and also Appendix 4.4 for the Elkhorn Extension access road).

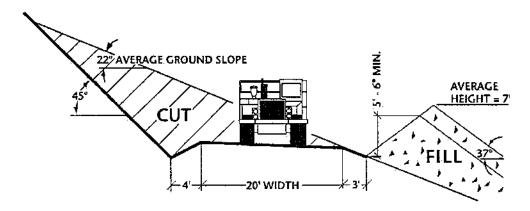


FIGURE 8. HAUL ROAD CROSS-SECTION FOR HAUL TRUCKS - CAT D300D

3.3 Stockpiles

Because of the accessibility of the open bench mining method used at the Elkhorn Quarry, it has not been necessary to stockpile huge amounts of rock. Outbound highway trucks and off road trucks are loaded at the Elkhorn Quarry site from the production stockpiles totaling about 25,000 tons of processed gypsum. These stockpiles are constantly being replenished.

In preparation for spring break-up when trucking activities may be shut down for a period of up to a month, stockpiles of processed material may be increased to about 45,000 tons. Mining operations continue throughout this period. Up to a 20,000 ton reserve is also stockpiled adjacent to the rail loading facility near the railroad tracks about twelve miles west of the mine so that there is no interruption of supply to the customers receiving rail shipments.

In total, a maximum of about 65,000 tons of processed rock may be kept in stock piles at any one time.

3.4 Product Haulage System and Shipping Facilities

Product from the Elkhorn Quarry Extension will be handled by the existing crushing/haulage/loading infrastructures. Rock shipments to customers will be by truck or rail depending on respective freight rates and customer demand. Outbound highway trucks are loaded and weighed at the mine site on a truck scale. These trucks exit directly onto a private company road which follows along Windermere Creek for about 10 kilometers then swings north and west to its intersection with Highway

93/95 near the Crossroads east of Invermere (see Figure 1). From there highway trucks proceed to Exshaw, Calgary and Rocky Mountain House in Alberta and to Spokane, Washington.

Company operated off-highway trucks transport rock from the mine site to our rail loading facility north of Athalmer along the Columbia River. This facility is located on the Shuswap Indian Reserve one kilometer north and west of the crossroads. These 80 ton capacity trucks are loaded by front end loaders at the mine site. They travel along 20 kilometers of private road to access the railroad loading facilities. The haulage trucks dump directly into an in-ground hopper or onto a stockpile. During spring break-up when off-highway trucking is shut down to protect the roadway, a stockpile of up to 20,000 tons of rock is used at the rail loading site. A front end loader feeds the hopper and conveyor loading system when trucks are not available to dump directly into the hopper. The rock is transferred by a system of conveyors into 100 ton rail cars.

Once processed, stockpiled and loaded, crushed gypsum is hauled to Westroc's wallboard plant in Calgary and Lafarge's cement plant at Exshaw. For agricultural use gypsum is hauled to Limeco Products Ltd. at Rocky Mountain House, Alberta and Greenacres Gypsum at Spokane, Washington. Railway shipments go to Westroc's wallboard plant on Annacis Island near Vancouver, B.C. and to Inland Cement at Edmonton. Occasionally rail shipments are made to Spokane, Washington, U.S.A.

3.5 Utilities and On-Site Facilities

There is no need for water in any significant quantity.

At present the energy for crushing plants, conveyors, weigh scale and miscellaneous electrical requirements is produced on-site by a diesel electric generator plant with a 500 kVA capacity. It is estimated that about 700,000 Kw/h are used at the Windermere operations on an annual basis.

Cap and powder magazines are stationed nearby on mine property.

The existing service facilities for the repair of trucks and other equipment, mine office, and change facilities for employees, will be retained at the current location. This location is equidistant between the proposed extension and the community of Invermere. The facilities are beside the haul road which ties the quarry to the rail loading facilities on the Columbia River (see Figure 1).

3.6 Development Schedule

The gypsum reserves of the existing Elkhorn Quarry will be depleted in two to three years at present levels of production. It is intended that development ore from the Elkhorn Quarry Extension will join with the Elkhorn Quarry production in October of 1995 and over a period of 3 to 5 years it will become the primary source of ore.

If present development and production rates continue, the combined reserves should give about a 17 year life to the Windermere and Elkhorn Quarries.

3.7 Production Levels and Mine Life

Although production was as high as 870,000 tons in 1980, this rapidly fell in response to two factors. First, in that same year a gypsum mine was opened on the west coast of Mexico. Due to very favourable water transportation rates, the loaded cost in Vancouver, B.C. and Bellingham, Washington was below the total cost of rock and CP Rail rates from Windermere.

Secondly, a downturn in the housing market did not completely recover until the early 1990's. Over the next few years sales dropped by 400,000 tons. Present levels are approaching 500,000 tons annually and the market should be able to sustain in excess of 400,000 tons in the foreseeable future.

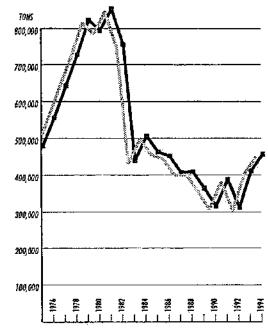


FIGURE 9. Tons of Gypsum Shipped FROM WINDERMERE OPERATIONS

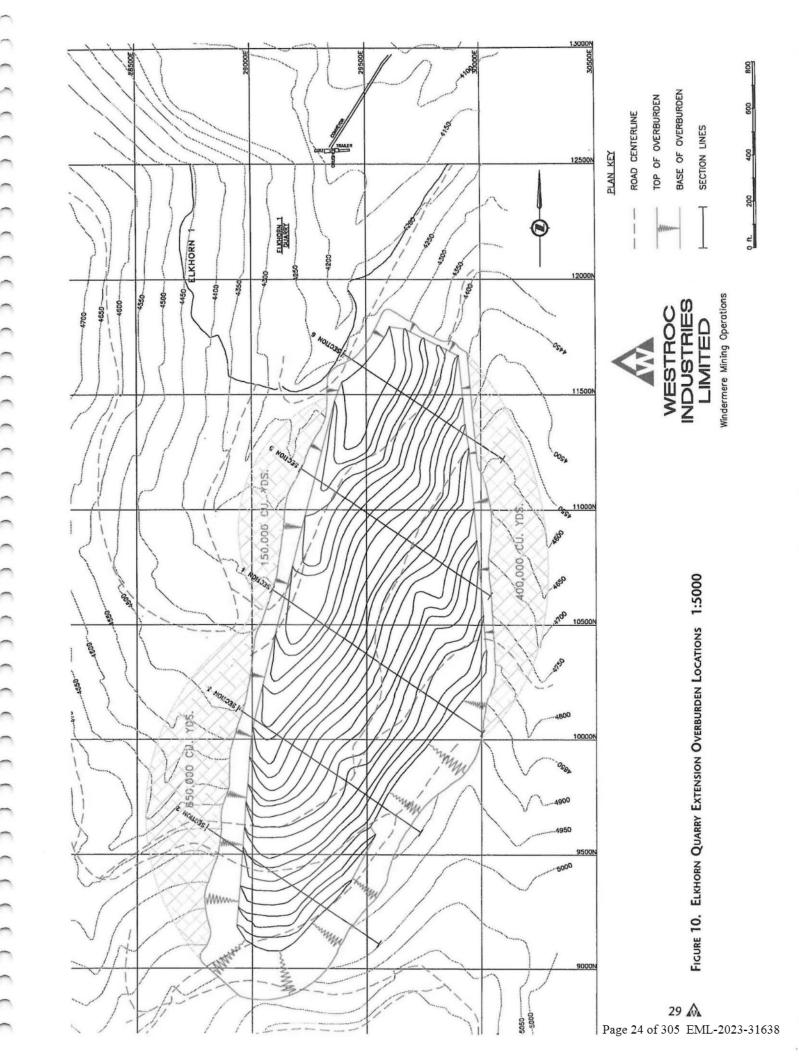
Westroc's quarry equipment is sized for a theoretical production rate of 350 tons per hour, however, the production rate is controlled by the output of the secondary crusher. Daily production rates average about 25,000 tons. The quarry operates over a 14 hour day, five day week with most of the employees working 10 hours per day and four days a week.

The proposed extension to the Elkhorn Quarry contains about 4,800,000 short tons of good quality mineable gypsum. At present rates of extraction, based on a continued and steady demand for gypsum, the life expectancy of the Extension alone is about 14 years.

The lower part of the Windermere Quarry No. 3 still has some 400,000 tons of extractable reserve of good quality gypsum.

3.8 Overburden

An estimated 1,400 thousand cubic yards of overburden will be moved during the Elkhorn Quarry Extension mining operation. The majority of the overburden, about 850 thousand cubic yards, will be deposited along the northwest side of the mine. About 400 thousand cubic yards will be moved to the southeast side and about 150 thousand cubic yards will be located on the southwest perimeter. See Figure 10. Note that Section Lines 2 to 6 are illustrated in as cross-sections in Appendix 4.5, Figures 18 to 21.



The overburden will be contoured and seeded as the opportunities to reclaim arise. The gypsum and limestone overburden is not known to have any injurious effects on flora or fauna and, in fact, the quickly deteriorating gypsum contributes to building up the soil.

3.9 Reclamation

As gypsum breaks down quickly into soil when exposed to the elements it assists in making many of the disturbed surface areas into good candidates for reclamation.

In older and permanently abandoned areas suitable for reclamation, the slopes have been contoured and drainage ditches have been built to let surface water into the adjacent naturally stabilized areas. This has been a successful strategy in eliminating the erosion of newly stabilized areas from the above surface runoff. Hydro seeding of these areas has been very successful. Black poplar, willows and fir trees are establishing new forests in the reclaimed areas. The Windermere quarries now contribute substantially to the winter range for Big Horn Sheep and Mule Deer.

Areas abandoned for more than five years have been contoured and seeded to prevent erosion.

Soil and glacial till are saved wherever practical, however, the limited quantity available suggests that these soils can only be applied to select areas which need more extensive reclamation action.

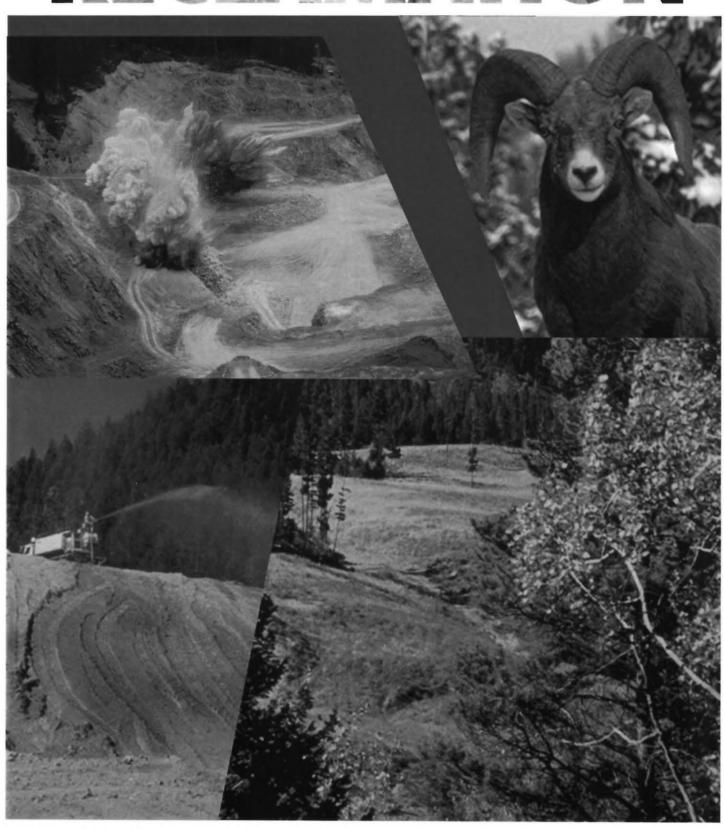
Total surface area to be exposed at the extension site is about 25 ha. Some of this area will finally remain as exposed cliffs. The outer slopes and overburden areas will be reclaimed. They will eventually be contoured and stockpiled soils will be placed and seeded.

Most of the overburden from the extension will be placed on the northwest side of the mine. This material will be contoured and seeded. The gypsum and limestone overburden is not known to have any injurious effects on flora or fauna and the quickly deteriorating gypsum contributes to building up the soil.

In nearby reclamation areas, steeper slopes have been contoured in short step-like benches. This innovative terracing effect has been very successful for retaining soils and seed on steep areas and this method will be utilized where appropriate. Reclamation will be progressive as areas are mined. The present schedule of production suggests that within 2 to 3 years from the onset of production reclamation will commence.

An ongoing program of reclamation is in place at the Windermere Mining Operations.

RECLAMATION



WESTROC

Page 26 of 305 EML-2023-31638

APPENDIX 4.1

Fie	GURE 11. MINERAL LEASE			
Annual rental \$	\$4,270.00			
Map No.	82J/5W		MINING LEASE NO.	319259
Area (hectares) .	426.78	Province	(d) (D) -(Golden
		British Columbia Ministry of	f Land Dietrict	Cranbrook
		Energy, Mines Petroleum Resc		Aug. 18/94
		Mineral Tenur Section 37	e Act	
Lessee	Westroc Industrie	es Limited	· · · · · · · · · · · · · · · · · · ·	
Address	Invermere, B.C. V	/OA 1KO		
from the date first lessee held as the	above written, all Crown minerals ava a holder of the claim or claims herein	allable under the terms of the <i>Mi</i> n described.	re Act, hereby demises unto the lessee, neral Tenure Act within and under the lea	sehold together with the rights the
	•			
Title No(s)	312002	.,		
Lot No(s).	16966			
The lessee h amendments mad apply to the said I shall bind the less	g done by the tessee, his servants, wo sereby covenants and agrees at all tin de thereto from time to time, and the leasehold, and all such amendments	orkmen, or agents in the exercise mes to perform, observe, and concerns of any regulations of any regulations of any regulations as are from time and extent as if the same as macon of the term of this lease prior	is, claims, and demands that may be bro a or purported exercise of the rights, power amply with the provisions of the <i>Mineral</i> nich may from time to time be made under to time made shall be deemed to be included, or amended, were set out herein as our to the expiry of the current term.	ers, and privileges hereby granted Tenure Act, and the Mines Act and er authority thereof, as to the same orporated into these presents an
- Z1	S WHEREOF, the Jassor and Jessee		and seals as of the day and year first at Westroc Industries	Limited Lessee Lessee
		Witness	Minister of Energy, Mines and Pe	troleum Resources, Lessor

I, M. Bruce Paierses, a British Columbia Land Serveyor, of the Octobic of Inserment, Bossin, Cohunkis, cientify that I was present of and paragodity superintended the servey represented by this pion, and that the terrey and splan are cented. The nursey was completed on the 6th day of Jone, 895. SURVEY PLAN of DISTRICT LOT 16966 being ELKHORN GROUP MINERAL CLAIM, SURVEY PLAN OF MINERAL CLAIM **APPENDIX 4.1** Corners of Lors MING, MINOT, 16488 and 16230 shan KOOTENAY DISTRICT HULLING GIES ST OPEN BIT ESCISSES INUS Bearings are astronomic and derived Distances are in mattes and decimals BCGS 823- 041 Golden Mining Division Standord Copped Pest Place Becerings to BT's ave magnetic Shandard from Post Phoced Angle Iron Post Found Troverse Neb Placed Sketch FIGURE 12. Legend Ę #3 cm Piles #70" 0.3m #70 40cm for \$23° 54m 40cm Play 335° 42m 9694 .7.a į F. **** **** Scale 1.50 25.00 ha. 24 25-00 ha. 25.00hg. Unit + Unit 31 cut Detail **** AREA . 427 ho. 23.20 ha Unit 30 25:00 hg. Unit 25 25.00 ha. Unit No 300126 ELKHCRN GROUP
Record No. 300126
Located No. 6, 1991 99691 D. L. TO TA Unir 29 25:00 ha. 25.00 ho. 25-00 ha. 56 Call Tool S 675 25cm Per 310" 30. 25.00 ha. 25.00 ho. Unit 27 25.00 ho. 24.05 00 Unit 17 Unit 16 Unit 28 9.024 ha ####! ####! *** *** LEGAL CORNER POST ELKHORN GROUP (SS E4) Four Prs. Mountain Ridge Troverse "7*"*a 9654 Page 28 of 305 EML-2023-31638

FIGURE 13. LAND CAPABILITY FOR AGRICULTURE

The map below shows the extension area as being rated 7 T/C, which means that "soils in this class have no capability for arable culture or permanent pasture."



CLASS 6

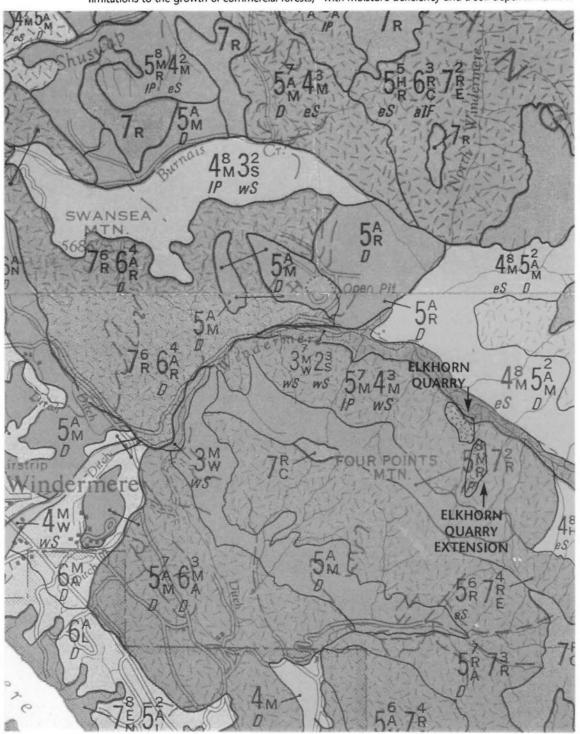
Soils in this class are capable only of producing perennial forage crops and improvement practices are not feasible.

CLASS 7

Soils in this class have no capability for arable culture or permanent pasture.

FIGURE 14. LAND CAPABILITY FOR FORESTRY

This map shows the area as being rated as Class 5 which means that "Lands have moderately severe limitations to the growth of commercial forests," with moisture deficiency and a soil depth limitation.



CLASS 3
CLASS 4
CLASS 5

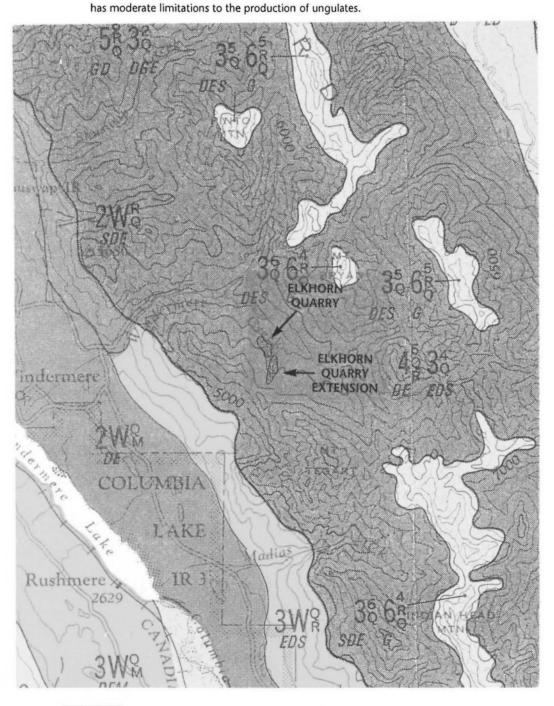
Lands having moderate limitations to the growth of commercial forests.

Lands having moderately severe limitations to the growth of commercial forests.

Lands having severe limitations to the growth of commercial forests.

FIGURE 15. LAND CAPABILITY FOR WILDLIFE – UNGULATES

The map below shows the extension area as being rated Class 4 which means that the land



CLASS 3

Lands in this class have very slight limitations to the production of ungulates.

CLASS 3W

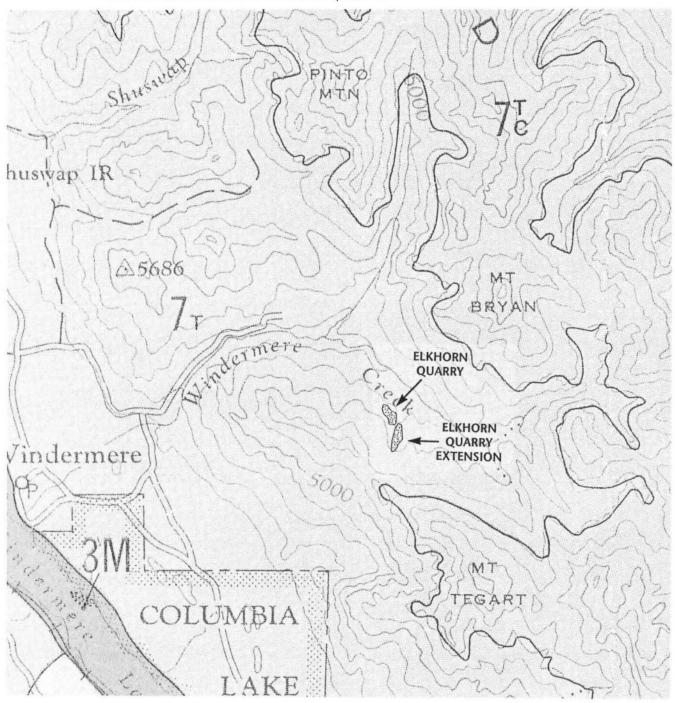
Lands in this special class are areas that are winter ranges on which animals from surrounding areas depend.

CLASS 4

Lands in this class have moderate limitations to the production of ungulates. Capability on these lands is moderate. Limitations are similar to those in Class 3, but the degree is greater.

FIGURE 16. LAND CAPABILITY FOR WILDLIFE - WATERFOWL

The map below shows the extension area as being rated Class 7, which means that the land has such severe limitations that almost no waterfowl are produced.



CLASS 7 Lands in this class have such severe limitations that almost no waterfowl are produced.

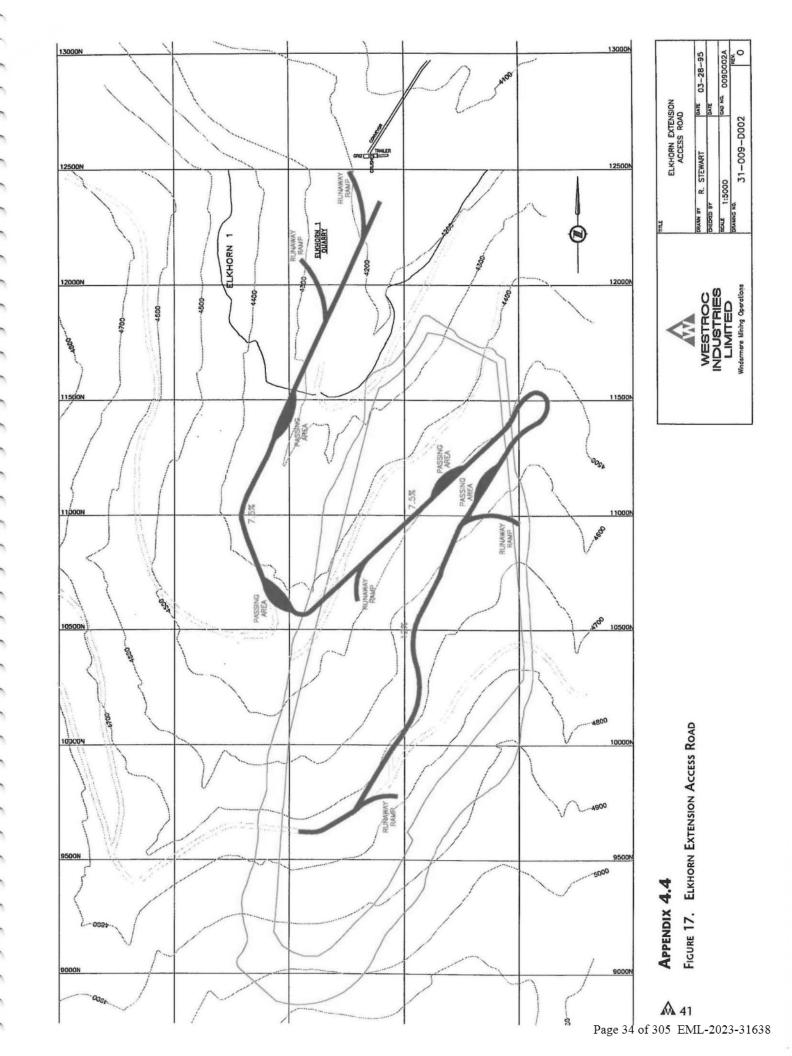
APPENDIX 4.3 - REFERENCES FOR ARCHEOLOGICAL ASSESSMENT

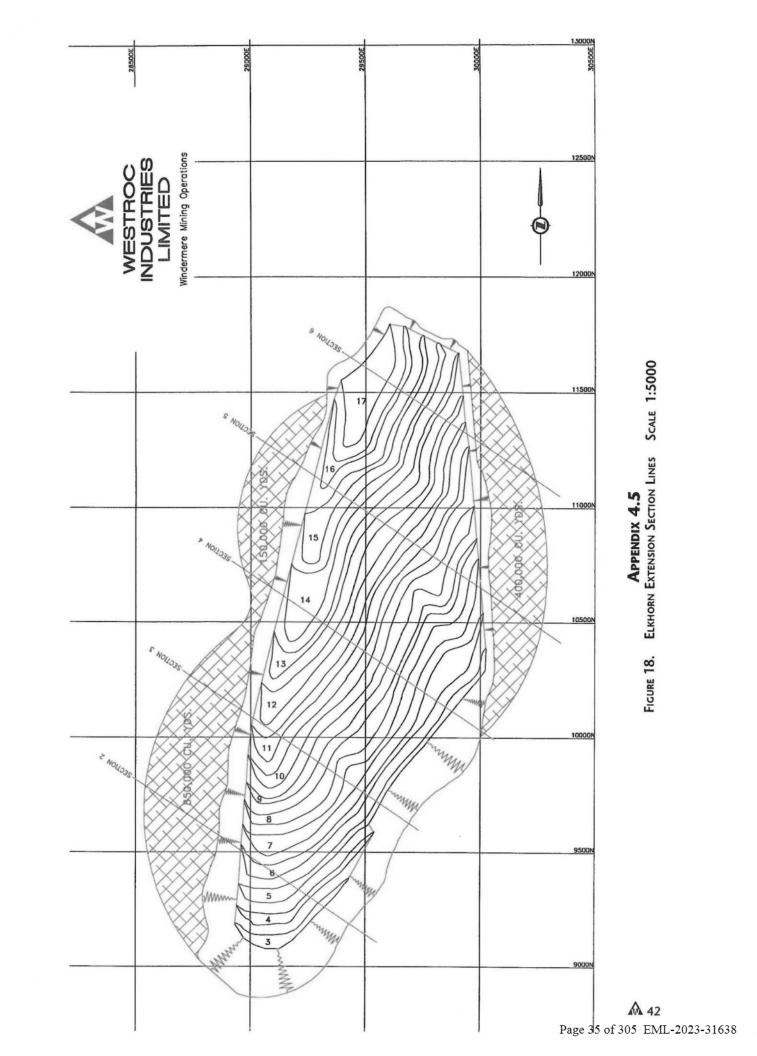
Choquette, Wayne T.

- 1991 Heritage and Native Interests. Section 5.3 in Keystone BioResearch Ltd.
 Mica Wildlife Mitigation Strategy Report. On file, BC Hydro, Vancouver.
- 1993 Archeological Resources Overview for the Nelson Forest Region. Report prepared for CORE, on file, Ministry Library, Ministry Responsible for Culture, Victoria.

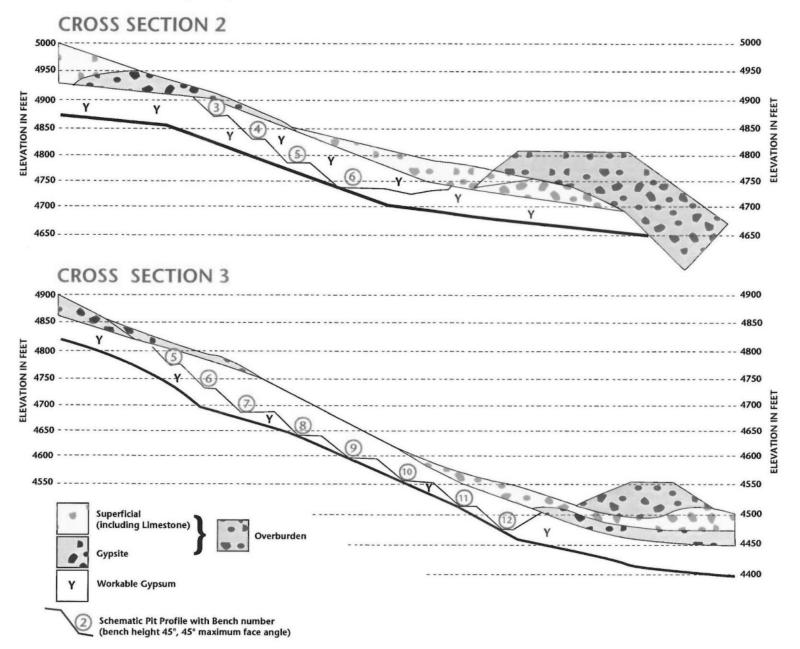
Westroc Industries Limited.

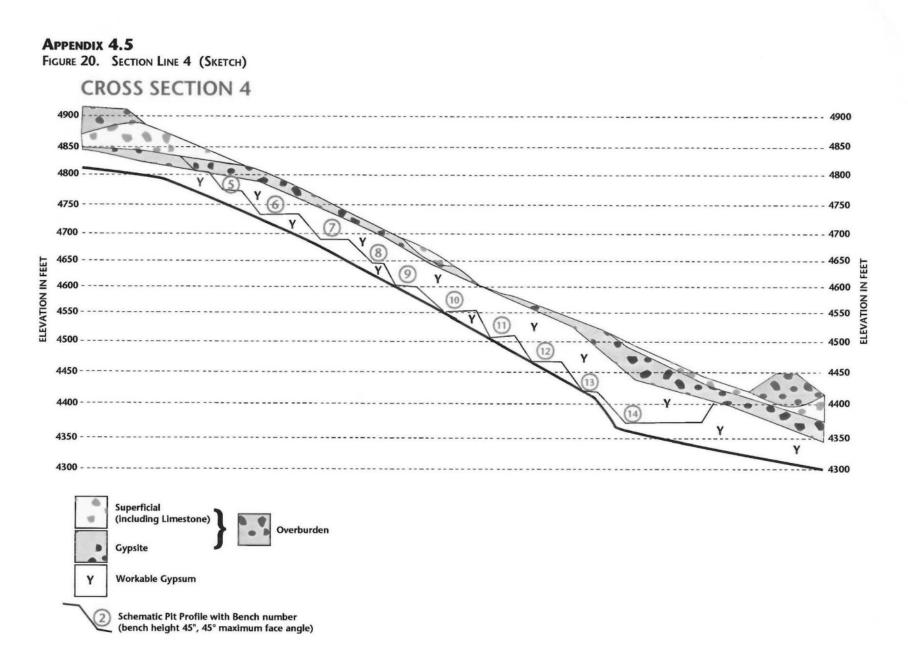
n.d. <u>Westroc Gypsum</u>. Pamphlet. Westroc Industries Limited, Invermere.





APPENDIX 4.5
FIGURE 19. SECTION LINES 2 AND 3 (SKETCH)

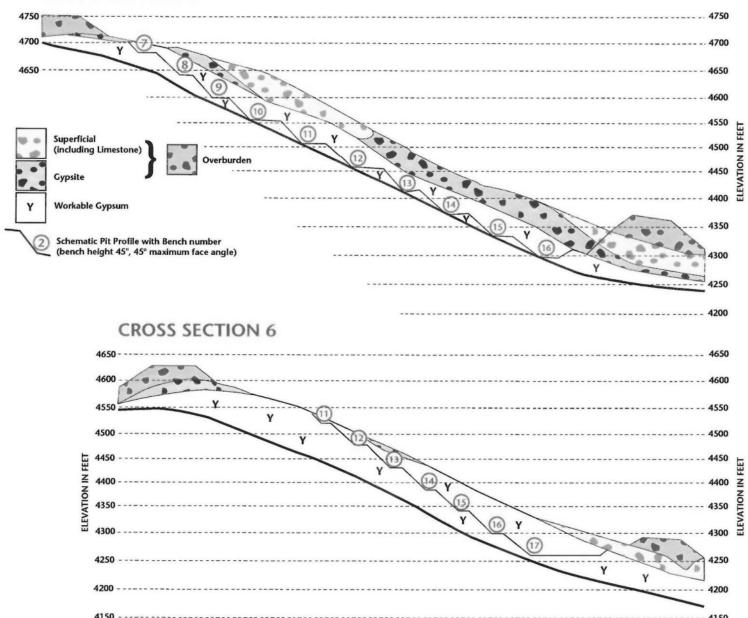




APPENDIX 4.5

FIGURE 21. SECTION LINES 5 AND 6 (SKETCH)

CROSS SECTION 5



 oject Approval Cert			
	Appendix A		
Corresponden	ce with Elkview C	oal Corporation	
•		·	



ELKVIEW COAL CORPORATION

R.R. #1, Hwy. 3 SPARWOOD, B.C. V0B 2G0 TEL: (604) 425-8325 FAX: (604) 425-8763

File: 165-0501

March 13, 1995

Mr. G.S. Reeves General Manager McGillivray Corporation 89 Ridgemont Drive Fernie, BC V0B 1M2

Attention: Mr. Gerald Reeves, P. Eng.

RE: MCGILLIVRAY COAL PROPERTY

In our meeting of February 13, 1995 the principals of your company, my staff and I jointly discussed a viable and valuable resource which we all felt should be developed as soon as possible.

The coal reserves of the McGillivray and Loop Ridge area present an excellent opportunity for a small mining operation to produce quality metallurgical coal and sell it to a large scale producer.

As ! explained in our meeting, the Ministry of Mines in B.C. has a mandate to optimize resource extraction, with a minimum environmental impact. The McGillivray and Loop Ridge coal reserve has a relatively low strip ratio and therefore fits the ministry mandate.

We believe that a small contract operation will contribute toward improving the local economy and relieving some of the unemployment in the Elk Valley area. The McGillivray operation will be capable of delivering raw coal to Elkview's processing plant directly without interfering with our present operation.

If your operation can deliver raw coal at a comparable or lower cost to ours, then we both have an opportunity to gain financially. The low strip ratio and lower overhead costs of the proposed McGillivray operation are a definite advantage.

Elkview Coal Corporation agrees in principle to purchase coal delivered by your company from the McGillivray and Loop Ridge areas on a first refusal basis.

We are confident that Mr. Pask, Mr. Morris and yourself have the experience and professional integrity to develop the McGillivray and Loop Ridge reserves.

We would appreciate receiving a 10,000 tonne bulk sample from the property as soon as possible in 1995 in order for us to define the blending potential prior to proceeding with the 200,000 tonnes you have tentatively planned for the first year of production.

You may use this letter to express Elkview Coal Corporation's support for your company and the McGillivray coal reserves. As corporate citizens we should work together to utilize this resource to the mutual benefit of all parties involved.

Yours truly,

ELKVIEW COAL CORPORATION

Wolf P. Nickel General Manager

WPN/sjk

wolf\gsreeves.let

 roject Approval Cert			
	Appendix B		
Correspondence	e with Crestbrook I	Forest Industries	



CRESTBROOK FOREST INDUSTRIES LTD.

P.O. BOX 4600

TELEPHONE (604) 426-6241

CRANBROOK, BRITISH COLUMBIA, CANADA V1C 4J7
Land Section

P.O. Box 400

TELEX 041-45114

Fernie BC VOB 1M0

April 18, 1995

McGillivray Mining 89 Ridgemont Dr. Fernie BC VOB 1M2

Attention: Mr. G.S. Reeves P. Eng.

Subject: McGillivray Coal Property Proposal

Further to your presentation to Joe Tress and myself, we have had an opportunity to review the proposal with CFI Management. CFI is prepared to allow access to the land and coal reserve subject to the following conditions:

- There will be no net loss of the CFI forest land base as the growing capability of the land must be maintained and the reclamation plan must address return of land to full forest production.
- 2. The mining activities must not adversely impact wildlife winter range, the CP Rail line and the ANG Pipeline.
- 3. The project would be developed and approved by CFI under two Phases;

Phase 1 - 10,000 tonne bulk sample in 1995 confined to existing test pit area exclusively, and

Phase 2 - production mining from 1996 confined to the existing test pit area and other non-productive forest areas as much as possible, only to the area north of the ANG pipeline.

- 4. McGillivray Mining to be responsible for all government approvals, liability, mining operations, and reclamation including bonding through M.E.M.P.R.
- 5. As the lands are currently owned by Elkview Coal and under Option to CFI, Elkview must agree to the use.
- 6. Prior to any work, McGillivray Mining will address the concerns of the public including the Corbin Wildlife Committee to CFI's satisfaction.
- 7. CFI is to receive a royalty of \$.10/tonne from Phase 1 bulk sample, to be based on hauled volumes of metallurgical grade coal.
- 8. Royalties from Phase 2 will be negotiated after analysis of the bulk sample and after McGillivray Mining finalizes a contract for the production coal.

- 9. Access to the land and coal resource under Phase 1 will be under a Land Use Permit between CFI and McGillivray Mining.
- 10. Access to the land and coal resource under Phase 2 will be under a formal non registered lease Agreement between CFI and McGillivray Mining.
- 11. CFI makes no representations or warranties that any further land and coal resource will be available in addition to the above Phase 1 and Phase 2 project.
- 12. The rights to the coal resource defined under Phase 1 and Phase 2 will be exclusively for McGillivray Mining under the time schedule defined in Clause 3. above. Should McGillivray Mining not be able to meet the time schedule, CFI reserves the right to pursue any and all alternatives, as CFI deems appropriate. Should the time schedule not be met, due to circumstances beyond the reasonable control of McGillivray Mining, then the time schedule may be extended upon agreement of CFI and McGillivray Mining.
- 13. The rights contemplated under this Agreement are not assignable or transferrable by McGillivray Mining.

Prior to any further work being undertaken on the project, we require your acknowledgement and agreement to the above conditions. If acceptable please sign the letter and return one original for our records.

Yours truly,

J.A. Thorner, P. Eng. Land Superintendent

JAT:mjs

Agreed to and Accepted By McGillivray Mining

per:	Date:
per:	 Date:
per:	 Date:

 		210 3 18	<u></u>	
	Appen	dix C		
Resu	mes of Corp	orate Princip	als	

FRED SOWCHUK TRUCKING LTD. COMPANY PROFILE

Fred Sowchuk Trucking first began operation in 1945 with a contract to haul mine props to the Coal Creek and Michel underground mines then owned by The Crows Nest Pass Coal Company.

In 1949 the company purchased a fleet of trucks and began hauling a variety of products in and around the Michel Mines.

Fred Sowchuk Trucking was incorporated in 1958.

During the following years the company began hauling logs. Sowchuck Trucking was the largest independent contractor hauling logs in the east Kootenays. Following the sale of the logging operations in 1975 the company focused its efforts on contract mining in southeast B.C.

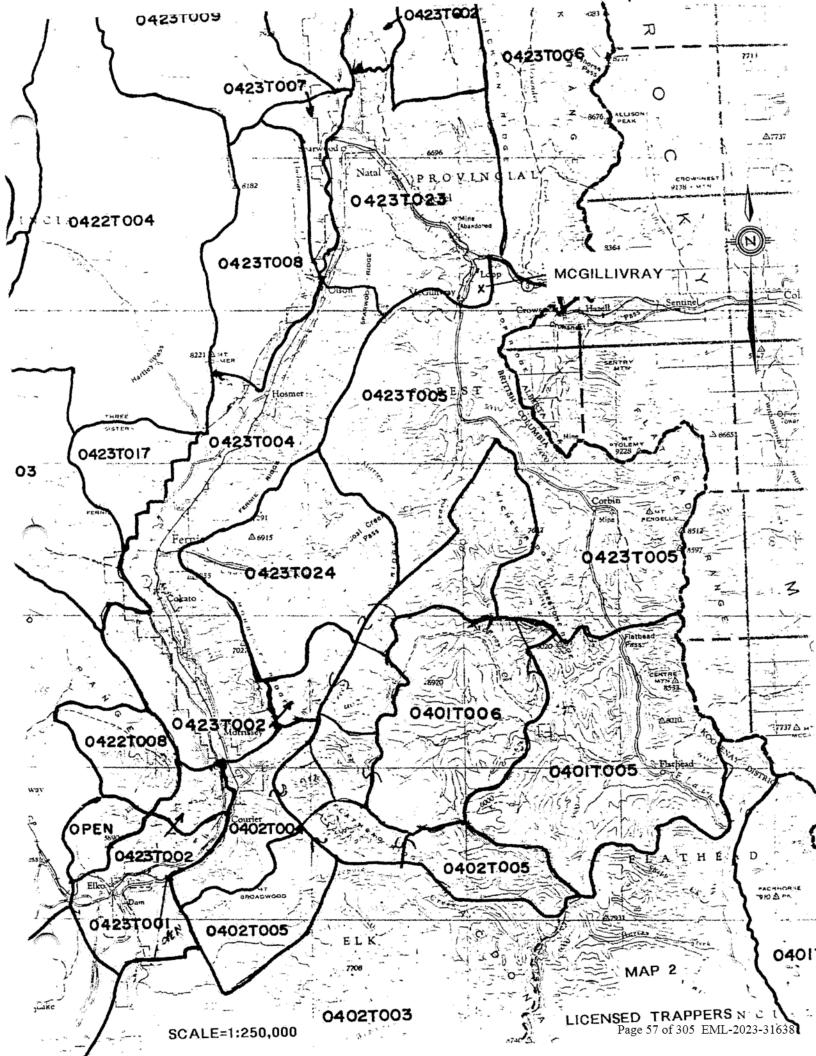
Freed Sowchuk Trucking Ltd. has developed a strong team of long term employees. They company and its employees have a strong commitment towards safety and environmental awareness. The team, which operates under the direction of Mr. Russel Pask, Manager, has a vast background including:

- o Off-Highway Hauling.
- o Environmental sites.
- o Mine reclamation.
- o Construction.
- o Contract Mining.

A partial list of clients includes :

- o Line Creek Resources.
- o Elkview Coal Corporation.
- o Fording Coal 1td.
- o Cominco Sullivan Mine at Kimberly.
- o Westar Balmer Mine and Greenhills Mine.
- o Byron Creek Collieries.
- o Alberta Transportation and Highways.

 				·	
	Арре	endix D			
		Land Use	rs		



Application for a l	Project Approval	Certificate
---------------------	------------------	-------------

Appendix F

Rock Slope Engineering



PITEAU ASSOCIATES

GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS

215 - 260 WEST ESPLANADE NORTH VANCOUVER, BC. CANADA V7M3G7 TELEPHONE (504) 986-8551 FAX (604) 985-7286 Our file: 1502

November 25, 1995

Mr. Gerald S. Reeves, P.Eng. General Manager McGillivray Mining Ltd. P.O. Box 1916 Fernie, B.C. VOB 1M0

Dear Gerry:

Re: Preliminary Geotechnical Assessment of Open Pit Slopes

for the McGillivray Mine

Piteau Associates Engineering Ltd. has conducted a preliminary geotechnical assessment for the proposed open pit slopes for the McGillivray Mining Project in the Crowsnest Pass in southeast British Columbia. The investigation has included the following:

- a site visit on November 9, 1995
- discussion of site conditions with Messrs. G. Reeves and R. Morris
- review of geological and geotechnical information provided by McGillivray Mining Ltd.
- preliminary structural analyses and stability analyses of geotechnical information
- preparation of preliminary slope design criteria for the project.

It is our understanding that the project will involve contract mining of approximately 800,000 tonnes of coal from one main seam over a four-year period, and will result in development of an open pit approximately 600m long varying from 30 to 120m depth. Figure 1 provides a preliminary layout of the open pit as provided by McGillivray Mining Ltd.

ENGINEERING GEOLOGY

Information from geological mapping and percussion drilling has indicated that the bedrock at the site consists primarily of interbedded sandstones, siltstones, shale and coal of the Kootenay Formation which dips generally to the west or southwest. A high angle fault, the Ericson Fault, is projected to occur approximately 50 to 100m east of the main coal seam. Rocks mapped to the east of this fault are interpreted to consist of massive to fractured limestone.

Mr. Gerald S. Reeves, P.Eng. General Manager McGillivray Mining Ltd.

-2- November 25, 1995

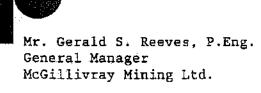
Bedding orientations mapped at McGillivray are variable (Fig. 2). Dip direction of bedding varies from southwest in the northern portion of the deposit, to west in the southern portion of the deposit. Although the average bedding dip is 54°, bedding dips vary from 47 to 90° in various locations.

The main coal seam strikes southeast in the northern part of the pit, with a change in the trend to north-south in the middle and southern portions of the deposit (Fig. 1). Interpreted average dip of the footwall of the seam ranges from 50 to 54° in the north to 55 to 72° in the southern part of the deposit (Fig. 1). The interpreted contours of the footwall of the main coal seam also indicate a significant variation in the orientation (dip direction and dip), and a distinctive "dog-leg" in the trend of the main seam. The cause of this dog-leg is unclear and may be related to a natural fold in the strata, or the presence of a fault which may also be responsible for the thickening of the coal seam in the middle portion of the pit. The true cause of the change in orientation should be more closely evaluated in the early phases of mining to optimize the slope designs for the footwall (east side) of the pit.

Available mapping of joints and fractures provided by McGillivray Mining has indicated that there are three distinct sets of joints (fractures), as indicated in Fig. 3. It is interesting to note that a number of shallow dipping joints, which dip at about 40° to the northeast and east, were mapped in the test pit. The importance of these fractures on stability will be assessed in the following sections.

Little is known concerning the quality and competency of the rock masses at McGillivray. Examination of the slopes in the recent test pit indicate that bedding joint spacing varies from 100 to 300mm in the footwall and hanging wall rocks. The occurrence of possible continuous joints or faults which may trend in an east-southeast direction across the pit subparallel to Joint Sets A and B may result in zones of ravelling and increased potential for instability of benches. Limiting of bench heights and provision of adequate catch berms, as discussed with Mr. Reeves, is endorsed.

Groundwater conditions are expected to be favourable due to the location of the deposit on a sloping sidehill. However, the potential for groundwater recharge from the limestone and Ericson Fault to the east of the pit may require specific slope depressurization measures consisting of horizontal drainholes.



November 25, 1995

PRELIMINARY SLOPE DESIGN FOR FOOTWALL SLOPES

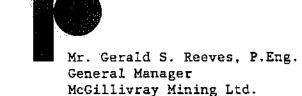
Stability of footwall slopes on the east side of the main coal seam will be controlled primarily by the orientation (dip) of the footwall and bedding joints, the spacing of bedding joints, the shear strength of the bedding joints and the presence of groundwater. Available information has indicated that the dip of bedding joints is variable and joints are relatively closely spaced. Hence, the footwall slope must be designed to limit the size of potential slab, buckling, bilinear and related planar sliding mechanisms of instability, and control any debris from potential instability on catch berms.

-3-

Based on the proposed mining method and schedule, it is considered appropriate to design the footwall slopes using 20m high benches which are excavated in 10m high lifts. Footwall bench faces should be developed subparallel to bedding to reduce the potential for development of slab sliding and related failures. Based on the kinematic analyses of bedding and discontinuity populations, we recommend a maximum 45° interramp slope and a minimum berm width of 8 to 10m on the footwall side of the pit, as shown in Fig. 4. The minimum berm width may require a shallower slope angle in the northern portion of the deposit due to the interpreted shallower dip of the coal seam in this area. Maximum 45° interramp slopes are recommended in other areas of the footwall, unless additional information collected during the early mining phases indicates that higher benches and/or steeper slopes are feasible. Temporary haulroads may be developed on the footwall side of the pit, provided road width is adequate and a rockfall catch ditch is established to control rockfalls and related stability problems.

Regardless of the design for the footwall slopes, the upper 10 to 15m of the open pit may require additional grading and sloping to control weak or weathered zones within the rock mass.

As little is known concerning the potential groundwater conditions in the footwall strata, we recommend provision be made to install a number of exploratory horizontal drainholes into the footwall slope during each year of mining. If significant groundwater flows and/or pressures are encountered, additional assessments should be conducted to determine the requirements for systematic installation of drainholes for slope depressurization.



November 25, 1995

PRELIMINARY DESIGN OF HANGING WALL SLOPES

Stability of hanging wall slopes on the west side of the main coal seam will be controlled primarily by the potential for wedges or toppling to occur involving bedding and/or joints. In general, the interpreted average 45 to 55° dip of bedding in the northern part of the pit, and the oblique nature of pit wall with respect to the bedding in the areas of thickened coal, indicates that toppling may not be a problem, provided groundwater pressures are low and final wall slopes are excavated with carefully controlled blasting practices using trim blasting, buffer blasting and/or preshearing techniques.

Analyses of available information concerning discontinuity populations indicate that interramp slopes of 50° are feasible for preliminary design purposes. We recommend use of 20m high benches which are excavated in 10m high lifts using appropriate controlled blasting techniques, as shown in Fig. 5. Minimum berm widths of 10m are recommended. Depending on the performance of slopes in the first two years of mining, it may be possible to steepen slopes in the later stages of mining if slope performance and groundwater conditions are favourable.

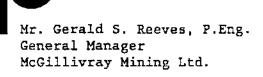
One or two exploratory drainholes are recommended in each of Year 2 and Year 3 to assess the possible depressurization requirements to control potential toppling.

The upper 10 to 15m of the open pit may require additional grading and sloping to a flatter angle if weak or fractured rock or unconsolidated soil deposits are encountered.

CONCLUDING REMARKS

Slope designs at McGillivray will depend on the quality of the rock mass, the orientation and physical characteristics of the discontinuity populations, and the effects of groundwater pressures and the excavation (blasting) procedures. Recommended preliminary slope designs are provided on the plan in Fig. 1 and on typical sections for the footwall and hanging wall in Figs. 4 and 5, respectively.

The proposed mine plan, which involves mining over a four-year period with development of a number of distinct pit development phases, will enable the rock mass conditions and engineering geology to be evaluated and the slope design to be optimized as mining proceeds.



-5- November 25, 1995

We strongly recommend that the rock mass characteristics and slope performance be carefully evaluated during each mining stage to enable the open pit slopes to be optimized as mining proceeds.

Yours very truly,

PITEAU ASSOCIATES ENGINEERING LTD.

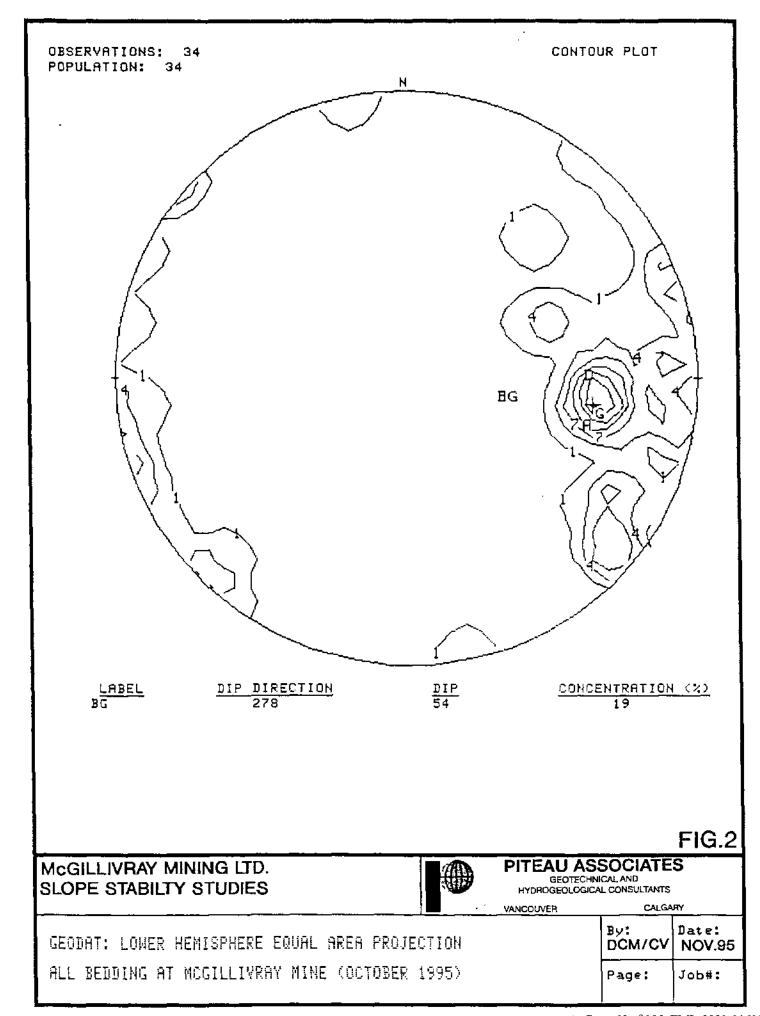
Dennis C. Martin, P.Eng.

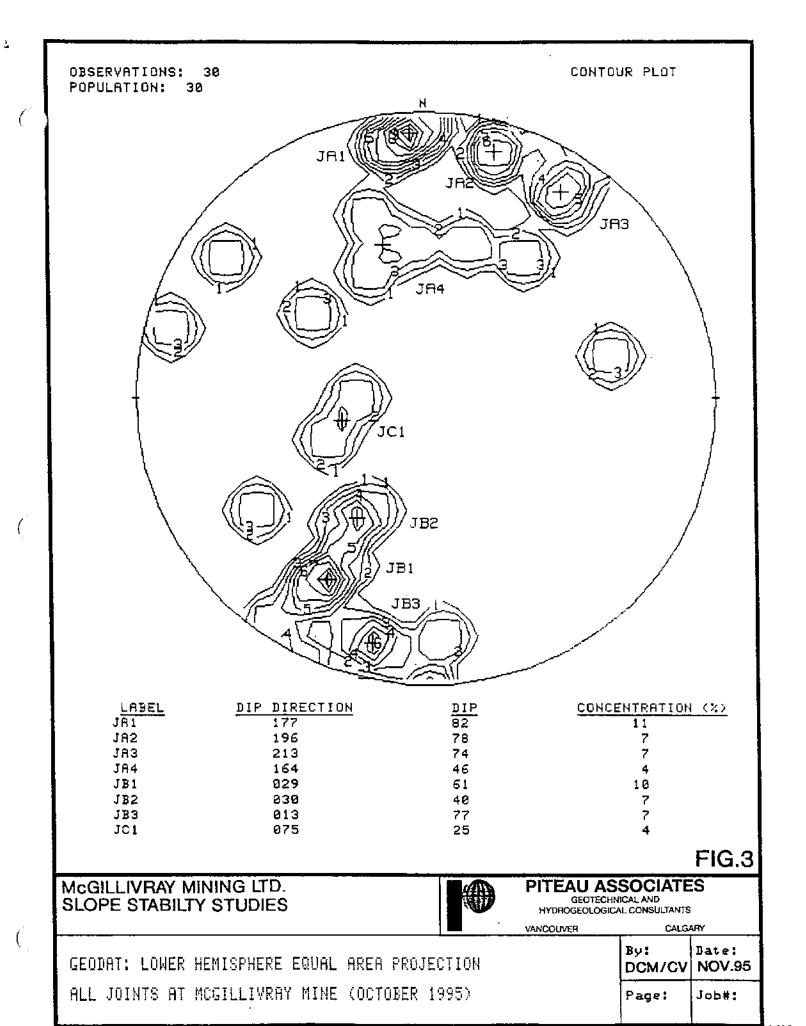
DCM/ef

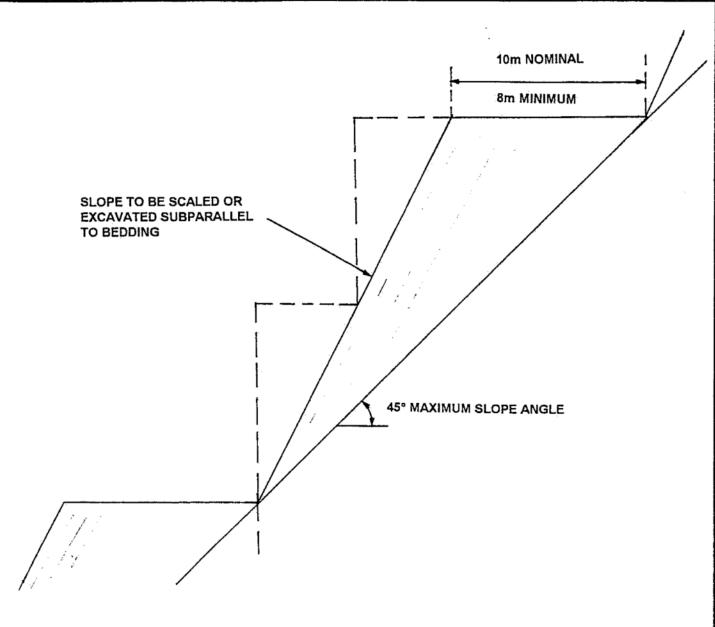
Enc.

ULTIMATE

PH







NOTES:

- 1. FINAL WALL BLASTS TO BE LAID OUT TO MINIMIZE DAMAGE TO BENCH FACES AND TOES.
- 2. FINAL TWO ROWS SHOULD BE LAID OUT WITH A LIGHTLY LOADED BUFFER ROW AND A DECOUPLED TRIM ROW. NO SUGRADE TO BE DRILLED WITHIN 11m OF FINAL SLOPE.
- 3. TRIM ROWS TO BE OFFSET FROM TOE A SUFFICIENT DISTANCE TO PREVENT CRATERING OR RELATED DAMAGE TO FINAL SLOPE.
- 4. FINAL BENCHES TO BE SCALED OR EXCAVATED SUBPARALLEL TO BEDDING.
- 5. WHERE BEDDING DIP IS <60°, AN INTERRAMP SLOPE ANGLE <45° WILL BE REQUIRED TO MAINTAIN MINIMUM 8m WIDE BERMS.

FIG.4

McGILLIVRAY MINING LTD. SLOPE STABILITY STUDIES



PITEAU ASSOCIATES GEOTECHNICAL CONSULTANTS

VANCOUVER

CALGARY

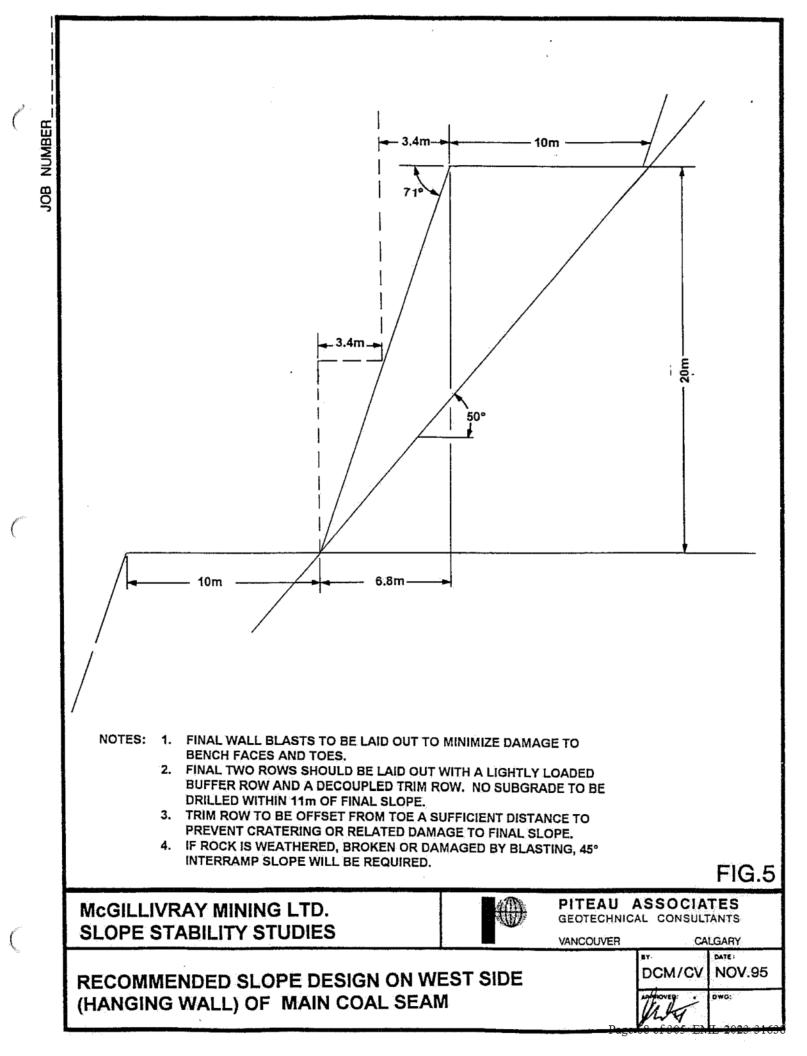
RECOMMENDED SLOPE DESIGN ON EAST SIDE (FOOTWALL) OF MAIN COAL SEAM

DCM/CV

NOV.95

OWG:

ge 201303 EML-2023-316



	_			
	Appei	ndix G		
Waste	Dump Found	dations and S	Stability	



PITEAU ENGINEERING LTD.

HYDROGEOLOGICAL AND GEOTECHNICAL CONSULTANTS

SUITE 100, 4500 - 161h AVENUE N.W. CALGARY, ALBERTA CANAOA T38 0M6 TELEPHONE (403) 286-2522 TELEX 03-821172 FAX (403) 247-4811 TADEUSZIL DABROWSKI FREDERIC B. CLARIDGE DENNIS C. MARTIN

McGILLIVRAY COAL MINING PROJECT GEOTECHNICAL ASSESSMENT OF PROPOSED WASTE DUMP

PREPARED FOR:

McGILLIVRAY

4167A

NOVEMBER, 1995

TABLE OF CONTENTS

Page No.
1. INTRODUCTION
2. SITE INVESTIGATION2
2.1 GENERAL 2
2.2 TOPOGRAPHY AND DRAINAGE2
2.3 GEOLOGY
2.3.1 Bedrock Geology3
2.3.2 QUATERNARY DEPOSITS
2.3.3 PROPOSED MINE SITE
2.4 FOUNDATION CONDITIONS4
3. PROPOSED DUMPING PLAN 5
3.1 DUMP DEVELOPMENT
3.2 WASTE ROCK PROPERTIES5
4. STABILITY ANALYSIS 6
5. CONCLUSIONS AND RECOMMENDATIONS
5.1 CONCLUSIONS7
5.2 RECOMMENDATIONS
6. REFERENCES9

LIST OF TABLES

TABLE 1 TERRAIN LEGEND

LIST OF FIGURES

FIGURE 1 SITE LOCATION MAP

TABLE OF CONTENTS (Cont'd.)

LIST OF FIGURES (Cont'd.)

FIGURE 2	SITE PLAN
FIGURE 3	TERRAIN CLASSIFICATION
FIGURE 4	CROSS SECTION THROUGH TEST PITS
FIGURE 5	PROPOSED WASTE DUMP: CROSS SECTION A-A'
FIGURE 6	MICHEL CREEK VALLEY: CROSS SECTION A-A' THROUGH
	PROPOSED WASTE DUMP

LIST OF APPENDICES

APPENDIX I TEST PIT LOGS

1. INTRODUCTION

The project site for McGillivray Mining Ltd. is on land owned by Crestbrook Forest Industries (CFI), located approximately 20 km east of Sparwood, British Columbia, and 3 km south of the Coal Mountain coal mine access road (Figure 1). Mining is to begin in May, 1996, with annual production of approximately 200,000 tonnes of coal. A waste dump is proposed for the waste rock produced by mining operations (Figure 2).

This report presents the results of a geotechnical assessment carried out for the proposed dump. The waste dump lies on the east flank of the Michel Creek valley, approximately 400 m from the creek. The total estimated volume of material placed will be 2,600,000 m³.

The objectives of the geotechnical assessment are as follows:

- describe the site topography, drainage and foundation conditions;
- review the proposed dumping plan;
- analyse dump stability; and,
- provide recommendations for dumping.

2. SITE INVESTIGATION

2.1 GENERAL

Site conditions were established by a combination of air photo interpretation, site reconnaissance, and examination of *in situ* soil conditions in a test pit program. Topographic maps and stereo air photo pairs (1: 20,000 scale; 1995) were reviewed to obtain information on the site specific geology of the terrain in the vicinity of the proposed mine dump in the Michel Creek valley. The study area lies in the Front Ranges of the Rocky Mountains (Holland, 1964). The air photo interpretation is presented in Figure 3 and a summary of the terrain legend is provided in Table 1.

Foundation conditions were determined from the excavation of five test pits. The test pits are located along and down slope of the lower mine road as shown in Figure 2. Test pit logs are provided in Appendix I. A cross section of the foundation soils through TP-1 to TP-5 is presented in Figure 4.

2.2 TOPOGRAPHY AND DRAINAGE

Natural foundation slopes underlying the majority of the dump site are in the range of 8° to 9°, steepening to 15° in the upper portion of the dump. The valley slopes adjacent to Michel Creek are variable, but average approximately 20°. The proposed dump site is located within a forested area. The present ground topography is illustrated in the proposed dump plans provided in Figure 2.

The main drainage feature is Michel Creek which is located approximately 400 m from the toe of the proposed dump. From a review of the aerial photographs and a cursory reconnaissance of the area, no significant gullies or hazards are evident in the foundation area. Therefore, it is assumed that drainage will tend to be as sheet flow, or within the shallow colluvial deposits or bedrock. It is the intent of the operator to minimize surface water intrusion into the dump by constructing a diversion ditch above the dump. Some minor seepage is anticipated, but discharge volumes are anticipated to be low in relation to the capacity of the waste rock to convey the seepage.

2.3 GEOLOGY

2.3.1 BEDROCK GEOLOGY

The mine site and dump are located in the shales, siltstones and sandstones of the Morrissey Formation which is the lowermost formation of the Kootenay Group. The bedrock ridge to the east of the mine consists of Mississippian limestones and dolomites of the Mount Head and Rundle Mountain Group dolomite and quartitic sandstone (Price, 1962).

2.3.2 Quaternary Deposits

Quaternary deposits of glacial and recent origin overlie bedrock in the study area. Glacial sediments include morainal till, glaciofluvial gravel, and glaciolacustrine fine sand. Morainal sediments were deposited during the last phase of the Cordilleran Glaciation and rest directly on the bedrock. Glaciolacustrine materials were deposited in meltwater as the ice retreated. Sand and gravel deposits adjacent to Michel Creek and on the slopes of the study area are fluvial in origin, or are colluvial deposits consisting of fine to coarse material derived from mass wasting processes. The fluvial deposits are at a lower elevation than the glaciolacustrine and morainal deposits and consist of reworked glacial deposits.

Surficial deposits of till form a thin veneer (less 1 m thick) in the vicinity of the mine site. These deposits are slightly thicker and form a blanket over the sedimentary bedrock in the vicinity of the proposed mine dump, as indicated from the test pit logs provided in Appendix I. The foundation soils, as determined from test pitting, is described in Section 2.4.

2.3.3 Proposed Mine Site

The proposed mine dump is located downslope of the pit on a fairly flat bedrock cored bench above Michel Creek. Bedrock in the bench consists of Morrissey Formation sandstone, siltstone and shale. Till and glaciolacustrine sand deposits, 5 m or greater in thickness, overlie the bedrock.

2.4 FOUNDATION CONDITIONS

The foundation stratigraphy generally consists of a sand layer underlain by a till deposit and sandstone bedrock. In TP 5, no upper sand layer was present and a 1 m thick gravel deposit was encountered within the till deposit. Also, at TP 5, the sandstone bedrock was overlain by a 0.75 m thick sand layer.

The upper sand deposit is fine to medium grained, firm to dense and contains a trace of fines and occasional gravels, pebbles and cobbles. Encountered within the sand deposit are veins of carbonaceous material. The sand deposit varies in thickness from 0.5 to 3 m.

Underlying the sand is a silt and clay till deposit. The till deposit is low-medium plastic, very stiff and contains a trace to little sand. Occasional pebbles and coal fragments are present in the till. The deposit varied in thickness between 0.5 and 2 m. Sandstone bedrock was encountered at 1.52 and 5.18 m below grade. No groundwater was encountered in any of the test pits although sand/gravel seeps were observed occasionally within the till deposit.

No soft or highly compressible deposits were observed within the excavations. For the stability analysis, the density and friction angle parameters for the foundation soils are assumed to be 20 kN/m³ and 30°, respectively.

3. PROPOSED DUMPING PLAN

3.1 DUMP DEVELOPMENT

Dump development will begin by constructing the planned new access road (Figure 2). The dump will be constructed by end dumping of waste rock, advancing the dump to the west. The dump face will form at an estimated repose angle of 37°. The dump will be constructed to an elevation of 1380 m, which will result in a dump height, before reclamation of the slope, of approximately 30 m (Figure 5). The dump face will be reclaimed to a 2:1 slope. A second lift is planned to raise the dump height to 1390 m (Figure 5).

3.2 WASTE ROCK PROPERTIES

Most (over 90%) of the waste material will comprise sedimentary rock with the remainder being till and colluvial overburden. The majority of the soil overburden, which is estimated to be 1 to 4 m thick, will be scraped into windrows around the perimeter of the pit and subsequently used for reclamation and reforestation.

Waste rock will comprise siltstone, sandstone and shale beds of the Morrissey Formation. Material mined from the footwall (approximately 25% of total waste rock) is more competent and blocky, consisting of siltstone and sandstone. This rock will tend to be in the 150 to 250 mm size range after blasting.

Waste rock mined from the hanging wall (approximately 75% of total) consists of thinly bedded shale, siltstone and sandstone. This rock is relatively weak and will tend to break down to smaller sizes (<150 mm) during ripping and dozing.

Overall, the waste dump is anticipated to behave as a coarse granular fill. The minor amount of water on the site will drain readily through the waste. For the stability analysis, a friction angle of 37° and a unit weight of 19 kN/m³ was assumed, consistent with the experience at similar waste dumps at other mountain coal mines in British Columbia and Alberta.

4. STABILITY ANALYSIS

Section A (Figure 5) through the highest portion of the dump was analysed for stability. The analysis was performed for a pre-reclamation stage, with the dump face still at the angle of repose (37°). The foundation consists of sand and clay-silt till with occasional layers of gravel (Figure 4). The underlying bedrock, at a depth of 3 to 7 m, is competent sandstone. Conservative strength parameters were assumed for the foundation sand and clay-silt till; a friction angle of 30° and no cohesion. The factor of safety against failure for Section A is 1.48.

Over-steepening of the slope directly beneath the crest may occur. This build up of material may exceed the angle of repose and may lead to minor sliver failures on the dump face.

The potential for a failure of the dump is low, however, the consequences of a high mobility mass runout are serious. Below the dump there are two power lines, a railway and lower in the valley there is a public road and Michel Creek (Figure 6). Factors that will limit the length of a potential runout are the low dump height, the gentle foundation slope (8.5°), the absence of lateral confinement, the absence of soft wet soils, and the presence of trees in the path of a potential runout. A mass runout can only occur if water is contained within the dump and the material liquefies. Circumstances that could contribute to a mass runout of the dump are a combination of poor draining rock with fines (exceeding approximately 10 to 15% silt), runoff or seepage from the hillside, and contained ice and snow. Measures for minimizing the potential for a failure and extent of a runout are recommended in Section 5.2.

The topography of the site, the moderate slope, the unconfined runout path, and the frictional nature of the waste dump and foundation material indicates that if a dump runout should occur, it will have a normal mobility. In a report by Golder Associates Ltd. and O. Hungr, Geotechnical Research Ltd. (1994) a normal mobility event is estimated to have a dynamic friction angle of 18 to 25°. Using a dynamic friction angle of 18°, measured from the crest, the potential dump runout is approximately 100 m, which is 100 m short of the closest infrastructure (Figure 6).

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

The geology of the foundation of the waste dump site has been interpreted from air photo analysis, ground reconnaissance, and a test pit program. The stability analysis of the proposed waste dump indicates that the dump will be stable with respect to deep seated failure. However, minor sloughing of the repose angle slope should be anticipated. The risk of failure of the dump is low, but the consequence of a high mobility failure is serious.

5.2 RECOMMENDATIONS

The following recommendations pertain to dump construction:

- 1. Restrict the amount of fine material placed into the dump.
- 2. The dump should not be advanced more rapidly than 1 m/day, if possible, to enhance both the generation of frictional strength of the rockfill, as well as consolidation of any local compressible soil in the dump foundation.
- 3. Waste rock should not be dumped over discrete layers of ice, or snow accumulations exceeding approximately 0.5 m in thickness.
- 4. Cracks on top of the dump should be filled in to prevent surface water from infiltrating into the dump. Drainage should be directed off the dump platform and away from the dump. A containment berm should be constructed to prevent surface water from running down the dump face.
- 5. Dump behaviour and crest development should be monitored routinely as dumping progresses. Observations of crack development in the crest and bulge formation in the toe of the dump should be performed weekly during dump development. If the rate of advance of

the dump increase to greater than 1 m/day, or if large deformations occur (>0.3 m/day) the frequency of inspection and monitoring should be increased accordingly.

Report Prepared by:

PITEAU ENGINEERING LTD.

David Taplin, Ph.D., P.Eng.

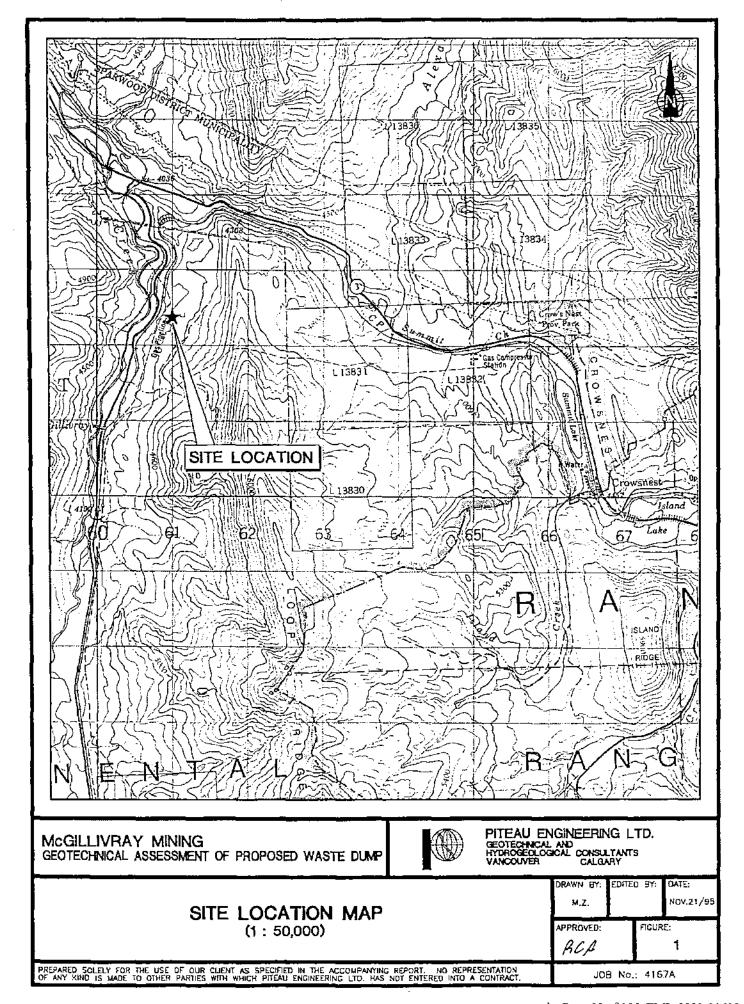
F.B. Claridge, M.S., P.Eng.

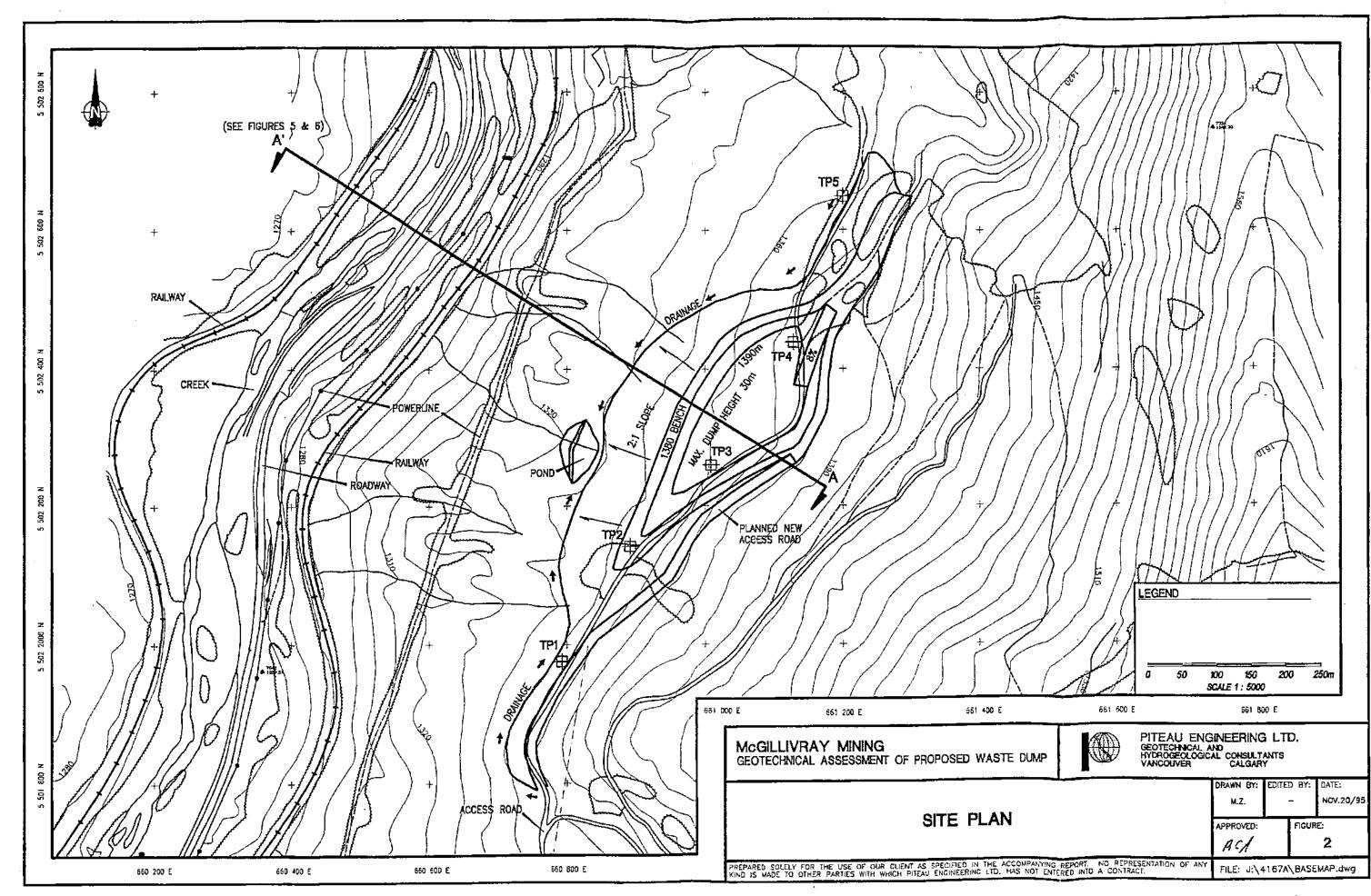
R.C. Armstrong, M.Sc.

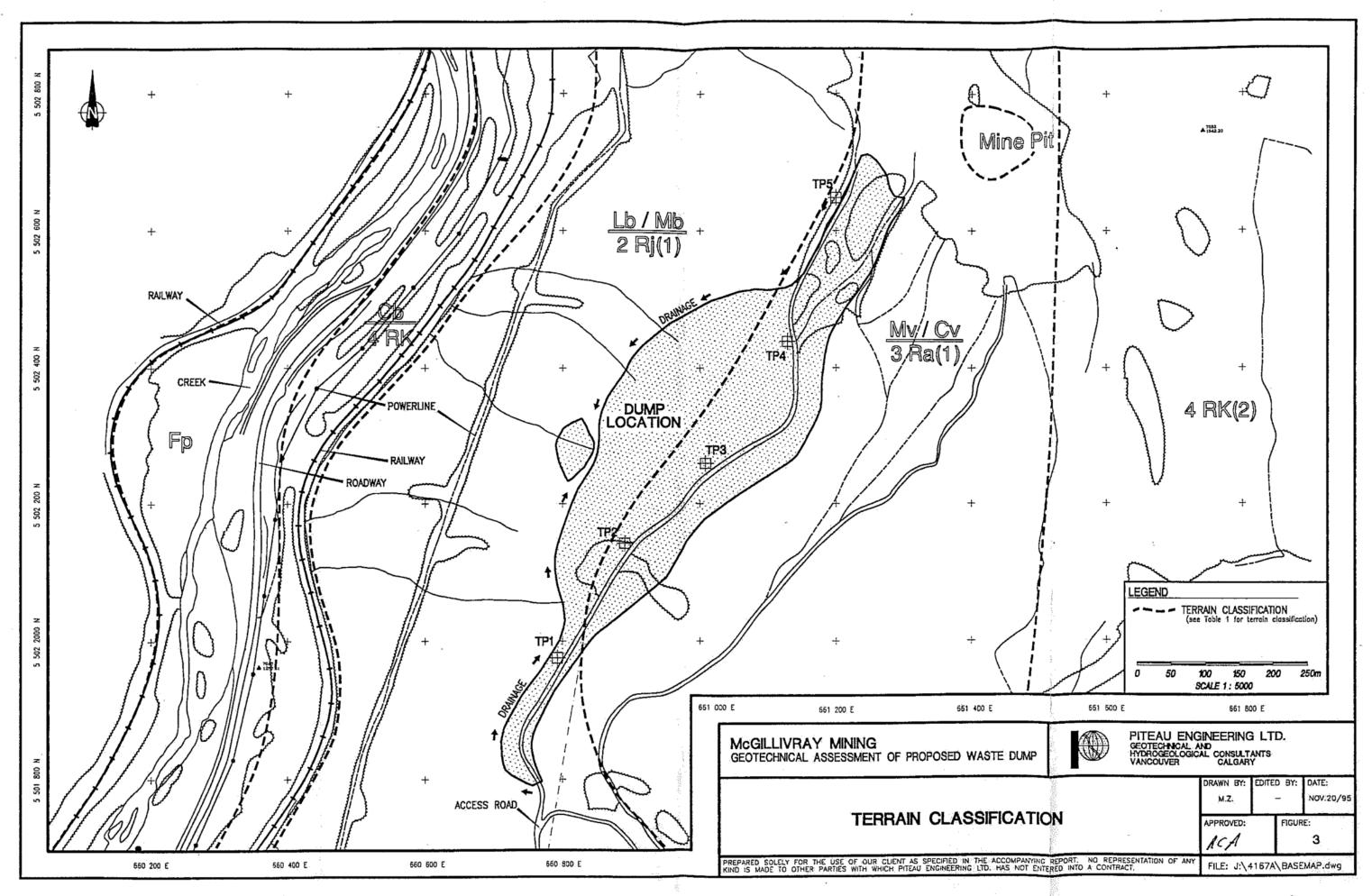
6. REFERENCES

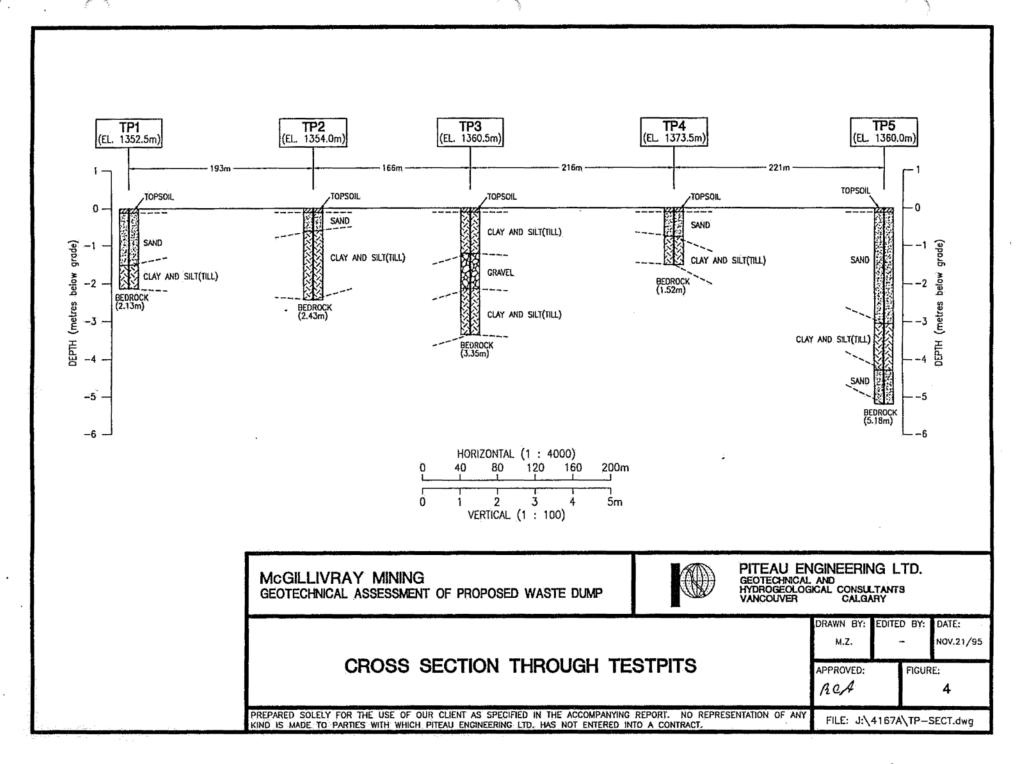
- Golder Associates Ltd. in association with O.Hungr Geotechnical Research Ltd., 1994. "Runout Characteristics of Debris from Dump Failures in Mountainous Terrain Stage 2: Analysis, Modelling and Prediction", Report to CANMET and Department of Supply and Services Contract No.: 23440-0-9198/01-X8G. March 1994.
- Holland, S.S., 1964. "Landforms of British Columbia A Physiographic Outline", British Columbia Department of Mines and Petroleum Resources. Bulletin No. 48. pp. 138.
- Howes, D.E. and Kenk, E., 1988. "Terrain Classification System for British Columbia (Revised Edition)", Recreational Fisheries Branch, Ministry of Environment and Surveys and Resource Mapping Branch, Ministry of Crown Lands, Province of British of Columbia. MOE Manual 10, December. 1988.
- Price, R.A., 1962. "Geology of Fernie East Half British Columbia-Alberta", Geological Survey of Canada. Map 35-1961. Scale 1 inch to 2 miles.

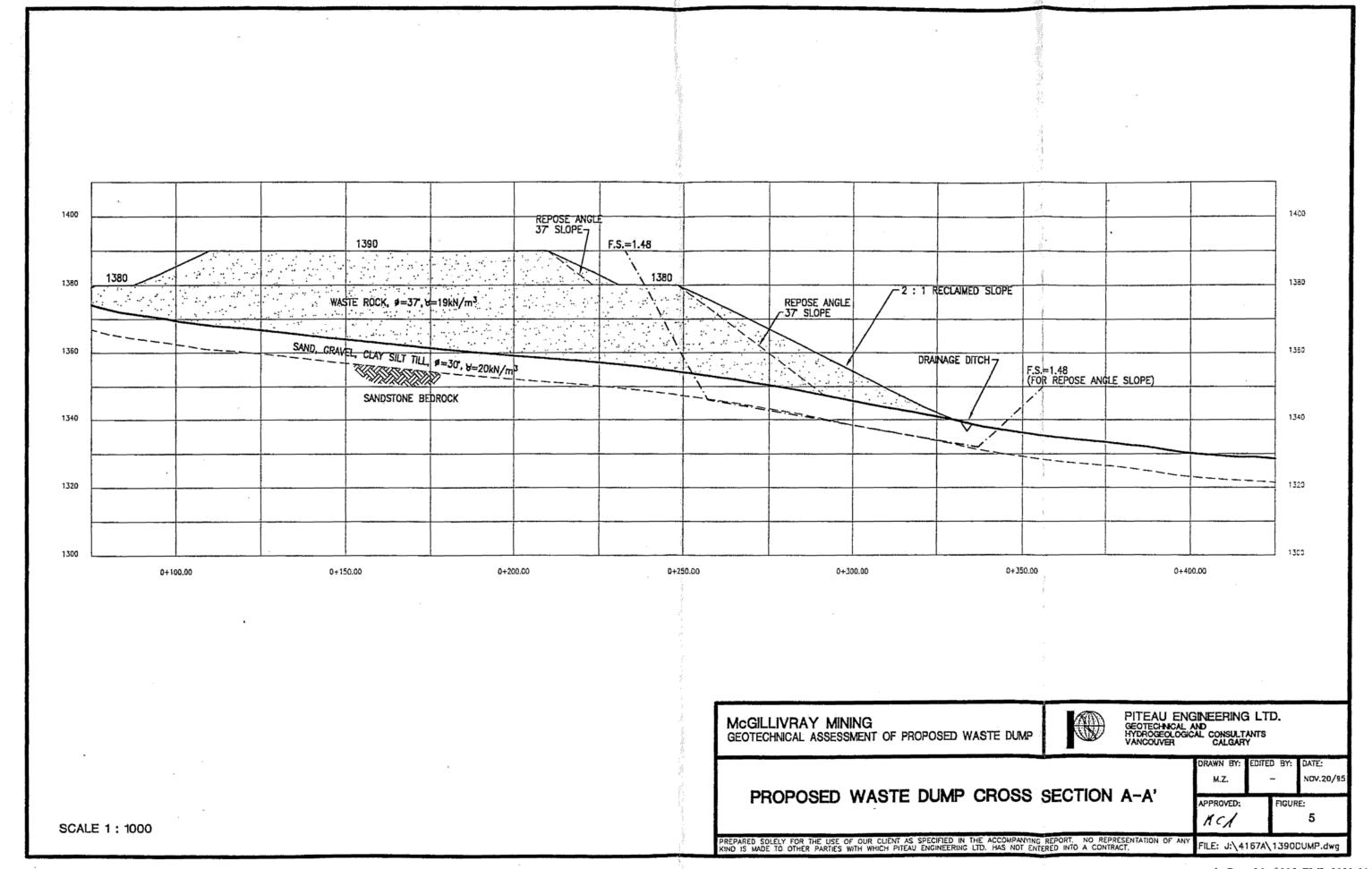
JAMIGTANIGTAN REPORTS MOVEMB95.000

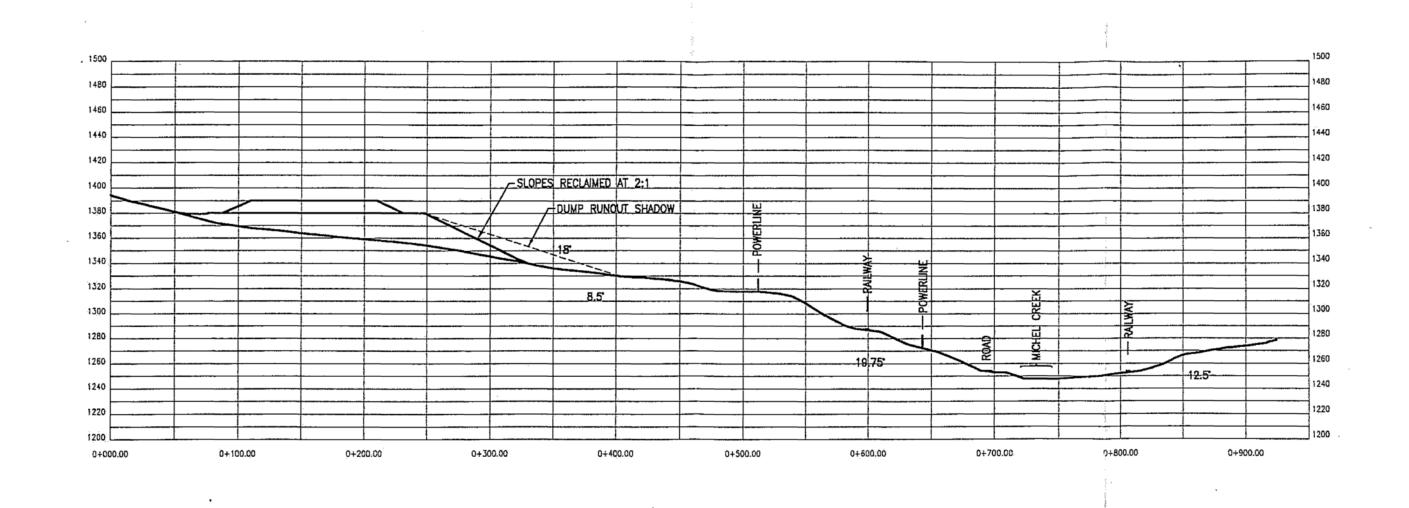












McGILLIVRAY MINING
GEOTECHNICAL ASSESSMENT OF PROPOSED WASTE DUMP

PITEAU ENGINEERING LTD.
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS
CALGARY

DRAWN BY: EDITED BY: DATE:
NOV.21/95

THROUGH PROPOSED WASTE DUMP

PREPARED SOLELY FOR THE USE OF OUR CLIENT AS SPECIFIED IN THE ACCOMPANYING REPORT. NO REPRESENTATION OF ANY
KIND IS MADE TO OTHER PARTIES WITH WHICH PITEAU ENGINEERING LTD. HAS NOT ENTERED INTO A CONTRACT.

PITEAU ENGINEERING LTD.
GEOTECHNICAL AND HYDROGEOLOGICAL CONSULTANTS
CALGARY

DRAWN BY: EDITED BY: DATE:
NOV.21/95

APPROVED: FIGURE:
A C A FILE: J:\4167A\VLY-SECT.dwg

SCALE 1: 3000

APPENDIX I

TEST PIT LOGS

B SHALT HOSE B SHALT HAVE TO THAN THE LOVEL TO THAN SULT ITILL): Tow plostic doop, very stiff, trose of Fine sand, corbonaces and reinal/coal frogrents, green shown colour. Sandy/gravel seeps. 10 10 10 10 10 10 10 10 10 1	1		ACT NO.: PIT NO.: ING:	4167 TP-1	COMPI LOCAT EASTI		D. Tapli	n				TEST PIT CONTRACT ELEVATIO	OR:						
DESCRIPTION SAPLES S	⊽	B BUL	k sample C hater level						×	× oi	STURB LIR							TO	N
DESCRIPTION B SOLFABOX TOPSOIL: (organic) SNND: Fine grained, Firm, to dense, dry to down, trace Fines, accosional gravel and pebbles, rootlets, light brown colour. 1.52 CLAT AND SILT ITILL): law plastic, damp, very stiff, trace of Fine sand, corbonaceous material/coal fragments, greenish brown colour. Sandy/gravel seeps. TOTAL DEPTH = 2.13 m BEDROCK: SANDSTONE		חאאזנו	TC MATER LEAF	<u> </u>						L0			١.	1,	, 2			9	_
SAND: Fine grained, Firm, to dense, dry to does, trace Fines, accossional gravel and pebbles, rostlets, light brown colour. 1.52 CLAY AND SILT ITILL): law plastic, does, very stiff, trace of Fine sand, carbonacous material /coal Fragments, greenish brown colour. Sandy/gravel seeps. TOTAL DEPTH = 2.13 in BEDROCK: SANDSIONE.	-	_ ا		DESC	RTPTTON		į	S		Т	EVEL	CONSTRUCTION			ညာ ,	30	, 4) ,	
TOPSOIL: (organic) SAND: Fine grained, Firm, to dense, dry to domp, trace Fines, accosional gravel and pebbles, rootlets, light brown colour. 1.52 CLAY AND SILT HILLD: low plastic, damp, very stiff, trace of Fine sand, carbonaceous material/coal fragents, greenish brown colour. Sandy/gravel seeps. TOTAL DEPTH = 2.13 m BEDROX: SANGSTONE				BÇ00i	(27 / 12014			TYPE	CONDITI	NUMBER	INTER L	DETAILS	X colos	tic lin	HATER it 30	CONTE	ינות הוו זר	più	İ
DLAY AND SILT HILL): low plastic, damp, very stiff, trace of fine sand, carbonaceous material/coal fragments, greenish brown colour. Sandy/gravel seeps. TOTAL DEPTH = 2.13 a BECDROOK: SANDSTONE	0.0	22		TOPSOIL: (orga	niel.				_	_					Ĩ	Ť	TÎ	1	-
DECEMBER COLOUR. 1.52 CLAI AND SILT ITILL: low plastic, damp, very stiff, trace of fine sand, corbonaceous material/cool fragments, greenish brown colour. Sandy/gravel seeps. TOTAL DEPTH = 2.13 n BEDROCK: SANDSTONE 50 60 70 80				SAND: Fine gro	oce fines, occor	dense, sianal			•				⊕						
CLAY AND SILT (TILL): low plastic, damp, very stiff, trace of fine sand, carbonaceous material/coal fragments, greenish brown colour. Sandy/gravel seeps. 10 TOTAL DEPTH = 2.13 a BEDROCK: SANDSTONE	F1,U		1.52	brown colour.	iles, Tuditeis,	rrgiit													
greenish brown colour. Sandy/gravel seeps. TOTAL DEPTH = 2.13 m BEDROCK: SANDSTONE F60 -70 -80	-2.0	1											•	,					_
-5.0 BEDROCK: SANOSTONE -6.0 -7.0 -8.0	-3.0			greenish brown	TILL): low plants f, trace of finanterial/coal fraction colour: Sandy/	stic, e sand, gments, gravel													_
6.0	4.0																		-
-7.0	5.0						37.7					-							
-8.0	-6.0						tromata de example de la certificación de la c												
	-7.0														W. Control of the Con				
	-8.0																		-
	-9.0											·							

-

CONTRACT NO.: TEST PIT NO.: NORTHING:	4167 COMPILED BY: I TP-2 LOCATION: EASTING:). Taplin				TEST PIT CONTRACTO ELEVATION	R						
SAMPLE TYPES B BULK SAMPLE Z STATIC MATER LEVEL Z DYNAMIC MATER LEVEL			SAMPLI	_	STURB IR 00	N		TES PEXE	TROMET	ER k		ATI	DN —
SOIL/ROCK	DESCRIPTION	TIPE	CONDITION	NUMBER	HATER LEVEL	PIEZONETER CONSTRUCTION DETAILS	10	tic'll	20 HATE	, 3	O ,	¥0 X Hould	1112
0.6	TOPSOIL: (organic). SAND: Fine grained, Firm to dense, trace fines and gravel, occasional pebbles, rootlets, light brown colour.		,					*	X				
	pebbles, rootlets, light brown colour. CLAY AND SILT (TILL): low plastic, damp, stiff to very stiff, trace of fine sand, carbonaceous material/coal veins, medium brown/dark grey colour.	***				•	€	<u></u>					
	TOTAL DEPTH = 2.43 n BEDROCK: SANDSTONE												

									-			1	
	· •												

-73

CC	ONTRACT NO.:	RNATIONAL LTD. 4167 TP-3	COMPILED BY: 0. LOCATION: EASTING:					TEST PIT CONTRACTO ELEVATION	DATE:				Γ,1	
SA V	MPLE TYPES B BULK SAMPLE STATIC MATER LEVEL DYNAMIC MATER LEVEL					∏ F∂	INDITION ISTURE AIR DOOD.	DN .	TE	ENETRI	INF	kg/ca2		ON
# EGP14 #	SOIT/SOCK	DESCRIPTIO)N		CONDITION	NUMBER	HATER LEVEL	PIEZOMETER CONSTRUCTION DETAILS	Δ 9 10 X plastic	PT BL	DIS/0.3	30 T	40	1
-1.0		TOPSOIL: (organic). CLAY AND SILT (TILL): to very stiff, damp, tra carbonaceous material (occasional pebbles, med			•					Ф				
-2.0		GRAYEL: damp to noist, fines, occasional pebble medium brown colour. CLAY AND SILT (FILL): trace to little fine sa occasional pebbles, car							(4)					
-3.0		grey-brown mottling, me	dium brown colour,						⊕					
-4.0		TOTAL DEPTH = 3.35 n BEDROCK: SANDSTONE				The second secon								
-5.0					The same of the sa									
-6.0														
-7.0 -8.0				And the second s					,					
-9.0						The state of the s								
									Pag	e 91	of 305	5 EN	IL-202	23-

K	OME	EX INTE	RNATIONAL LTD.	OFFICE	REP	ORT	ON	S.	ITE	INVESTI	GAT	ION	1	SHE	ET . 1	0F	1.		
TE		CT NO.: IT NO.: NG:	4167 TP-4	COMPILED BY: C LOCATION: EASTING:). Topl	in				TEST PIT CONTRACTO ELEVATION	R:	1							
\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	BULK	TYPES C SAMPLE C HATER LEVEL IG HATER LEVEL	ı						SAMPLE CONDITION X X DISTURBED FAIR 6000 LOST			TEST INFORMATION PENEJROTETER kg/cm2. 1, 2, 3, 4							
C OCPTH in	SYNBOL.	SOIL/ROCK	DESCRIPTIO	N		TYPE	PLES	NUMBER	MATER LEVEL	PIEZOMETER CONSTRUCTION DETAILS	X X Dicest	ic I i	LOUS/O 20 HATER 111 30		40 1100 70	18/11	50 X		
-1.0	ロー・ハンハン	0.11	IOPSOIL: (organic). SAND: Fine grained, dam trace to little Fines, recous material (coal veinebbles, light to medium at 0.45 m.	notlets, carbona ns), occasional	-		•					&							
-2.0.			CLAY AND SILT (TILL): I very stiff, trace to lit gravel, carbonoceous mot	ow plastic, moist	t,														
3.0			occasional pebbles, fine grey/medium brown colour TOTAL DEPTH = 1.52 m	sand stringers.	υ,										STATE OF THE PROPERTY OF THE P				
-4.0			BEDROCK: SANDSTONE														enclader, cardenore and adoptive delication of the cardenores.		
-5.0	No. of Parties and																		
-6.0				r															
-8.0						en e									Committee de la committee de l				
-9.0																			
10.0											Pas	re 92	bf 3	05 EN	IL-20	28-3	163		

	TRACT NO.:	4167 TP-5	O OFFICE COMPILED BY: 0 LOCATION:	Taplin	n				TEST PIT	R:	Ξ:				
	THING: LE TYPES		EASTING:		CA	NOI C	COND	TTTO	ELEVATION	N:					
1	BULK SAMPLE				ĺ	××	DIST	TLR8!			TES	T I	NFC	RMA	ίT
	ATIC HATER LEVEL NAMIC HATER LEVE						FAIR			-	PENE	TRONET	ER kg/	ca2	_
						À	L031	r —		<u></u>	1,	, 8		3	ţ
E.		DESCRI	ואמדדמ	ŀ	SAMP			띯	PIEZOMETER CONSTRUCTION	1		8L0HS/	0.3n 30	,	4(
ВСРТН	SYMBOL	BESSIT	111014	ĺ	TYPE	TIME!	RUMBER	KATER LEVEL	DETAILS	χ pla	tic i	ait	R CONT	X TK∃ i	i
00	SOIL/ROCK	TOPSOIL: (organi	cl.		2 2	5.	Z	2		1	0	30	50	+	7
			dium grained, damp,			.									
		trace fines, root	lets, occasional gravel	-											
-1.0		bonaceaus materia	les up to 0.3 m, car- I (coal veins), grey	į								\top		\top	-
	1969 1963	tine sand lenses, colour. Gravel s	light to medium brown eeps at 2.43 m.	į						1		İ			
-2.0															
E.U	2.43														
				1											
-30	3.05									_		_		-	_
		CLAY AND SILT (TI	L): low plastic, damp, y structure, carbonaceou ins), trace fine sand	s											
		material (coal ve greenish brown co	inal, trace fine sand									Œ			
1.0	() 4.29		dium grained, damp,							_	-	+		-	•
		occasional gravel,	carbonaceous material,												
		ard K of Owl Colods	•							6					
-5.0						=	-								-
and the second s		TOTAL DEPTH = 5.10 BEDROCK: SANDSTO													
-6.0							1								
0,0			•												
-7.0						***************************************								_	
										No.					
-8.0												_		+	
-9.0												\dagger			
						- 1		["	age 9	160	ا م		

 	<u> </u>			
	Appe	endix H		
	Faratur	A		
	Forestry	Assessment	L	

McGILLIVRAY MINING LTD.

PROPOSED WASTE ROCK DUMP SITES FOREST PRODUCTIVITY ANALYSIS

Prepared by: Kimmur Forestry Consultants Ltd.

Wes Pinsent Fernie B.C.

November 13, 1995.

Prepared For: McGillvary Mining Ltd.

TABLE OF CONTENTS

1.0	Introduction	l
2.0	Data Collection Methods	2
3.0	Existing Site Inventory	3
	3.1 Polygon A 3.2 Polygon B 3.3 Polygon C 3.4 Polygon D 3.5 Polygon E	4 5 6
4.0	Existing Site Analysis	8
5.0	Forest Growth Projection for Reclaimed Waste Rock Dump Sites	9
6.0	Recommended Reclamation Techniques	. 10
7.0	Summary	. 11
API	PENDIXES	
I	Site Maps	
II	Volume Pre/Post Treatment	
Ш	PI SI16,5 VS. PI SI15	

1.0 Introduction

The following report examines McGillvary Mining Ltd. proposed open pit coal mine waste rock dump sites from a forest productivity stand point. The report inventories the existing forest values and projects forest growth on the fully reclaimed sites proposed by McGillivray Mining Ltd.

This report is broken down into the following sections: Data Collection Methods, Existing Site Inventory, Existing Site Analysis, Forest Growth Projection for Reclaimed Waste Rock Dump Sites, Recommended Reclamation Techniques and Summary.

2.0 Data Collection Methods

Data collection was completed using standard B.A.F. 3 prism plots at approximately a 8% sampling intensity. Dump site areas were stratified into 5 polygons. Timber volumes were calculated using species specific cumulative tally sheets. A total of 12 plots were established in the proposed dump site areas. The following information was collected at each plot:

- Species composition
- -Average age, height and diameter
- -Crown closure %
- -Site Index
- -Site class
- -Edatopic grid
- -Pest and disease %
- -Slope %
- -Regeneration levels
- -Indicator species
- -Competing Vegetation
- -Soil type
- -LFH depth
- -Coarse fragment %
- -Moisture regime
- -Wildlife usage
- -Biodiversity concerns
- -Watershed concerns
- -General comments

3.0 Existing Site Inventory

As previously stated the dump sites were stratified into five polygons identified by polygon A, B, C, D and E on the attached map (Appendix I). Stratification was based primarily on current site forest growth productivity, species composition, timber volumes, site index and biogeoclimatic classification.

The following describes each polygon and examines them from a Forest productivity and value standpoint:

3.1 Polygon A

Area: 1.8 ha. Crown Closure: 58%

Species Composition: Pl90 Sx5 At5 Slope: 25%

Volume: 240 m3/ha.(coniferous) Avg. Age: 76 yr.

Biogeo. Classification: MSdk04 Avg. Height: 19.6 m

Edatopic Grid: 3-C Avg. D.B.H.: 20.3 cm

Site Index: 16 Soil Texture: Clay loam to silt loam

Regen.: Sx 250 s.p.h., 1.5m, 15yr. L.F.H. Depth: 10 cm

Polygon Description

Polygon A is chacterised by its even age Lodgepole Pine overstory and it's Msdk04 biogeoclimatic classification. The Pine has good form with minimal taper. It has a generally healthy appearance and is putting on good annual increment. Overall timber volume is made up of approx. 60% sawlog and 40% post.

The understory of polygon A is made up of primarily of Spruce with an average height of 1.5 meters and an avg. age of 15 years. Stocking is somewhat patchy particularly in the North portion of the polygon. Overall the Spruce regeneration averages approximately 250 s.p.h. The understory has a generally healthy appearance with pest and disease levels of less than 2%.

Forest floor vegetation consists primarily of Pine grass, Oregon Grape and Soopolallie. The forest floor is clean with light slash and brush.

Soil textures vary from a clay loam to a silty loam. LFH depth averages 10cm. Rooting depth is over 50cm. Coarse fragments are less than 30%.

3.2 Polygon B

Area: 4.4 ha. Crown Closure: 67%

Species Composition: Sx50 Pl30 Lw5 Ac5 Slope: 15%

Volume: 268 m3/ha.(coniferous) Avg. Age: 70 yr.

Biogeo. Classification: MSdk01 Avg. Height: 21.0 m

Edatopic Grid: 4-C Avg. D.B.H.: 28.1 cm

Site Index: 19 Soil Texture: Clay loam to silt loam

Regen.: Sx 100 s.p.h., 1.5m, 20yr. L.F.H. Depth: 17 cm

Polygon Description

Polygon B consists of Spruce leading sawlog stand with a MSdk01 biogeoclimatic site classification. Other then a small amount of dwarf mistletoe, polygon B was found to be in good health. All species present showed good form and vigour. The Spruce and Pine component of the polygon are putting on good annual increment and have very little rot. Volume is 100% sawlog.

There is a scattered Spruce understory throughout the polygon averaging 1.5m in ht., 20 yrs. of age and 100 s.p.h. The understory is generally in good health with fair leader growth.

Forest floor vegetation consists primarily of Soopallie, Alder, Wheatgrass and Pinegrass. The forest floor is clean with very little deadfall.

Soils vary from a silty loam to a clay loam texture. The LFH layer has a rich appearance and averages 17cm. in depth. Coarse fragment percentage is less than 30% The polygon is fairly well drained with the occasional wet area.

3.3 Polygon C

Area: 5.4 ha. Crown Closure: 35%

Species Composition: Sx60 At40 Slope: 10%

Volume: 82 m3/ha.(coniferous) Avg. Age: 80 yr.

Biogeo. Classification: MSdk01 Avg. Height: 20.8 m

Edatopic Grid: 4-C Avg. D.B.H.: 34.6 cm

Site Index: 19 Soil Texture: Clay loam

Regen.: Sx 150 s.p.h., 1.5m, 20yr. L.F.H. Depth: 23 cm

Polygon Description

Polygon C is a relatively open grown Spruce Aspen mixed wood stand. The Spruce are typically limby with quite heavy taper. Coniferous volume is low at 82m3/ha. The Aspen component is quite sound with very few conks or punks present. Several old exploration trails run through the polygon.

The understory consists of a somewhat clumpy Spruce averaging 1.5m in height and 20 years of age. Young Aspen clones are also present throughout the understory.

Forest floor vegetation consists of Soopolallie, Wheatgrass and patches of Willow. Very few little deadfall or slash is present. In some cases competing vegetation is restricting Spruce regeneration development.

Soils are a clay loam texture with a coarse fragment percentage of less than 30%. The LFH layer averages over 20cm and has a rich appearance. Rooting depth is over 50 cm.

Wildlife usage was more evident in this polygon, with lots of deer and moose sign evident.

3.4 Polygon D

Area: 1.9 ha. Crown Closure: 10%

Species Composition: Pl70 At30 Slope: 20%

Volume: 38 m3/ha.(coniferous) Avg. Age: 58 yr.

Biogeo. Classification: MSdk01 Avg. Height: 15.5 m

Edatopic Grid: 4-C Avg. D.B.H.: 26.6 cm

Site Index: 16 Soil Texture: Clay loam to silt loam

Regen.: Sx50 Pi50 1.5m, 15yr. L.F.H. Depth: 8 cm

350 s.p.h.

Polygon Description

Polygon D is best described as three man made clearings approximately 20 yrs. old. Within these clearings the occasional larger sized Pine and Aspen were left relatively undisturbed. The few remaining trees in the clearings have quite heavy taper and relatively poor form. No pest or disease problems were noted.

The understory consists of Spruce and Pine regeneration showing good leader growth and vigour. Stocking is somewhat patchy and averages approximately 350 s.p.h. Vegetative competition is not limiting regeneration development.

Forest floor vegetation consists of Timothy, Wheatgrass, Willow and Rose. Slash is light throughout the polygon.

Soils are a clay loam to silty loam texture and are relatively well drained. Coarse fragment are less than 30%. LFH depth averages 8 cm with some pockets as deep as 15cm. Original clearing work did not cause much disturbance to soil structure.

3.5 Polygon E

Area: 3.1 ha. Crown Closure: 0%

Species Composition: Grass Slope: 20-50%

Volume: 0 m3/ha.(coniferous) Avg. Age: N/A

Biogeo. Classification: MSdk04 Avg. Height: N/A

Edatopic Grid: 3-C Avg. D.B.H.: N/A

Site Index: 15 Soil Texture: Clay loam to silt loam

Regen.: Scattered Sx < 20 s.p.h L.F.H. Depth: 2 cm

Polygon Description

Polygon E consists of a reclaimed area from a previous mining operation. The area was recontoured and seeded heavily with a reclamation seed mixture of Timothy, Sweet Clover, Crested Wheatgrass and Brome grass. Very little tree growth has established on the site, due primarily to the heavy reclamation seed mix that was applied. The scattered Sx that has established on the site is doing well, showing good vigour and leader growth.

Soil texture on the site varies from a clay loam to a silt loam texture. When the site was reclaimed it appears that the soil was removed in one lift. This resulted in a higher coarse fragment % and a somewhat degraded soil condition.

4.0 Existing Site Analysis

The existing site of the proposed waste rock dumpsites currently contain a wide variety of forest productivity. These productivities range from very little forest growth to a relatively high value sawlog stand.

Current total merchantable coniferous timber volume on site is 2126m3. This volume is composed of approximately 60% sawlog and 40% post material. All of the volume is approaching rotation age. The timber is in good condition with very little rot and is still putting on good increment. Pest and disease levels are less than 2%.

Site operability is good, with gentle slopes and very little deadfall.

Regeneration throughout the area is healthy and putting on good leader growth. Regeneration levels are somewhat patchy but average 174 s.p.h. and 1.5 m in height. Species composition is made up of 80% Spruce and 20% Pine.

Soil textures in the proposed dumpsites vary from clay loam to silty loam. Soil profiles have a very healthy appearance with average LFH depths of 12cm. Coarse fragments are less than 30% throughout. Rooting depths are over 50cm. Drainage is good with very few moisture holding areas.

Existing surface area suitable for tree growth within the proposed dump site areas is 16.6 ha. Of this area 11.6 ha. currently has merchantable timber on site.

5.0 Forest Growth Projection for Reclaimed Waste Rock Dump Sites

Based on the current site inventory and site index values a stand yield summary was developed using the Ministry of Forests growth model (TIPSY). Summaries were developed for both White Spruce and Lodgepole Pine. (See appendix II) Stand yield summaries were also developed for a fully reclaimed site planted to Lodgepole Pine at 1600 s.p.h.

The following table shows the growth model results versus the actual measured inventory volumes based on a 12.5cm utilization and inventory data collected in Polygon A and B:

Species	Site Index	Age	Growth Model m3/ha.	Inventory m3/ha.
White Spruce	19	70	253	268
Lodgepole Pine	16.5	76	230	240

The stand yield summary for a fully reclaimed site showed the following information:

Species	Site Index	Age	Growth Model
			m3/ha.
Lodgepole Pine	*15	76	218

The above tables are graphically displayed in Appendix III.

*A site index value of 15 was chosen on the fully reclaimed site based on the following factors: current site index values, soil textures and depth, LFH depth, edatopic grid, ease of soil stripping and stock piling, coarse fragment % and projected average waste rock size. Taking all these factors into consideration some site productivity loss is anticpated which is reflected in the site index value.

As previously stated the proposed waste rock dump sites currently have a surface area suitable for tree growth of 16.6 ha. Due to the proposed height and 2:1 backslopes the final surface area potentially suitable for tree growth is expected to increase to 17.9 ha (personal comment G. Reeves). This represents a 8% increase in surface area.

The current merchantable coniferous volume on the proposed waste rock dump sites is 2126 m3. This volume occurs on an area of 11.6 ha. The projected volume on the fully reclaimed waste rock dumpsites at an 80 year rotation age is 3902m3. This projected volume would occur on a area of 17.9 ha.

Recommended Reclamation Techniques

The key to obtaining the projected volumes on the fully reclaimed sites, is to ensure appropriate site reclamation techniques are used. In to order obtain the projected growth rates the following reclamation methods should be used:

- 1.) Timber salvage should done with minimal soil compaction and rutting.
- 2.) Stump removal should be done with minimal soil disturbance in mind.
- 3.) All topsoil should be salvaged, ranging in depth from 8 to 30 cm.
- 4.) Topsoil should be properly stored.
- 5.) When topsoil is returned to site it should be spread as evenly as possible with minimal compaction.
- 6.) Waste rock size should be kept small i.e. less than 15cm. average diameter.
- 7.) Coarse woody debris should be evenly spread to cover an area of approximately 20% of the reclaimed site.
- 8.) Erosion control structure such as rock lined berms may be required.
- 9.) Reclaimed surface should have rough texture.
- 10.) Site should be spring planted with container stock 412+ Lodgepole Pine with suitable providence at a rate of 1600 s.p.h.
- 11.) Planting should be done within 1 year of final site reclamation.
- 12.) Soil testing should be done before and after site reclamation.
- 13.) Site fertilization may be required depending on soil testing results.
- 14.) Stocking surveys and a stand tending prescription should be done within five years of final reclamation.

7.0 Summary

In summary Kimmur Forestry Consultants Ltd. believes that it is possible to reclaim the proposed waste rock dump sites, to a level of Forest productivity very comparable to the existing level.

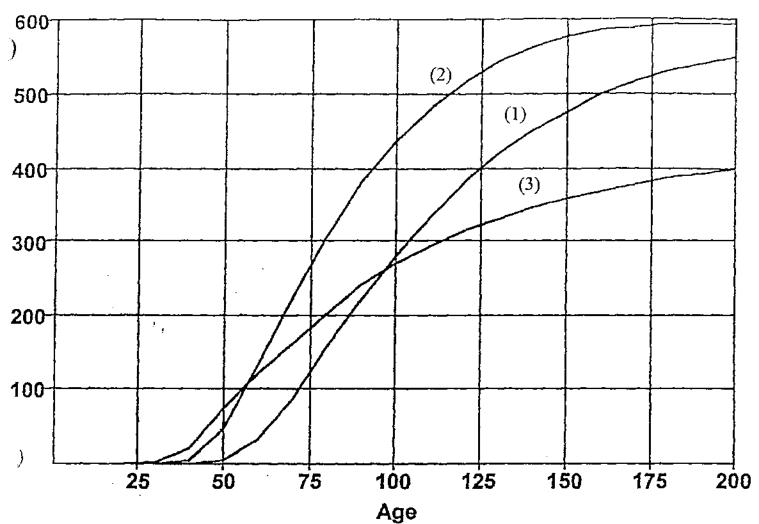
By proceeding with the proposed dump sites 2136 m3 of timber would be harvested slightly before ideal rotation age. Existing regeneration averaging 174 s.p.h. would be lost. However in return a fully reclaimed site with a 8% larger surface area producing 3902 m3 at an 80 year rotation would be present.

APPENDIX I



APPENDIX II





- (1) Sw SI 15m NATURAL
- (2) Sw SI 19m NATURAL
- (3) PI SI 15m PLANTED

PRODUCT : Managed Stand Yield Summary

AGENCY : MOF Research Branch

PROJECT : McGillvary Mine Ltd Msdk 01

DATE : Nov 09/95; 15:34:01

DELAY : 0 years

SITE : 15 m @ bh age 50

SOURCE : TASS v2.05.24 93-JAN-07

VERSION : WinTIPSY Version 1.0

SPECIES : White Spruce REGEN : Natural

DENSITY: 1600 trees/ha

TREAT. : Untreated. FILE : F:\TDATA\PROGRAMS\WINTIPS

OAFs 1&2: 5.00% 5.00% (Operational Adjustment Factors)

Cumulative production

	 		Volu	ute (1	13/ħa)			MEAN	STEM		250 F	rimel		
Are yds		Tot 0.0		12.5		chanta 22.5	able 27.5	32.5	BA (m2)	DBHg (cm)	CNT /ha		MRCH Vol.	DBHg (⊄m)	LC (%)
o i	o	C	0	Q	0	0	0	0	0	0.0	1520	0	G	0.0	٥
10	0	0	0	0	0	0	0	0	0	0.0	1505	1	0	0.0	٥
20	0	0	0	0	0	0	0	0	C	0.0	1478	3	0	0.0	0
30	1	1	0	0	0	0	0	0	1	2.1	1442	13	0	0.0	٥
40	10	10	6	1	0	0	0	O	4	5.7	1409	40	1	10.0	47
50	35	35	32	14	4	0	0	0	10	9.6	1371	64	12	15.3	67
60	86	85	84	60	32	7	2	0	19	13.6	1306	81	34	20.1	67
70	148	147	146	120	86	41	11	3	27	16.7	1241	87	60	24.2	63
80	218	217	217	191	158	100	41	13	35	19.4	1171	89	92	27.6	56
90	279	277	277	250	222	159	87	32	40	21.3	1113	90	122	30.1	52
100	337	331	331	305	280	218	139	62	44	23.1	1045	90	153	32.2	48
110	395	383	383	357	337	280	198	105	47	24.8	975	90	185	34.2	45
120	443	425	425	399	384	331	249	148	50	26.3	913	89	213	35.7	42
130	483	458	458	432	421	372	293	187	51	27.5	859	89	238	36.9	41
140	517	485	485	460	451	407	331	222	52	28.7	811	88	260	38.0	40
150	547	508	508	483	477	438	365	258	53	29.8	764	88	281	38.9	39
160	573	527	527	503	499	465	394	289	54	30.8	725	87	300	39.6	38
170	595	543	543	518	515	486	418	317	54	31.4	700	87	316	40.3	37
180	614	557	557	532	530	505	438	342	55	32.1	677	86	332	40.9	36
190]	632	567	567	542	541	519	455	362	55	32.7	652	86	346	41.4	36
200	647	575	575	551 	549	531	470	380	55 	33.3	627	85	360	41.9	35

PRODUCT : Mean Annual Increment Summary

AGENCY : MOF Research Branch PROJECT : McGillvary Mine Ltd MSdk 01

SPECIES : White Spruce

REGEN : Natural DENSITY: 1600 trees/ha TREAT.: Untreated

OAFs 1&2: 5.00% 5.00%

MAX MAI : 3.2 m3/ha 0 130 years

SOURCE : TASS v2.05.24 93-JAN-07 VERSION: WinTIPSY Version 1.0 DATE : Nov 09/95; 15:34:01

SITE : 15 m @ bh age 50

DELAY : 0 years

FILE : F:\TDATA\PROGRAMS\WINTIPS

UTILIZ : Merchantable 17.5+

Age (Yrs)	Top Ht (m)	Vol /ha (m3)	MAI /ha (m3)
0.0	0.0	0	0.0
10.0	0.5	0	0.0
20.0	1.9	٥	0.0
30.0	4.4	0	0.0
40.0	7.4	0	0.0
50.0	10.5	3	0.1
60.0	13.5	32	0.5
7D.0	16.2	85	1.2
80.0	18.6	158	2.0
90.0	20.7	221	2.5
100.0	22.6	280	2.8
110.0	24.3	337	3.1
120.0	25.8	384	3.2
130.0	27.1	420	3.2
140.0	28.2	451	3.2
150.0	29.3	477	3.2
160.0	30.2	498	3.1
170.0	31.0	515	3.0
180.0	31.7	529	2.9
190.0	32-4	540	2.8
200.0	33.0	549	2.7

PRODUCT : Managed Stand Yield Summary SOURCE : TASS v2.05.24 93-JAN-07 AGENCY : MOF Research Branch VERSION : WinTIPSY Version 1.0

PROJECT: McGillvary Mine Ltd Msdk 01 DATE: Nov 09/95; 15:33:40

SPECIES : White Spruce SITE : 19 m @ bh age 50

REGEN : Natural DELAY : 0 years

DENSITY: 1600 trees/ha
TREAT.: Untreated FILE: F:\TDATA\PROGRAMS\WINTIPS

OAFs 1&2: 5.00% 5.00% (Operational Adjustment Factors)

Cumulative production

	 		Volu	me ()	m3/ha)		!	MEAN	STEM		250 F	rinel	2.5+	
Age yrs		Tot		12.5	Merc 17.5	hanta 22.5		32.5	BA (m2)	DBHg (cm)	CNT /ha		MRCH Vol.	DBHg (cm)	LC (%)
0	0	0	0	0	0	0	Q	0	0	0.0	1520	0	0	0.0	0
10	0	0	0	0	ο	0	0	0	0	0.0	1503	1	٥	0.0	٥
20	0	0	0	0	C	0	0	0	0	0.9	1469	5	0	0.0	0
30	5	5	2	0	0	0	0	0	2	4.2	1425	29	Q	2.1	10
40	33	33	29	12	3	0	Đ	0	9	9.4	1381	63	11	15.0	67
50	104	103	102	77	46	13	4	0	22	14.6	1295	84	41	21.4	66
60)	195	194	194	168	134	79	27	8	33	18.6	1203	89	81	26.5	58
70]	284	281	281	253	225	161	88	33	40	21.4	1124	91	123	30.1	51
80	367	359	359	332	309	249	167	82	46	23.9	1027	91	167	33.1	46
90	443	426	426	399	384	329	246	145	50	26.1	935	91	209	35.5	43
100	503	476	476	449	439	390	311	202	53	27.9	858	90	246	37.3	41
110	553	515	515	489	483	442	367	257	54	29.6	788	90	278	38.7	39
120	596	546	546	521	517	484	413	307	55	31.0	733	89	306	39.9	38
130	630	571	571	546	543	518	449	350	56	32.1	696	89	331	40.9	36
140	661	590	590	564	563	543	479	384	56	33.1	657	88	354	41.7	36
150	687	604	604	579	578	563	504	413	56	34.1	620	88	375	42.4	35
160	709	611	611	587	586	574	521	437	56	34.9	584	87	392	43.0	35
170	727	615	615	591	590	580	534	456	55	35.7	552	86	408	43.6	34
180	742	618	618	593	593	585	544	473	55	36.5	523	86	421	44.0	34
190	754	617	617	594	594	587	550	484	54	37.1	500	85	433	44.4	34
200	765	616	616	593	593	587	554	492	53	37.6	481	84	443	44.7	34

PRODUCT: Mean Annual Increment Summary SOURCE: TASS V2.05.24 93-JAN-07 AGENCY: MOF Research Branch VERSION: WinTIPSY Version 1.0

AGENCY: MOF Research Branch VERSION: WinTIPSY Version 1.0
PROJECT: McGillvary Mine Ltd Msdk 01 DATE: Nov 09/95; 15:33:40

SPECIES: White Spruce SITE : 19 m @ bh age 50

REGEN : Natural DELAY : 0 years
DENSITY : 1600 trees/ha

TREAT. : Untreated FILE : F:\TDATA\PROGRAMS\WINTIPS

OAFs 162: 5.00% 5.00% UTILIZ : Merchantable 17.5÷

1	Top	Vol	MAI
Age	Ht	/ha	/ha
(Yrs)	(m)	(m3)	(m3)
0.0	•		
	0.0	0	0.0
10.0	0.7	C	0.0
20.0	2.6	0	0.0
30.0	6.3	0	0.0
40.0	10.4	2	0.1
50.0	14.3	45	0.9
60.0	17.7	134	2.2
70.0	20.8	225	3.2
80.0	23.3	309	3.9
90.0	25.6	383	4.3
100.0	27.5	438	4.4
110.0	29.1	482	4.4
120.0	30.5	517	4.3
130.0	31.7	543	4.2
140.0	32.8	562	4.0
150.0	33.7	578	3.9
160.0	34.5	5B6	3.7
170.0	35.2	590	3.5
180.0	35.9	593	3.3
190.0	36.4	593	3.1
200.0	36.9	593	3.0

MAX MAI : 4.4 m3/ha @ 100 years

SOURCE : TASS V2.05.24 93-JAN-07 PRODUCT : Managed Stand_Yield Summary AGENCY : MOF Research Branch VERSION: WinTIPSY Version 1.0 DATE : Nov 09/95; 15:40:29

PROJECT : McGillvary Mine Ltd MSdk 01

SPECIES : Lodgepole Pine REGEN : Planted

DENSITY: 1600 trees/ha

TREAT. : Untreated FILE : F:\TDATA\PROGRAMS\WINTIPS

SITE

DELAY : 0 years

: 15 m 0 bh age 50

OAFs 1&2: 5.00% 5.00% (Operational Adjustment Factors)

Cumulative production

			Volu	ime (1	m3/ba	}				MEAN	STEM		250 F	rimel	2.5+
yra yra		Tot		12.5		chanta 22.5	27.5	32,5	BA (m2)	DBHg (cm)	CNT /ha	CC:	MRCH Vol.	DBHg (cm)	LC (%)
0	0	a	0	0	0	0	0	0	0	0.0	1518	1	0	0.0	0
10	1	1	0	0	0	D	0	0	0	0.8	1464	20	٥	0,0	0
20	9	9	5	0	0	O	9	0	4	5.7	1398	69	0	9.0	65
30	40	39	38	16	2	0	0	0	13	11.1	1352	89	10	14.9	88
40	85	84	84	61	21	2	Q	0	22	14.6	1324	92	25	18,9	73
50	141	140	140	117	74	15	2	O	30	17.0	1309	92	43	22.0	61
60	185	183	183	159	121	40	6	Q	35	18.4	1299	92	57	23.8	54
70	222	220	220	196	161	72	13	2	38	19.4	1291	92	72	25.3	50
80	260	258	258	233	202	109	27	5	41	20.2	1280	91	87	26.5	47
90	297	295	295	269	242	149	47	9	44	21.0	1267	91	102	27.7	44
100	324	322	322	295	271	181	67	15	46	21.6	1245	90	115	28.6	43
110	346	343	343	31,7	294	208	84	20	47	22.2	1224	90	126	29.3	42
120	366	362	362	336	314	232	103	27	48	22.6	1196	89	137	29.9	42
130	384	377	377	351	332	252	121	35	49	23.1	1164	89	146	30.4	41
140	399	391	391	365	347	269	137	41	49	23.5	1136	88	154	30.9	40
150	412	402	402	376	360	284	152	47	50	23.9	1109	88	161	31.3	40
160	424	410	410	384	371	297	165	55	50	24.3	1078	87	168	31.6	39
170	433	418	418	392	380	308	177	62	50	24.6	1050	87	174	32.0	39
180	441	424	424	398	388	31B	188	68	50	24.9	1025	86	179	32,2	39
190	449	429	429	404	394	327	197	73	50	25.2	1001	86	184	32.5	38
200	455	433	433	408	400	334	205	78	50	25.4	980	85	189	32.7	38

SPECIES : Lodgepole Pine REGEN : Planted DENSITY : 1600 trees/ha

TREAT. : Untreated

OAFs 1&2: 5.00% 5.00% MAX MAI: 3.0 m3/ha @ 90 years

PRODUCT : Mean Annual Increment Summary SOURCE : TASS V2.05.24 93-JAN-07 AGENCY : MOF Research Branch VERSION : WinTIPSY Version 1.0 AGENCY : MOF Research Branch PROJECT : McGillvary Mine Ltd MSdk 01

> SITE : 15 m 0 bh age 50 DELAY : 0 years : F:\TDATA\PROGRAMS\WINTIPS FILE

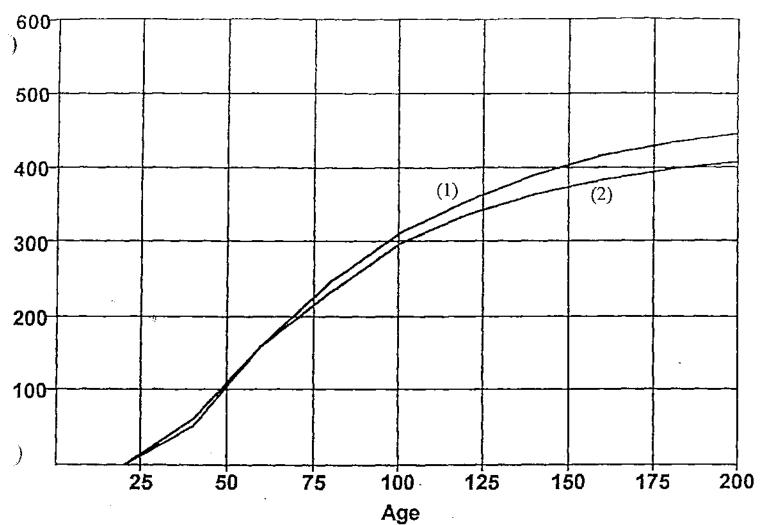
> > UTILIZ : Merchantable 12.5+

DATE : Nov 09/95; 15:40:29

Age	Top Ht	Vol /ha	MAI /ha
(Yrs)	(m)	(m3)	(m3)
(112)		(143)	(2112)
0.0	0.1	0	0.0
10.0	2.1	0	0.0
20.0	5.4	0	0.0
30.0	8.6	15	0.5
40.0	11.4	60	1.5
50.0	13.7	117	2.3
60.0	15.7	159	2.7
70.0	17.3	195	2.8
80.0	18.6	232	2.9
90.0	19.8	268	3.0
100.0	20.8	295	3.0
110.0	21.6	317	2.9
120.0	22.4	335	2.8
130.0	23.0	351	2.7
140.0	23.6	364	2.6
150.0	24.1	375	2.5
160.0	24.5	384	2.4
170.0	24.9	391	2.3
180.0	25.3	398	2.2
190.0	25.6	403	2.1
200.0	25.9	408	2.0

APPENDIX III





- (1) PI SI-16.5m
- (2) PI SI 15m PLANTED

PRODUCT : Managed Stand Yield Summary SOURCE : TASS v2.05.24 93~JAN-07 AGENCY : MOF Research Branch VERSION : WinTIPSY Version 1.0

PROJECT: McGillvary Mine Ltd Msdk 04 DATE: Nov 09/95; 15:44:37

SPECIES : Lodgepole Pine SITE : 16 m 0 bh age 50

REGEN: Natural DELAY: 0 years
DENSITY: 1600 trees/ha

TREAT. : Untreated FILE : 'F:\TDATA\PROGRAMS\WINTIPS

OAFs 1&2: 5.00% 5.00% (Operational Adjustment Factors)

Cumulative production

i			Volu	ıne (ı	13/ha) }			MEAN	STEM		250 F	rimel2	2.5+	
Age yrs	Gross	Tot		12.5	Merc 17.5	hants 22.5		32.5	BA (m2)	DBHg (cm)	CNT /ha	CC (%)	MRCH Vol.	DBHg (cm)	LC (%)
0 (0	0	0	0	0	0	0	0	0	0.0	1520	0	О	0.0	0
10	0	0	0	0	0	0	Ð	0	0	0.0	1473	В	0	0.0	0
20	4	4	1	0	0	0	0	0	2	4.0	1399	44	0	8.6	62
30	30	30	27	11	1	0	0	٥	10	9.7	1322	74	8	15.1	90
40	73	72	71	50	22	3	0	0	19	13.9	1235	85	25	19.4	82
50	134	132	131	110	79	31,	5	1	27	17.2	1173	89	49	23.4	70
60	183	181	180	159	132	73	19	3	32	19.2	1120	90	70	25.9	62
70)	229	227	226	203	180	119	45	9	37	20.8	1075	90	91	27.8	57
80	275	271	271	248	228	168	79	19	40	22.2	1033	90	113	29.6	53
90]	311	306	306	282	266	207	113	36	42	23.3	994	90	131	3 0. 8	50
100	343	335	335	311	297	242	145	53	44	24.3	954	89	148	31.8	48
110	371	359	359	336	324	274	178	75	45	25.2	906	89	163	32.7	47
120	395	380	380	357	348	302	205	93	46	26.1	864	89	177	33.5	45
130	416	39B	398	375	368	325	231	113	47	26.8	839	89	190	34.1	44
140	435	414	414	391	385	345	253	130	48	27.3	818	88	201	34.7	44
150	451	428	428	405	400	361	272	145	48	27.8	798	88	211	35.1	43
160	464	439	439	416	412	376	289	159	49	28.3	778	87	221	35.6	43
170	477	448	448	426	422	388	304	174	49	28.7	757	87	229	35.9	42
180	488	456	456	433	431	399	318	186	49	29.1	738	86	237	36.3	42
190	497	463	463	440	438	409	329	197	49	29.5	720	86	244	36.6	41
200	505	468	468	445	444	417	340	207	49	29.9	704	85	250	36.9	41

PRODUCT : Mean Annual Increment Summary SOURCE : TASS v2.05.24 93-JAN-07 AGENCY : MOF Research Branch VERSION : WinTIPSY Version 1.0

PROJECT : McGillvary Mine Ltd MSdk 04 DATE : Nov 09/95; 15:44:37

SPECIES: Lodgepole Pine SITE: 16 m @ bh age 50

REGEN: Natural DELAY: 0 years

DENSITY: 1600 trees/ha
TREAT.: Untreated FILE: F:\TDATA\PROGRAMS\WINTIPS

OAFs 1&2: 5.00% 5.00% UTILIZ : Merchantable 12.5+

Age (Yrs)	Top Ht (m)	Vol /ha (ш3)	MAI /ha (m3)
0.0 10.0 20.0 30.0 40.0 50.0 60.0 70.0 80.0 90.0 110.0 120.0 130.0 140.0	0.0 1.7 5.3 9.0 12.1 14.7 16.9 18.6 20.1 21.3 22.3 23.2 24.0 24.6 25.2	0 0 0 10 49 109 158 203 247 282 311 335 356 375 391 405	0.0 0.0 0.0 0.4 1.2 2.2 2.6 2.9 3.1 3.1 3.1 3.2 2.9 2.8 2.7
160.0 170.0 180.0 190.0 200.0	26.2 26.6 26.9 27.2 27.5	416 425 433 439 445	2.6 2.5 2.4 2.3 2.2

MAX MAI : 3.1 m3/ha @ 90 years

PRODÚCT : Managed Stand Yield Summary SOURCE : TASS v2.05.24 93-JAN-07 AGENCY : MOF Research Branch VERSION: WinTIPSY Version 1.0 : Nov 09/95; 15:44:00 PROJECT : McGillvary Mine Ltd MSdk 04 DATE

SPECIES : Lodgepole Pine SITE : 15 m @ bh age 50 DELAY : 0 years

: Planted

DENSITY : 1600 trees/ha TREAT. : Untreated

: F:\TDATA\PROGRAMS\WINTIPS FILE

OAFs 1&2: 5.00% 5.00% (Operational Adjustment Factors)

Cumulative production

			Volu	ume (m3/ha	}			}	MEAN	STEM		250 F	rimela	2.5+
Age yrs	Gross	Tot		12.5	Merc 17.5	chanta 22.5		32.5	BA (m2)	DBHg (cm)	CNT /ha		MRCH Vol.	DBHg (cm)	LC (%)
0	0	0	0	0	0	0	0	0	0	0.0	1518	1	0	0.0	0
10	1	1	O	0	0	0	٥	0	٥	0.8	1464	20	Ð	0.0	٥
20 (9	9	5	0	0	0	Q	0	4	5.7	1398	69	0	9.0	65
30	40	39	38	16	2	0	0	O	13	11.1	1352	89	10	14.9	88
40	85	84	84	61	21	2	0	Û	22	14.6	1324	92	25	18.9	73
50	141	140	140	117	74	15	2	0	30	17.0	1309	92	43	22.0	61
60	185	183.	183	159	121	40	6	0	35	18.4	1299	92	57	23.8	54
70	222	220	220	196	161	72	13	2	38	19.4	1291	92	72	25.3	50
80	260	258	258	233	202	109	27	5	41	20.2	1280	91	87	26.5	47
90]	297	295	295	269	242	149	47	9	44	21.0	1267	91	102	27.7	44
100	324	322	322	295	271	181	67	15	46	21.6	1245	90	115	28.6	43
110	346	343	343	317	294	208	84	20	47	22.2	1224	90	126	29.3	42
120	366	362	362	336	314	232	103	27	48	22.6	1196	89	137	29.9	42
130	384	377	377	351	332	252	121	35	49	23.1	1164	89	146	30.4	41
140	399	391	391	365	347	269	137	41	49	23.5	1136	88	154	30.9	40
150	412	402	402	376	360	284	152	47	50	23.9	1109	88	161	31.3	40
160	424	410	410	384	371	297	165	55	50	24.3	1078	87	168	31.6	39
170	433	418	418	392	380	308	177	62	50	24.6	1050	87	174	32.0	39
180 (441	424	424	398	388	318	188	68	50	24.9	1025	86	179	32.2	39
190	449	429	429	404	394	327	197	73	50	25.2	1001	86	184	32.5	38
200	455	433	433	408	400	334	205	78	50	25.4	980	85	189	32.7	38

AGENCY : MOF Research Branch

PROJECT : McGillvary Mine Ltd MSdk 04

SPECIES : Lodgepole Pine

REGEN : Planted

DENSITY: 1600 trees/ha

TREAT. : Untreated

OAFs 1&2: 5.00% 5.00% MAX MAI: 3.0 m3/ha @ 90 years

PRODUCT : Mean Annual Increment Summary SOURCE : TASS v2.05.24 93-JAN-07 VERSION: WinTIPSY Version 1.0 DATE : Nov 09/95; 15:44:00

> SITE : 15 m ê bh age 50

DELAY : 0 years

FILE : F:\TDATA\PROGRAMS\WINTIPS

UTILIZ : Merchantable 12.5+

Top Ht (m)	Vol /ha (m3)	MAI /ha (m3)
0.1	0	0.0
		0.0
	_	0.0
		0.5
		1.5
		2.3
		2.7
17.3	195	2.8
18.6	232	2.9
19.8	268	3.0
20.8	295	3.0
21.6	317	2,9
22.4	335	2.8
23,6	351	2.7
23.6	364	2.6
24.1	375	2.5
24.5	384	2.4
24.9	391	2.3
25.3	398	2.2
25.6		2.1
25.9	408	2.0
	Ht (m) 0.1 2.1 5.4 8.6 11.4 13.7 17.3 18.6 19.8 20.8 21.6 22.4 23.6 24.1 24.5 24.5 24.9 25.3 25.6	Ht /ha (m) (m3) 0.1 0 2.1 0 5.4 0 8.6 15 11.4 60 13.7 117 15.7 159 17.3 195 18.6 232 19.8 268 20.8 295 21.6 317 22.4 335 23.6 351 23.6 351 23.6 364 24.1 375 24.5 384 24.9 391 25.3 398 25.6 403

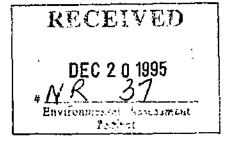
December 13, 1995

McGillivray Mining Ltd., P.O. Box 1916, Fernie B.C. VOB 1MO

Mr Norm Ringstad Project Assessment Director Third Floor, 1810 Blanshard Street, Victoria B.C. V8V 1X4

Attention : Norm Ringstad

Dear Sir ;



Our forestry consultant, Kimmur Forestry Consultants Ltd. has requested a change to their report. The attached page will replace their page 10 in Appendix H of our Application for a "Project Approval Certificate".

The change is based on the depth of topsoil to be recovered for the reclamation and the reforestation program. It is now felt that the top layer of soil will provide enough material to satisfy the need.

Yours truly,

McGillivray Mining Ltd.

Gerald S. Reeves P. Eng, General Manager

cc A. Whale.

T. Milligan

D. Martin

L. McDonald

Project Director

Recommended Reclamation Techniques

The key to obtaining the projected volumes on the fully reclaimed sites, is to ensure appropriate site reclamation techniques are used. In to order obtain the projected growth rates the following reclamation methods should be used:

- 1.) Timber salvage should done with minimal soil compaction and rutting.
- 2.) Stump removal should be done with minimal soil disturbance in mind.
- 3.) All topsoil should be salvaged, ranging in depth from 8 to 30 cm.
- 4.) Topsoil should be properly stored.
- 5.) When topsoil is returned to site it should be spread as evenly as possible with minimal compaction.
- 6.) Waste rock size should be kept small i.e. less than 15cm, average diameter,
- 7.) Coarse woody debris should be evenly spread to cover an area of approximately 20% of the reclaimed site.
- 8.) Erosion control structure such as rock lined berms may be required.
- 9.) Reclaimed surface should have rough texture.
- 10.) Site should be spring planted with container stock 412+ Lodgepole Pine with suitable providence at a rate of 1600 s.p.h.
- 11.) Planting should be done within I year of final site reclamation.
- 12.) Soil testing should be done before and after site reclamation.
- 13.) Site fertilization may be required depending on soil testing results.
- 14.) Stocking surveys and a stand tending prescription should be done within five years of final reclamation.

)

Appendix I

Archaeological and Heritage Resources

KTUNAXA/KINBASKET TRIBAL COUNCIL

S.S. #3, SITE 15, COMP. 14, MISSION ROAD CRANBROOK, B.C. VIC 6H3

Fax (604) 489-5760

Telephone (604) 489-2464

November 13, 1995

Gerry Reeves McGillivray Mining Ltd. Fernie, B.C.

Dear Gerry,

Re: Results of archaeological resources impact assessment of the proposed McGillivray Loop Coal Mine

The following is a report on my archaeological inspection of the proposed McGillivray Loop coal mine, carried out on October 19, 1995.

The mine is situated on land owned by Crestbrook Forest Industries Ltd. on the northeast end of Loop Ridge in the southern Canadian Rocky Mountains near the west end of the Crowsnest Pass, B.C. The area examined comprises a clearing approximately 10 ha in size that contains an existing pit and the surrounding pit that was reclaimed after mining by Kaiser Resources and Westar Coal from 1969 - 1971.

Much of the area is either bare rock or northwest to west facing slopes that have been extensively altered and revegetated to grass. The surrounding slopes on the north, east and south support a predominantly lodgepole pine forest with some western larch. At the western edge of the property, the forest is more open and contains cottonwoods.

The pit vicinity and the lower road provided abundant subsurface exposure of the development area. No subsurface testing was necessary.

This investigation was undertaken to address archaeological issues of concern under the <u>BC Heritage Conservation Act</u>. The project was discussed with Hugh Taylor of the Department of Land and Resources, Ktunaxa/Kinbasket Tribal Council. The input from McGillivray Mining Ltd. is acknowledged, but it is noted that such consultation as part of good business practice must not be construed as replacing the government's fiduciary responsibility to the Ktunaxa Nation.

TOBACCO PLAINS

No deposits or features of archaeological significance were observed in the area examined during this reconnaissance. Therefore, the proposed mine poses no threat to any archaeological resources.

I trust this information is suitable for your purposes. If you have any questions or require further information, please do not hesitate to contact me.

Yours truly,

)

Wayne T. Choquette

Resource Protection Advisor

Ktunanxa/Kinbasket Tribal Council

McGillivray Mining Ltd.

Application For A Project Approval Certificate

Submitted to: Executive Director of the Environmental Assessment Office.

Submitted by : McGillivray Mining Ltd.

Prepared By: G. S. Reeves Associates International Ltd. Gerald Reeves, P.Eng., and, Morris Geological Co.Ltd. Robert Morris, P.Geo.

Date: November 30, 1995

CONTENTS

				Page.
Man	agem	ent Summ	ary	1
1.0	Prop	onent and P	roject Introduction (Section 7(2))	2
2.0	The I	Purpose and	Major Project Components (Section 7(2)(a))	5
3.0	Exist	ing Backgro	ound Information (Section 7 (2)(b))	5
40	3.1	3.1.1 3.1.2 3.1.3 3.1.4 3.1.5 3.1.6 3.1.7 3.1.8 3.1.9 3.1.10 3.1.11	ntal and Physical Setting Climate Water Lakes and Streams Soils and Surficial Geology Vegetation Wildlife Fisheries Agriculture Forestry Inhabited Places Near Mine Site Recreation Socio Economic Setting	6 6 7 7 8 8 9 9 9 9 10
4.0	Proje	On Site Fac	(Section 7 (2)(c)) cilities	10 10
	4.2	Off Site Far	cilities	10
5.0	Proje	ct Construc	tion Plan and Timetable (Section 7 (2)(d))	11
6.0	New	or Expanded	d Public Works Required (Section 7 (2)(e))	11
7.0	Poter	ntial Effects	of The Project (Section 7 (2)(f))	11
	7.1 7.2 7.3	Socio-Ecor 7.1.1 7.1.2 Labour For Health	Economy Unemployment	11 16 17 18 18

				Page
	7.4	Environmer		18
		7.4.1	Surficial Geology	19
		7.4.2	Waste Characterization Program	19
		7.4.3	Surface and Ground Water Quality	19
		7.4.4	Surface and Ground Water Hydrology	19
		7.4.5	Vegetation and Forestry Resources	20
		7.4.6	Wildlife Resources	20
		7.4.7	Fisheries and Aquatic Resources	20
		7.4.8	Land Capability	20
		7.4.9	Archaeological and Heritage Resources	21
8.0	Prop	osed Preven	tative or Mitigative Measures (Section 7 (2)(g)	22
9.0			to Land Use and Resource Issues (Section 7 (2)(h))	22
	9.1	Mineral Cla	ims	22
	9.2	Traplines		22
	9.3	Native Land		22
	9.4	Logging Rig	ghts	22
	9.5	Hunting		23
10.0			lation Liaison (Section 7(2)(i,j,k,l,m,n,))	23
	10.1		mation Distribution and Consultation Activities	23
	10.2		uture Public Consultation	23
	10.3	First Nation	Consultation Activities	23
	10.4	-	uture First Nation Consultation	24
	10.5	Consultation	n with Government Offices, Municipalities,	
		Regional Di	stricts and B.C. 's Neighbouring Jurisdictions	24
	10.6	Issues ident	tified From 10.5	24
11.0	Geolo	ogy and Res	erves	25
	11.1	Regional Ge	eology	25
	11.2	Site Geolog	у	26
	11.3	Coal Quality	/	27
	11.4	Reserves		27
12.0	Mine	Planning		28
	12.1	Bulk Sample	e Extraction 1995	28
	12.2	Ultimate Pit	Plan (see Rock Slope Engineering, Appendix F)	28
	12.3	1996 Mine a	and Dump Plan	28
	12.4	1997 Mine a	and Dump Plan	29
	12.5	1998 Mine a	and Dump Plan	30
	12.6		and Dump Plan	30
			•	

		Page
13.0	Rock Slope Engineering	31 .
14.0	Dump Foundations and Stability	31
15.0	Forestry Assessment and Planning	31
16.0	Top Soil Management	32
17.0	Abandonment Plan 17.1 Reclamation Planning	33 33
18.0	Coal Stockpiles	35
19.0	Haul Roads 19.1 Main Corbin Road Access 19.2 Lower Haul Road 19.3 Upper Haul Road 19.4 In Pit Roads 19.5 Switchbacks or Tight Curves	35 35 35 36 36
20.0	Settling Pond Requirements and Drainage	36
21.0	Mine Operations 21.1 Equipment Required 21.2 Operating Schedule 21.3 Safety and Loss Control 21.4 Drilling and Blasting 21.5 Planning Cycle	38 38 39 39 39 40
Note:	Pursuant to the B.C. Environmental Assessment Act, Part 2, Div. 2, t	his report ha

ıs been organized to follow the order as specified by Section 7 (Application).

Bibliography 41

List of Appendices

Αpı	pendix A	Corres	pondence	with	Elkview	Coal Co	rporation

Appendix B Correspondence with Crestbrook Forest Industries

Appendix C Resumes of Corporate Principals

Appendix D Licensed Land Users

Appendix E a) Environmental Baseline Study (Requirements from the Ministry of Environment)

b) Environmental Baseline Interim Report

Appendix F Rock Slope Engineering

Appendix G Waste Dump Foundations and Stability

Appendix H Forestry Assessment

Appendix I Archaeological and Heritage Resources

1

List of Figures

		Location
Figure 1	Location Map	Following Text
Figure 2	Site Plan	Following Text
Figure 3	Typical Mining Cross Section	Following Text
Figure 4	Geology Map	Following Text
Figure 5	Typical Geology Cross Section A A'	Following Text
Figure 5a	Typical Geology Cross Section B B	Following Text
Figure 6	Phase 1 Bulk Sample Site From Highway 3, Photo	Following Text
Figure 7	Looking South at Old 1969 Test Pit Highwall, Photo	Following Text
Figure 8	As Built of Bulk Sample 1995 Pit	Following Text
Figure 9	Ultimate Pit	In Appendix F
Figure 10	End 1996 Mine and Dump Plan	Following Text
Figure 11	End 1997 Mine and Dump Plan	Following Text
Figure 12	End 1998 Mine and Dump Plan	Following Text
Figure 13	End 1999 Mine and Dump Plan	Following Text
Figure 14	Reclamation Plan and Schedule	Following Text
Figure 15	Mine Abandonment Plan	Following Text
Figure 16	Construction Timetable	Page 11
Figure 17	Population by Community	Page 13
Figure 18	Typical Haulage Road Design Cross Section	Following Text
Figure 19	Stratigraphic Column	Following Text
Figure 20	Settling Pond	Following Text

List of Tables

		Page
Table 1	Populations by Community, south-eastern B.C.	13
Table 2	Major Elk Valley Employers	14
Table 3	Age Structure of Population by Community, 1991	15
Table 4	Estimates of 1991/1992 Employment for south-eastern B.C.	16
Table 5	Estimates of 1991/1992 After Tax Income	17
Table 6	Status of Westar Mine Workers, March 1994	18
Table 7	Coal Quality	27
Table 8	Reclamation Schedule	34
Table 9	Proposed Equipment List	38

Management Summary:

The management of McGillivray Mining Ltd. is pleased to present this application for a project approval certificate to the Executive Director of the Environmental Assessment Office. The application is submitted to request a certificate to mine these coal reserves at full production capacity beginning in May 1996.

Our objective is to develop the McGillivray coal reserves which represent a viable and valuable resource in southeast British Columbia. As responsible mining professionals, we intend to pursue development with maximum extraction and minimal environmental impacts. A very small scale contract type open pit operation which is carefully planned will be capable of maintaining or enhancing land productivity and wildlife habitat in the area of interest.

We have successfully extracted a coal "Bulk Sample" in 1995 and the coal was delivered to Elkview Coal Corporation's preparation plant.

A letter of intent has been signed in which McGillivray Mining Ltd. has agreed to deliver approximately 200,000 raw tonnes of metallurgical coal per year to Elkview Coal Corporation through 1996 and 1997.

Our reserves include 800,000 tonnes in the proven category from one coal seam, within the immediate area of the old mine. The area north of the pipe line could contain several million tonnes of coal.

This report addresses the first four years of production. As further exploration is completed the project could potentially expand. The abandonment plan leaves the project in excellent condition to allow mining expansion to the south. Waste material from further expansion could be backfilled into the mined out area.

We have retained competent, professional consultants to ensure the integrity of this project.

)

1.0 Proponent and Project Introduction:

An opportunity has been identified to develop a valuable and viable metallurgical grade coal reserve in southeast B.C. This property provides a proven reserve capable of supporting a small contract open pit coal operation.

The contract mine will deliver raw coal to large scale producers already operating open pit mines and preparation plants near Sparwood B.C.

Metallurgical coal is used for steel production and the coal reserves identified will provide a high quality coal while providing jobs for unemployed Elk Valley residents.

The project has been broken down into two initial Phases of development. Phase 1 refers to a bulk sample of roughly 20,000 raw tonnes, which was completed in the Fall of 1995. Phase 2 refers to production mining at the rate of approximately 200,000 tonnes of raw coal per year over a four year period through 1996 and 1999. The mine could continue to produce coal beyond 1999 as more reserves and customers are identified. This Application refers to production mining for Phase 2.

Potential customers for McGillivray coal reserves are Elkview Coal Corporation, Fording Coal Ltd., and Line Creek Resources Ltd. Coal samples will be shipped to potential customers for analysis during 1995 and beyond.

Reputable consulting firms are being retained to complete environmental baseline studies, rock slope engineering studies, stability analysis, forestry, and other specialized investigations.

The area of interest is referred to as the "McGillivray" or "Loop Ridge" area located roughly twenty kilometres east of Sparwood B.C. on Highway 3 and three kilometres south on the Coal Mountain (Corbin) access road. Figure 1 is a location map that relates the property to the town of Sparwood, Elkview Coal Corporation's Sparwood operations and Fording Coal's Coal Mountain operations.

McGillivray Mining Ltd. was formed during 1995. Each of its three directors has over 20 years of experience in open pit mining and are residents of the Elk Valley.

The management and operating team of McGillivray Mining are dedicated to professionalism and sustainable development. We have strong backgrounds in geology, engineering, and mine operations. A large portion of our experience has been dedicated to starting and developing metallurgical coal mines in southeast B.C.

The management team for McGillivray Mining Ltd. has enjoyed good relations with the Ministry of Energy Mines and Petroleum Resources, Ministry of Environment, and the Occupational Health and Safety branch.

The owners and directors of McGillivray Mining Ltd. include:

- Mr. Gerald S. Reeves, B.Sc. Mining, P.Eng.: General Manager.
- Mr. Robert J. Morris, M.Sc. Geology, P.Geo.: Geology and other technical and administrative functions.
- Mr. Russell Pask,: Mine operations. Currently managing a successful contract mining company (Fred Sowchuk Trucking Ltd.) with a long history in the Elk Valley. Mr. Pask and his supervisors hold "Shift Boss" certificates.

Appendix C provides detailed information about the corporate directors.

Preliminary mapping by the Geological Survey of Canada (Price 1961) identified coal-bearing strata in the area. The Alberta Natural Gas Company Ltd. (ANG) completed seven core holes in 1964 and the property was extensively explored by Crows Nest Industries, and Kaiser Resources Ltd. between 1964 and 1970. The property is identified as a multi seam high quality metallurgical coal deposit with extensive reserves.

Reports indicate that, based on extensive drilling, trenching, and mapping, the property will support an economic, low strip ratio (roughly 3.5:1) open pit mine. Strip ratio is measured as bank cubic meters of waste rock and overburden per tonne of raw pit run coal.

In 1969-1970 a large test pit was excavated (Figure 7) and approximately 55,000 tonnes of metallurgical grade coal was hauled to the Michel coke ovens still operating at that time. The test pit exposed a very thick coal seam (over 10 meters thick) over a height of roughly 30 meters. The test pit was reclaimed in 1973 and the property was abandoned.

The data base and other information was retained in the files of Westar Mining Ltd. and became the property of Elkview Coal Corporation after their acquisition of the Sparwood operations. This data has been transferred to McGillivray Mining Ltd. Elkview Coal Corporation will have first right of refusal to buy McGillivray coal. Appendix A provides a letter from Mr. Wolf Nickel, General Manager for Elkview Coal Corporation to McGillivray Mining Ltd.

In 1992 Morris and Reeves identified the potential for a small contract mining operation that will deliver 200,000 to 300,000 tonnes of pit run coal per year to a large scale producer in the vicinity of the McGillivray property.

Exploration and quality testing was completed in 1993 and a decision was made to proceed with a bulk sample in 1995 and production mining in early 1996.

Crestbrook Forest Industries Ltd. owns the land and coal reserves and they have agreed to allow production mining to proceed. Appendix B provides a copy of their letter to McGillivray Mining Ltd.

)

The property is legally described as a portion of Lot 1, Plan 9514 of the Tent Mountain Block.

2.0 The Purpose and Major Project Components:

The purpose of the McGillivray contract coal mine is to provide for the utilization of a viable low strip ratio resource with a minimum of environmental impact.

The Elk Valley area, which includes Fernie, Sparwood, and Elkford in southeast B.C. has recently been impacted by severe changes and job loss. These negative developments resulted from a very large scale coal producer declaring bankruptcy (s.21) and a depressed coal market.

The Elk Valley is presently in a state of slow recovery but there is still a great deal of unemployment. The new owners of the Balmer operations are establishing coal contracts but they are still operating well below their annual plant capacity. A window of opportunity now exists for a small contract operation to provide coal to the large producer.

The development of the McGillivray coal reserves provides a opportunity to utilize a very viable resource with minimal environmental impacts and to assist the large scale producers with their mine development plans as they schedule higher ratio reserves.

The McGillivray project will not only provide jobs for Elk Valley residents but will contribute to the recovery of the Elk Valley in general.

The McGillivray project will operate as if it were a coal quarry. Raw coal will be mined with conventional construction equipment and hauted in highway type coal trucks to an existing preparation plant.

The major project activities will include the following:

- Drill, blast, load, haul and dump waste rock in low elevation minor dumps.
 Maximum back-filling of mined out areas will be included.
- Load coal at the mine site and haul it to the purchasers plant.
- Stockpile topsoil as much as possible for reclamation purposes.
- · Reclaim the areas of disturbance for abandonment.
- Construction will be confined to road upgrading and site preparation.
- Logging activities will precede waste dump construction.

3.0 Existing Background Information:

The proponent retained the services of Interior Reforestation Co. Ltd. in 1995 to gather and document environmental baseline information. This process was completed as part of the "Application for a Coal Bulk Sample", April 21, 1995. Section 3.0 includes the results of their preliminary investigations.

An Environmental Baseline Study began in May 1995 and Piteau Associates from Calgary Alberta was retained to complete the studies and provide an interim report for the purpose

of this application. The scope of work for Piteau Associates was developed and approved by the Ministry of Environment office in Cranbrook B.C., and will continue over a one year period. Appendix E provides the terms of reference from the Ministry of Environment and the interim report from Piteau Associates.

3.1 Environmental and Physical Setting

The proposed mine area is in the middle of an industrial area with Elkview Coal Corporation's operations immediately to the northwest and Fording Coal's Coal Mountain operations 20 km to the south. A twinned Alberta Natural Gas Pipeline crosses the property roughly 600 meters to the south. The land is not, therefore, as attractive as other areas in the district for hiking, snow sports, or other outdoor recreation. The area has been used by hunters but there is no potential for fishing. The primary land use is coal mining and forestry.

The west side of the property is bound by the Canadian Pacific Rail Line and the east side is bound by a ridge forming limestone.

The proposed pit excavation is located on a northwest facing grassed slope. The areas south and north of the pit are covered by forest and the least productive forest land exists below and west of the proposed pit area.

3.1.1 Climate

The average temperature and precipitation data for the years 1980 to 1992 was acquired from the Environment Canada weather station in Sparwood B.C. This weather station is located approximately 14 km northwest of the mine site and 310 meters lower in elevation.

Average temperatures range from a high of 15.3°C in July to a low of -8.2°C for December. Monthly precipitation ranges from a low of 33.3 mm in March to a high of 66.9 mm in November.

Wind data was acquired from Elkview Coal Corporation. Winds from the south to southwest are prevalent at the Mannix weather station and average between 11 and 14 km per hour. The prevalent wind direction at the Sparwood weather station is south to southeast. The Mannix weather station is approximately 10 km from the mine site.

3.1.2 Water

The area identified for the proposed mine site is located on a gently dipping (20°) dry slope. There are no water courses or springs in the pit area but minor to intermittent drainage's are crossed by the access roads. Culverts were installed as part of the access road upgrading for 1995. Figure 2 provides a site plan and air photo of the pit area.

Site inspections to date have not revealed significant weeping faces or ground water concerns in the area of the mine or mine access. There have been no stope failures or signs of instability as a result of erosion or ground water flows.

The old test pit provides an excellent opportunity to examine the rock mass and potential ground water concerns in the pit area. Here a 30 meter high exposure of the old highwall shows no signs of weeping faces or pooling in the pit bottom. The bedding is dipping roughly 60° to 65° to the west and there are no signs that the bedding is conducting any water.

Drainage will be accomplished by constructing a series of drainage ditches to control both clean water around the active mine area and silty water from the active working area of the mine. Dirty water will be directed to settling facilities illustrated on the "Mine and Dump Plans".

Water quality studies have begun as part of the Environmental Baseline study. The 1995 water quality data for freshet has been gathered and other studies are under way using site specific guidelines from the Ministry of Environment. Hydrology information is provided in the Environmental Baseline interim report (Appendix E).

The Ministry of Environment has advised that there are no water licenses in the area of interest.

3.1.3 Lakes and Streams

There are no major streams, lakes, or fish habitat in the immediate vicinity of the proposed mining area.

3.1.4 Soils and Surficial Geology

The soils in the vicinity of the proposed mine are classified as anthropogenic in the Ministry of Environment Biophysical Resources of the East Kootenay Area, soils report. The Anthropogenic Land type consists of severely man modified materials, caused by open pit mines.

Soils in the valley bottom are in the Lancaster Soil Association and are derived from fluvioglacial parent material, which are well drained and are generally sandy loam in texture.

Soils to the south of the mine site are in the Morrissette Soil Association and are derived from morainal parent material. These soils are moderately well drained and are silty clay loam in texture. This is a dark, shaley soil that is easily compacted.

Soils to the north of the mine site are in the Galton Soil Association and are derived from fluvioglacial parent material. These soils are well drained and are a gravely sandy loam in texture. These soils are found on sandstone derived terraces and fans.

Soils east of the mine site are in the Ridge Range Soil Association and are derived from Colluvial parent material. These stoney soils are rapidly drained and a gravely sandy loam in texture. Approximately 20% of this material is classified as Rock Outcrop.

3.1.5 Vegetation

The proposed mine site is located in the Msdk (Dry Cool Mountain Spruce) biogeoclimatic subzone as described in the Field Guide for Site Identification and Interpretation for the Nelson Forest Region. This subzone is characterized by climax zonal sites with stands of white spruce and subalpine fur with minor amounts of Douglas fir. Seral stands of lodgepole pine are common. False azalea, Utah honeysuckle and buffaloberry are common shrubs. Gooseberry, twinflower, pinegrass and heart-leafed arnica are common herbs. The mine site is located on a forest type classified as Open Range on the Crestbrook Forest Industries Forest Cover Maps. This Open Range is really a reclaimed mine excavation.

The area surrounding the pit area is dominated by lodgepole pine and trembling aspen. The majority of the pine stands are between 61 and 80 years old and are between 10 and 28 meters tall. Spruce and Douglas fir make up a minor component of the timbered stands.

Knapweed is known to occur near the site. Operators will be made aware of the presence of knapweed and a spraying program may be required.

3.1.6 Wildlife

The area around the proposed mine site is classified as E² X² M³ W₄ by the Ministry of Environment's Biophysical Classification for Wildlife Capability. This means that the area is generally high quality elk and moose winter range, moderate capability mule deer winter range, and low capability white tail deer summer range. High quality winter range has the capability of supporting 7 to 10 elk or 3 to 5 moose per square km per winter while moderate winter range has the potential to support 5 to 11 mule deer per square km per winter. Low quality summer range has the capability to support 2 to 5 white tailed deer per km square per summer. This area is important to ungulate species from late fall to early spring (D. Martin MOE personal communication).

Calving and fawning areas exist below the mine area and above the Michel Valley near the CPR rail line. Adequate movement corridors exist above and below the pit area. Mining activities will be timed so as to minimize the impact on wildlife. The mine management may chose not to operate during severe winter months to accommodate the wildlife. It is, therefore, very important that an approval be received by April 1996 in order for the operations team to meet their contractual obligations of 200,000 tonnes during 1996.

The area above the mine site is classed as low capability elk and mule deer summer range and very low capability moose summer range. The Michel Valley well below the elevation of the mine is very high capability elk winter range, moderate capability moose and mule deer winter range and low quality white-tailed deer summer range.

3.1.7 Fisheries

There are no streams or bodies of water in the proposed mining area or along the access roads that provide fish habitat.

Michel Creek is located 1,000 meters to the west of the pit area and a fishery value is present. The Environmental Baseline work will identify fish populations in Michel Creek (Appendix E).

3.1.8 Agriculture

The Canadian Land Inventory Map for the soil Capability for Agriculture identifies the area around the proposed mine site as 6 to T7 CT. This means that 80% of the area is class 6 agricultural soil, which is only capable of producing perennial forage crops and improvement practices are not feasible. This area is affected by adverse topography, with either the steepness or the pattern of slopes limiting agricultural use. Twenty percent of the area is classified as 7 CT. Soils in this class have no capability for arable culture or permanent pasture and are limited by adverse topography and climate.

3.1.9 Forestry

The Canada Land Inventory Map for forestry identifies the area around the proposed mine site as 47 M53 RM. This means that 70% of the area is class 4 forest land which has moderately severe limitations to the growth of commercial forests. Productivity from these soils will usually be from 51 to 70 cubic feet per acre per year. Soil moisture is the most limiting factor for timber production in the pit area. Thirty percent of the area is Class 5 forest land having severe limitations to the growth of commercial forests. Productivity from these lands will usually be from 31 to 50 cubic feet per acre per year.

3.1.10 Inhabited Places Near the Mine Site

The closest community to the mine site is the town of Sparwood B.C. Sparwood is located roughly 20 km west of the mine area and has a population of 2,000 people. The Corbin town site is located roughly 20 km to the south and six to eight residents live there.

3.1.11 Recreation

)

The Canada Land Inventory Map for Outdoor Recreation identifies the area around the mine as 5OQV. This means that the area has Class 5 outdoor recreation capability, which is moderately low. This area is classed as land affording opportunity for viewing upland wildlife with a variety in topography. Hiking and nature studies are possible activities in this area. The area is used by hunters between April 1 to June 15 and from September 1 to November 15.

3.1.12 Socio Economic Setting

Considering the negative impacts on the Elk Valley economy from the recent mine bankruptcies and down sizing of mines in the area, a new project like the McGillivray operation can only help the economy and provide some jobs for Elk Valley residents.

Considering that an average home may have two adults and two children in this area, each job created could affect four people. If the project could support 80 employees then 320 people will be positively impacted by the project. The operation and improved employment conditions will result in a positive impact on the local merchants and suppliers as well.

4.0 Project Facilities:

The McGillivray coal project will be operated without the need for any new infrastructure. All of the required facilities will be provided by the mining contractor (off site) or the purchaser of the coal (off site).

4.1 On Site Facilities

On site facilities will include a gate, first aid supplies, water storage and mine rescue supplies. Sewage facilities will be self contained and pumped out regularly. Communication facilities will be provided by mobile radios operated from mine supervisor's trucks, mine equipment, and a central dispatch.

4.2 Off Site Facilities

Fred Sowchuk Trucking Ltd. (contractor) has maintenance facilities along Highway 3 at the main access to Elkview Coal Corporation roughly 5 km east of Sparwood B.C. There will, therefore, be no need to establish any permanent on site facilities at the McGillivray mine site. All of the facilities will be supplied by using small trailers as needed.

Large scale producers near the McGillivray coal project will purchase the coal on a raw basis and process it through their existing plants. There will be no need for the preparation plants to expand or make major modifications to receive the coal.

5.0 **Project Construction and Timetable:**

McGillivray Mining Ltd. is scheduled to deliver roughly 200,000 raw tonnes of coal each year beginning in 1996. For this reason the operation must have approval early in 1996 in order to accommodate the contract obligations.

The construction work associated with the operation will include:

- Removing trees from the mine and dump areas.
- Stockpiling topsoil.

- Widening of access roads as required.
- Road upgrading was completed in 1995 as part of the bulk sample program.

Figure 16	Construction Timetable.					
1996 Schedule	May June July August September	October				
Tree Removal						
Widen access roads						
Stockpile Topsoil						

6.0 New or Expanded Public Works:

There will be no new or expanded public works as a result of the McGillivray Coal Project.

Potential Effects of the Project: 7.0

7.1 Socio-Economic

The major socio-economic effect of the project will be that eighteen to twenty employees will be working at the minesite on each shift. If four shifts are required, 80 employees will be needed. The communities of Sparwood, Fernie, and Elkford will be positively affected by the project.

A recent study by The Ministry of Forests from Cranbrook B.C. entitled "Cranbrook Timber Supply Area, Socio-Economic Analysis" prepared by Pierce Lefebvre Consulting of Vancouver B.C. in March 1995, has been used to obtain the most recent source material

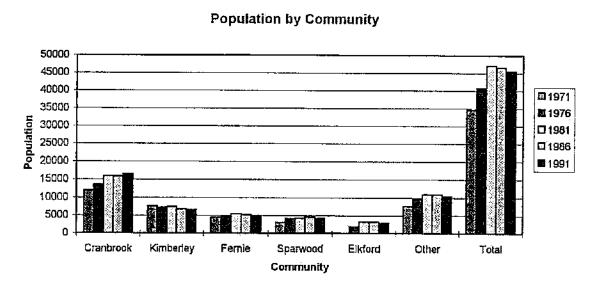
considering socio-economic issues for the area of interest. For the purpose of this report the source of information will be referred to as PLC, 1995.

The population of the mining communities will not be significantly changed because of the contract mine. Figure 16 provides a bar graph of the populations from the 1981 and 1991 census estimates, PLC, 1995. Table 1 illustrates population and percent change between 1971 and 1991 for communities in southeast B.C.

Table 1	Population by Community				
	<u>1971</u>	<u>1976</u>	<u>1981</u>	<u>1986</u>	<u>1991</u>
Cranbrook/Kimberley:					
Cranbrook	12000	13510	15941	15893	16447
Kimberley	7641	7111	7375	6732	6531
Census B	4226	6008	6913	7118	6914
Sub-total	23867	26629	30229	29743	29892
Elk Valley:					
Femie	4422	4608	5444	5188	5012
Sparwood:	2990	4050	4161	4540	4211
Elkford		1873	3126	3187	2846
Census C	3271	3563	3986	3758	3433
Sub-total	10683	14094	16717	16673	15502
Other	THE STATE ST	CONTRACTOR OF THE STATE OF THE	164	134	76
Total	34550	40723	47110	46550	45470

Source: Statistics Canada, Census Data. Extracted from PLC, 1995.

Figure 17



Source: PLC, 1995

The Elk Valley communities of Sparwood, Elkford and Fernie were developed to service the coal mining industry. Fernie was incorporated in 1904, Sparwood in 1966 and Elkford in

1971 when the Fording coal started a new mine 65 km north of Sparwood. The new mine employed 1,560 workers, PLC, 1995.

Coal mining is the dominant activity in the Elk Valley but the natural setting has provided for forestry, cattle ranching, outdoor recreation. Tourism is also an important part of the Elk Valley economy including golf, fishing, hunting, downhill and cross country skiing, and snowmobiling.

Table 2 illustrates the major Elk Valley employers. Employment is expressed in person years (PY). This is "a standard measure of employment that takes into account part time or seasonal full time work. For example, if an employee works full-time for six months, he or she accounts for 0.5 PYs of employment. Using PYs allows different types of employment to be compared on a similar basis ", PLC, 1995.

Table 2

Major Elk Valley Employers

Mining	PY's
Five coal mines (existing mines)	2/070
McGillivray Mines Ltd. (proposed)	240
Forestry	
Crestbrook Forest Industries	212
Galloway Lumber	108
Canada Cedar Pole	27
Public Sector	
School District #1	313
City of Fernie	50
District of Elkford	20
District of Sparwood	40
Fernie District Hospital	75
Sparwood General Hospital	60
Other	
Transwest Dynequip	54
Fernie Snow Valley (ski hill)	65
Overwaitea Foods	60
Total	3,154

Source: PLC, 1995

The McGillivray operation management may choose not to operate during December, January and February in order to accommodate the wildlife in severe winter conditions. If eighty employees work for 0.75 years for four years then the number of person years will be 240 for this application. Table 2 compares the McGillivray operation to the other five coal producers combined. This represents an increase for mining of 11.6%.

Considering the 1991 census the age structure of the population by community for southeast B.C. is presented in Table 3. In The Elk Valley 26% of the population is under 15 years old compared with all of B.C. at 20%. The population over 56 years is 7% while all of B.C. has 13% of the population over 65 years old, PLC, 1995.

Table 3

Age Structure of Population by Community, 1991

	Cranbrook	Kimberley	Elk Valley	B.C. Average
Age Structure			4.00	
% under 15	23	19	26	20
%15 to 34	30	24	31	30
%35 to 44	16	16	19	17
%45 to 64	20	22	17	20
%65 and older	11	19	7	13
1991 Population	16,447	6531	15,502	3,275,500

Source: Census Data, from PLC, 1995.

7.1.1 Economy

The main industries supporting the economy of the area are mining and forestry. Tables 4 and 5 provide estimates of employment and income prepared by the Treasury Board Secretariat of the Ministry of Finance and Corporate Relations. These tables also indicate that agriculture, ranching, tourism and the service sector are important contributors, PLC, 1995.

<u>Table 4</u> <u>Estimates of 1991/92 Employment in the Cranbrook</u>
<u>Timber Supply Area</u>

Number of Employees

	Cranbrook	Kimberley	<u>Fernie</u> <u>Elk</u> Valley	Other	Generated	% by Sector
Basic						
Mining	324	558	776 1876	580	1491	27
Forestry	937	194	68 32	896	665	13
Public Sector	1715	698	479 419	834	1074	25
Tourism	574	145	220 162	334	186	8
Agricul.	52	22	24 10	291	73	2
Other	1688	171	156 95	690	722	17

Source: PLC, 1995

In the Elk Valley region coal mining produced 18.7 million tonnes between 1987 and 1991. This dropped to 10.6 million tonnes in 1992 or 44% due to major shut downs at three of the five producing mines. Production increased to 12.9 million tonnes in 1993 and to 16.1 million tonnes by the end of the first quarter of 1994. Due to the fact that the world coal market has been depressed, employment levels are not expected to return to the 1991 levels. Ownership demands for higher productivity and more efficiency have reduced the size of the workforce, PLC, 1995. One producer has been operating at less that full capacity.

There are no plans for any new major mines in the Elk Valley region but there is a strong potential for a small contract type operation to succeed. The McGillivray project will increase the potential of the purchaser to produce additional coal without having to mine it themselves. The coal may be sold on a spot market as a stand alone product or blended to enhance the raw coal feed at the plant.

Table 5

Estimates of 1991/92 After Tax Income

After Tax Income (\$Million)

Basic Industry	Cranbrook	Kimberley	∘Femie ∘Elk ⊮ Valley∘	Other	Non- Basic	% by Sector
					SYLET AND SAGRAGES	to who have not become
Mining	7.9	16.0	23.1 60.4	20.3	26.4	27
Forestry	21.5	5.0	17 0.9	27.9	11.2	11
Public	33.5	14.9	10.8 10.5	22.3	18.3	18
Sector						
Tourism	5.6	1.5	2/5 1.9.	4.4	3.1	3
Agricul.	0.7	0.3	0.3 4 0.1	4.8	1.1	1
Other	32.5	3.9	3.5 2.4	19.6	12.2	12
Pension	20.5	13.5	6:1 4.2	2.8	9.2	9
Investment	22.2	5.4	5.3 4.4	0.9	8.2	8
Transfer	7.9	3.4	2.8 4.1	6,8	5.2	5
UIC	6.1	2,6	2.1 3.2	5.2	4.1	4
Soc.Secur.	5.7	1.5	1:12 0.9	0.8	2.1	2

Source: PLC, 1995

7.1.2 Unemployment

During the 1980's and early 1990's the Elk Valley suffered greatly along with other parts of the East Kootenay region. Average levels of unemployment are only starting to return to the B.C. normal levels. Jobs in forestry and mining bring high pay rates and when this high income is lost it is not easily replaced, PLC, 1995.

In 1992 the Westar Mining operation near Sparwood B.C. closed down. This created a serious unemployment problem in the Elk Valley. Table 6 provides the status of Westar mine workers as of March 1994, PLC, 1995.

<u>Table 6</u>

Status of Displaced Westar Mining Workers (as of March, 1994)

% of Displaced Workers	Sparwood	Fernie	Elkford	Other	Total
at local mines	36	37	38	30	35
own business	4	6	3	3	4
not in workforce	6	7	4	7	7
school	5	3	3	11	6
unemployed/status unknown	29	29	35	21	27
relocated/working	12	16	11	16	14
relocated/unknown	8	2	6	12	7

Source: PLC, 1995

The displaced workers are displaced as follows, PLC, 1995;

- relocated (34%),
- started their own business (6%),
- no longer in the labour force (10%),
- two years after the lay off 50% continue to live in the Elk Valley but are still unemployed, looking for work or in employment training programs.

7.2 Labour Force

The McGillivray project will have a positive effect because it will be operating on a similar shift schedule to the larger producers. The coal mines in the Elk Valley operate 24 hours per day and include two twelve hour shifts per day. The McGillivray operation will potentially employ up to eighty people and provide some new jobs for Elk Valley residents.

7.3 Health

The McGillivray coal project will be operated as a small contract operation. There is no potential for this small scale operation to require major infrastructure or sewage treatment facilities. Sewage will be managed using portable facilities and there will be no contaminated discharge from the project that will become a health hazard.

Water and air quality monitoring will be part of the mine operations process. Dust created by a small scale contract operation will be controlled using a water truck.

7.4 Environmental Effects

The Environmental Baseline Study will be completed in the Spring of 1996. From this baseline information it will be possible to determine any negative effects created by the mining operation. As the operation progresses a monitoring and reporting program will be established. The Environmental Baseline interim report is located in Appendix E.

7.4.1 Surficial Geology

The soils inside the vicinity of the proposed open pit perimeter are in an Anthropogenic Land type consisting of severely man modified materials, as caused by open pit mines. This area is covered by tall grasses and undertain by well drained loam and silty clay which has been dozed during reclamation. In places bedrock is exposed. The surficial geology inside the pit perimeter will be mined out and selected soils will be stockpiled for future reclamation.

Soils to the immediate west of the proposed pit perimeter and under the proposed waste dump area are in the Morrissette Soil Association and are derived from morainal parent material. These soils are moderately well drained and are silty clay loam in texture. This is a dark, shaley soil that is easily compacted. Exploration work has revealed bedrock at between three and seven meters. The soils in this area will be partly stockpiled for reclamation.

7.4.2 Waste Characterization Program

The waste materials produced by the mine will include topsoil, shale, siltstone and sandstone. These materials will be excavated from the open pit mine and placed in low elevation waste dumps. The waste materials will be end dumped from waste haul trucks. The top soil will be partly stockpiled for reclamation purposes.

7.4.3 Surface and Ground Water Quality

Inside the proposed mine area the only signs of water outside of temporary surface run-off exist in small seeps along the lower road (Figure 2). A surface and ground water sampling program and hydrology study are included in Appendix E. As the mine progresses a water quality program will be included and this will be co-ordinated with the Ministry of Environment office in Cranbrook B.C.

Michel Creek is located roughly one kilometre to the west and has been included in our investigations.

The practice normally followed by open pit mines is to keep the clean water clean and divert it around the active workings while silted flows are controlled and directed through a ditching and settling facility.

7.4.4 Surface and Ground Water Hydrology

To date there have been no permanent or significant flows observed inside the proposed active mine area. The hydrology in the vicinity of the mine is addressed in Appendix E. The mine drainage system will be designed to control flows and manage stream velocities if streams occur on a temporary basis. An in pit dewatering program will be developed

should ground water flows develop inside of the open pit area. These ground water flows will be controlled by drainage ditches and directed into settling ponds as required.

7.4.5 Vegetation and Forestry Resources

The effects of the operation on forestry resources are explained in Appendix H by Kimmur Forestry Consultants Ltd. The mining and dumping areas have been assessed for existing and potential land use plans. Inside the pit perimeter the tall grasses will be removed with the topsoil. The net effect of the project will be that there will be more usable productive land inside the areas of disturbance at abandonment than there is presently. A long term forest will be planted on the reclaimed areas, following the recommendations of the Forestry consultant.

7.4.6 Wildlife Resources

The effect on the wildlife resources is an important consideration for this project. Inside the areas of disturbance the reclamation plan will accommodate elk, deer, and sheep by providing more surface area of high quality land than there is presently. The abandonment plan (Figure 15) will create more southwest facing slopes than there are presently (8.7 ha, new) and provide for sheep terrain (6.6 ha, new) inside of the ultimate pit area where it is not back-filled.

The wildlife migration corridors east and west of the active mine area will not be impacted by the operation. The management of McGillivray Mining Ltd. may not operate the mine between December and February inclusive to further accommodate the wild life needs during winter conditions.

Wildlife studies are included in Appendix E by Piteau Associates.

7.4.7 Fisheries and Aquatic Resources

The only fisheries in the general area of the proposed mine site are in Michel Creek roughly 1 km to the west of the active mine area. Appendix E provides the results of our fisheries studies to date. The future water quality program will ensure that any negative impacts on the fishery value of Michel Creek are identified.

7.4.8 Land Capability

The McGillivray coal project will create a more productive and larger useful forestry land surface than is presently found inside of the proposed area of disturbance. There are two waste dumps required in the four year plan. These include an in-pit dump or backfill and an outside dump located along the west side of the lower access road. As these waste dumps are reclaimed at slopes of 2:1 a greater land surface will be created than presently exists. The reclaimed dumps will be reforested to provide for a long term forestry land base, as specified by the forestry consultants.

7.4.9 Archaeological and Heritage Resources

The Archaeological and Heritage Resources have been addressed in Appendix I, by Mr. Wayne Choquette

8.0 Proposed Preventative and Mitigative Measures:

The proposed preventative and mitigative measures have been discussed in Section 7.0 of this report under "Potential Effects of the Project". The preventative measures discussed include:

- surface and ground water management,
- fish and wildlife.

)

- water and air quality,
- · sewage treatment.
- dust control, and,
- a program to monitor the project after the certificate is granted. This will be coordinated with the Ministry of Environment representatives.

9.0 Plans Pertaining to Land Use and Resource Issues:

The plans illustrating the land use and forestry resource issues are provided in Appendix H. Plans related to the mining activities are located in Figures 9 through 15.

9.1 Mineral Claims

The B.C. Access Centre has advised that there are no mineral leases in the area of interest, as of April 17, 1995.

9.2 Trapping

Licensed users have been investigated and include trappers, guides and outfitters. There are no guides or outfitters using the area and the only trapper (licence number, 0423t 023) has given up use of the area of interest because of Ministry of Environment's land closure (as per phone call 20 Nov. 1995). Appendix D provides a licensed trappers map of the area.

9.3 Native Land Claims

Surface rights, and land ownership is controlled by Crestbrook Forest Industries Ltd. A "Land Lease" will be provided to McGillivray Mining Ltd. for the purpose of coal mining.

The First Nation council has been advised of the intent to develop the project and there have been no issues raised to date concerning native land claims on these private lands (Appendix I).

9.4 Logging Rights

Logging rights will be controlled by the land owner, Crestbrook Forest Industries Ltd.

9.5 Hunting

The Ministry of Environment presently has a full closure in place for the McGillivray Area. There is no vehicle access permitted but hunting on foot is allowed. Hunting boundaries will be carefully marked during periods of active mining, following recommendations of the Ministry of Mines.

10.0 Public and First Nation Liaison:

A program has been initiated in 1995 which has established initial liaison with the public and First Nation groups.

10.1 Public Information Distribution and Consultation Activities

The consultation program began with the "Bulk Sample" extraction in 1995 but the information included an explanation of the scale of the operation at full production. Notification and consultation has included the following:

- The Fernie Free Press, April 26, 1995.
- The British Columbia Gazette, April 27, 1995.
- The Elk Valley Miner, May 2, 1995.
- Meeting with Crestbrook Forest Industries Ltd. and The Corbin Wildlife Society to discus our intentions and their concerns on May 19, 1995.
- The Elk Valley Integrated Forestry Task Force, presentation on June 14, 1995 by Gerald Reeves P. Eng.
- The Fernie Free Press, June 21, 1995.
- The Elk Valley Miner, August 1, 1995.

10.2 Proposed Future Public Consultation

Future public consultation will include the following:

- Further local project updates through the Elk Valley Miner and The Femie Free Press.
- A public presentation will be held locally which will include maps and plans of the proposed mine along with photographs of the "Bulk Sample" program. This presentation will be attended by a representative of the Environmental Assessment Office.

10.3 First Nation Consultation Activities

The First Nation consultation efforts have been directed through the tribal council office in Cranbrook and Mr. Wayne Choquette who is an archaeologist retained by the proponent to assess the mining area and explain his findings to the First Nation representatives.

)

On October 16, 1995 the tribal office in Cranbrook was contacted and McGillivray Mining Ltd. was advised that, where private land is involved the First Nations representatives normally do not get involved. Mr. Hugh Taylor (the First Nation land and resources representative) did not express any concerns or raise any issues regarding land claims. He advised the proponent that the Ministry of Mines will provide them with a copy of this report.

10.4 Proposed Future First Nation Consultation Activities

After this report is reviewed by the First Nation representatives the proponent will arrange a meeting with them to discuss the findings of Mr. Wayne Choquette and the First Nation team their request.

10.5 Consultation with Government Offices, Municipalities, Regional Districts and B.C.'s Neighbouring Jurisdictions

Consultation with the B.C. Ministry of Energy, Mines and Petroleum Resources and the Ministry of Environment began in 1993 with a report presented during separate meetings with each group. The report was entitled "McGillivray Area Preliminary Exploration and Strategy", August 16, 1993 by Robert Morris P.Geo, and Gerald Reeves P.Eng. This report was circulated throughout the government offices to advise them of the potential of the McGillivray area.

Approvals for exploration work were co-ordinated through the Ministry of Energy, Mines and petroleum Resources office in Cranbrook in 1993.

A report was presented to The Ministry of Energy Mines and Petroleum Resources and a land use review committee including representatives from several government agencies on April 21, 1995. This report was entitled "Application for Approval of A Coal Bulk Sample". The report provided all of the known information available up to April 21, 1995 for the area of interest. This Application was successful and a bulk sample was delivered to the Elkview Coal Corporation in September 1995.

10.6 Issues Identified From Section 10.5

The areas of concern expressed by the government agencies include the following:

Fish and Wildlife:

The McGillivray area provides some winter range for ungulates and migration paths exist above and below the mining area. The "Ultimate Pit" area will disturb a northwest facing slope that was reclaimed in 1971 and is now covered with tall grass (Figure 2).

There are no south facing slopes impacted in the four year mine plan. The mine waste dumps will be reclaimed at slopes of two horizontal to one vertical (2:1) and will create south and southwest facing slopes to enhance the area for wildlife. These slopes will provide class 1 ungulate habitat at abandonment. Half of the area of the northwest facing grass slope (Figure 2) will be back-filled with rock and reclaimed at a slope of 2:1 (Figure 15). This will provide south and southwest facing slopes inside the area of the ultimate pit which is now facing northwest.

The management of McGillivray Mining Ltd. intend to plan their operation and coal haulage schedule to accommodate the wildlife needs during severe winter months. The mining operation will not impact the migration corridors along Loop Ridge, to the east or the slopes immediately above the Canadian Pacific Railway tracks to the west which are also used by deer during calving season.

Wildlife studies have been addressed by Piteau Associates in Appendix E.

Water Quality:

Water quality concerns have focused on Michel Creek. The Ministry of Environment from Cranbrook has asked the proponent to monitor the water quality for several metals and nutrients. Algae growth inspections were also requested. A request was made to sample and test ground water flows from below the mining area before it flows into Michel Creek and to sample Michel Creek both up and down stream of the mine site. The terms of reference, approved by the Ministry of Environment, and the water quality program is included in Appendix E.

11.0 Geology and Reserves:

11.1 Regional Geology

The McGillivray mining area is underlain by coal-bearing strata (Mist Mountain Formation) of the Jurassic/Cretaceous Kootenay Group. Geologically, the area represents the northeast edge of the Crowsnest Coalfield. This edge of the coalfield is highly faulted with the Erickson normal fault being the most prominent structural feature. Figure 4 shows the regional geology of the area.

The coal-bearing strata is west dipping and forms the east limb of a major syncline. The total area of the coal-bearing formation in the McGillivray area is roughly 100 hectares on the north and 100 hectares on the south of the ANG pipe line. The Alberta Natural Gas Company Ltd.(ANG) showed that up to ten coal seams are crossed by their pipeline.

11.2 Site Geology

)

The proposed mine site is centred at UTM 5 502 700 N and 661 400 E, Zone 11, near the centre of NTS map sheet 82G/10. Surface elevations vary from 1 350 to 1 500 m, while footwall elevations of the main seam range from 1 300 to 1460 m.

The area of the seam is approximately 350 m long in the north/south direction and 100 m wide, east/west. Within this area sixteen exploration holes were drilled in 1970, a total of 881.18 m, producing a drill hole spacing of approximately 30m. The holes were not logged by down-hole geophysical methods, nor were they surveyed down-hole (all of the holes were assumed to be vertical). Records show hole collar co-ordinates, total depth of hole, depth to coal, thickness of coal, and seam number. From the drill hole data base and the surface trace of the coal, footwall and hanging wall contour maps were prepared, and from these, cross sections (true east/west) were made.

The footwall of the main seam is moderately uniform and shows an overall strike of 155° and average dip of 60° to the southwest. In detail, the top portion of the seam dips more steeply, up to 80° near the surface and in the bulk sample pit. There is a slight kink in the footwall contours from north to south, as the strike changes from about 150° in the north to 165° in the south. This inflection point coincides with the thickest portion of the coal and may reflect a thrust fault along the seam.

Two air track holes were drilled into the footwall of the bulk sample pit to test for coal below the main coal seam. In both holes, only thin coaly layers were observed. The section above the main coal seam hosts one layer of coal which will be mined if it is deemed recoverable (at least one metre thick) as it is exposed. Figure 19 is a composite stratigraphic column for the proposed mine area.

11.3 Coal Quality

Coal quality has been assessed from the data provided by Elkview Coal Corp. This was further confirmed by a trenching and sampling program conducted by McGillivray Mining Ltd. in 1993 and the bulk sample taken in 1995. The property will provide a high quality metallurgical coal that will perform well in coal preparation plants that are operating in southeast B.C.

Table 7

Coal Quality

	Raw Coal (1)	Clean Coal (2)
% Ash	22.14	7,45
% Volatile Matter	23.48	incomplete
% Fixed Carbon	54.38	incomplete
Free Swelling Index (FSI)	4.5	7,5
% Sulphur	0.39	0.50
Gross Calorific Value cal/gram	6,501	incomplete
Reflectance in oil (3)	1.07	incomplete
% Yield (@ 1.50SG)		69.9

Notes:

- 1. As reported by Chemex Labs Ltd., Vancouver, 1993, for coal from the face of the old test pit.
- 2. As reported by Elkview Coal Corp., 1995, from near surface of the bulk sample site, a 1,000 lb. sample.
- 3. As reported by David E. Pearson and Associates, Victoria, 1993, for the same sample as #1 above.

11.4 Reserves

Early workers in the McGillivray area estimated geological reserves to be in the order of 140 Mt. Our estimates are confined to the cleared area of the old mine site, and include up to 1 Mt of in-situ coal in the main seam.

A mine design has been established in the cleared area of the old mine site which show as much as 800,000 tonnes to be recoverable. These reserves can be classified as proven.

The coal-bearing strata north of the ANG pipeline would indicate reserves of a further 4 Mt. Several areas are noted to host thick coal seams and exploration programs will be developed to explore the coal reserves north of the ANG pipeline during the mining period.

12.0 Mine Planning:

The mine planning has been organized in two Phases with Phase 1 representing the 1995 "Bulk Sample" extraction and Phase 2 representing production mining during 1996 and 1999 inclusive.

12.1 Bulk Sample Extraction 1995

A bulk sample extraction of roughly 20,000 raw tonnes of coal has been planned and completed during 1995. This was a necessary step because the buyers have had the opportunity to process McGillivray coal to define how McGillivray coal will perform in their preparation plant.

The bulk sample application was submitted to the Ministry of Energy Mines and Petroleum Resources on April 21, 1995. Approval was received July 26, 1995 (File No. 0600417 - 14675-30). Figure 8 provides a plan view of the as-built survey at the completion of the bulk sample program.

12.2 Ultimate Pit Plan

An ultimate pit plan has been provided in Appendix F which includes the Piteau Associates rock slope engineering report and pit wall design recommendations.

The ultimate pit provides a birds eye view of the open pit excavation after all of the material is extracted from it. This plan is necessary to allow the pit wall design engineer to assess the pit wall for potential failures and to recommend pit wall configurations that will be stable. The ultimate pit will be achieved by mining ten meter high benches.

The ultimate pit will be partly back-filled with waste rock in the north half of the pit by the end of year two mining (Figure 11).

The proposed bench configurations and elevations are provided in Appendix F.

After the geological data base was assessed, and considering economic limitations, an ultimate pit ratio of 3.3 bank cubic meters (bcms) of waste per tonne of raw coal was used to define the ultimate pit limits. The pit will produce roughly 783,000 tonnes of raw coal and 2,584,000 bank cubic meters of waste rock.

Coal will be mined from one main thick seam, (15 to 20 meters thick) and from a smaller upper seam, (3 to 5 meters thick).

12.3 End 1996 Mine and Dump Plan

The mine plan for 1996 represents the first year of production mining and will release 200,000 raw tonnes of coal and 640,000 bcms of waste rock, Figure 10.

)

)

Mining will begin in the north half of the ultimate pit area with a starter pit beginning at elevation 1380 meters and achieving a depth of 1330 meters. This area will release 200,000 tonnes of coal and 388,000 bcms of waste rock.

Coal and waste from the north starter pit will be hauled out of the pit via an access road which provides a safe 8% gradient between 1380 and 1330 elevations. The lower access road (road #1 figure 2) to Michel Creek Valley and the Corbin access will be used to accommodate both the waste and coal haulage from the north pit.

Waste rock from the north starter pit will be placed in a single lift at 1380 meters elevation (Figure 10) just south of the pit area. The maximum dump height will be roughly 20 meters. This dump surface will be easily achieved as the existing 1380 meter elevation access road is expanded to the west.

A drainage ditch and settling pond will be constructed to control run off water around the toe of the dump.

The year one plan will also include pre-stripping in the south half of the pit area. Prestripping will be completed between 1470 and 1430 elevations exposing metallurgical coal for year two mining.

Waste rock from the south pit area will be hauled down to the main waste dump along the lower access road and placed into a fill at 1370 meters elevation (Figure 10). A ramp will be end dumped at a gradient of 5%. Waste rock from the south pit area will be hauled down the upper road (road #2, Figure 2).. Some of the rock will be used in the construction of the upper access road. In-pit ramps will be limited to a 10% grade

12.4 End 1997 Mine and Dump Plan

During 1997 all of the mining activity will be concentrated in the south half of the ultimate pit area, Figure 11.

With the completion of the north starter pit in 1996 it will be possible to start a back-filling operation in the north pit area.

Mining benches active during year two will include 1440 to 1380 inclusive. The coal release will be 200,000 raw tonnes and 686,000 bcms of waste rock will be mined.

The coal will be hauled down the upper access (Figure 2 road #2)to the Michel Creek Valley and the Corbin Access.

Waste will be hauled along the east side of the pit to 1390 elevation where it will be end dumped into the mined out north starter pit.

The main waste dump outside of the pit area to the west is not active during year two (1997). It will be possible to re-slope a portion of the 1996 waste dumps and reclaim them. The abandonment plan for the McGillivray property is to provide a forestry land base and it will be possible to spread topsoil and reforest the dump slopes below the 1380 elevation dump along the west side.

Figure 14 provides a plan view of the staged reclamation program for the property which will allow for annual reforestation.

12.5 End 1998 Mine and Dump Plan

During year three (1998) active mining benches will include 1410 meter elevation to 1350 meter elevation inclusive. The coal release will be 200,000 raw tonnes and the waste associated with the coal will be 600,000 bcms, Figure 12.

Coal and waste rock will both be hauled out along the west side of the pit over the 1380 meter elevation waste dump. Coal will be hauled to the Corbin Access in Michel Creek Valley and waste rock will be placed into the 1380 dump to the south.

In pit ramps will be limited to 10% gradients and a flat haulage road will be used along 1370 elevation below the reclaimed 1390 back-filled dump slope in the north pit area.

The back-filled waste dump in the north pit area will be reclaimed during 1998. It will be possible to place topsoil onto the re-sloped dump and plant trees in preparation for abandonment.

12.6 End 1999 Mine and Dump Plan

During 1999 the ultimate pit will be completed as mining activity takes place on benches 1400 meters to 1330 meters inclusive. Waste volumes will include 658,000 bcms of rock and 200,000 raw tonnes of coal which will be hauled via the lower access road to Michel Creek Valley, Figure 13.

Waste rock will be placed into the 1380 meter elevation waste dump and this lift will be completed. A final ten meter lift (1390 meters elevation) will be placed on top of the 1380 dump. This lift will provide the dump capacity required to complete the four year plan.

A flat bench will be constructed on the waste dump at 1380 meters elevation as the dump faces are reclaimed to a slope of two horizontal to one vertical (2:1).

A pit road will be established along the west pit wall where the bedding is dipping out of the road to the west at roughly sixty five degrees. This will provide the safest ultimate pit access at a grade of 8%. Maximum ramp grades in the pit bottom will be at 10%.

The waste dumps will be reclaimed and re-forested up to 1380 meters elevation at the end of 1999. The 1999 dump and the final abandonment plan will be reclaimed by end year 2000.

13.0 Rock Slope Engineering:

The proponent has retained the services of Piteau Associates (Vancouver B.C.) to develop the final pit wall designs for the McGillivray project.

The preliminary ultimate pit was designed by G.S. Reeves Associates International Ltd. and geotechnical mapping was initiated by Morris Geological Co.Ltd.

A site visit and geotechnical mapping program was completed by Piteau Associates and their report is included as Appendix F.

14.0 Dump Foundations and Stability:

The proponent has retained the services of Piteau Associates to provide the waste dump design specifications for the McGillivray project (Appendix G).

A site inspection and exploration program was completed in October 1995 to investigate dump foundation conditions adjacent and to the west of the lower access road.

The program included five backhoe trenches using a 225 Cat backhoe. Detailed descriptions are provided in the Piteau report.

Two air track bore holes were also drilled to confirm the depth to bedrock. These holes were drilled on the lower road. The backhoe reached bedrock at each trench location.

The report from Piteau Associates in Appendix G demonstrates that the waste pile will be safe and stable with a safety factor of 1.48.

15.0 Forestry Assessment and Planning:

McGillivray Mining Ltd. has developed a four year mine plan that will provide the land owner (Crestbrook Forest Industries Ltd.) with a larger productive long term land base than the area can presently provide.

Kimmur Forestry Consultants Ltd. were retained to provide an assessment of the area before mining and after the reclamation program. Appendix H contains their report and recommendations.

The area of the old open pit excavation presently has no tree growth on it but presents a reclaimed grass slope as a result of previous mining activity. The mine plan presented by McGillivray Mining Ltd for 1997 (year 2 mining) requires that the north half of this area be back-filled and reclaimed with 2:1 slopes. These slopes will be reconditioned with topsoil and planted with trees during 1998 (year 3 mining, Figs. 11, 14, 15).

The area required for waste rock disposal outside of the pit area presently contains 13.5 hectares of partly forested land on very gentle slopes. McGillivray Mining Ltd. will provide a staged reclamation program that will increase the forestry land base to 14.6 hectares at abandonment. This represents an increase of 1.1 hectares of forestry land as a result of mining (an 8% increase).

It will be possible to stockpile topsoil in the dump area and condition the 2:1 slopes as the gentle slopes are planted with trees for abandonment.

The area selected for the waste dump provides stable conditions for waste piles (Appendix G) and is located in a low growth area on gentle slopes. The maximum dump height has been controlled at thirty meters to provide for better access and ease of reclamation and reforestation.

The total increase in the forested land base considering the pit and outside dump areas is 4.6 hectares.

16.0 Topsoil Management:

Topsoil will be stockpiled in selected areas on the mine site. During 1995 topsoil was stockpiled along the east edge of the bulk sample excavation, Figure 8. This material will be relocated to the north to accommodate the expanded mine planes.

More top soil will be stored in the northwest corner of the pit area along the pit crest to provide for reclamation of the 1390 elevation waste dump which back-fills the north half of the open pit in year 2 mining (1997), Figure 14.

Topsoil for the waste dump designed outside of the pit area along the lower access road will be dozed into piles along the base area of the waste dump. This soil will be placed onto the re-sloped dump surfaces as the slopes are reclaimed in stages, Figure 14.

The four year plan allows for the following reclamation schedule:

Table 8

Reclamation Schedule

Mining Year	Area of Mine (ha)	Area of Dump (ha)	Area Reclaimed (ha)*
1996 (year 1)	5.5	8.9	0
1997 (year 2)	2.4	0 (backfill)	3.1
1998 (year 3)	1.7	3.9	2.7
1999 (year 4)	0	0.7	4.0
2000 (year 5)	0	0	9.5
Total Area	9.6	13.5 (main dump)	19.3**

^{*} the area reclaimed reflects slope lengths at 2:1 slopes.

During 1996 which is scheduled as year one mining there will be no reclamation work as the mine and outside waste dump will be initiated. Top soil will be stockpiled during this period along the northeast pit perimeter and in the vicinity of the 1380 meters elevation waste dump beside the lower access road.

During 1997 or year 2 mining the development of the outside 1380 meter elevation waste dump will stop and the north half of the pit will be back-filled with waste rock from the south half of the proposed ultimate pit. During this period it will be possible to re-slope and begin reclamation of the 1380 meter elevation waste dump slopes constructed in 1996, year 1.

In 1998 which represents year 3 mining it will be possible to complete re-sloping and reclaim the back-filled dump constructed during year 2 (1997).

Further reclamation work will be completed on the 1380 meter elevation dump along the lower access road. This dump is active during 1988 mining (Figs. 11, 12).

In 1999 the four year mining plan is completed. During this year the 1380 meter elevation waste dump slopes are mostly reclaimed and reforested and a final 1390 lift is placed on the dump (Figure 13).

In the south half of the ultimate pit area it will not be possible to re-slope or reclaim the surface. The pit walls remaining may bring new wildlife into the area and provide sheep terrain (Figure 13). As the property is further explored and if future reserves are promising, it may be very feasible to plan a back-filling operation into the remaining south half of the ultimate pit,

In the year 2000 there is no further mining proposed at this time however reclamation work will continue as the 1380 and 1390 elevation waste dumps are finally reclaimed and reforested.

^{**} includes roads.

17.0 Abandonment Plan:

)

An abandonment plan for the four year operation is provided in Figure 15. The abandonment plan presents waste dumps resloped at an angle of 26.6 degrees (2:1) and reclaimed to provide Crestbrook Forest Industries with a more productive 80 year forest than presently exists (Appendix H).

The abandonment plan also provides more southwest facing slopes than presently exists as wildlife habitat.

Road reclamation will be a combination of resloping along the crest areas and planting grasses along the road surfaces. The road access is important in the area because it provides access for the ANG pipeline maintenance and forest fire access.

Two waste dumps will be reclaimed in the mine plan. The waste dumps include an in pit backfill dump at 1390 meters elevation and a waste dump outside of the pit area beside the lower access road at a maximum elevation of 1390 meters.

The guidelines for the forestry reclamation program are outline in the Kimmur report in Appendix H, page 10. They explain techniques that should be used to provide for a good forestry reclamation program.

The south half of the ultimate pit will remain as a benched wall creating sheep terrain. This area will provide an excellent opportunity for backfilling should the pit be expanded beyond the four year plan. It will likely be possible to place all of the waste from any expansion plans north of the ANG pipeline directly into the year four ultimate pit area.

The drainage system established throughout the four yearly plans (Figures 10, 11, 12, 13) will provide the ability to keep the clean natural run-off out of the working area and directs flows into a natural drainage. At abandonment there will continue to be silted water flowing out of the base of the north backfilled pit. This flow will represent an accumulation of water from the completed ultimate pit. All of the silted water will be treated along the 3 % grade drainage ditches below the pit and dump areas. Catchment areas will be established in the drainage ditches and a settling facility will provide the final treatment before the water is discharged into the natural drainage system.

17.1 Reclamation Planning

As the four year mine plan is developed it will be possible to re-slope and reclaim areas of disturbance. It is hoped that the program for reclamation bonding will forgive parts of the funds that are committed as the project is reclaimed, Figure 14.

18.0 Coal Stockpiles:

There are no coal stockpiles presently required on the mine site. In the future it may be necessary to allow for small stockpiles of coal inside the mining area and should this occur the design and control of stockpiles will be reviewed with the government agencies responsible for their control.

19.0 Haulage Roads:

The three haulage road segments outside of the pit area are discussed separately to explain how they will be designed and used during the four year mine plan.

The roads are described as follows:

- The main Corbin road access.
- Lower haul road #1,(Figure 2).
- Upper haul road #2, (Figure 2).
- In pit roads Figures 10, 11, 12, 13.

19.1 Main Corbin Road Access

This road begins at the rail loop and the junction of the property access with the main Corbin access road. As this road is travelled to the north it traverses roughly 1.6 km at an overall grade of 5.3%. This portion of the haulage system stops at the junction of the upper and lower pit access roads (Figure 2).

The main Corbin access portion will be upgraded to accommodate highway type coal haulage trucks. Figure 18 provides a typical cross section of the two way coal haulage road with a running surface of ten meters. A ditch will be constructed along the inside edge of the road and a safety berm will be placed along the outside edge of the road.

Waste rock material from the mine will not be hauled along the main Corbin road access to waste dumps.

19.2 Lower Haulage Road

During year one mining (1996) the lower road will be filled with waste rock from the pit area to an elevation of 1380 meters. The lower road (road #1, Figure 2) will be relocated over the 1380 meter elevation waste dump as illustrated in Figure 10. This road will accommodate a two way waste haulage for 35 ton capacity waste trucks with a running surface of roughly 11.5 meters. Figure 18 illustrates the design cross section for the waste haul road including a drainage ditch and safety berm as required. The lower road will include a strike length of roughly 1.1 km with maximum grades of 5% at the south end and

8% at the north end where the north pit area is accessed during year one mining. This road will also be used for the coal haulage from the north pit area during year one.

19.3 Upper Haulage Road

The upper haul road (road #2, Figure 2) traverses roughly 1.3 km at an overall grade of 6.8%. This haul road will be upgraded to coal haulage design specifications (Figure 18) for two way haulage by the end of year one mining.

During year one mining it will be necessary to pre-strip waste rock from the upper south end of the pit to prepare for coal release during year two mining. Waste rock from this area will be hauled down the top road and may be used for road construction. Some of this waste rock will be placed into the waste dump along the lower access road (Figure 10). After year one mining is completed there will be no further waste haulage down the upper access road in this four year plan. The upper haul road will be designed as a coal haulage (Figure 18).

19.4 In Pit Roads

In pit roads will be designed for two way waste haulage's for 35 ton capacity waste trucks. Figure 18 provides a typical waste haulage road cross section. The in pit ramps will be designed at 8% wherever possible but a maximum grade of 10 % will be used when necessary.

19.5 Switchbacks or Tight Curves

Switchbacks in the pit area will be flat where possible with turning circles designed to allow for safe continuous haulage.

Some super-elevation of the outside of the switch backs may be required (approximately 1 meter). Figure 18 provides a typical switchback. The turning radius selected will accommodate a 769 C Caterpillar 35 ton capacity waste hauter.

20.0 Settling Pond Requirements and Drainage:

To be consistent with good environmental practices the mining plans will call for perimeter ditching above the active mine workings that will convey flows into existing drainage patterns and carry them out of the active mine area. These ditches will be designed at overall grades of roughly 3% and where steeper grades are encountered in may be necessary to use drop structures and large rocks to take the energy out of the flowing water. The area above the proposed pit is very dry but spring run off will create some flow conditions. This approach will keep the clean water clean and out of the active area. Ditches along the uphill side of the main access roads will convey flows before they reach the active mine areas.

Surface water runoff from the development areas of the mine site, including roads, waste dumps, and cleared and disturbed areas will be intercepted by ditches and/or berms. These flows will be collected and directed to a treatment pond to reduce the suspended solids concentrations to below the accepted criteria of 50 mg/L (Piteau Associates comment).

The treatment facility will consist of a pre-sedimentation cells to remove coarse sediment and at least one settling cell or pond. Given the terrain at the site it may be necessary to construct the settling facilities in a terraced manner. The configuration of the cells will permit the installation of a flocculation facility should it be required to achieve the pond effluent criteria.

The sedimentation facility will be designed to treat the runoff resulting from the maximum 1 in 10 year, 24 hour rainfall event (Piteau Associates comment).

Flows in excess of the design discharge will be diverted, without treatment, around the treatment facility to preserve its integrity and prevent the reintroduction of settled solids into natural water courses (Piteau Associates comment).

Inside the pit area the pit water will be controlled using in-pit ditching and the silted flows will be drained from south to north as the pit is deepened each year. Silted water will be conveyed into a drainage system designed to control flows into a settling pond structure. Figure 10 illustrates the silted drainage system and grades will be roughly 3% with energy dissipating structures installed as required. Figure 20 provides a cross section of the settling pond structure.

If water is encountered in the north pit area during year one mining a sump or combined sump and pumping operation may be required to allow for the final removal of coal from the pit floor.

Pit drainage will ultimately flow into the mined out north pit after year one mining is completed. The mine plan calls for a backfilling of this area during year two mining (Figure 11). The question about controlling the pit drainage beyond year one mining will be addressed as follows:

McGillivray Mining Ltd. will be completing an exploration drilling program in the north pit area in 1996. The objective will be to improve our knowledge of the footwall location and the northern extent of the main coal seam. It is expected that the coal seam will pinch out at some point in depositional glacial gravel's west of the main pit area. Once this point is known the northern extent of the north pit excavation will be defined. It may be possible to excavate the north end of the pit to daylight and allow the flows to be trained into a settling pond and then into a natural drainage system. Once the additional exploration work and final design is completed in 1996 the drainage plan will be reviewed with the appropriate government agencies.

)

A drainage ditch is planned along the 1350 bench elevation to convey pit water during the four year mining period along the east pit wall to the north pit where it will drain out into a drainage system that will collect silted flows and direct them into the settling facilities below the waste rock dump. The drainage plan may be necessary to keep the pit bottom dry during year four mining. The possibility also exists that the pit may remain relatively dry throughout the four year period.

21.0 Mine Operations:

Mining operations will be managed by a mining contractor with a strong reputation in southeast B.C. (Fred Sowchuk Trucking Ltd.). Considering the four year plan, the contractor will provide the labour force, equipment, field supervision, maintenance facilities, safety and loss control and other requirements to ensure good operating practices.

The contract mine will not require any structures that will be permanent on the mine site and there are presently no plans to bring electric power into the area of interest. A portable trailer and washroom facility may be required on site.

21.1 Equipment Required

It is proposed that the project will require the equipment listed in Table 9 to develop the coal reserves.

Table 9

Description	Number of Units (Approximately)
14 G Cat Grader	1
Water Truck	1
Fuel Truck	1
Maintenance truck	1
988 Cat Loader / Rock	1
988 Cat Loader / Coal	1
Highway Coal Haulers	4
Off Highway Waste Trucks 35 ton	4
Light Plants	2
D8 Cat Dozer	
D9 Cat Dozer	1
225 Cat Backhoe	1
Blast Hole Rotary Drill	ì
Blasting Truck (part time)	i
Pickups	ż
ı	_

21.2 Operating Schedule

The mine is presently scheduled to operate two twelve hour shifts per day seven days per week but this schedule could change once actual operating performance is assessed. The mine may operate approximately nine months of the year to accommodate the wildlife concerns in the area.

21.3 Safety and Loss Control

The safety and loss control program will be managed by the mining contractor. This program will include first aid supplies and mine rescue supplies being located on site and supervised by a certified holder of a valid "Shift Boss Certificate". The safety and loss control program will be co-ordinated with The Ministry of Energy Mines and petroleum Resources.

A main gate will be located along the lower access road. The mining area will be clearly marked with signs.

Mobile radios and radio phones will be used to co-ordinate the mine operations. A central dispatch exists at the office of Fred Sowchuk Trucking Ltd.

21.4 Drilling and Blasting

McGillivray Mining Ltd. expects to rip and doze a large portion of the waste rock especially along the hangingwall side of the coal seam. Here the waste rock appears to be thinly layered with beds of shale and siltstone/sandstone. It is expected that the portion of the waste rock that can be ripped will decrease as the coal is exposed at greater depths. A rough estimate indicates that 30% of the waste rock may be ripped with cat dozers. For this reason, and also to reduce pit wall damage, a drilling and blasting program will be required.

The drilling and blasting program will be co-ordinated with ICI explosives and their blasting physics department. Before mining begins a detailed drilling and blasting program will be established.

The drilling program will include a 18 to 23 cm diameter rotary blast hole drill developing 10 m high benches and drilling roughly 1.0m of subgrade.

Blast patterns will be spaced to provide particle sizes best suited for efficient loading with a 988 Cat front end loader. This material will likely be 80% passing 15 centimetres in size. Blast patterns may range from 6m x 6m to 8m x 8m, for full production blasts.

For highwall and footwall blast design special studies will be co-ordinated with the ICI blasting physics team to determine peak particle velocities suitable for our pit walls. This may involve pre-shearing or decoupled blasting techniques used throughout the Elk Valley

mining community. The program will be aimed at developing pit walls that are achieved with minimal wall damage.

The type of blasting materials will be controlled largely by the amount of pit water found in the blast holes. It is expected that most of the blast holes will be dry and that ANFO (Ammonium Nitrate and Fuel Oil) will be used exclusively. For wet holes a 6 mil plastic liner may be used to line the holes before the ANFO is used. The charges will be detonated using TNT primers and initiated with conventional methods. Blast delay time will be tested to provide for the optimum blast performance. The project will not require enough ANFO or blasting materials to justify any permanent facilities. Bulk Explosives Ltd. from Calgary will provide the needed materials on a contract basis as they are required.

Fly rock will be controlled as part of the blasting program.

Should very wet holes occur in the pit bottom it may be necessary to use a slurry or packaged slurry which will repel water and allow blasting. The use of this material is expected to be minimal.

21.5 The Planning Cycle

The operations team will be provided with short term monthly or weekly mining plans. These plans will be broken down from quarterly plans and an annual business mine plan. In this way the annual budgeted plan is controlled through the operating plans. In order to control this process a weekly survey will be completed and the as built bench positions will be plotted. The mine will be planned for the following week by the mining engineer designing inside of the monthly plan using the survey plan as a guide.

Bibliography:

Roger J. Berdusco, <u>A Case Study and Analysis of the Reclamation of Three Surface Coal Mines in the Crowsnest Pass Region of British Columbia, UBC Thesis, 1974, Dept. of Forestry.</u>

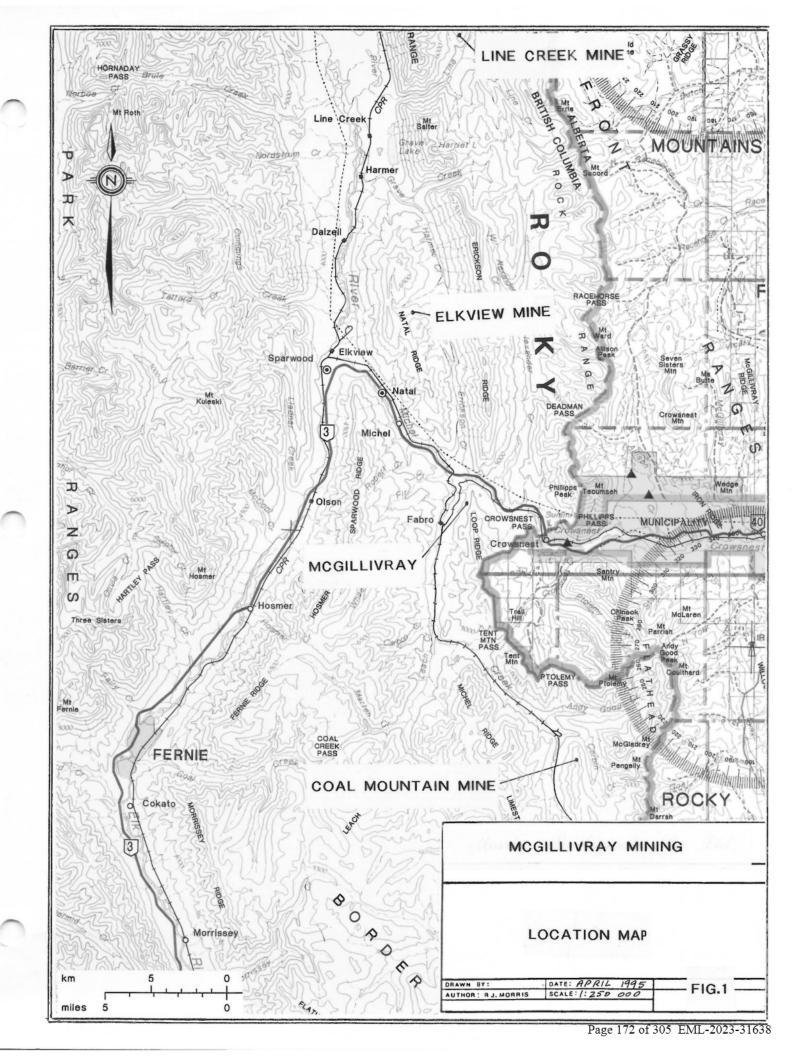
J.J. Crabb, Supplementary Report on the Geology of the Loop Area, October, 1964.

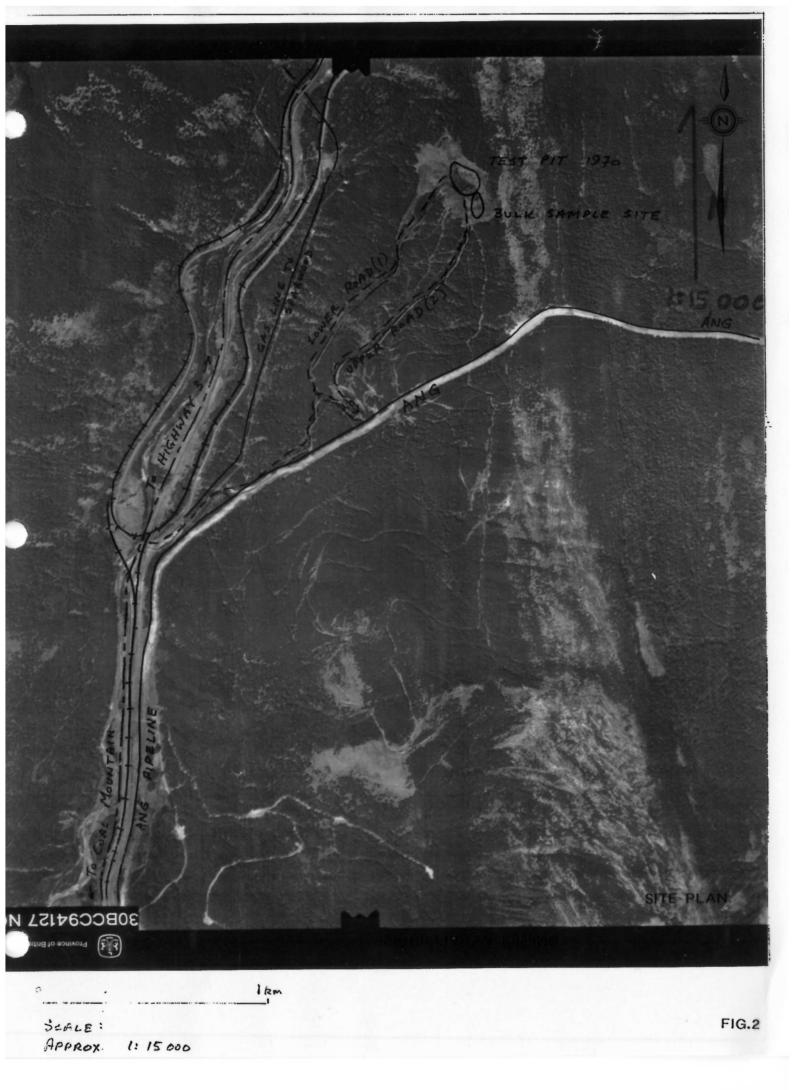
Pierce Lefebvre Consulting, Ministry of Forests, <u>Cranbrook Timber Supply Area, Socioeconomic Analysis, March 1995.</u>

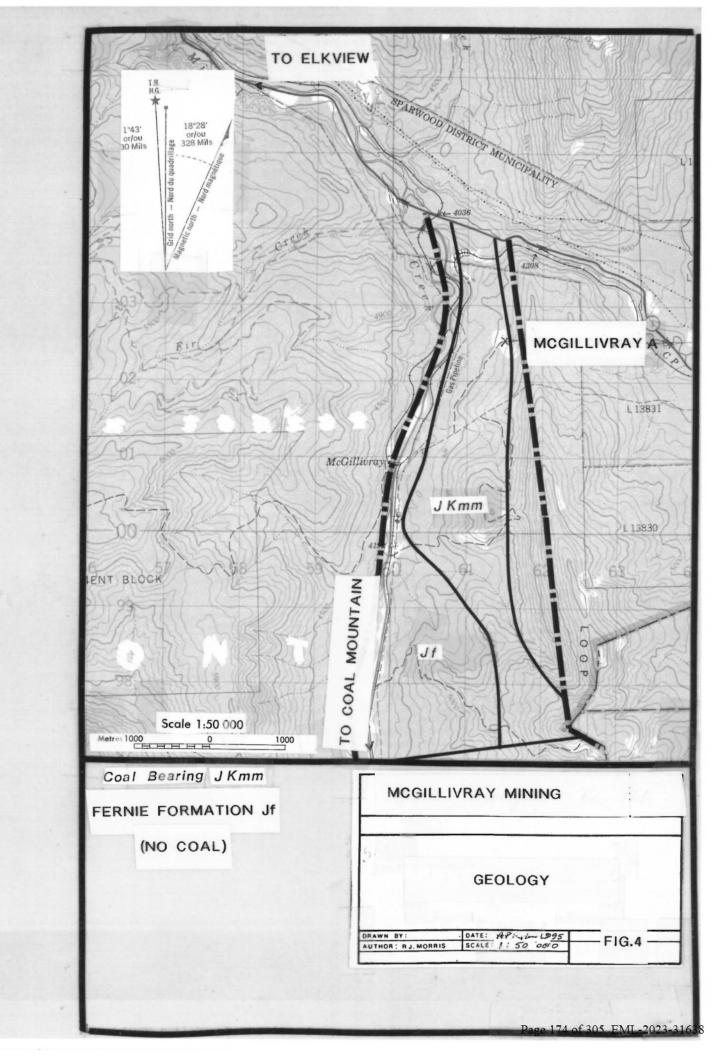
C.B. Newmarch, <u>The Geology of the McGillivray and Loop areas, South-eastern B.C., May, 1964.</u>

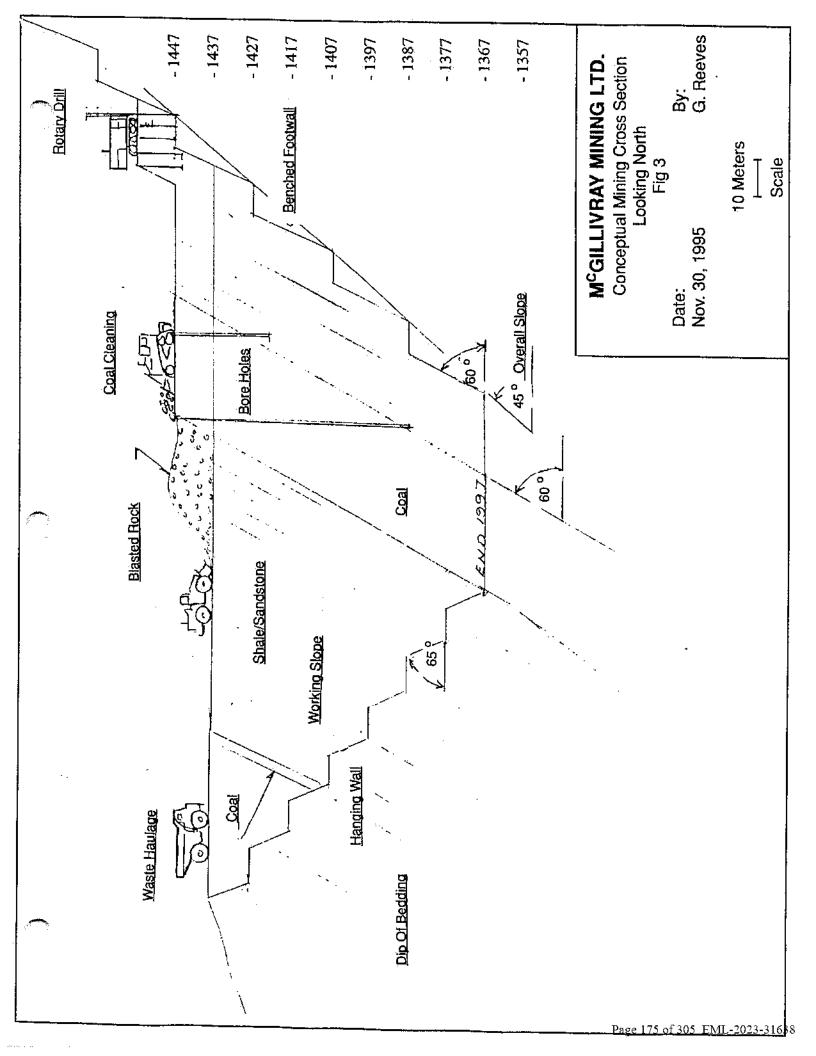
Gerald S. Reeves and Robert J. Morris, McGillivray Mining Ltd., <u>Application for a Coal Bulk Sample, April 21, 1995.</u>

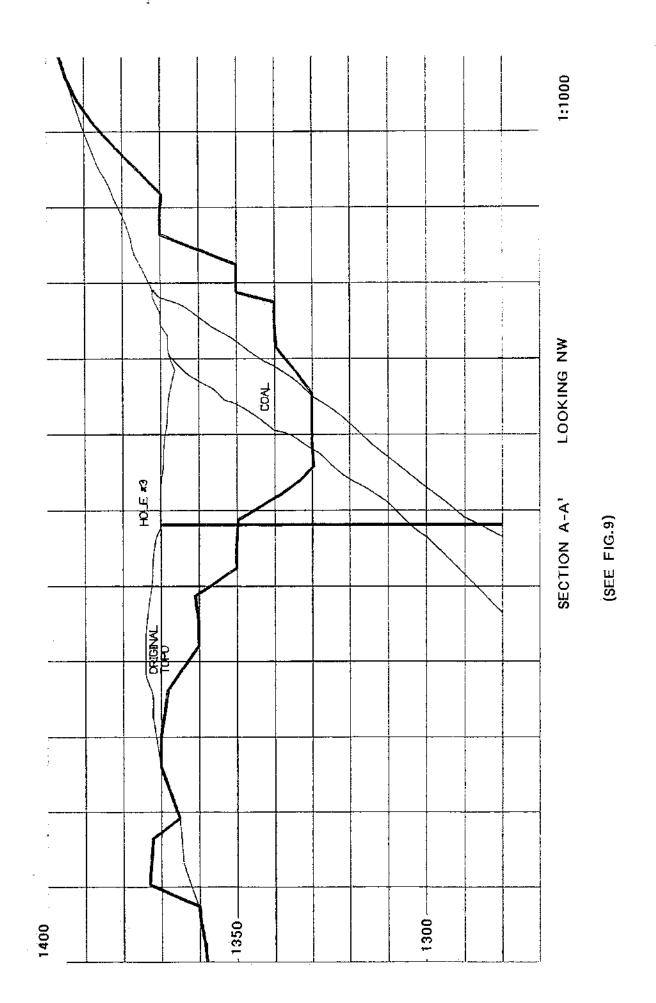
H. Wilton-Clark, and C.B. Newmarch, <u>The McGillivray Area, South-eastern B.C., June, 1961.</u>

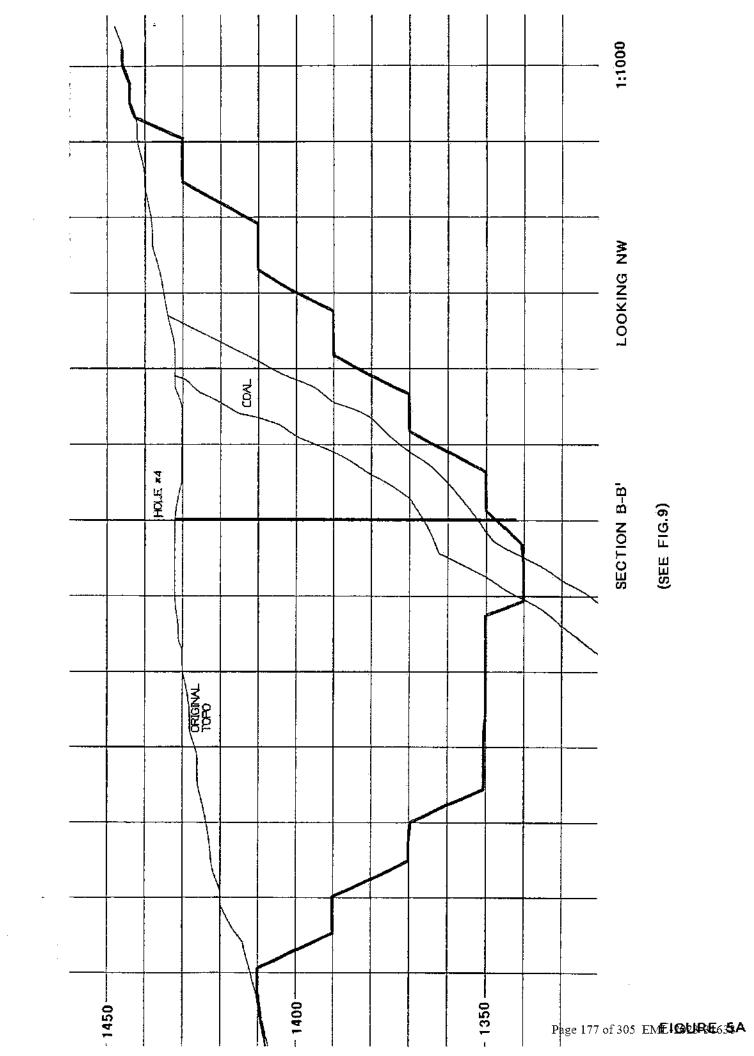


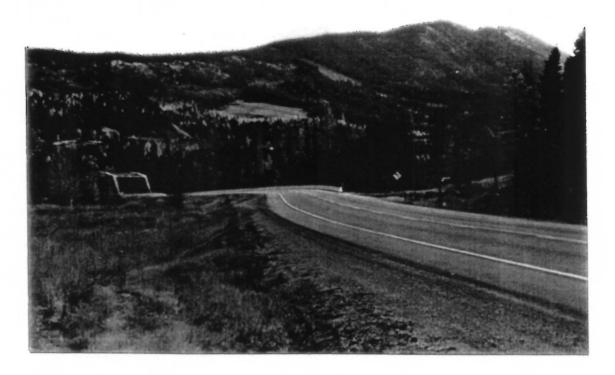










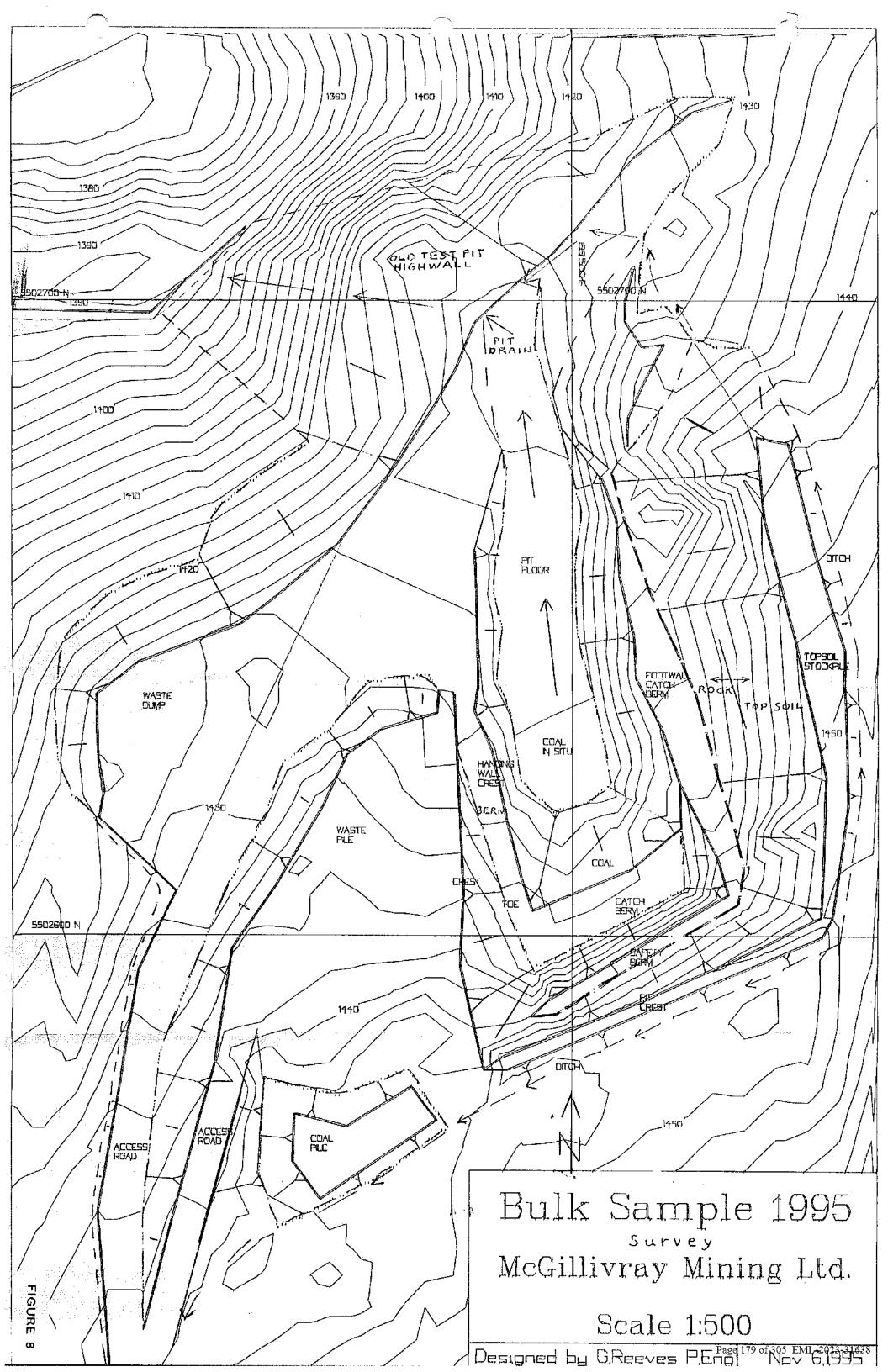


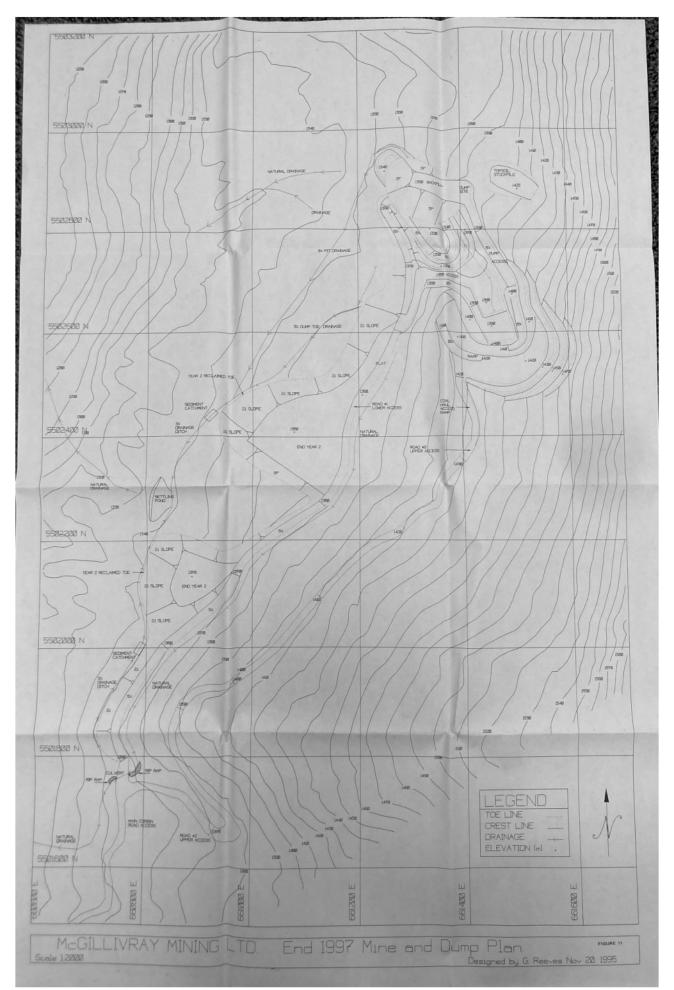
THE McGILLIVRAY AREA, LOOKING SOUTHEAST FROM HIGHWAY #3
Figure 6.

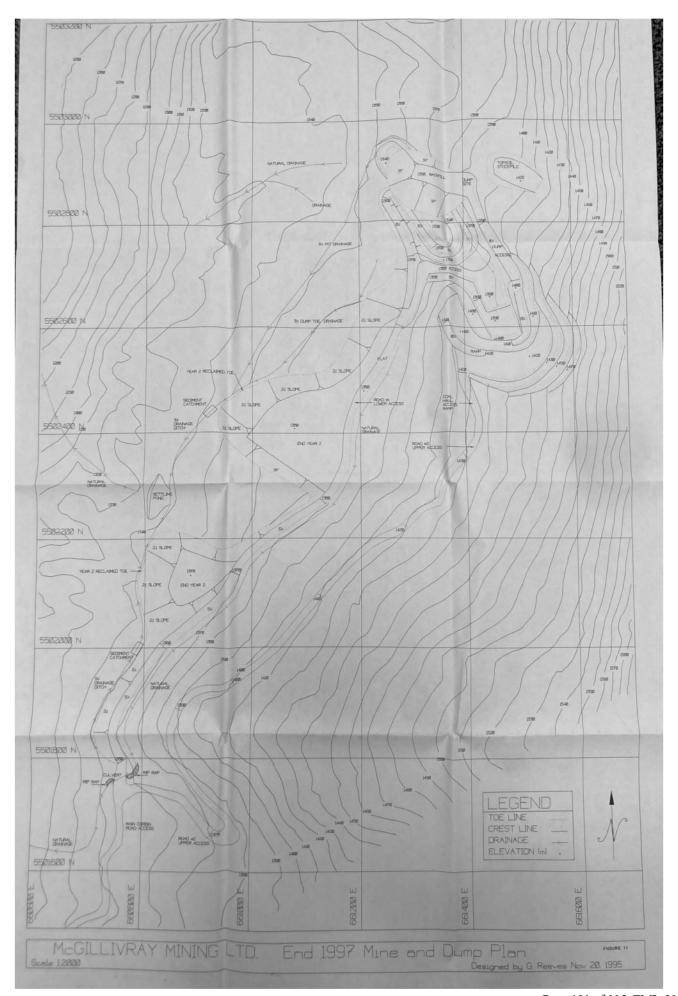


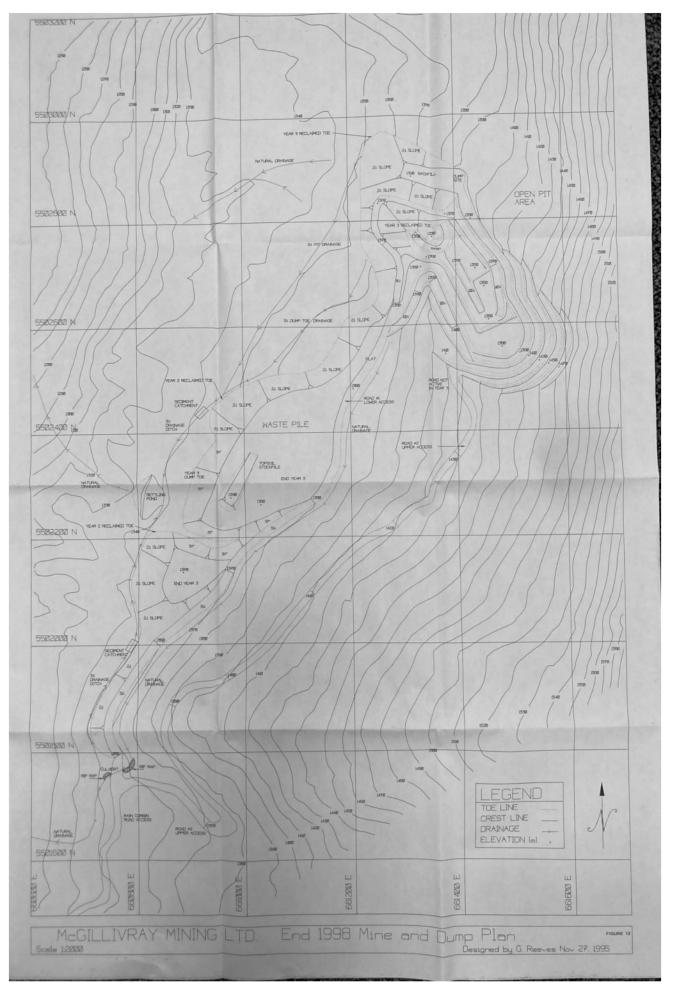
Figure 7.

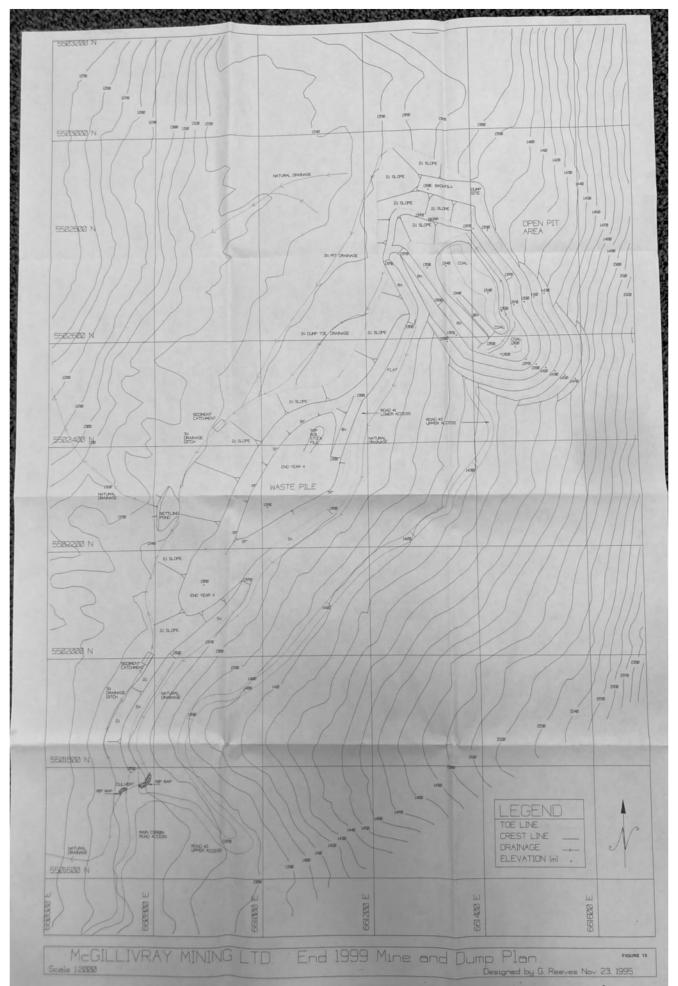
COAL EXPOSURE IN EXISTING PIT

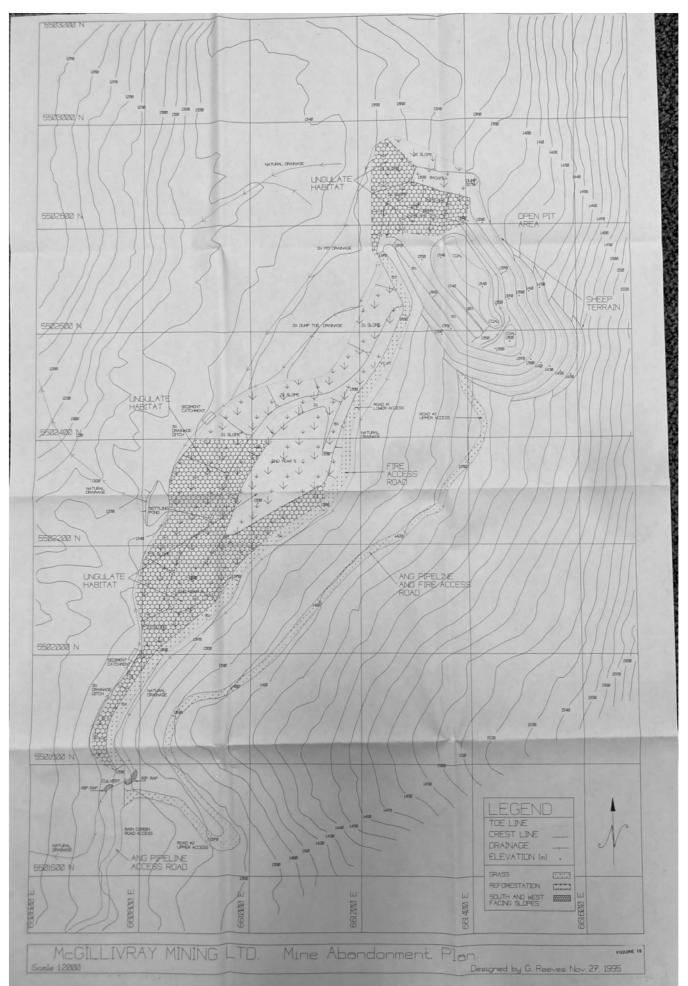


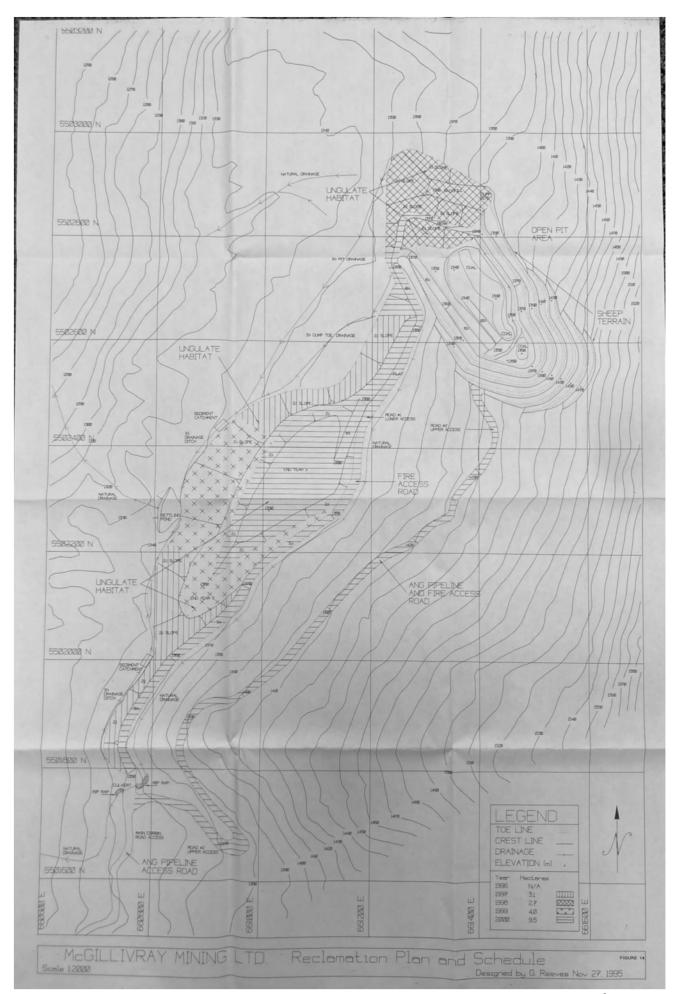












HAULAGE ROAD SPECIFICATIONS

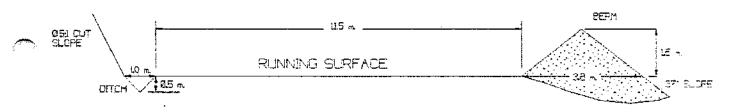
TYPICAL COAL HAUL ROAD

CROSS SECTION



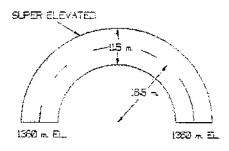
TYPICAL WASTE HAUL ROAD

CROSS SECTION



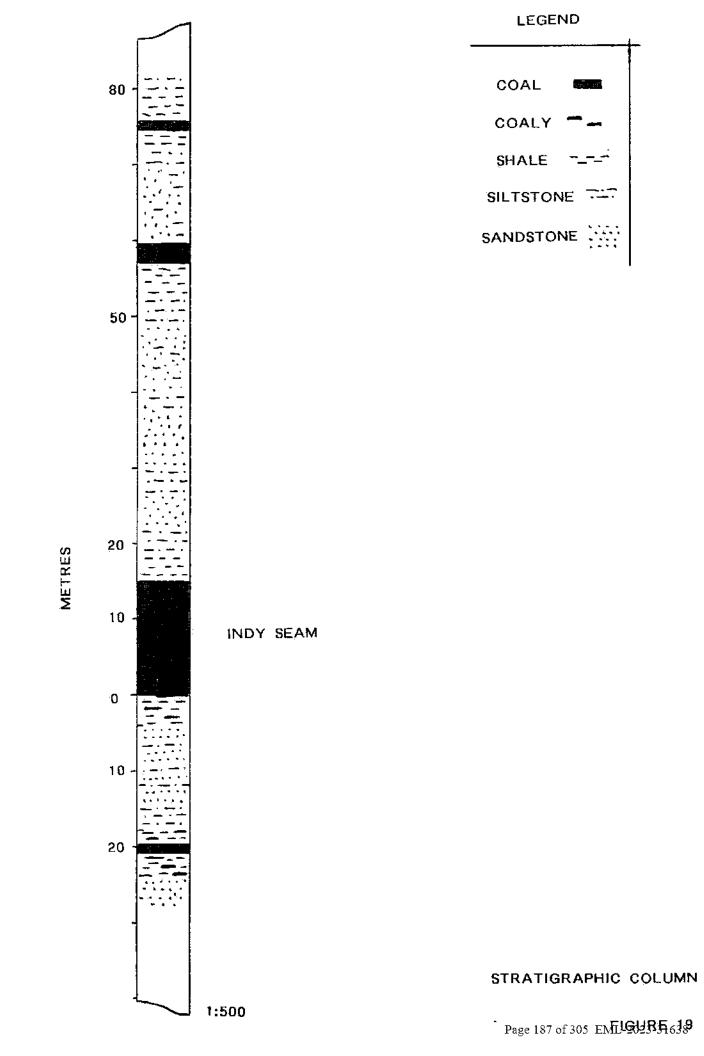
TYPICAL SWITCHBACK DESIGN

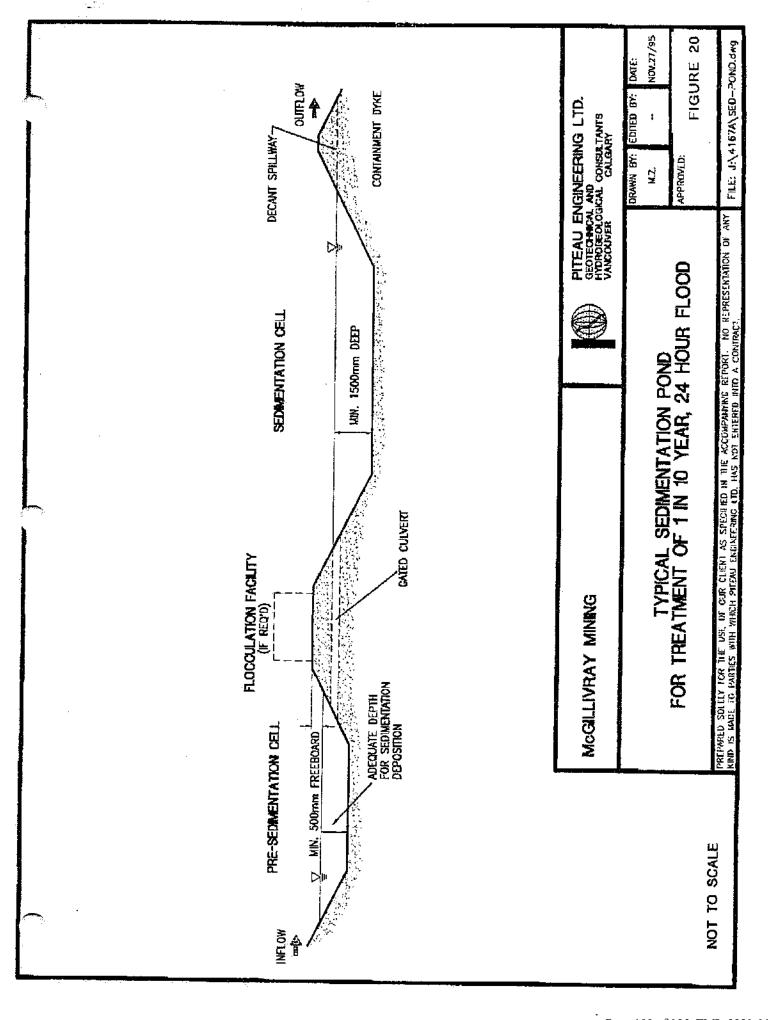
(35 TON WASTE HAULER)



NOT TO SCALE

FIGURE 18





	oject Approval Certificate
	Ann an aline F
	Appendix E
A) Environment	al Baseline Study (Requirements from the Ministry of Environment



Province of British Columbia Ministry of Environment, Lands and Parks

BC::: Environment

Koolenay Region Region 4 205 Industrial Road G. Cranbrook British Columbia. V1C 6H3-Telephone: (604) 489-8540

May 15, 1995

Gerald S. Reeves McGillivary Mining

Re: Terms of Reference for Environmental Baseline Studies for the Proposed McGillivray Coal Mine Development

Dear Sir;

Attached please find the terms of reference for the base line water quality, and fish and wildlife assessment for the above mine proposal.

This package does not include requirements for surface water. It is our assumption that this information will be submitted as part of your application for your Mine Development Certificate.

Please note that following our review of the baseline information package, additional detailed studies may be required. If you have any questions regarding the attached please free to contact the undersigned at 489-8548 or Les McDonald for water quality at 489-8515.

Yours truly

J.D. Martin

East Kootenay Habitat Biologist



BC Environment

Kootenay Region Region 4 205 Industrial Road G Cranbrook British Columbia V1C 6H3

Telephone: (604) 489-8540

May 15, 1995

Gerry Reeves McGillivray Mining

Re: Baseline Fish and Wildlife Studies, McGillivray Coal Mining Project

The following terms of reference are for baseline fish and wildlife habitat assessment, population inventory and seasonal fish and wildlife use patterns.

It is important that baseline fish and wildlife information be collected prior to initial mine disturbance.

This information will be required for assessing potential impacts on fish and wildlife habitat, populations and use patterns, interim mitigation or compensation options as well as requirements for end leave reclamation.

Baseline fish and wildlife assessment should include:

Landscape Level Fish and Fish Habitat Inventory

This should include known presence or absence of fish in water course that may be influenced by the mine development including downstream impacts from changes in flows or levels, sedimentation etc. This should include major fish streams as well as the lower reaches (reaches with stream gradients less than 12%) of tributary watercourses.

- * Landscape level information should be collected within the area bounded by and including Michele Creek (confluence of Wheeler Creek to Alexander Creek), the height of land of Loop Ridge, and to the south by an unnamed westerly flowing tributary of Michel Creek entering Michel Creek approximately 100 meters north of the confluence with Wheeler Creek.
- Fish and Fish Habitat Classification for all streams, lakes and wet lands as per the Forest Practices Code classification process.

3) Animal Inventory

Inventory (presence or absence) at the landscape level must be collected for all ungulates, bear, fur bearers, and bird species. This data base should include red and blue listed species, regionally significant species as well as possible rare and endangered plant communities.

4) Landscape Level Wildlife Habitat Inventory at 1:50,000 mapping level

This mapping should include ecosystem, biophysical capability and suitability mapping, including known migration corridors, sensitive habitats (riparian, avalanche paths, wildlife licks, nesting sites, fawning and calving areas etc.)

5) Operational Level Wildlife Habitat Inventory at 1:20,000 mapping Level

This level will require the same information as the landscape level mapping however mapping should be restricted to areas within 300 meters of the immediate area that will be impacted by any proposed mine development including roads, dumps, and exploration disturbance.

Based on the above baseline information additional information may be required to:

 assess potential areas for interim mitigation to offset habitat losses, wildlife seasonal use research,

 radio tracking of wildlife species to determine seasonal use patterns, and

- population health monitoring to determine long term impacts of this project on wildlife and fish populations in the area.

If you require any additional information or clarification regarding the above please contact the undersigned at your convenience.

Yours truly,

J. D. Martin

East Kootenay Habitat Biologist

JDM/ss



PROVINCE OF BRITISH COLUMBIA

Environmental Protection

MINISTRY OF ENVIRONMENT LANDS AND PARKS

MEMORANDUM

205 Industrial Rd. G, Cranbrook, B.C., V1C 6H3 Ph: (604) 489-8515 Fax: (604) 489-8506

May 11, 1995

File: 44500-20/McGillivary Mining

To:

Doug Martin

Senior Habitat Biologist

<u> McGillivary Mining - Environmental Impact Assessment</u> Terms of Reference

The following are terms of reference for a baseline water quality assessment in advance of application for a Mine Development Certificate. Without knowing the details of the transition of this project from current MDC process to the Environmental Assessment Act, when it is proclaimed, I am sure that this assessment will satisfy our requirements regardless. should commence this sampling as soon as possible in order to capture important freshet data that, if missed, cannot be collected again for a year.

The groundwater seepage by the CPR tracks below the proposed pit will be the most likely place that any explosive residual nitrogen would appear. It is important to gather some data on the current quality of this seepage to compare against the quality during Phase II, production mining, should this occur. Monthly samples over one year should be adequate. If this seepage flows through a culvert under the tracks, or via some surface drainage, it would be useful to measure the flow when possible, at the same time as water quality sampling.

At the same time and frequency as the seepage samples, a site above and below on Michel Creek should be sampled for the same parameters. I realize they only plan to operate during non-winter months but any seepage losses will continue after active mining is shut down for the season. The Michel Creek sites we discussed were at the rail loop (upstream) and just upstream of Alexander Creek (downstream).

The following is a list of parameters to be analyzed and minimum requirements for Minimum Detection Limits, ie. lower than these but not higher:

<u>Parameter</u>	Required MDL (mg/L)
nitrate nitrite ammonia orthophosphate Metals scan * cadmium	0.02 0.005 0.005 0.003

chromium	0.002
selenium	0.002
zinc	0.005

* most labs provide an ICP metals scan of around 30 elements, the scan should contain those metals listed with at least the MDC's shown (for some of these MDC's the lab may have to do a specific analysis. All metals are to be analyzed in the total form (no field filtration). If any of the samples are turbid they should also be analyzed for total suspended solids.

As we have discussed, Michel Creek receives significant quantities of natural phosphorus which make it particularly sensitive to nitrogen discharges. It would be useful if the Company could begin to establish a permanent photographic record of the algal growth on the rocks at the downstream site on Michel Creek. Photographs of a large boulder from the site should be taken before and after freshet and again in late August. Light conditions should be kept a constant as possible. Field notes are also useful. I can discuss the details of this with the proponent or consultant at a later date.

In addition to the sampling program outlined above the Company should develop a year by year prediction of the amount of explosive (ANFO and gel forms) that is expected for the life of the mine. I believe Mr. Reeves is familiar with the explosive use/nitrogen residual models developed by Pommen and by Ferguson and Leask.

If you or the proponent have any questions, contact myself or Mark Strosher.

Les McDonald, RP Bio

Senior Impact Assessment Biologist



Province of British Columbia

BC Environment

205 Industrial Road G Cranbrook, British Columbia V1C 6H3

Telephone: (604) 489-8510 Fax: (604) 489-8506

MINISTRY OF ENVIRONMENT, LANDS AND PARKS AND MINISTER RESPONSIBLE FOR MULTICULTURALISM AND HUMAN RIGHTS

File: 43450-30/McGillivary Mining

July 17, 1995

GS Reeves Associates International Ltd. 89 Ridgemont Dr. Fernie, B.C. VOB 1M2

Attention: Mr. Gerald S. Reeves

Dear Sir:

Re: <u>Proposed Baseline Water Ouality Monitoring for</u>
McGillivary Coal Mine Project

The following is confirmation of discussions held at our meeting on July 17, 1995. I have reviewed the water quality monitoring program proposed by Piteau Engineering Ltd. for the baseline environmental study for the Environmental Assessment Act project application and have the following recommendations and suggestions.

- * The two sites on Michel Creek need only be sampled monthly from March to November inclusive for nutrients and suspended solids, with an additional mid-winter sample in January. Enough information on metals levels can be obtained by sampling for them in March, May, and September.
- * The intermittent creek can be sampled as specified when it is flowing.
- * The groundwater seep should be sampled monthly for all parameters as specified. As we discussed I recommend a sand point pipe be installed in the appropriate location (above the impervious strata). This will serve as a permanent sample location and minimize the influence of changing micro-site location on water quality over time.
- * For quality assurance, three blanks and duplicates spaced evenly over the one year program should suffice for all parameters.
- * For algal growth, only the photographs are necessary.
 Rising nitrogen levels in the seep, and ultimately Michel
 Creek will indicate the need for more effort in this area.

I have taken the liberty of listing the acceptable analytical minimum detection limits for the important parameters below:

Parameter	Minimum Detection	<u>Limit (ma/L)</u>
Nitrate (as N) Nitrite (as N) Ammonia (as N) Orthophosphate Non-filterable Residue total cadmium total chromium		0.005 0.005 0.005 0.003 4.0 0.0001 0.002
total selenium		0.001
total zinc		0.005

If any part of the aforementioned needs clarification please give me a call.

Yours truly,

Les McDonald, RP Bio

Senior Impact Assessment Biologist

LM/lm

c.c.: Doug Martin

pplication for a Project Approval Certificate					
		Appendix I	E		
	B) Environme	ental Baseline	Interim Repo	rt	

McGILLIVRAY COAL MINE ENVIRONMENTAL BASELINE STUDY

FISH AND WILDLIFE AND

WATER QUALITY AND HYDROLOGY

INTERIM REPORTS

INTRODUCTION

McGillivray Mining Ltd. received approval to extract a bulk coal sample (Phase I), roughly 10,000 tonnes of high quality metallurgical coal, from an area near the north end of Loop Ridge in south east British Columbia. The project site, land owned by Crestbrook Forest Industries (CFI), is located roughly 20 km east of Sparwood B.C. and 3 km south on the Coal Mountain coal mine access road (Figure 1).

Phase II of the project consists of annual full production of roughly 200,000 tonnes of coal proposed to commence in May 1996. Phase II, however, requires an Environmental Baseline Study in support of the application for production mining. The Terms of Reference for the study were developed by Ministry of Environment, Lands and Parks, Kootenay Region. Piteau Engineering Ltd. was contracted by McGillivray Mining Ltd. to conduct the fish, wildlife, water quality, and surface water hydrology components of the Baseline Study.

This appendix consists of two reports, the first entitled "Baseline Fish and Wildlife Studies" and the second "Water Quality and Surface Water Hydrology". These interim reports summarize the results of work conducted from May through October, 1995. A final report is to be written at the completion of the 12 month program in mid-1996.

JA4167\REPORTS\INTRO96.DOC

McGILLIVRAY COAL MINING PROJECT BASELINE FISH AND WILDLIFE STUDIES INTERIM REPORT

PREPARED FOR:

MCGILLIVRAY MINING LTD.

PREPARED BY:

PITEAU ENGINEERING LTD. IN CONJUNCTION WITH
TOWNSEND & ASSOCIATES ENVIRONMENTAL SPECIALISTS LTD.

KI95-4167

TABLE OF CONTENTS

	Page No.
1. INTRODUCTION	1
2. SITE DESCRIPTION OVERVIEW	2
3. FISHERIES	4
3.1 STUDY REQUIREMENTS	4
3.2 METHODOLOGY	.,4
3.3 RESULTS	6
3.3.1 REPORTED: RESEARCH AND OUTDOOR OBSERVERS	6
3.3.2 OBSERVATION: DIRECT PROJECT COLLECTION	7
4. ANIMAL INVENTORY	17
4.1 STUDY REQUIREMENTS	17
4.2 METHODOLOGY,	17
4.3 RESULTS	19
4.3.1 Ungulates, Bears and Fur bearers	19
4.3.1.1 Reports: research and outdoor observers	19
4.3.1.2 Observation: direct and indirect project collection	22
4.3.2 BIRD INVENTORY	24
4.3.2.1 Reported: research and outdoor observers	24
4.3.2.2 Observation: direct project collection	25
5. WILDLIFE HABITAT INVENTORY	27
5.1 CLASSIFICATION	27
5.2 MAJOR FOREST COVER TYPES	29
5.3 ASSOCIATED VEGETATION TYPES	30
6. SUMMARY OF REMAINING BASELINE STUDY ACTIVITIES	33
7. LITERATURE CITED	34

LIST OF TABLES

TABLE 1	AGE CLASS ESTIMATES AND ASSOCIATED LENGTHS COLLECTED
	BY R. L. & L., 1994
TABLE 2	SUMMARY OF SEVERAL STREAM CHARACTERISTICS MEASURED
	AT FOUR MICHEL CREEK REACHES
TABLE 3	SUMMARY OF RESULTS FOR VISUAL FISH SIGHTINGS IN FOUR
	MICHEL CREEK REACHES
TABLE 4	SUMMARY OF SEVERAL STREAM CHARACTERISTICS MEASURED
	AT THREE MICHEL CREEK TRIBUTARIES
TABLE 5	SUMMARY OF RESULTS FOR VISUAL SIGHTINGS IN THREE
	MICHEL CREEK TRIBUTARIES
TABLE 6	SEASONAL AND YEARLY IDENTIFICATION OF THREE COLLARED
	ELK
TABLE 7	SUMMARY OF STRIP SURVEYS ON LOOP RIDGE
TABLE 8	MAIN OVER STORY AND UNDERSTORY SPECIES COMMON TO CFI
	SITE ASSESSMENTS AND 1995 STRIP SURVEY

LIST OF FIGURES

SITE PLAN SHOWING STUDY AREA BOUNDARY FOR FISH AND
WILDLIFE BASELINE STUDY
PRELIMINARY WILDLIFE HABITAT AND FISHERIES SURVEY
ASSESSMENT
STRIP SAMPLE NORTH OF ANG PIPELINE
STRIP SAMPLE SOUTH OF ANG PIPELINE

LIST OF PHOTOS

РНОТО 1	REACH #1 ON MICHEL CREEK, LOOKING DOWNSTREAM FROM
	CONFLUENCE WITH WHEELER CREEK.
РНОТО 2	TRIBUTARY #1 ENTERING MICHEL CREEK FROM EAST,
	APPROXIMATELY 500 M DOWNSTREAM OF WHEELER CREEK
	CONFLUENCE.
РНОТО 3	REACH #2 ON MICHEL CREEK LOOKING DOWNSTREAM FROM
	APPROXIMATELY 550 M BELOW WHEELER CREEK CONFLUENCE.
РНОТО 4	TRIBUTARY #2, LOOKING DOWNSTREAM FROM A POINT
	APPROXIMATELY 200 M UPSTREAM OF CONFLUENCE WITH
	MICHEL CREEK.
РНОТО 5	UPSTREAM BEGINNING OF REACH #3 ON MICHEL CREEK.
РНОТО 6	DOWNSTREAM NATURAL UN-CHANNELIZED PORTION OF REACH
	#3.
РНОТО 7	TRIBUTARY #3 APPROXIMATELY 200 M FROM CONFLUENCE
	WITH MICHEL CREEK
РНОТО 8	START OF REACH #4 ON MICHEL CREEK.
РНОТО 9	TRANSITION FROM CHANNELIZED TO NATURAL SECTION OF
	REACH #4

LIST OF APPENDICES

APPENDIX A	BASELINE FISH AND WILDLIFE STUDIES TERMS OF REFERENCE -
	J.D.MARTIN, MAY 15, 1995.
APPENDIX B	LOOP RIDGE OVERSTORY COVER TYPES CRESTBROOK FOREST
	INDUSTRIES LTD. 1:20,000 MAPPING LEVEL.
APPENDIX C	STREAM SURVEY FORMS.

APPENDIX D	STRIP SAMPLE SUMMARY SHEETS AND FIELD NOTES, SEPTEMBER		
	30 AND OCTOBER 1, 1995.		
APPENDIX E	BODIE CREEK BASIN BIRD INVENTORY, ELKVIEW COAL		
	CORPORATION		
APPENDIX F	BIRD SPECIES OF POSSIBLE OCCURRENCE IN BODIE AND LOOP		
	RIDGE AREAS.		
APPENDIX G	PRE-LOGGING SITE ASSESSMENTS DESCRIBING LOOP RIDGE		
	ECOSYSTEMS.		

1. INTRODUCTION

This report presents interim results of the Fish and Wildlife component of the Environmental Baseline Study for the proposed McGillivray Coal Mine. The Terms of Reference for this component are contained in the May 15, 1995 letter from J.D. Martin, East Kootenay Habitat Biologist to Gerry Reeves, McGillivray Mining Ltd. (Appendix A). Townsend & Associates Environmental Specialists Ltd. were sub-contracted by Piteau Engineering Ltd. to undertake the Baseline Fish and Wildlife Studies, as identified in J.D. Martin's Terms of Reference letter. A final report on the Fish and Wildlife component will be issued upon completion of the work in mid-1996.

2. SITE DESCRIPTION OVERVIEW

In general, Loop Ridge has a north-south orientation, and extends south from Highway 3 for approximately 10 km. The study area within which landscape level (1:50,000 mapping level) information specific to fish and fish habitat, animal inventory and wildlife habitat inventory should be collected, is identified in the Terms of Reference and is shown in Figure 1. The specified area, consisting of three small watersheds (roughly 13 km²), is bounded by and includes Michel Creek from the confluence of Wheeler Creek to Alexander Creek to the height of land of Loop Ridge, and to the south by an unnamed westerly-flowing tributary of Michel Creek entering Michel Creek approximately 100 m north of the confluence with Wheeler Creek.

Within this area a further subdivision, (an area approximately 1.5 km² within which active mining is proposed), requires the same baseline information be collected at 1:20,000 mapping level. This more detailed mapping is restricted to the areas around the present test pit, and is bounded by Alberta Natural Gas pipeline on the south, the height of land on the east, B.C. Gas pipeline on the west and 300 metres from the furthest north point of proposed mining development.

In 1969-70, within the area around the present test pit, a larger test pit was excavated to extract approximately 90,000 tonnes of coal, and was subsequently reclaimed and abandoned. The present test pit and proposed production mining are located on the reclaimed area associated with the 1969 test pit at an elevation of approximately 1400 m A.S.L. The surrounding areas are part of a managed forest under ownership of CFI and subject to long-term harvest plans. (J. Tress, pers. comm.).

In 1995, on the southwest end of Loop Ridge road development and cut-block logging has been undertaken in accordance with CFI's phased approach to harvest, wherein all resource values and public input are incorporated into logging plans. Loop Ridge is predominantly a Lodgepole pine canopy interspersed with small stands of spruce, fir, and aspen as well as areas of open range. Detailed overstory cover type mapping of Loop Ridge at 1:20,000 scale has been completed by CFI and is provided in Appendix B.

3. FISHERIES

3.1 STUDY REQUIREMENTS

Landscape level (1:50,000 mapping level) fish and fish habitat inventory requirements are specified in the Terms of Reference. The assessment is to identify presence or absence of fish in water courses that may be influenced by the mine development, including major fish streams, as well as the lower reaches of tributary water courses. The study will provide basic physical descriptions of Michel Creek and the lower reaches of the study area tributaries in accordance with B.C. Forest Practices Code. Within the study area Michel Creek has been significantly modified by the record flood of June 6 and 7, 1995 and subsequent mechanical channelization undertaken to protect the Coal Mountain mine access road, and the CPR mainline rail grade.

3.2 METHODOLOGY

Methods from the Forest Practices Code will be employed to meet Terms of Reference objectives for fish and fish habitat inventory. This study was required to identify presence or absence of fish and will use a combination of direct and indirect methods to achieve this end. The following methods will be employed:

- 1) direct observation of fish
- 2) reports from other researchers in the area
- 3) reports from credible outdoor observers

Landscape level fisheries habitat will be mapped by walking four reaches (totalling approximately 4595 m) representative of meso-habitat in Michel Creek between Wheeler Creek and Alexander

Creek confluences. Stream survey forms will be completed for the representative reaches of Michel Creek, as well as for the lower reaches of study area tributaries.

The Forest Practices Code Guidebook for Fish-Stream Identification states that there are major differences between the comprehensive information required by resource agencies for management or scientific purposes and the surveys required for fish-stream identification. The Guidebook indicates that the basic information needed for fish-stream identification is simply presence or absence, and is not based on the abundance, population age structure, or the potential of the habitat to produce fish. Once fish presence has been confirmed, the process is complete.

Fish sampling procedures outlined in the Guidebook suggest successively greater levels of sampling intensity to determine presence or absence. From simplest to most intensive, the sampling methods recommended are:

- 1) viewing
- 2) angling
- 3) pole seine
- 4) Gee traps
- 5) electrofishing

Systematic sampling procedures start with the simplest method, and progress through the hierarchy of methods until presence or absence is confirmed. Once fish are sighted or caught, the procedure is complete. The specimens are to be properly identified (Nelson and Paetz 1992), and sampling information recorded.

Along the four representative reaches on Michel Creek and within the three tributaries "viewing" will be conducted from the bank as well as through snorkelling. Seining and baited Gee Traps will also be used when conditions permit or when viewing is ineffective.

Electrofishing can increase stress and mortality on adults, and can also reduce egg-to-fry survival when conducted on or near redds. Ministry of Environment, Lands and Parks personnel suspect bull trout (fall spawners) may be present in Michel Creek. Therefore, electrofishing will not be employed as a means of determining presence or absence. Visual observation (e.g. snorkelling) of spawning fish or evidence of redds will be undertaken during stream reconnaissance for landscape level fish habitat classification. One problem foreseen with detecting spawning redds, in the wake of the recent mechanical channelization, is spotting fresh disturbance of spawning-size gravels due to insufficient time for algae re-establishment on stream substrate. Because the fall survey will be undertaken in low flows, it is suspected that deeper pools will provide the best opportunity for confirming fish presence or absence, since deep pools represent suitable cover for over-wintering. The presence of bull trout in fall may indicate that Michel Creek is used for spawning, juvenile rearing and/or overwintering.

3.3 RESULTS

3.3.1 REPORTED: RESEARCH AND OUTDOOR OBSERVERS

In a study by R. L. & L Environmental Services Ltd. (1993) {R. L. & L} for Elkview Coal's Bodie Creek Development proposal, two fish species were found in Michel Creek at a site near the confluence with Alexander Creek located at the lower end of the McGillivray Mine Project study

area. This fall study yielded 31 fish; 30 cutthroat trout (*Oncorhynchus clarki*) and 1 mountain whitefish (*Prosopium williamsoni*). During this same period at sites nearer the confluence with the Elk River, R. L. & L (1993) found cutthroat trout, mountain whitefish, bull trout (*Salvelinus confluentus*) and longnose dace (*Rhinichthys cataractae*). In a related study, R. L. & L (1994) determined age-length relationships for three fish species in Michel Creek downstream of the confluence with Alexander Creek (Table 1). These studies may provide valuable baseline data, since they reflect fall fisheries status in Michel Creek prior to the June 1995 flood and subsequent mechanical channelization.

Two well known local sportsmen and fishermen have indicated that Michel Creek has provided very good cutthroat fishing for the past several years (L. Fontana and B. Savillo pers. comm.).

3.3.2 OBSERVATION: DIRECT PROJECT COLLECTION

Fish and fish habitat classification surveys were undertaken September 29, 30, and October 1, 1995. Photographs of surveyed tributaries and Michel Creek reaches are presented in the Photos Section. Reach locations are identified in Figure 2. Three tributaries were found originating on Loop Ridge, and entering Michel Creek downstream of Wheeler Creek, upstream of the rail loop and well upstream of any influence of mine development (Figure 2). They were investigated using visual sighting procedures, as well as baited Gee-type traps.

Table 1: Age class estimates and associated lengths for three fish species collected by R. L. & L. (1994) from Michel Creek downstream of the Alexander Creek confluence. CT=cutthroat trout; BT=bull trout; MW=mountain whitefish.

SPECIES	AGE	AVERAGE LENGTH
		(mm)
СТ	1	55
	2	136
	3	183
	4	-
	5	367
BT	3	160
	5	306
MW	1	77
	2	161
	3	-
	4	-
	5	327
	6	354
	7	387
	8	451
	9	-
	10	_
	11	429

In Michel Creek, the spring flood of June 6, 1995 washed out long stretches of the Coal Mountain access road, as well as portions of the CPR mainline rail bed. Subsequent to the flooding, heavy equipment was used to channelize the stream course to protect against future damage to road and rail routes. A site visit on September 5, 1995 revealed that Michel Creek had essentially been turned into a wide, uniform sluiceway for a large portion of its length between Wheeler Creek and the confluence with Alexander Creek. With the exception of a few bedrock pools, the channelized stream course could best be described as shallow, braided and unconfined (Photo 3). In the areas observed, channel widening resulted in high gravel banks with no evident instream or bank cover (i.e. large organic debris, instream vegetation, overstream vegetation, deep pools or cutbanks). Some large boulders had been placed individually or in clusters into the channel in an arbitrary fashion, but channel width and related low flow negated any cover potential (Photo 3).

On the main stem Michel Creek, four reaches totalling approximately 4595 m were snorkelled (Figure 2, and Tables 2 and 3). In addition, three tributaries entering Michel Creek downstream of Wheeler Creek and originating in drainage basins on Loop Ridge were sampled by snorkelling and bank observation for a total distance of approximately 400 m (Figure 2).

In general, it should be emphasized that the channelized sections of stream exhibited little cover of any form, and were characterized by depths not much in excess of 20 to 25 cm. Although snorkelling is successful in these water depths, few fish were observed in the channelized reaches.

Table 2: Summary of several stream characteristics measured for each of the four Michel Creek reaches surveyed Sept 29, 1995. See Appendix C for detailed survey forms.

Reach #	Approximate Length Surveyed (m)	Avg. Wetted Width (m)	Natural or Channelized	% Pool / % Riffle	Fish Presence Confirmed
1	553	7.5	natural	42 / 58	yes
2	555	28	channelized	0 / 100	yes
3	1163	12.5/8*	both **	12/88	yes
4	2324	19	both ***	19/81	yes
Total	4595				

Note no run sections were present

^{*} Avg. wetted widths were 12.5 m in channelized sections and 8 m in natural sections.

^{** 230} m (23%) of riffle section surveyed was channelized.

^{*** 785} m (34%) of total reach surveyed was channelized.

Table 3: Summary of results for visual fish sightings in four reaches of Michel Creek September 29, 1995. See Appendix C for detailed fish survey forms. CT=cutthroat trout; MW=mountain whitefish; BT=bull trout; EB=eastern brook trout. SW=swimming.

Reach Number	Species	Number/ Species	Size Range (mm)	Estimated Ages ¹	Approximate ^{2,3} number of fish	Method
					per km	
1	СТ	41	150-360	3-5	75	sw
	MW	60	150-380	2-7	109	sw
2	СТ	2	200-330	3-4	4	sw
3	CT	44	50-330	1-4	3,8	sw
4	CT	40	100-355	1-5	18	sw
	MW	33	100-330	1-5	15	sw
	BT	1	254	4	1	sw
	EB	1	300	?	1	SW

Due to the sampling method (viewing) used in this survey age class and sexual maturity were not directly established. See text.

²Given the sampling method this will likely be an under estimate

³Estimate is rounded up to the nearest whole fish

For example in Reach 2, the only fully channelized reach, four fish/km were estimated whereas Reach 1, a fully natural reach, held 184 fish/km (Table 3). The most abundant fish in the Michel Creek were cutthroat trout (57.2%) and mountain whitefish (41.9%) {Table 3}. However, in the tributaries, eastern brook trout (49.5%) and mountain whitefish (34.3%) were more abundant than cutthroat trout (14.3%){Table 5}.

Only one Bull trout was encountered in the course of sampling the four Michel Creek reaches (Table 3). No bull trout spawning redds were observed either in Michel Creek or in the three tributaries investigated. This may indicate that: i) bull trout do not spawn in Michel Creek; ii) they do not spawn in the areas we sampled; iii) they had passed through the reaches we sampled to spawning areas further upstream; or iv) they had not yet arrived in Michel Creek.

Only one eastern brook trout (Salvelinus fontinalis) was observed in the main stem of Michel Creek (Table 3). However, at least 52 were observed in the three tributaries, indicating that spawning had or was about to start (Table 5). We found no evidence of redds along the approximately 400 m of tributaries surveyed.

Given the proximity of the R. L. & L. (1994) study area to this study area, there is no reason to believe that fish in main stem Michel Creek above the confluence with Alexander Creek, would show a marked difference in growth rate. Therefore, R. L. & L. (1994) data show that in main stem Michel Creek our estimated cutthroat lengths would equate to age classes 1 through 5; our estimated mountain whitefish lengths would equate to age classes 1 through 7 and our estimated bull trout length would equate to age class 4 (Tables 1 and 3). Although this estimate is

Table 4: Summary of several stream characteristics measured for each of the three Michel Creek tributaries sampled on September 29, 1995. See Appendix C for detailed survey forms.

Tributary Number	Length Surveyed (m)	Avg, Wetted Width (m)	Basic Stream Description	Fish Presence Confirmed
1	100	2	small channel overhanging bank vegetation, 50/50 pool:riffle	Yes
2	250	0.75	slow, winding, weedy meadow channel; sticks, logs, overhanging bank cover	Yes
3	50 / 50	2 / 0.75	channelized 250 m long ditch below hanging culvert / 50 m above hanging culvert	Yes/Yes

See photo 7

Table 5: Summary of results for visual sightings in three Michel Creek tributaries, September 29, 1995. See Appendix C for detailed survey forms. CT=cutthroat trout; MW=mountain whitefish; EB=eastern brook trout. VO=visual observation other than snorkelling. SW=swimming.

Tributary Number	Species	Number	Size Range (mm)	Approximate ^{1, 2} number of fish per km	Method
1	CT MW EB ?	13 36 31 1	100-150 50-150 75-250 50	130 360 310 10	VO-Gee Trap³
2	EB	21	50-100	84	VO-SW
3	CT/ ?	2 / l	75-100 / 50-100	8 4	VO-Gee Trap⁴

Given the sampling method this will likely be an under estimate

² Estimate is rounded up to the nearest whole fish

¹ 19 hours effort, no capture

^{4 14} hours upstream of hanging culvert, no capture

reasonable for main stem fish it cannot be used for species found in the tributaries. The tributaries may be physically and chemically different than the main stem. Therefore, fish populations (e.g. cutthroat trout) resident in the tributaries may show vastly different growth rates.

Regarding Tributary 3, the newly installed culvert under the main road was placed so that there was approximately a 1 m drop into the down side ditch. The stream essentially flowed down the road ditch, then through a channel dug to enable the tributary to reach Michel Creek, after skirting a portion of mechanically channelized main stem. The juveniles observed were in this ditch only a short distance below the hanging culvert (Photo 7). A visual investigation upstream of the hanging culvert revealed juvenile habitat similar to portions of tributary number two (Photo 4). One fish was observed in this upstream channel however, it could not be identified to genus and species. A baited Gee trap set in for 14 hours captured no fish. Re-installation of the culvert to eliminate the hanging end would allow up and downstream movement in this tributary. Presently, above and below culvert fish populations are isolated.

Most fish observed during this sample period were found in pools. This may be due to low flows, so fish are already starting to concentrate in overwintering pools. As well, it may also be due in part to the decrease in effectiveness of snorkelling as a method for spotting fish in shallow, rough riffles and rapids. Rough riffles and rapids are plentiful in the natural sections of the reaches we sampled, whereas, very shallow water and shallow rough riffles are abundant in the channelized sections.

In 1996, another stream survey for presence or absence will be undertaken in spring just prior to freshet, which is intended to identify presence or absence of larger immigrant cutthroat trout preparing for spring spawning.

4. ANIMAL INVENTORY

4.1 STUDY REQUIREMENTS

Terms of Reference for the McGillivray Project specify that inventory (presence or absence) at the landscape level (1:50,000 mapping level) must be collected for all ungulates, bear, fur bearers and bird species. The data base should include red and blue listed species, as well as possible rare and endangered plant communities. Information related to Loop Ridge and vicinity, available from other studies will be incorporated into the McGillivray Baseline Study. Field work and ground-truthing specific to the McGillivray project area will be undertaken to ensure that project objectives are met.

4.2 METHODOLOGY

This study was required to identify presence or absence of ungulates, bears, birds and fur bearers and will use a combination of direct and indirect methods to achieve this end. The following methods will be employed:

- 1) direct observation of individuals
- 2) observation of sign
- 3) reports from other researchers in the area
- 4) reports from credible outdoor observers

Direct observation of some individuals will be possible while walking sample lines as well as by using binoculars and spotting scope from the main road in the valley floor paralleling Loop Ridge. Observation of sign will be achieved by walking a strip sample laid out to cover the

various habitats present in the study site. Schmidt and Gilbert (1978) differentiate between a line transect and a strip sample in the following manner:

"In a strip sample, all animals within a certain distance of a line are counted. In a line transect, all animals observed are included in the sample, no matter how far from the line they are."

Observations from the road to spot individuals, particularly ungulates, could be considered a form of line transect in its least-refined level as a simple determination of presence or absence. Summer and winter observation of sign along a pre-set line is the strip sample method. The strip sample method will be used in this study to record presence or absence of target species through identification of pellets, scat, tracks and other positive field identifiers (Peterson 1961; Murie 1982; Angrove and Bancroft 1983; Scotter and Flygare 1986; Scotter et al. 1990; Wilkinson 1990; Rezendes 1993).

The study area has been divided by the Alberta Natural Gas pipeline (ANG) into north and south sections. The greatest effort will be focused on the north side of ANG where active mining is proposed.

Two observers will each search a 2 m wide band as they walk abreast along a predetermined route, thereby covering a combined strip width of 4 m, except in locations with very dense cover. Following a game trail in dense cover (e.g. alder) each observer will view the same 2 m wide band. This will reduce the potential for missing sign due to the dense cover.

Leaf drop can also obscure sign even in more open habitat, and thick grass or forb cover that has been flattened by heavy rain or snowfall further decreases the probability of finding sign. Therefore, we will complete the fall field work as soon as possible in order to minimize the impact of leaf fall.

We will contact other researchers known to have done field work in the vicinity, or review their work where available through libraries, industry or appropriate government agencies. This will include CFI, B.C. Environment, Fish and Wildlife Branch, Elkview Coal Ltd., the owner of the registered trapline on the site, as well as credible local sportsmen who have had a long association with hunting and fishing in the vicinity.

4.3 RESULTS

4.3.1 Ungulates, Bears and Fur bearers

4.3.1.1 Reports: research and outdoor observers

Although formal historic wildlife inventory data for the Loop Ridge study area is sparse, there are credible reports of sightings of various animals utilizing the site. For example, on the site of the present bulk sample extraction, which was reclaimed to grassland in 1970, we recall sighting elk during periods of snow cover over an 11 year span. During this same period, bighorn sheep were occasionally sighted in the area of Highway 3 at the extreme north end of Loop Ridge. These observations may suggest possible transitory use of Loop Ridge by bighorn sheep. Two well known sportsmen and capable outdoor observers have indicated that Loop Ridge is good elk range (L. Fontana and B. Savillo pers. comm.).

The Environmental Impact Assessment in support of Elkview Coal Corporations' December 1994 Bodie development application contains considerable information related to Loop Ridge. Gibson and Sheets (1994) report on the results of an elk movement study, as well as 50 wildlife survey helicopter flights. The elk movement studies recorded the movements of collared elk between 1983 and 1994, and the wildlife survey flights were flown in winter during the same period.

In the ungulate study, Loop Ridge is contained within the defined area of distribution of elk from Harmer to Natal Ridge. Over the years, three collared female elk were repeatedly located on the north end of Loop Ridge (Gibson and Sheets 1994) {Table 6}.

Table 6: Seasonal and yearly identification of three collared elk on the north end of Loop Ridge.

NAME	<u>SEASON</u>	YEAR	
Batal	Spring	1984	
Dompke	Spring	1986-1992	
Nopey	All seasons	1984	

In mapping elk movements, Gibson and Sheets (1994) identify a migration route off the south end of Erickson Ridge, trending south up Michel Creek alongside Loop Ridge.

During the winter wildlife surveys from 1983 to 1994 for an area outside Loop Ridge the following observations were recorded (Gibson and Sheets 1994):

- 2 elk at northwest toe of Loop Ridge near confluence of Alexander and Michel Creeks;
- 2 moose near Michel Creek approximately 3 km upstream of confluence with Alexander Creek;
- 1 white-tailed deer approximately 1 km upstream of the confluence of Michel and Alexander Creeks.

Gibson and Sheets (1994) note that monitoring intensity the study varied considerably for each individual and may have included long periods (up to several years) when radio collars were non-functional and only visual observations were possible. This implies there may have been more ungulate activity along Loop Ridge than indicated by the sketchy data for this area.

The owner of the registered trap line on Loop Ridge, C. Podrasky, confirms the presence of lynx (Lynx canadensis) and marten (Martens Americana) on his trapline on the lower west-facing slopes. Mr. Podrasky also confirms the presence of black bear on Loop Ridge, but has not seen either grizzly bear, or wolf on the east side of Michel Creek (pers. comm.).

Discussions with J. Tress, from CFI indicate that this years logging crew on lower Loop Ridge have reported a grizzly bear in the vicinity of their operation. Mr. Tress also reports a set of wolf tracks crossing a logging access road on lower Loop Ridge south of the ANG right-of-way (pers. comm.). As well, G. Reeves reported spotting a grizzly bear on the upper west side of the ANG right-of-way in late summer 1995 (pers. comm.).

Recently, D. McIntyre confirmed two sets of cougar (Felis concolor) tracks in snow at the north tip of Loop Ridge, adjacent to Highway 3, which suggests at least transitory use of Loop Ridge by this species.

4.3.1.2 Observation: direct and indirect project collection

The total length of the strip samples was approximately 11.6 km with 69% of that length surveyed north of the ANG right-of-way (Table 7, Figures 3 and 4). Elk, moose and deer were observed south of the ANG right-of-way (Figure 4). Although 16 bear scats were encountered on the fall survey lines, none could be irrefutably identified as grizzly, so all bear scat was simply classed as "bear". We have no reason to believe that grizzly bear and wolf do not occur on Loop Ridge as part of their seasonal territory.

Apart from spotting a long-tailed weasel, little other direct sign of fur bearers was observed on the survey lines. A suspected badger hole near the north edge of the old test pit opening (current bulk sample location) will be investigated further in late spring during attempts to identify calving/fawning areas. Two locations showing bear tree markings (claw marks) were identified within the study area.

Table 7: Summary of strip sample surveys on Loop Ridge, September 30 and October 1, 1995. See Appendix D for detailed summary sheets and field notes for each leg of the strip sample.

Location	Approximate Strip Length (m) / area (m²)	Sign Type	Quantity
North of ANG line	8015 /	Elk pellet groups	173
	32,060	Moose pellet groups	19
		Deer pellet groups	3
		Bear scat	15
		Coyote scat	6
		Weasel direct observation	1
South of ANG line	3600 /	Elk pellet groups	23
	14,400	Elk direct observation	8
		Moose pellet groups	8
		Moose direct observation	2
		Deer pellet groups	14
		Deer direct observation	6
		Bear scat	1
Locations	11,615 /	Elk pellet groups	196
Combined	46,460	Elk direct observation	8
		Moose pellet groups	27
		Moose direct observation	2
		Deer pellet groups	17
		Deer direct observation	6
		Bear scat	16
		Coyote seat	6
		Weasel direct observation	1

4.3.2 BIRD INVENTORY

4.3.2.1 Reported: research and outdoor observers

Saunders-Savoy (1994), conducted a bird inventory in Bodie Creek basin as part of Elkview Coal Corporation's environmental assessment supporting a Mine Development Certificate Application for the Bodie Dump. The Bodie Creek Basin bird inventory study area is approximately 7 km from the Loop Ridge study area, so it is reasonable to conclude that many of the bird species found in the Bodie Creek Basin will also be found in similar habitat on in this project study area.

Saunders-Savoy (1994) identified 56 bird species and found breeding evidence for 40 of those species. The Bodie Creek Basin was stratified into six basic habitat types as follows: Brush Meadow, Douglas Fir, Aspen, Grass Meadow, Riparian and Pine. These habitat types also occur in the study area.

The most common bird species found at Bodie were black-capped chickadee, mountain chickadee, golden crowned kinglet, yellow-rumped warbler, chipping sparrow and dark-eyed junco. The number of bird species occurring in the different habitat types were:

Brush meadow	37
Grass meadow	30
Aspen	28
Pine	26
Riparian	22
Douglas Fir	20

Loop Ridge has a westerly aspect as opposed to the southerly aspect of the Bodie Creek Basin yet all 6 avian habitat types occur on the Loop Ridge study area. The dominant habitat type on Loop Ridge is Lodgepole pine. In the Elkview study, relatively few birds were observed in this habitat type in May and July, although in August and September, large numbers of chickadees, kinglets and warblers were foraging in mixed species flocks.

The species identified in the Bodie Creek basin, and expected to also occur in the Loop Ridge study area, are presented in Appendix E. Also listed in Appendix F are those species which may be expected to be found in the area based on geographical distributions and habitat requirements, but which were not found during the Bodie inventories.

4.3.2.2 Observation: direct project collection

Presence of the following birds were confirmed for Loop Ridge during the September 30 and October 1, 1995, strip samples:

dark-eyed junco Junco hyemalis

ruffed grouse Bonasa umbellus

blue grouse Dendragapus obscurus

downy woodpecker Picoides pubescens

grey jay Perisoreus canadensis

varied thrush Ixoreus naevius

merlin hawk Falco columbarius

Since most birds had migrated prior to our fall field work, additional bird inventory field work will be carried out within the May/June 1996 time frame.

In summary, our fall reconnaissance confirmed the presence of the following wildlife on Loop Ridge:

Ungulates:

elk, moose, mule deer, white-tailed deer

Bear:

black, grizzly

Fur bearers:

long tailed weasel, lynx, marten, coyotes, wolf

Birds:

dark-eyed junco, grey jay, varied thrust, ruffed

grouse, blue grouse, downy woodpecker, merlin

Further work to identify additional fur bearers that may utilize Loop Ridge will be undertaken in January or February 1996, several days after a fresh snowfall.

5. WILDLIFE HABITAT INVENTORY

5.1 CLASSIFICATION

Wildlife habitat classification for all of Loop Ridge was derived from the 1:50,000 Biophysical Wildlife (Ungulate) Capability map developed for that area by methods described in MOE Manual 4, Wildlife Capability Classification (Demarchi *et al.* 1983). The Loop Ridge area is contained within map sheet "Crowsnest 82G/10", mapped by Demarchi (1979) from field work conducted in 1976. Wildlife habitat classification data taken from Demarchi's (1979) Crowsnest 82G/10 map sheet was transferred to a 1:20,000 scale forest cover type map that encompasses all of Loop Ridge (Figure 2).

The area north of the ANG pipeline, where mining development is proposed has the following ungulate range classification:

- Class 2 winter range for elk and moose
- Class 3 winter range for mule deer
- Class 4 summer range for white-tailed deer.

Class 2 winter ranges have a high capability and a potential carrying capacity of 6.6 to 9.8 elk, or 3.1 to 4.5 moose per square kilometre per year. If the animals use adjacent summer range for part of the year, and only use the winter range for six months, carrying capacity would double to 13.2 to 19.6 elk or 6.2 to 9 moose per square kilometre for the six month period.

Class 3 winter range for mule deer has a potential carrying capacity of 5.4 to 10.6 animals per square kilometre per year.

The soils in this habitat unit are classified as moist, upland forest soils where dense conifer forests become established. This unit is also classed as subject to winter snow accumulations of between 0.5 and 1.0 m, which can affect winter use by some ungulates.

The adjacent habitat unit, east up to the height of land on Loop Ridge, is Class 4 summer range for elk and mule deer and Class 5 summer range for moose. The unit is characterized by upland forest soils and bedrock and slopes are typically steeper than 35°. This low capability habitat could potentially support 0.8 to 3.3 elk or 1.2 to 5.3 mule deer per square kilometre per year.

During the fall strip survey the upper leg of the survey line traversed the ridge top in this habitat unit from south to north almost to the drop-off at the north end. A considerable number of winter elk pellet groups (43) {Appendix D} were encountered, suggesting that the ridge top may be blown clear of snow, making forage available for at least a portion of the winter.

The habitat unit to the west down slope to Michel Creek is classified as Class 1 winter range for elk, and Class 3 winter range for mule deer and moose. This very high capability habitat could potentially support 10 to 13 elk per square kilometre per year, and is characterized by moist lacustrine soils and moderate winter snow accumulations. The unit is also a corridor for a rail grade as well as the Coal Mountain mine access road. It should be noted that road cut and fill slopes, as well as other disturbed areas of the valley bottom, have been reclaimed and revegetated, making these areas attractive as winter forage for elk.

Other Loop Ridge values specific to ungulates include wallows and licks, as well as suspected elk calving areas. CFI, with cooperation from several local sportsmen, have identified 7 wildlife licks and 1 wallow on Loop Ridge. These special use features have been located on a 1:20,000 scale map by CFI (Figure 2), and a buffer zone allocated around each lick and wallow to ensure protection during development of future logging plans.

The fall 1995 strip surveys identified two additional licks and two additional wallows that have been also be included in the inventory of special use features (Figure 2). One wallow is situated 72 m northwest of the proposed active mine. It is a very heavily used area, with additional signs of ungulate use in the forest to the northwest of the wallow. We have not included a buffer zone around these sites.

5.2 MAJOR FOREST COVER TYPES

CFI have recently developed long-term, phased logging plans to enable harvest on Loop Ridge in a manner that considers and accommodates other resource values, while maximizing fibre production (J. Tress, pers. comm.). Loop Ridge is primarily a lodgepole pine forest, with smaller stands of mixed spruce/fir/aspen, or fir-leading communities represented in a minor way in the vegetative cover (Appendix B). The ridge is within the MSdk (dry cool Montane Spruce) biogeoclimatic zone.

CFI's inventories on Loop Ridge north of ANG pipeline indicate most stands are Age Class 4 (61 to 80 years old). The uniformity of conifer ages may be due to a fire on Loop Ridge approximately 80 years ago. Most lodgepole pine stands are in height class 2 (10.5 to 19.4 m)

and larch stands are mainly height class 3 (19.5 to 28,4 m). Crown closure for the majority of the conifer stands is between 45 and 65%.

5.3 ASSOCIATED VEGETATION TYPES

Pre-logging site assessments for two cut blocks on Loop Ridge were recently completed at 1:10,000 scale mapping level (Appendix G). The format and level of detail follow the methodology outlined in Luttmerding et al. (1990), and meet the standards of the B.C. Forest Practices Code. Since these sites are on the same aspect and slope of Loop Ridge, 2 km south of the proposed mining area, the data applicable to the logging sites will be deemed representative of the west aspect of Loop Ridge.

Comparison of the vegetation found in CFI's vegetation tables for their pre-logging assessments, with the most abundant vegetative cover noted during our strip samples supports the contention that west-facing Loop Ridge is relatively homogeneous throughout its length.

For example, the main components of the timber, shrub and herb layers were common to both CFI assessments and observations along our survey lines (Table 8).

Table 8: Main overstory and understory species common to CFI 1993 and 1994 site assessments data, and Townsend & Associates October 1995 strip survey observations.

Overstory:	Lodgepole pine	Pinus contorta
Understorey:		
Shrub layer:	Buffalo-berry	Sheperdia canadensis
	Snowberry	Symphoricarpos albus
	Alder	Alnus spp.
	Juniper	Juniperus communis
	Thimbleberry	Rubus parviflorus
Herb layer:	Pinegrass	Calamagrostis rubescens
	Showy Aster	Aster conspicuous

The current bulk sample is within an area re-sloped and revegetated after mine closure in 1970. The following grasses and forbs are presently providing lush cover on approximately 10 ha. remaining after 1995 bulk sample extraction:

Timothy	Phleum pratense
Alfalfa	Medicago spp.
Brome	Bromus inermis
Fescue	Festuca spp.
Crested wheatgrass	Agropyron spp.
Clover	Trifolium spp.

This seed mix is doing well on this site. Plants are robust and there was evidence of grazing throughout the length of the strip survey line crossing the reclamation. A seed mix utilizing

these species would probably be successful for subsequent reclamation arising from future site development.

The remaining vegetation work at the 1:20,000 scale operational mapping level involves a site reconnaissance in early summer 1996 to identify possible rare or endangered plant communities.

6. SUMMARY OF REMAINING BASELINE STUDY ACTIVITIES

February/March 1996:

- 1) continued animal inventories
- 2) continued wildlife habitat mapping
- 3) strip survey for fur bearers, ungulates
- 4) identify areas of intense winter use

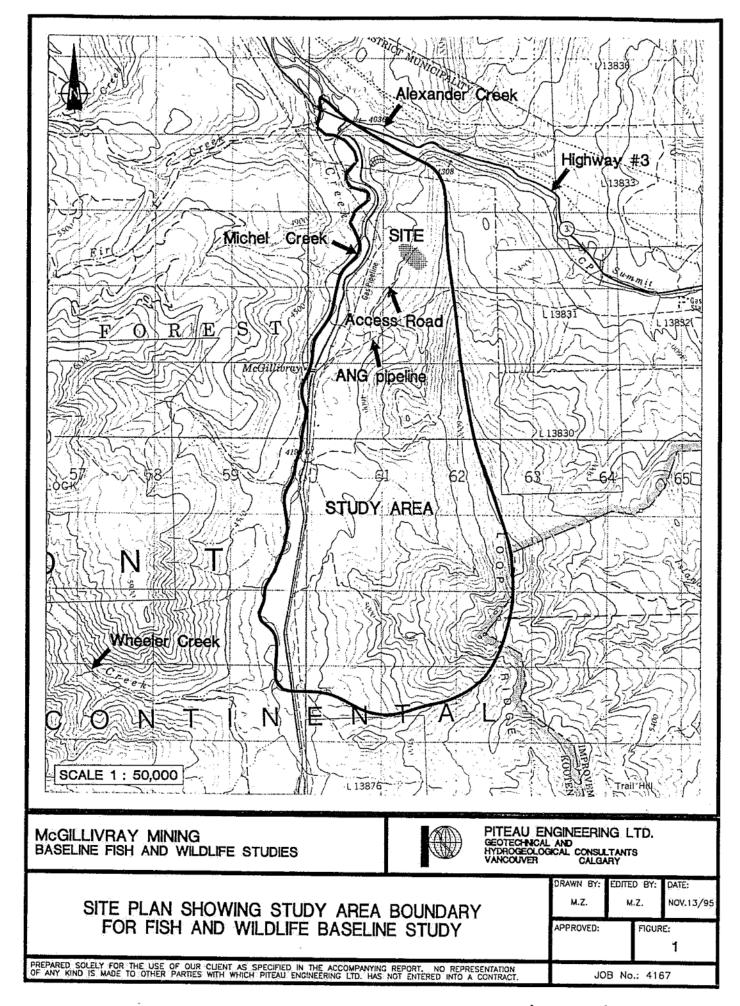
May/June 1996:

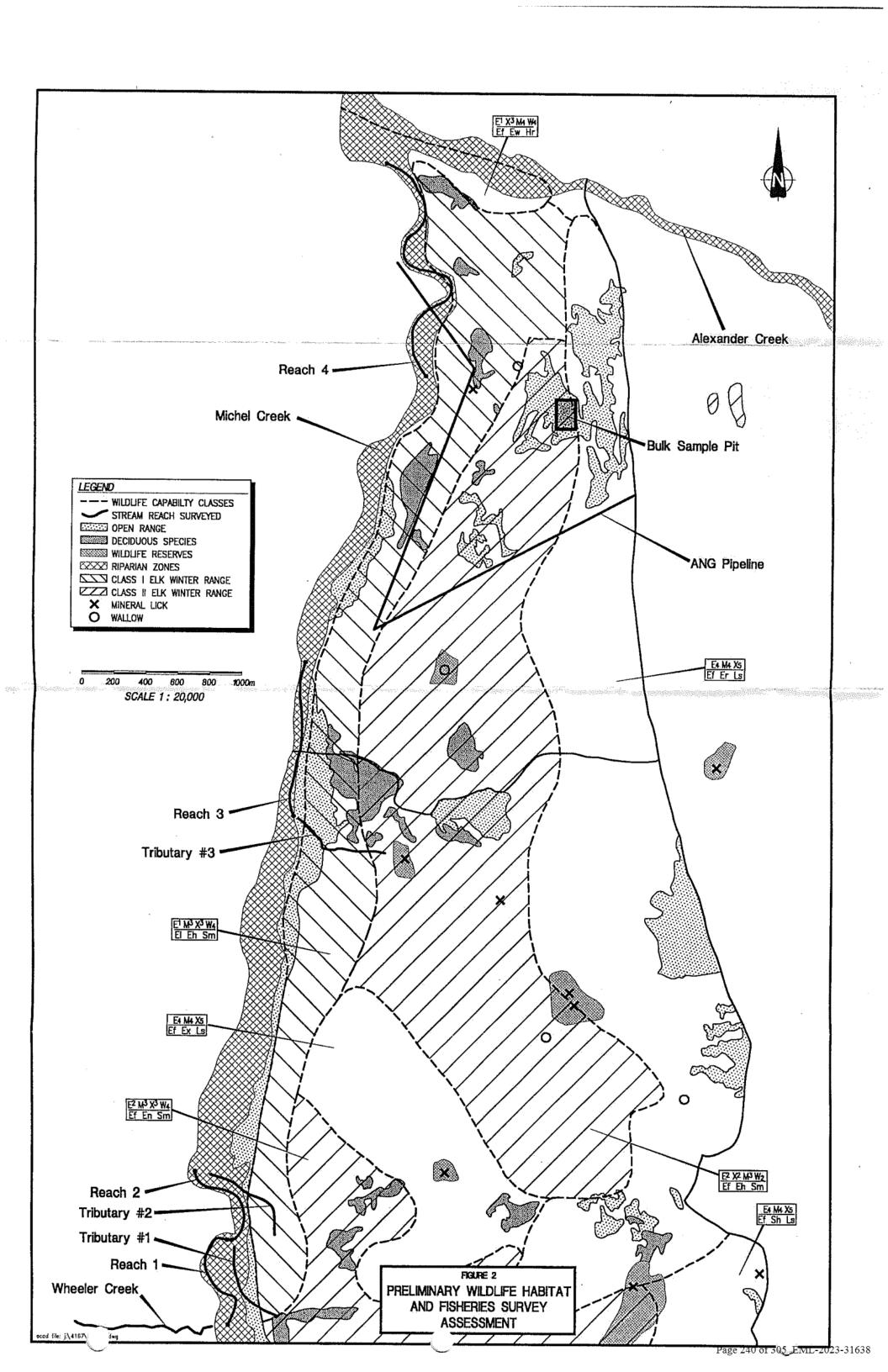
- 1) completion of fisheries field work
- 2) look for fawning/calving areas
- 3) complete search for bear, fur bearer and ungulate use
- 4) finalize wildlife habitat mapping
- 5) completion of bird and plant inventories
- 6) synthesize collected data into final report

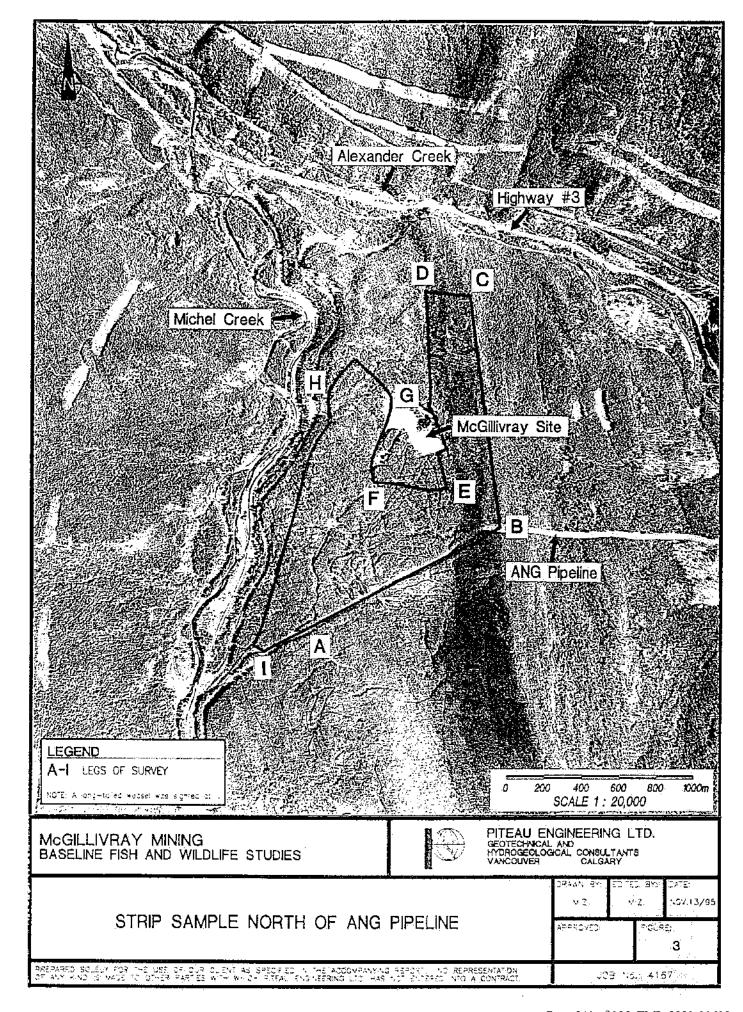
7. LITERATURE CITED

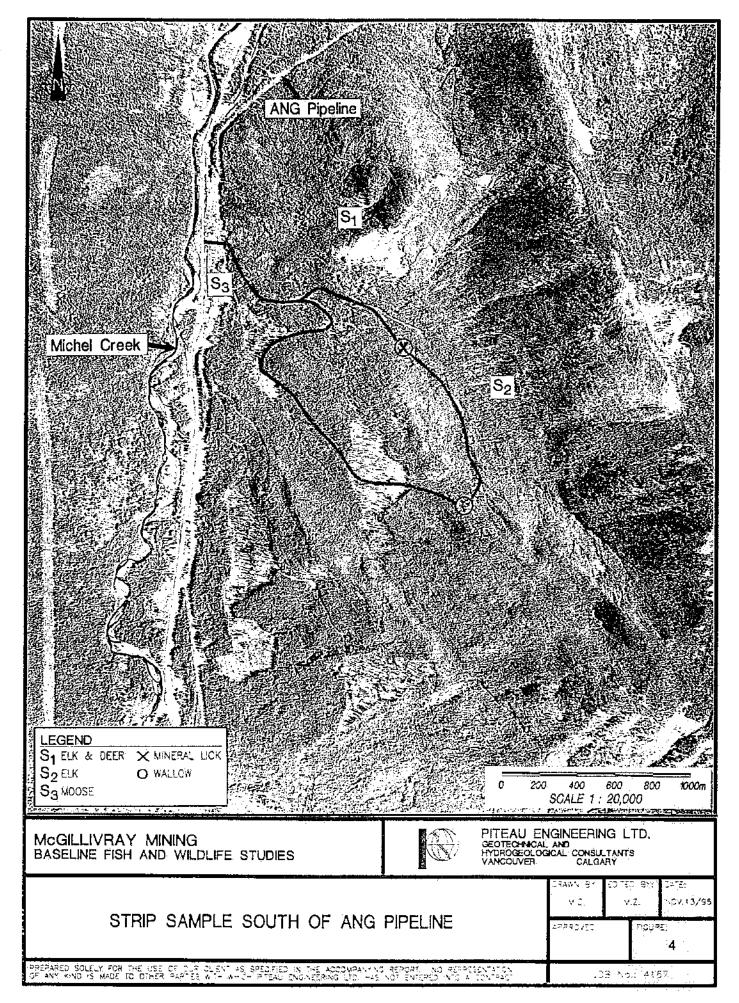
- Angrove, K. and B. Bancroft, 1983. A Guide to Some Common Plants of the Southern Interior of British Columbia, B.C. Ministry of Forests, Victoria, B.C.
- Demarchi, D. A. 1979. Biophysical Wildlife (Ungulate) Capability Map "Crowsnest 82G/10". Ministry of Environment, Manual 4.
- Demarchi, D. A. 1983. Biophysical Wildlife (Ungulate) Capability Map. Ministry of Environment, Manual 4.
- Gibson, C. and D. Sheets 1994. Environmental Impact Assessment. Elkview Coal Corporation Bodie development application. Appendix E -Ungulates.
- Inkpen, W. and R. Van Eyk, *Unknown year*. Guide to the common native trees and shrubs of Alberta. Alberta Environment, Environmental Protection Services Pesticides Chemicals Branch.
- Luttmerding, H. A., D. A. Demarchi, E. C. Lea, D. V. Meidinger and T. Vold, 1990. MOE Manual 11, Describing Ecosystems in the field, 2nd edition, Ministry of Environment, Lands and Parks, Victoria, B.C.
- Murie, O. J., 1982. Animal tracks. Peterson Field Guides, Houghton Mifflin Company, New York.
- Nelson, J. S. and M. J. Paetz, 1992. The fishes of Alberta. Second edition, The University of Edmonton Press and The University of Calgary Press, Alberta.
- Peterson, R. T. 1961. Western birds. Peterson Field Guides Houghton Mifflin Company, New York.

- Rezendes, P. 1993. Tracking and the art of seeing: how to read animal tracks and sign. First edition, second printing. Camden House Publishing Inc. Vermont.
- R. L. & L. Environmental Services Ltd. 1993. Preliminary fish assessment. Elkview Coal Corporation Bodie Creek Development Proposal.
- R. L. & L. Environmental Services Ltd. 1994. Preliminary fish assessment. Elkview Coal Corporation Bodie Creek Development Proposal.
- Saunders-Savoy, E. 1994. Environmental Impact Assessment. Elkview Coal Corporation Bodie Mine Development Certificate Application. Bird inventory.
- Schmidt, John L. and Douglas L. Gilbert, 1978. Big Game of North America, Ecology and Management. Stackpole Books, Harrisburg, PA.
- Scotter, G. W. and H. Flygare, 1986. Wildflowers of the Canadian Rockies. Hurtig Publishers Ltd., Ontario.
- Scotter, G. W., T. J. Ulrich and E. T. Jones, 1990. Birds of the Canadian Rockies. Western Producers Prairie Books, Saskatchewan.
- Wilkinson, K. 1990. Trees and shrubs of Alberta. Lone Pine Publishing, Alberta.









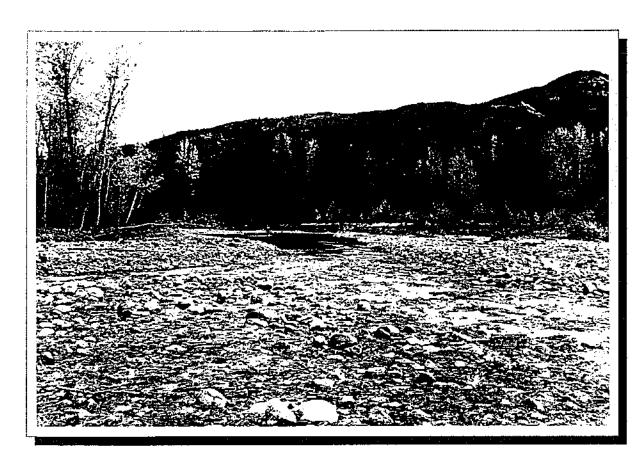


PHOTO 1: Reach #1 on Michel Creek, looking downstream from the confluence with Wheeler Creek. Note lack of bank cover.

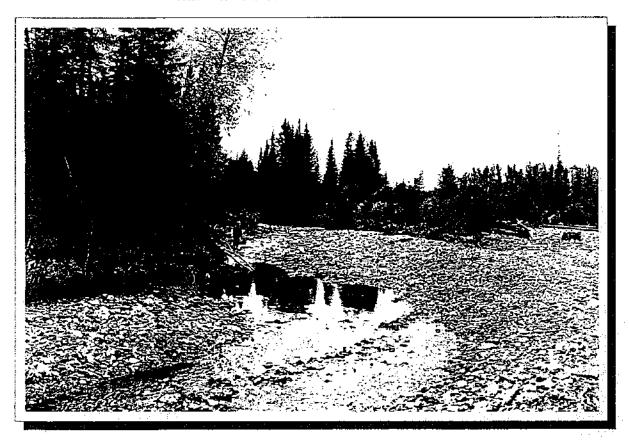


PHOTO 2: Tributary #1 entering Michel Creek from east, approximately 500 m downstream of Wheeler Creek confluence.

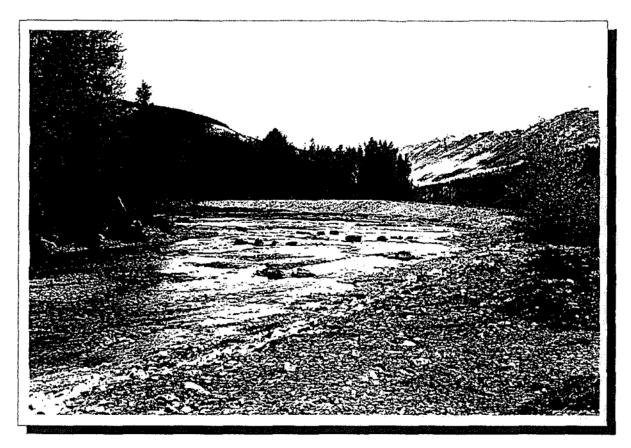


PHOTO 3: Reach #2 on Michel Creek looking downstream from approximately 550 m below Wheeler Creek confluence. Average depth in this reach at these flow levels is approximately 20 cm. No cover for fish.



PHOTO 4: Tributary #2, Looking downstream from a point approximately 200 m upstream of confluence with Michel Creek. Note person standing behind to be a second to be a sec



PHOTO 5: Upstream beginning of Reach #3 on Michel Creek. Note wide shallow, wetted width with no instream or shoreline cover. Photo point is approximately 1 km upstream of rail loop bridge, looking downstream.



PHOTO 6: Downstream natural un-channelized portion of Reach #3.

Note larger substrate, some shore cover adjacent to pool_{Page 245 of 305 EML-2023-31638}



PHOTO 7: Tributary #3 approximately 200 m from the confluence with Michel Creek. Crosses main road approximately 1km upstream of rail loop bridge. Note hanging culvert blocking access to suitable upstream juvenile habitat.

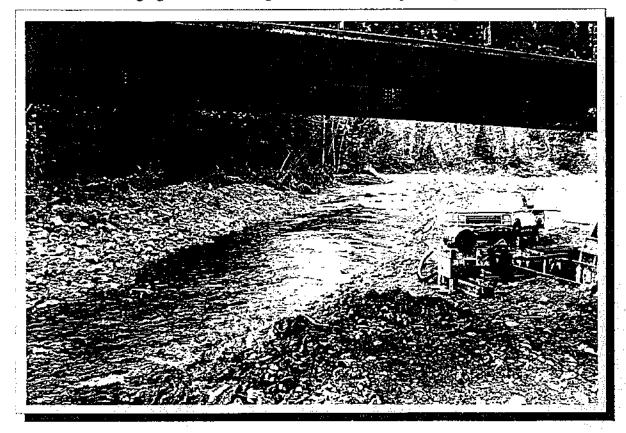


PHOTO 8: Start of Reach #4 on Michel Creek. Note observer snorkelling through pool at commencement of study section. Michel Creek has been channelized to keep it away from work on rail bridge abutment. Page 246 of 305 EML-2023-31638

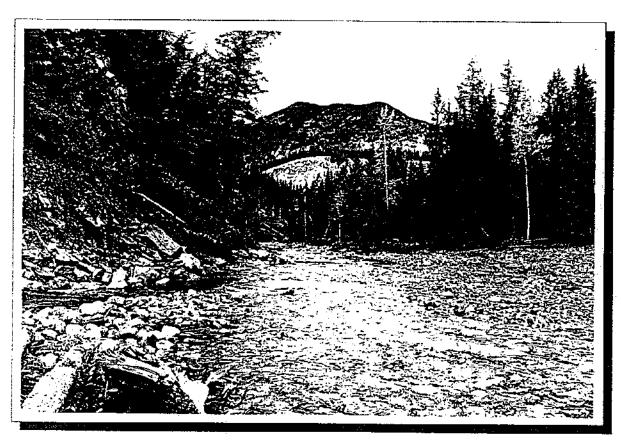


PHOTO 9: Transition from channelized to natural section of Reach #4. Photo point is just upstream of B.C. Gas pipeline crossing. Most fish were found in pools and pockets of natural sections, very few in channelized stream course.

APPENDIX A

BASELINE FISH AND WILDLIFE STUDIES TERMS OF REFERENCE - J.D.MARTIN, MAY 15, 1995.



Province of British Columbia Ministry of Environment, Lands and Parks

BC Environment

Kootenay Region Region 4 205 Industrial Road G Cranbrook British Columbia V1C 6H3 Telephone: (604) 489-8540

May 15, 1995

Gerry Reeves McGillivray Mining

Re: Baseline Fish and Wildlife Studies, McGillivray Coal Mining Project

The following terms of reference are for baseline fish and wildlife habitat assessment, population inventory and seasonal fish and wildlife use patterns.

It is important that baseline fish and wildlife information be collected prior to initial mine disturbance.

This information will be required for assessing potential impacts on fish and wildlife habitat, populations and use patterns, interim mitigation or compensation options as well as requirements for end leave reclamation.

Baseline fish and wildlife assessment should include:

1) Landscape Level Fish and Fish Habitat Inventory

This should include known presence or absence of fish in water course that may be influenced by the mine development including downstream impacts from changes in flows or levels, sedimentation etc. This should include major fish streams as well as the lower reaches (reaches with stream gradients less than 12%) of tributary watercourses.

- * Landscape level information should be collected within the area bounded by and including Michele Creek (confluence of Wheeler Creek to Alexander Creek), the height of land of Loop Ridge, and to the south by an unnamed westerly flowing tributary of Michel Creek entering Michel Creek approximately 100 meters north of the confluence with Wheeler Creek.
- 2) Fish and Fish Habitat Classification for all streams, lakes and wet lands as per the Forest Practices Code classification process.

Animal Inventory

Inventory (presence or absence) at the landscape level must be collected for all ungulates, bear, fur bearers, and bird species. This data base should include red and blue listed species, regionally significant species as well as possible rare and endangered plant communities.

4) Landscape Level Wildlife Habitat Inventory at 1:50,000 mapping level

This mapping should include ecosystem, biophysical capability and suitability mapping, including known migration corridors, sensitive habitats (riparian, avalanche paths, wildlife licks, nesting sites, fawning and calving areas etc.)

5) Operational Level Wildlife Habitat Inventory at 1:20,000 mapping Level

This level will require the same information as the landscape level mapping however mapping should be restricted to areas within 300 meters of the immediate area that will be impacted by any proposed mine development including roads, dumps, and exploration disturbance.

Based on the above baseline information additional information may be required to:

 assess potential areas for interim mitigation to offset habitat losses, wildlife seasonal use research,

radio tracking of wildlife species to determine seasonal use patterns, and

population health monitoring to determine long term impacts of this project on wildlife and fish populations in the area.

If you require any additional information or clarification regarding the above please contact the undersigned at your convenience.

Yours truly,

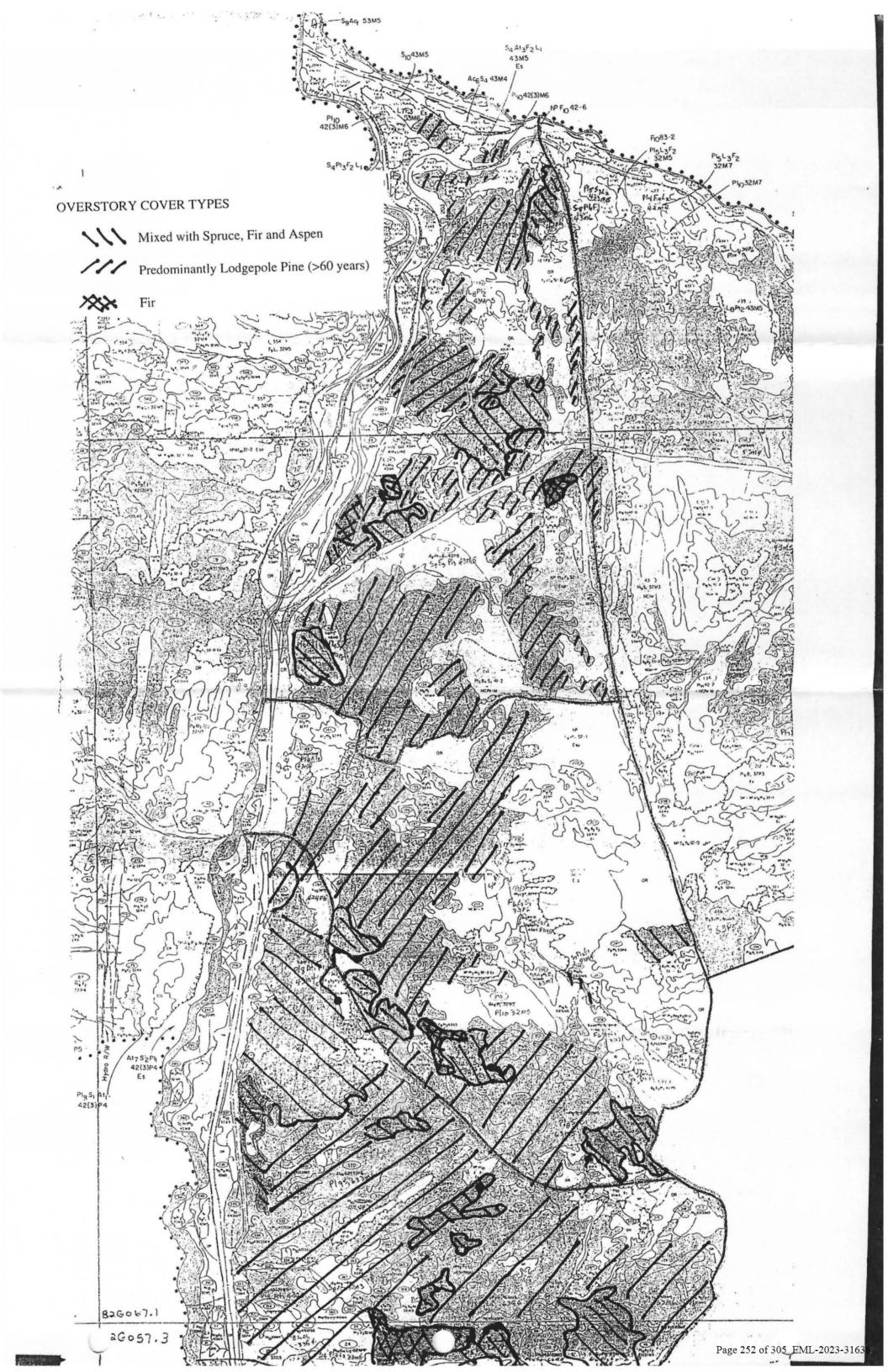
J. D. Martin

East Kootenay Habitat Biologist

JDM/ss

APPENDIX B

LOOP RIDGE OVERSTORY COVER TYPES CRESTBROOK FOREST INDUSTRIES LTD. 1:20,000 MAPPING LEVEL.



APPENDIX C
STREAM SURVEY FORMS

3000			FISH SUM	MARY			STREAM/VALLEY CROSS-SECTION (Looking Downstream)
;	Species	No.	Size Range (mm)	Life Phase	Use	Method/Rel.	H L
_	cT	2	3-4"		1		PLANIMETRIC VIEW
_		0			 		-
	· · · ·	444	AY., 1 - 4 12 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1				-
-	 	(V) () () (-	-	1	<u> </u>
÷	 				375		-L (v)
		-	(X)			- 「
_		a			-		-
_	1				ļ		
_					<u> </u>		-
_	<u> </u>						
_		1.1.1			<u> </u>		<u></u>
	\$	rangen .		an Aliga (1996) Sanggaran	g Mill George		COMMENTS
	Channe	l Sta	bility 🔲 ; Debris	☐; Manag	eme	nt Concerns	Obstructions : Riparian Zone : Valley Wall Processes : Etc.
	- 1	492	GING Culve	, t 1	,	250 m	U/S of Confliction o Michel Ck Blockage
	30	5	moll CT	note	1	rising	o in channel Dis of entuent
_		7.72			4/		hanging outact for overnight
_	- /-		HARS - NO			1 N 62	
	-		/ A 10 - 10			2 /N GE	22 /24(XI)
-	 				-		
-						and the second second	
			<u>, i </u>	-	*	No. 10 Aug.	
_							
_	7	San S					
_	\$ 'n/s	65. ja 1					Edited by:
		erpresser in Tradition is	n de de la companya d				Date Y M.D.

Total fish = 2

			FISH BUM	MARY		STREAM/VALLEY CROSS-SECTION [
;	Species	No.	Size Range (mm)	Life Phase	Use Method/Ret.	L (Looking Downstream)
_	EΒ	21	2"-4"	JUV	VISUAL &	PLANIMETRIC VIEW
_		3.45 .7.				
						<u> </u> -
_	¥ .		%0.00 AND TO AND			T
_	9.50			V		$-\mathbf{x}$
	Ş.e.			1		
_						
_						
_			e cycles and the control of			
_						-
_	9					COMMENTS
_	Channe	1 Sta	bility 🔲. Debris	Manag	ement Concerns	Obstructions : Riparian Zone : Valley Wall Processes : Etc.
_						NEL, WITH L'O.D. (STICKS, LOGS)
_		F	THE AV	120 Hans	ING BANK	
_	1	- }-			70 4 2 77 7	
_	1	-				
_		; V				(\mathbf{X})
_				14		
_	2 74.	115	A TOTAL CONTRACTOR			
_	1				<u></u> ,	
_		7 v#34			<u> </u>	
	12					Edited by:
		. 4				Dale Y M D:

1041 Pist = 21

711	4		FISH SUM	YRAMI				STREAM/VALLEY C	ROSS-SECTION	ОМ 🔲		
: a	9000	No.	Size Range (mm)	Life Phase	Use	Method/Rel.	L	(Looking Dow	(nstream)	_		R
7	CT	12	4-6"	Zur			1—	PLANIMETRIC VIEW	1			
	MWE	18	4-64						*			
1	18	30	3-10]_		•			
	muF?	6	2."	FRI			1-					·
1	5 8	1	40	Y]	(\mathbf{X})				-
	07	1	and a grant of anists]			şî.		-
	CKY!	1	3 /	1.2.4		, .]					-
-		12		Ling.			· ·				·····	
\top	\$v. //	sely-syst	and the same of the same of the			0.10	- Y7					
1		17.										_
	Ç	1864	an and the second of the second				COMMEN	TS ,				
С	hanne	Sta	bility 🔲 ; Debris	. Manag	emen	t Concerns	Obstructions []	Riparian Zone	Wall Processe	s [_], Etc.		
		11.2										
	NOT	B	511,12 12	N	117	, , ,	PLACED GUE	TRAP 133	\$A .			
							_	19 1110 - NA.			-	
	7. 74. (1. 1.		点。 图图数据描写。AV									
	f " "	f phi					(XI)					
			<u>. Partiri i</u>									le et
						v.		,				
_ _			-: -:		-							
	şà-		 							,		
		19-3		· · · · · · · · · · · · · · · · · · ·						Edited by:		
	14	a signir	r gjeskij						,	Date YM I):	

COLERN QUALITY & 2.20

7 stal 18/ 81

Page 256 of 305 EML-2023-31638

FOL	(P)	60',	40',20,	00,23,	7,43,	20,10,	15,	8,40	, 3	0. 50	,
				Laur Stake	*.	á				•	

FISH SUMMARY						STREAM/VALLEY CROSS-SECTION (Looking Downstream)				
Specie	No.	Size Range (mm)	Lite Phase	Use	Method/Rel.			R		
ET	1	10"	ADVLT		SNURKEL.	厂	PLANIMETRIC VIEW			
Rnin		6-1011	2	1	3 ~	-		A		
CT	6	6-10"	1 11		. 1	1	Channelesed sections	O April		
CT	2	18.7%	11		71	┝	- Channellis a for	. —		
1 1	1	14: (1	X /		1.1	-	- Channelised X	/* C		
RANN	= 1	111 11						-		
CT	1	12"	1			一		• -		
CT	3.	8-12"	,,			Ϳ╴				
RM	F 15	4-12"	JEA			\vdash				
CT	10	4-1011	27.6			L				
i E					9 - 1925 - 1921 - 1921 - 1921 - 1921 - 1921 - 1921 - 1921 - 1921 - 1921 - 1921 - 1921 - 1921 - 1921 - 1921 - 192		COMMENTS			
Chann	el Sta	ability 🔲 ; Debris	. Manag	emer	t Concerns	<u> </u>	Obstructions [], Riparian Zone [], Valley Wall Processes [], Etc.			
E3	- 1		Adult			1				
CT	·	8"			70	<u>'</u>	- some discolaration & moto, &	Close		
Cal	i i	191	5*				Pot has Morting or the			
CT	ə	l=7"	1,		<u> </u>	± .				
(7)	Ļ	Francis Control Control Control Control		11	¹k:		(1)			
CT		/ /3.1	<u>.</u>	<u>i</u> į		<u> </u>				
RM	WF		****	γ,	100000000000000000000000000000000000000					
f.m	کی وہا		13,	11.				· · · · · · · · · · · · · · · · · · ·		
<u> </u>	<u> </u>		10"	r'i		: !	Edited by:			
CT		1 to 3020 comment of the state	-10		·····	17.	Date Y M D			
J CT		4 4	OY SIDE	< µ	annel Sett	!				
			Pest	En.	416 m + 3.6"	{) .	Billion of James and Cittle of the Co	1485.0		
٧		1.						100		
			,				Deal	more of		
			the second							

POOL -/m) 30, 38, 20, 2, 3, 5, 10, 14, 3, 45 - 143 m.

STREAM/VALLEY CROSS-SECTION (Looking Downstream) FISH SUMMARY Species No. Size Range (mm) Lite Phase Use Method/Rel R PLANIMETRIC VIEW Adult Snorkel RMWF 5-12" 4-10" KmWF 6-8" RINWE Yoy FIY 5-8" COMMENTS Management Concerns . Obstructions . Riparian Zone . Valley Wall Processes . Etc. viffles average = 8" depth - chan reliced 5-12" 2 4-1:" r LAWE 2 8-10" 4-10" 4-12" KMWI two charactered ville Edited by: Date YMD:

99/5-

RIFFLE ((m) 160, 100, 150, 50, 100, 50 = 500 100)

FISH SUMMARY Species No. Size Range (mm) Lite Phase Use Method/Ret.	STREAM/VALLEY CROSS-SECTION L
CF 1200 years	PLANIMETRIC VIEW
C7 1 8"	H
	2.2 1
	\vdash (\mathbf{x}) \dashv
	<u></u>
	COMMENTS
Channel Stability Debris Management Concerns	, Obstructions, Riparian Zone, Valley Wall Processes, Etc.
CHANNELIZED SECTION WITH R	
	no, RIFTEN THRONGIONT, NO COURT OF THE
THICKLY DEALERS	Not Large Product (April 19 19 19 19 19 19 19 19 19 19 19 19 19
The first string and maken that the artist and a string of the artist and a string of the string of	Not Lucy (And)
	(\mathbf{X})
	2.43
A STATE OF THE STA	
	Edited by:
	Date Y M D:

Total fir: 2

		FISH SUM	MARY			STREAM/VALLEY CROSS-SECTION (Looking Downstream)
Spécies	No.	Size Range (mm)	Life Phase	Use	Method/Rel.) L
CT	5	200-320	ADULT		SNORKEL	PLANIMETRIC VIEW
RMWE	5	101 1 - 10 11	"//	, ē.	11	-
CT	16	150 - 360	11		- //	
RMWF	5	150 - 360	11/2	14	. //	\vdash \frown \dashv
PHUF	6	250-350	Y //		11.11.	$ (\mathbf{x})$
CT	B		1/11		11	\vdash
CT	1	1011	//	:	4	-
	35	10-15"	,1/		77	
CT		8-12"	11		"	
23/4	1	12"		1.	11	
				7. 7		COMMENTS
Channe	Sta	mility Debris	- Manag	emei	t-Concerns	. Obstructions . Riparian Zone . Valley Wall Processes . Etc.
(9	2	6-91	77	1	11. 7	in riffles
1 3 g	2	6-8"	n		11	
-RBH	1	54/3"				
CT	4	6-8"		1		
RMUT	7	6-10"				(XI)
No ICIA	-/-	14 - A/A 1 1 1		51		
10					the Agr	
	1		(* 2.m.) d.	 		
				1		
	81.		1	Ť		Edited by:
1			1	 		Date Y M D:
1				+		
	1 1 P					
" that	: <i>I</i> -	101 = 101	*			
. 4.		1	1	i	t 1/2	

APPENDIX D

STRIP SAMPLE SUMMARY SHEETS AND FIELD NOTES, SEPTEMBER 30 AND OCTOBER 1, 1995.

Abbreviations used:

BBS	Bear scat
WEP	Winter Elk Pellet Group
SEP	Summer Elk Pellet Group
WMP	Winter Moose Pellet Group
SMP	Summer Moose Pellet Group
WDP	Winter Deer Pellet Group
SDP	Summer Deer Pellet Group
CS	Coyote Scat
WS	Wolf Scat

DATE:

Sept 30, 1995

PROJECT AREA:

North of ANG

1300 m ASL - 1590 m ASL

LENGTH:

1360 M

TRANSECT:

AB

BBS - 9

WEP - 19

SEP - 2

WMP - 4

SMP -

WDP -

SDP -

CS - 3

WS - 1 (possible)

Elk track - 3 sets

VISUALS:

long-tailed weasel

chipmunk 2 grey jays

red squirrel (heard)

VEGETATION:

On ANG line:

Crested Wheat Grass

Alfalfa Red Clover

Timothy

Slender Wheat Grass Yellow Sweet Clover

Mullein

Canada Thistle Smooth Brome Fescue spp Adjacent to ANG line:

Overstory - Lodgepole pine

Associated - Alder

Thimbleberry
Salix (2 spp)
Raspberry
Golden Currant
Poplar (spp)
Buffalo-berry

DATE:

Sept 30/95

PROJECT AREA:

Ridge top

1590 m ASL - 1450 m ASL

LENGTH:

1500 M

TRANSECT:

BC

BBS - 2

WEP - 43

SEP - 20

WMP - 2

SMP - 1

WDP -

SDP -

CS - 1 WS -

...

VISUALS:

Merlin hawk

Bear sign - 2 small digs rocks and logs turned over Many beds along ridge (>25)

North/South game trail on ridge crest

VEGETATION:

Overstory - Lodgepole pine

Associated -Alder *

Salix spp (1) *
Thimbleberry
Pinegrass *
Golden Currant
Snowberry
Yarrow
Juniper

Canada buffalo-berry

Showy Aster *

^{* =} most abundant

DATE:

Sept 30/95

PROJECT AREA:

East/west down steep slope

1437 m ASL - 1327 m ASL

LENGTH:

300 M

TRANSECT:

CD

BBS -

WEP-6

SEP-2

WMP - 2

SMP -

WDP -

SDP -

CS -

WS -

VISUALS:

Varied thrush

Steep slope 30°

North/south game trails along slope (6)

VEGETATION:

Lodgepole pine/spruce

Associated -Pinegrass *

Sheperdia *
Showy Aster
Maple

Salix spp
Golden currant

Bunchberry Thimbleberry Snowberry

Fairy Bells (Disporum trachycarpum)

^{* =} most abundant

DATE:

Sept 30/95

PROJECT AREA:

North/south along game trail on old overgrown logging trail

1327 m ASL - 1430 m ASL

LENGTH:

1250 M

TRANSECT:

DE

BBS - 3

WEP - 23

SEP - 9

WMP - 4

SMP - 2

WDP -

SDP - 2

CS - 2

WS -

VISUALS:

Possible badger hole near N. edge of test pit opening

DE follows heavy north/south game trail

VEGETATION:

Overstory - Lodgepole pine

Associated -Alder *

Thimbleberry *
Pinegrass *
Showy Aster
Bunchberry

* = most abundant

DATE:

Sept 30/95

PROJECT AREA:

Downhill through thick pine/shrub stand

1430 m ASL - 1330 m ASL

LENGTH:

410 M

TRANSECT:

EF

BBS -

WEP - 4

SEP - 1

WMP - 3

SMP -

WDP -

SDP -

CS -

WS -

VISUALS:

Downy woodpecker

red squirrel

VEGETATION:

Overstory - Lodgepole pine

Associated - Thimbleberry *

Pinegrass *

^{* =} most abundant

DATE:

Sept 30/95

PROJECT AREA:

Along lower roadside, across 1970 test pit reclamation

1330 m ASL

LENGTH:

580 M

TRANSECT:

FG

BBS -

WEP - 4

SEP-10

WMP -

SMP -

WDP -

SDP -

CS -

WS -

VISUALS:

mule deer track - on road

cow and calf moose track - on road

coyote track - on road

sign of browsing on alfalfa and clover in test pit

VEGETATION:

1970 Test Pit Reclamation Vegetation

- Timothy

- Brome

- Alfalfa

- Clover (Alsike?)

- Fescue spp

- Crested Wheat Grass

- Slender Wheat Grass

Note: very heavy vegetation on old test pit makes it difficult to spot pellet

groups

DATE:

Sept 30/95

PROJECT AREA:

Dog leg through mixed open pine/aspen stand to BC Gas right-of-way

1290 m ASL

LENGTH:

535 M

TRANSECT:

GH

BBS-

WEP - 7

SEP - 7

WMP - 1

SMP -

WDP -

SDP -

CS -

WS -

VISUALS:

-bear-clawed trees - 6 large aspen

-small bear dig

-3 antler-rubbed trees (elk)

-good game trail NW off old reclaimed pit

-found good wallow and water hole 4 m x 4 m x 20 cm deep in

25 m² clearing surrounded by boggy grasses

VEGETATION:

Open Lodgepole pine/aspen canopy

Associated - mainly Pinegrass

DATE:

Sept 30/95

PROJECT AREA:

North/south on BC Gas right-of-way

1290 m ASL - 1280 m ASL

LENGTH:

1720 M

TRANSECT:

HI

BBS - 1

WEP - 1

SEP - 12

WMP -

SMP -

WDP -

SDP - 1

CS -

WS -

VISUALS:

- moose tracks >4 sets

- White-tailed deer tracks (1)

- mineral lick - well used - near point H

- several water holes along R.O.W. - all used

VEGETATION:

On BC Gas R.O.W:

- Timothy

- Brome

- Alfalfa

- Red Clover

- Red top

- Canada Thistle

DATE:

Sept 30/95

PROJECT AREA:

Junction of ANG and BC Gas lines to start at haul road corner

1280 m ASL

LENGTH:

360 m

TRANSECT:

IA

BBS -

WEP -

SEP - 3

WMP-

SMP -

WDP -

SDP -

CS -

WS -

VISUALS:

mule deer tracks - 2 sets

elk track - 1

VEGETATION:

extremely thick grasses and forbs on ANG right-of-way - difficult

to spot pellet groups

DATE:

Sept 30/95

PROJECT AREA:

South of ANG pipeline

LENGTH:

3600 m

TRANSECT:

Loop east from logging road approx. 1 km. south of rail loop

BBS - 1

WEP - 3

SEP - 20

WMP - 8

SMP - 0

WDP - 2

SDP - 12

CS -

WS -

VISUALS:

- Juncos (15), ruffed grouse (2), blue grouse (1)

- white-tailed deer tracks on road

- 5 elk (1 male, 4 female), 6 mule deer, 3 elk

- cow and calf moose

- well-used wallow above cut-block

- coyote track on road

- large lick near north side valley bottom

VEGETATION:

west-facing: Lodgepole pine with snowberry, thimbleberry.

Alder, Aster

north-east facing, just over saddle: subalpine fir/spruce, with Alder,

thimbleberry, mosses

Summary of Strip Sample Results

DATE:

Sept 30/95

PROJECT AREA:

North of ANG line

TOTAL LENGTH:

8015 m

TOTAL STRIP SAMPLE AREA:

24,045 sq m

TOTAL FOR ALL TRANSECTS:

BBS - 15

WEP - 107

SEP - 66

WMP - 16

SMP-3

WDP - 0

SDP - 3

CS - 6

PRESENCE CONFIRMED: direct or indirect

Ungulates:

elk, moose, mule deer, white-tailed deer

Bear:

black

Birds:

Downy woodpecker, merlin, grey jay, varied thrush

Fur bearers:

long-tailed weasel, red squirrel, coyote

PRESENCE SUSPECTED: Grizzly bear, wolf

APPENDIX E BODIE CREEK BASIN BIRD INVENTORY, ELKVIEW COAL CORPORATION

Birds recorded during inventories in Bodie Creek Basin, and expected to occur in Loop Ridge study area

Common Name

Scientific Name

HAWKS, EAGLES AND FALCONS

Sharp-shinned Hawk
Northern Goshawk
Northern Goshawk
Red-tailed Hawk
Buteo jamaicensis
Golden Eagle
Aquila chrysaetos
American Kestrel
Falco sparverius

GROUSE

Spruce GrouseDendragapus canadensisBlue GrouseDendragapus obscurusRuffed GrouseBonasa umbellus

OWLS

Long-eared Owl Asio otus

NIGHTHAWKS

Common Nighthawk Chordeiles minor

SWIFTS

Vaux's Swift Chaetura vauxi

HUMMINGBIRDS

Calliope Hummingbird Stellula calliope Rufous Hummingbird Selasphorus rufus

WOODPECKERS

Downy WoodpeckerPicoides pubescensNorthern FlickerColaptes auratusPileated WoodpeckerDryocopus pileatus

FLYCATCHERS

Olive-sided Flycatcher Contopus borealis
Dusky Flycatcher Empidonax oberholseri

SWALLOWS

Barn Swallow Hirundo rustica

JAYS, MAGPIES, CROWS

Gray Jay Perisoreus canadensis Steller's Jay Cyanocitta stelleri Clark's Nutcracker Common Raven Nucifraga columbiana Corvus corax

CHICKADEES

Black-capped Chickadee Mountain Chickadee

Parus atricapillus Parus gambeli

NUTHATCHES, CREEPERS

Red-breasted Nuthatch Brown Creeper Sitta canadensis Certhia Americana

WRENS

Winter Wren

Troglodytes troglodytes

KINGLETS

Golden-crowned Kinglet Ruby-crowned Kinglet

Regulus satrapa Regulus calendula

THRUSHES, SOLITAIRES, BLUEBIRDS

Mountain Bluebird Townsend's Solitaire

Veery

Swainson's Thrush Hermit Thrush American Robin Varied Thrush Sialia currucoides
Myadestes townsendi
Catharus fuscenscens
Catharus ustulatus
Catharus guttatus
Turdus migratorius
Ixoreus naevius

WAXWINGS

Cedar Waxwing

Bombycilla cedrorum

VIREOS

Solitary Vireo Warbling Vireo Red-eyes Vireo Vireo solitarius Vireo gilvus Vireo olivaceus

WARBLERS

Orange-crowned Warbler Yellow-rumped Warbler Townsend's Warbler Blackpoll Warbler American Redstart MacGillvray's Warbler Wilson's Warbler Vermivora celata
Dendroica coronata
Dendroica townsendi
Dendroica striata
Setophaga ruticilla
Oporornis tolmiei
Wilsonia pusilla

SPARROWS

Chipping Sparrow Vesper Sparrow

Spizella passerina Pooecetes gramineus White-crowned Sparrow Dark-eyed Junco

BLACKBIRDSBrown-headed Cowbird

TANAGERS, FINCHES Pine Siskin Western Tanager Red Crossbill Zonotrichia leucophrys Junco hyemalis

Molothrus ater

Carduelis pinus Piranga ludoviciana Loxia curvirostra

APPENDI	XF	
BIRD SPECIES OF POSSIBLE OCCURRENCE	E IN BODIE AND LOOP RIDGE AREAS.	

The following is a list of species which could be expected to breed in the area, based on gegraphical distributions and habitat requirements, but which were not recorded during the inventories in Bodie Creek. Due to the proximity, these species may also occur in the Loop Ridge area.

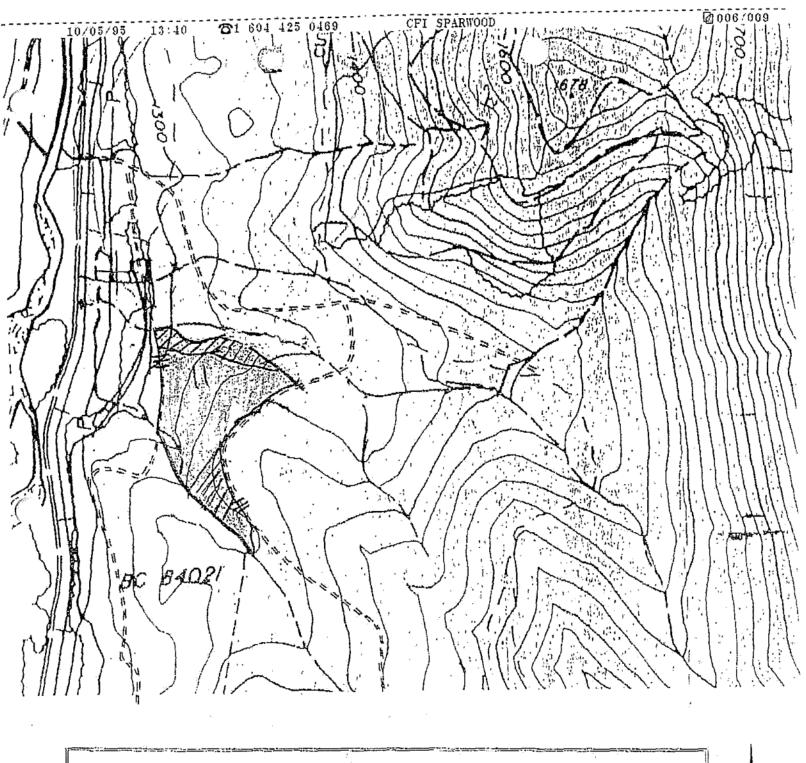
Cooper's Hawk
Mourning Dove
Great Horned Owl
Northern Pygmy Owl
Northern Saw-whet Owl
Red-naped Sapsucker
Hairy Woodpecker
Three-toed Woodpecker
Boreal Chickadee
Fox Sparrow
White-winged Crossbill
Cassin's Finch

Accipiter cooperii
Zenaida macroura
Bubo virginianus
Glaucidium gnoma
Aegolius acadicus
Sphyrapicus nuchalis
Picoides villosus
Picoides tridactylus
Parus hudsonicus
Passerella iliaca
Loxia leucoptera
Carpodacus cassinii

APPENDIX G
PRE-LOGGING SITE ASSESSMENTS DESCRIBING LOOP RIDGE ECOSYSTEMS.

PHE-MARYES I ST VICULTURE PRESCRIPTION FIELD DATA. J INITIAL PRESCRIPTION -- INTERIOR SITES

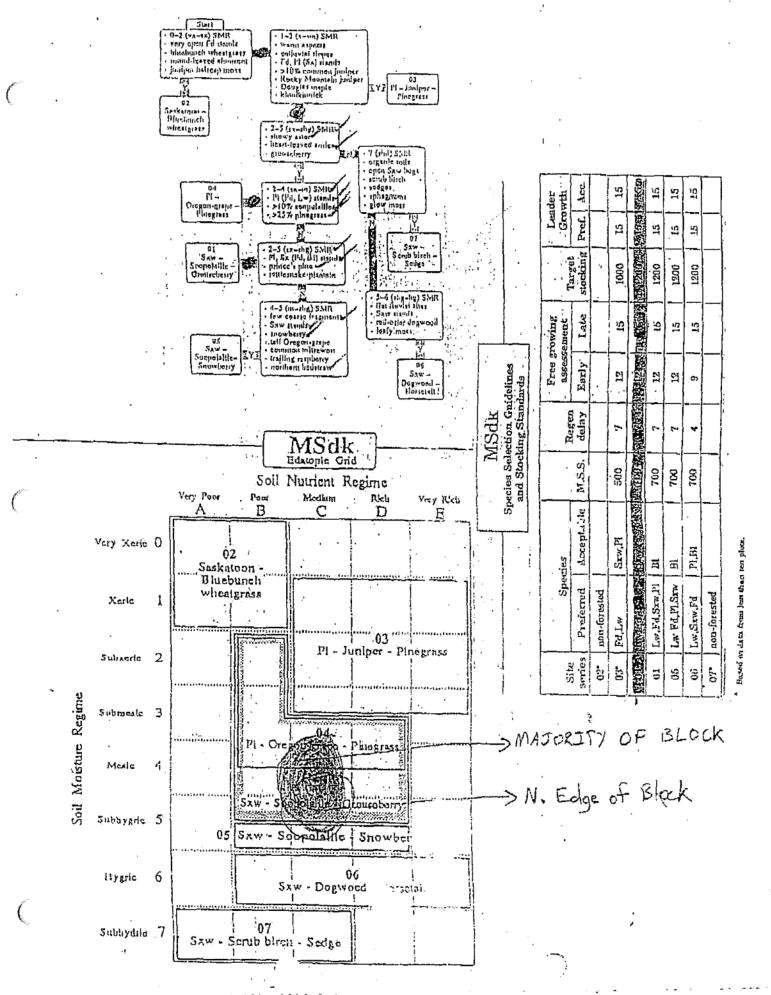
1	\cdot
•	Search of the Marketine was a serie paragraph of the paragraph.
	Undersend. 7. Licensee 7. Bes. Emphasis 4. C.F. 5. Incord 6. Stratum area 7. Betatum plot
· · ·	MF-27 (CFI 372 305) In
•	O LOCATION TO SUMME TO ME TO SERVATION TO A SPECIAL SLOPE POS TO SUPER STAPE
1 4	LOOP RIXE. LD. BRA-BROOK 93,04, 05 mile 1360 - 136 Max WINW MID HUMOCKY
	14. UT LIFEL A U 15 WA JENGOUNET GULL LES TE SLOPE O 20% TO 20% STORE W 16 LANDFORMPARENT MATERIAL
,	SB in 100m - 1x 100m SATESON 10-100 > 50% 25%
	let et a de la caracidata de la companya della companya de la companya della comp
į	10. Score stability implications found 20, 1860 ZONE SUBL VAN. 1911. SHE SETIES M. 21. MOIST. 22 MUT. No unstable indicators found MS Ide Ord 7-4 C:
,	
	23. TONEST CLOSE DEPTH (24) - TOTAL 24, HUMUS FORM 25 SURENCE ORGANIC MATTER FOOL CININGTENISTICS
,	12 2 1 1 - 5 MOR (MODER) Needles & Moss
	SOIL HORIZONS 32. SOIL CLASSIFICATION 31. C.F. DEDHOCK / LINIOLOGY
}	25. ROHEZON 27. DEPHIL20, TEXTURE (29. M GR 30. 121. BRIDGES OF 1
į.	(cm) a SIZE COL MOIST 34, ROOTING DEPTH 35, DIMINAGE
,	1. 117 07 0- Well Well
i t	
	1
• •	101 ALAGE 56 45 70 46
	36 SEASONAL SHE L'ACTORS (DATES: DELY, WET, FROZEN, SNOW) HEIGHT Z3- 19m 18m
•	many than a second of the seco
	157 UNITAVOUNABLE SUBSTITATES
ē	DESTRICT LAYER TO Y TAKE ON SPECIFY: CRN. CLASS D D D
•	CANDENALES Y YN CON SAND PRESENTALIVE CH. 3000 400 2000 9000
	MAGMENTAL LIVEN ON PUT MODERN TOWN TOWN TOWN TOWN
	STATE OF THE PROPERTY OF THE P
	LAYER STECIES W AGE HEIGHT DOW STEMBAR LAYER CONDITION / COMMENTS
	1251 84° 0 Pl, 9° 0 Sx 70 Zom 33-50-800 LIMBY Sx
Brazz,	$(1/2)^{2}(1/2)^{2}$ and $(-1/2)^{2}$
120	75 765 3 290 Pl 70 15m 120ch 50
	Middle Lot Actuary More FENCEPOSTS (~ 1.0,60.)
	REGIN,
•	A DESCRIPTION OF THE PROPERTY
·	LAYED INC SPECIES INC SPECIES INC SPECIES INC SPECIES INC SPECIES INC SPECIES INC
	SHOUD ISO Styp. 120 Alous 15 Rubes 110 Long 15
N. Edge	
OF Block	185 Calon. 1301 Cornus 130's Linn. Par 10th Arriva 5 1
- Y (C)	MOSS 130 9/60 130
(STRATUMZ))	VII II II A JAZANO ANTA DISTE DISTURBANCE, SENSITIVITY Description / Hacogimandation
20	Compaction HIGHON N. EDGE OF BLOCK (1.0 ha)
$\mathcal{L}_{i} = \mathcal{L}_{i}$	Compacion 11 Ed and Compacion
* 1	Ujapjacoment
, , , , , , , , , , , , , , , , , , ,	Surface Gradien
\	Sample Statement
Ί,	Maca Wasting
<i>f.</i>	
	Forest Floor Displaceds.
	Overeit (Finnescho)
į .	
	MALE DESTRUCTIONS AND SECONDAL HOUSE CONSTRUCT FOR EPT
	MOST OF THE BLOCKIAS NO SEASONAL HRUST CONSTRAINT EXCEPT FOR STRATUM I ON THE N. EDGE OF THE BLOCK.
	LOW STIME ON HALF WE EARL OF THE PARTY
<u> </u>	SIGNATURE
k.	



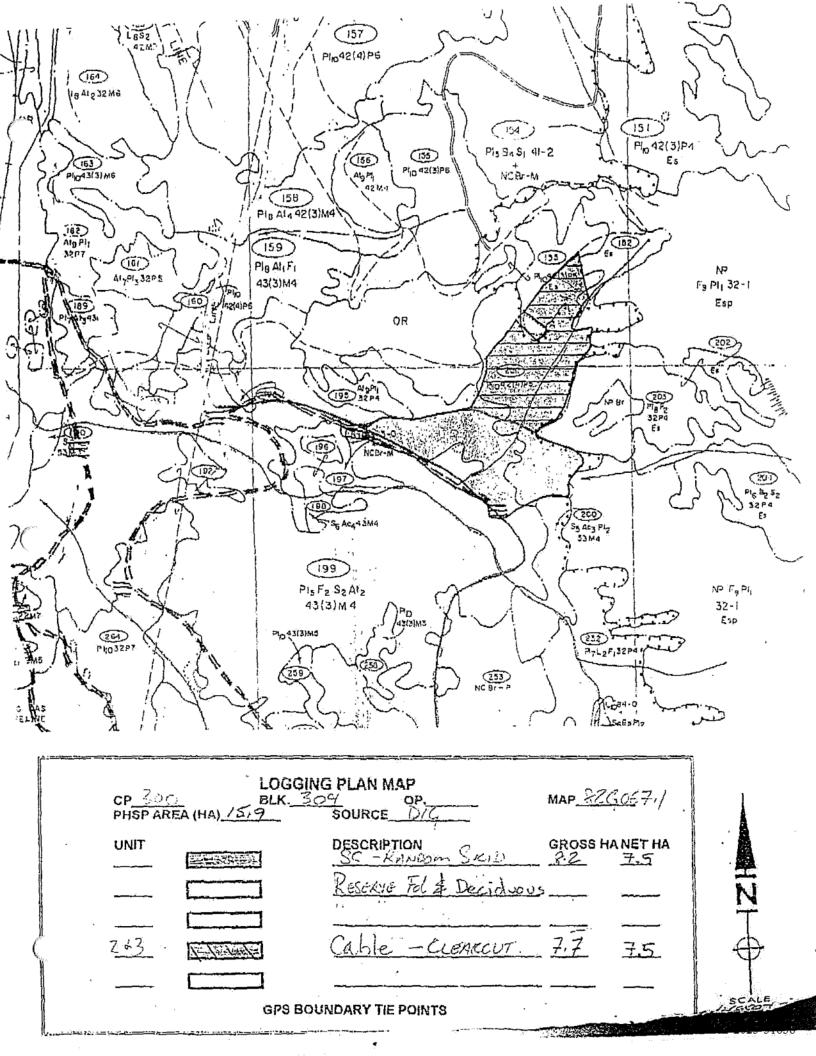
CP 372 PHSP ARE	LOGGIN BLK. 30 A (HA) 10 - 2	IG SUMMARY 5 OP. SOURCE Dig i fized	MAP 82G-0G7-1
UNIT _B		DESCRIPTION NO BLADED TRAILS (YINGH COMP. HAZARD) FB - RANDOM SKID TO SPEED TRAILS	GROSS HANET HA 1.0 D.8 9.7 8.7
		-PARTIALLY LIMB AND TOP AU 88 -RESERVE ALL LW, Fol DE AND HEALTHY UNDER	ECIPUOUS STARY
	GPS BOL	INDARY TIE POINTS	D 202 -f 205 E

SCALE 7:10000

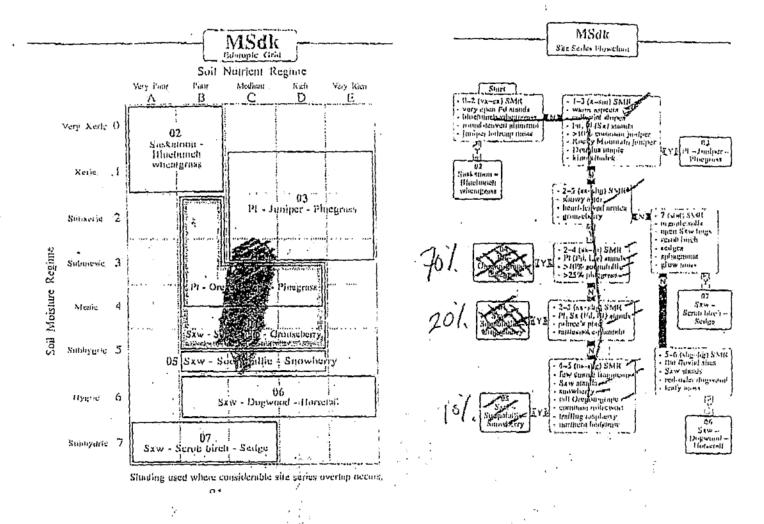
ML-2023-31638



		M	Sdk V	7eget	atio	n Tal	ble		
	Site Series	. 02	03	04	01	. 05	06	07	
TREES	Pseudotsuga menziesii Pinus contorta Lariz occidentalis				a Die		. e		Douglas-fir lodgepole pine western lands
	Picen glauca x engelmannii. Abies lasiocarpa	`.	E E	(경 (경		(23) (20)		i lisegedi.	hybrid white spruce subalpine fir
SHRUBS	Amelanchier alnifolia Acer glabrum Acer glabrum Juniperus scopulorum Juniperus communis Mahonia aquifolium Symphoricarpos albus Shepherdia canadensis Lonicera utahensis Menziesia ferruginan Lonicera involuciuta Cornus stolonifera Betula glandulosa				84 80 80 80 80 80 80 80 80 80 80 80 80 80		?⊕	-28	saskatoon Douglas maple Rocky Mountain juniper common juniper tall Oregon-grape common snowherry soopolallie Utah honeysuckle false szales black twinberry red-nsier dogwood scruh birch
HERBS	Ledum groenlandicum Agropyron spiculum Heuchem cylindrica Arctostaphylos uva-ursi Liunaea borenlis Calamagrostis rubescens					80- 1882)			Lobrador tea bluebunch whealgrass round-leaved alumnot, kinnikinnick twinflower pinegrass
	Aster conspicuus Arnica cordifolia Vaccinium scoparium Comus canadensis Thalictrum occidentale Equiselum arvense Carex app.		1 1_				[] []		showy aster heart-leaved arnica grouseberry hunchberry western meadowrue common horsetnil sedges
	Petasites sagittaļus					THE CONTRACT			arrow-leaved collaioot
MOSSES AND LICHENS	Polytrichum juniperinum Pleurozium schreben Hylocomium splendens Aulacomnium palustre Sphagnum copillaceum			. 10.2 − 11. □			1221	·	juniper haircap moss red-stemmed feathermoss step moss glow moss common red sphagnum
	Approximate Cover Classes:	□ <1%		- 795	7-	15%	<u>1</u>	- 25%	>25%



		M	Sdk'	Vege	tation	ı Tal	ole		
	Site Series	02	03	04	Oì	05	06	07	
TREES	Pseudotsuga menziesii Pinus contorta Larix occidentalis Picea glauca x engelmannii Abies lasiocarpa	(de ta)		(# 432%) - (270) 					Dougles-fir lodgepole pine western larch hybrid white spruce subalpine fir
SIRUBS	Amelanchier alnifolia Acer glabrum Acer glabrum Juniperus scopulorum Juniperus communis Mahonia aquifolium Symphoricarpos albus Shepherdia canadensis Lonicera utahensis Menziesia ferruginea Lonicera involucrata Cornus stolonifera Betula glandulosa Ledum groenlandicum								saskatoon Douglas mapic Rocky Mountain juniper common juniper tall Oregon-grape common snowberry soopolallie Utah honeysuckle false azalea black twinherry red-osier dogwood scrub birch Labrador tea
HERBS	Agropyron spicatum Heuchera cylindrica Arctostaphylos uwa-ursi Linnaea borealis Calamagrostis rubescens Aster conspicuus Arnica cordifolia Vaccinium scoparium Cornus canadensis Thalictrum occidentale Equisetum arvense Carex spp. Petasites sagittatus								bluebunch wheatgrass round-leaved alumnoot kinnikingick twinflower pinegrass showy aster heart-leaved arnica grouseberry bunchberry western meadowrue common horsetail sedges arrow-leaved coltsfoot
MOSSES AND LICHENS	Polytrichum juniperinum Pleurozium schreberi Hylocomium splendens Aulacomnium palustre Sphagnum capillaceum						OF ALL		juniper haircap moss red-stemmed feathermoss step moss glow moss conunan red sphagnum



MSdk	
Tree Species Selection and Stocking Standards Gu	id dines

Series		Tree Species		Hardwoods'	Stocking Standards (well-spaced/lim)			Regan Delay	Free Growing Assessment		Alin. Tree. Holgni (Conffers)
	Primary.	Secondary	Tertiary.	. je je ta se	"CSSpn	MSSpu	MSSn	(yra.)	Early	Late	(at)
01	baleanol-nen	, ,	4				•		•		
Ç3	Fo Lw Pl	Py9,14	BISX	At Ep	1000	500	400	7	. 12	15	PILW 1.0
04	Fd Lw Pl	Bi \$x	045'14		200,	700	600.	7	12.		01.4
01	Fd321_w32	21	- W. I		200	700.	500		-	-	Orliers 0.5
05	Fd32 Lw32 PLSx	·	سعداق سدر	Epare	oreigion.	700	500		-	خاد	Others 0.8
05	Sx Sx	Bi Fd 1,32 Lw1,32 pil		Aci At	1200	700	500	4	3	15	PILW 1.4 Others 0.6
07	non-forested								-	-	0,112.3

on elevated microsices

on south aspects (SSE to WSW)

⁷² risk of frost damage

¹⁴ in lower elevations of biogeoclimatic unit



Province of Ministry of British Columbia Forests

PRE-HARVES I SILVICULTURE PRESCRIPTION FIELD DATA AND INITIAL PRESCRIPTION - INTERIOR SITES

1 17 1 1 1 1 1	Produced Comment	TOTAL	DATA				
1. COENSE NO. 2.	LICENSEE	D. DES. FAM		S BLOCK I	G STRATUM	ADEA 17 8	TRATUMPLOT
MF 27	CFT	io. Int.d. ewil-s	300	304	C16022	ha //. a	INATOMICOT
D. LOCATION	a surveyou				NET		o of the only of
, 0	9. SURVEYOR TO FACET , DSZEKER	4 193 15 LG	1380	IGOO S	5FEU! 12,5	1 1 0	SUITE, SHAPE
11. STOPELAU 15. WA	וופת יין ויין מייים וייבאת לייוייי	0661 94 11 ,02	111113,			*******	
		16. SLOPE CATEGORY	0-29% 20-45%	611, SLOPE	% III . I.AI	ADI-OHMANA!	IENT MATERIAL
S+B			·	70			
19. SLOPE STABILITY IND LANGE Sour C BELER	ROOD IN CA STRA	Tum	20, EGC ZONE S	UB. VAN. PM		15 .	115T. 22. NUT.
			Dak	- Onciviou	104/61-		
0 + 11 +	TI (cm) = TO1AL 24.18	1	1	ONGANIC M		. CHARLE	nsnes
L 2 F 9 11		1008R		<u> 65, Ly</u>		DEND Serie	
26, HORIZON 27, DEPTI	SOIL HORIZONS	CF 30. 31.	32. SOIL CLASSIF		33. U.F	. DEDROCK /	LITHOLOGY
(cm)	a SIZ	- I' i'	1500015				
h7 o7 0 -			31. HOOTING DE			AINAGE	1
			40	سي		10 P	
B. ~ 45	CC (0		مرا المستخدلة المستحدا	SAM	PLE TREE	DATA	
C 1951	1 CL 30	2 Rac 5	SPECIES	71.1	(3)	121	1
4-		/3/	TOTAL AGE	63	47	74	
OG SEASONAL SITE FAC	TONS (DATES: DRY, WET,	FROZEN, SNOW)	HEIGHT	72	16	18	1 .
			1004		78	18,	OF HE SE OF T
7 UNITAVOURABLE SUE			CDN, CLASS	30_			
RESTRICT LAYER	N 30 cm have	LEREN Clay	CIM, CD(SS	. <u></u> <u> </u>		_دِD	
CAPBONATES	N an and	N	% LIVE CO.	50	80	50	
HACMENTAL	N 30 an >	70%.CF	10-YEAR GR.	10	. 15	7	1
· · · · · · · · · · · · · · · · · · ·		ತ್ತಿ√ಿನ್ನ ಿ39. OVE	IISTOREY NO.		: 13 Herry See	.8.01	
	ECIES % . AGE	HEIGHT DELL	STEMS/ha	LAYE	I CONDITIO	V / CCIAMENT	S
IMPEN PLE	(Fd) 60	18 18	1950 75	air mo	my dead	due to	100t 10t.
78.65 P1.	60	15 13	5000	POST PO	ila lagu	llies leid	5.1.4
AD NEGUN.	index to salar and the property and a specifical series of the salar series of the sal					المراجع المراجع المراجع المراجع المراجع المراجع المراجع المراجع المراجع المراجع المراجع المراجع المراجع المراجع	ÿ=1.2,
NEGEN,				F 4-1 14 of a 12 of a 17 of a		management of the	
4.1.3 m	la a selection in the se	Sisses AD - LIND	ERSTOREY	er a Séraia Maria	Sign Matter		
LAYER 1% C SPECIE	S % C SPECIES % C		SPECIES % C	SPECIES I			SPECIES 1 % C
	115 STALIC					110	20,00
			177743 110	1000	/ 		
HEAB CARU	34 AsCo 115		1		1	1 1	, ,
			<u> </u>				
MOSS	· I l'i	1		<u></u>			
VII H M L HAZ		SITE DISTURBAN					
VI H M L HAZ							
VI H M L HAZ							
Comp	edior (CCIAYEY S	oils, Hhrve Frozen	est when	CONVEN			
Comp	edior (CCIAYEY S	oils, Hhrve Frozen	est when	CONVEN			
VII H M L HAZ Comp Disple	ection (CLAYEY S coment) coment CLAYEY	oils, Hhrve Frozen	est when	CONVEN			
Comp Clapic Surface Mass	ection (CLAYEY S pement) Re Eroslon CLAYEN Wasting	oils, Hhrve Frozen	est when	CONVEN			
Comp Dispis Surface Mass	ection (CLAYEY S coment) coment CLAYEY	oils, Hhrve Frozen	est when	CONVEN			
Comp Dispis Surface Mass	ection (CLAYEY S pement) Re Eroslon CLAYEN Wasting	oils, Hhrve Frozen	est when	CONVEN			
Comp Comp Comp Cultary Mass Comp Cultary Culta	edior (CLAYEY Spendent) pement	oils, Harvi Prozen (Soils, S	est when there	CONVAN	17046	-SC ST	ratury
WI H M L HAZ Comp Dispis Surface Mass Variation Wall HAZ	ection (CCA YEY S coment) Provide CCA YEY Westing Floor Displacement (Harvosting)	OILS, HURVE FROZEN SOILS, S	TEPPER SC	CONVAN OPSS	175V/4C	-SC S1	ratury
VI H M L HAZ Comp Dispis Surfas Mass Varia VA H I HAZ Comp	ection (CLAYEY S coment) Re Erosion CLAYEN Wasting Floor Displacement II (Harvosting) AND	OILS, HARVE FROZEN SOILS, S SITE DISTURBAL SOILS, B	TEPER SC.	CONVAN OPS	1700/4C	COMMENDE	reaturn
Comp Comp Comp Comp Comp Comp Comp Comp Comp Comp Comp Comp	ection (CCA YEY S coment) Provide CCA YEY Westing Floor Displacement (Harvosting)	OILS, HARVE FROZEN SOILS, S SITE DISTURBAL SOILS, B	TEPER SC.	CONVAN OPS	1700/4C	COMMENDE	reaturn
Comp Dispis Surface Mass Amount HAI Comp	eation (CLAYEY S compant) The Erosion CLAYET Wasting Floor Displacement II (Harvosting) ARD AR	OILS, HARVE FROZEN SOILS, S SITE DISTURBAL SOILS, B	TEPER SC.	CONVAN OPS	1700/4C	COMMENDE	reaturn
Will H M L HAZ Comp Dispis Surface Mass Varia HAZ Comp	ection (CLAYEY S compant) Re Erosion CLAYEN Wasting Floor Displacema II (Harvosting) ARD action (CLAYEN action (CLAYEN >> Erosion	OILS, HARVE EROZEN SOILS, S BITEDISTURBAL BOILS, B	NCE SENSITIVITY OF LENGTH	CONVAN OPSS ICA IS DAY	iplion/Ao STRA	commanda	ratum?
Will H M L HAZ Comp Dispis Surface Mass Varia HAZ Comp	ection (CLAYEY S compant) Re Erosion CLAYEN Wasting Floor Displacema II (Harvosting) ARD action (CLAYEN action (CLAYEN >> Erosion	OILS, HARVE EROZEN SOILS, S BITEDISTURBAL BOILS, B	NCE SENSITIVITY OF LENGTH	CONVAN OPSS ICA IS DAY	iplion/Ao STRA	commanda	ratum?
Wil H M L HAZ Comp Dispis Surface Mass Varia HAZ Comp	eation (CLAYEY S compant) The Erosion CLAYET Wasting Floor Displacement II (Harvosting) ARD AR	OILS, HARVE EROZEN SOILS, S BITEDISTURBAL BOILS, B	NCE SENSITIVITY OF LENGTH	CONVAN OPSS ICA IS DAY	iplion/Ao STRA	commanda	ratum?

McGILLIVRAY COAL MINING PROJECT WATER QUALITY AND SURFACE WATER HYDROLOGY INTERIM REPORT

PREPARED FOR:
MCGILLIVRAY MINING LTD.

PREPARED BY: PITEAU ENGINEERING LTD.

KI95-4167

NOVEMBER, 1995

TABLE OF CONTENTS

	Page No.						
1. INTRODUCT	ION1						
2. BASELINE W	ATER QUALITY ASSESSMENT						
2.1 WATER	QUALITY SAMPLING						
2.1.1 5	SAMPLE DESIGN						
2.1.2 I	RESULTS						
2.1.3 I	FUTURE WORK5						
2.2 HYDRO	LOGY5						
2.2.1 H	FUTURE WORK6						
3. REFERENCES	5						
	,						
	LIST OF TABLES						
TABLE 1	SURFACE WATER QUALITY CHEMISTRY RESULTS						
TABLE 2	ESTIMATED FLOOD DISCHARGES FROM THE BULK SAMPLE AREA						
	LIST OF FIGURES						
FIGURE 1	LOCATION PLAN						
FIGURE 2	SITE PLAN WITH WATER QUALITY SAMPLING LOCATIONS						
LIST OF APPENDICES							
APPENDIX A	MCGILLIVRAY MINING - ENVIRONMENTAL IMPACT ASSESSMENT						
	TERMS OF REFERENCE (BASELINE WATER QUALITY						
	ASSESSMENT). LETTER TO DOUG MARTIN FROM LES MCDONALD OF BC MELP						

1. INTRODUCTION

This report presents interim results of the Water Quality and Surface Water Hydrology component of the Environmental Baseline Study for the proposed McGillivray Coal Mine (see Figure 1). The Terms of Reference for this work are contained in a letter from Les McDonald to Doug Martin of the BC Ministry of Environment, Lands, and Parks (Appendix A). A final report on the Water Quality and Surface Water Hydrology component of the Baseline Study will be issued upon completion of the work in mid-1996.

2. BASELINE WATER QUALITY ASSESSMENT

2.1 WATER QUALITY SAMPLING

2.1.1 SAMPLE DESIGN

Baseline water quality sampling is required prior to mine development to ensure that water quality norms at the site are well understood. If unusually high concentrations of some constituents (such as metals or nutrients) are naturally occurring at a site, then it is important to establish this prior to mine development.

In accordance with the recommendations of Les McDonald of the Ministry of Environment, Lands and Parks (Appendix A), a monthly sampling program is being carried out at four sampling locations (Figure 2). These locations are:

Location	Comments
Michel Creek Upstream	upstream of possible mine impacts
Michel Creek Downstream	downstream of the mine site, and upstream of the confluence of Michel and Alexander Creeks
Groundwater Seep	seepage beside the CPR tracks, below the pit
Intermittent Creek	located south of the groundwater seep

Analytical Schedule

In accordance with the recommendations of BC MELP, the analytical suite is as follows:

Nutrients:

nitrate, nitrite, ammonia, orthophosphate

Metals:

ICP 30-element metals scan, with particularly low detection limits for cadmium,

chromium, selenium, and zinc.

Others:

total suspended solids (only if water turbid). pH and electrical conductance (Ec)

were added at Piteau's recommendation.

The sampling schedule is as follows:

Sample Description	Analytical Schedule	Frequency
Michel Creek upstream	Nutrients only	Apr, Jun-Aug, Oct-Nov, Jan
	Nutrient & metals	March, May, September
Michel Creek downstream	same as Michel u/s	
Intermittent creek on site	No metals	Monthly (when flowing)
Groundwater Seep	All parameters	1 / month

The three key sampling locations for baseline water quality are the two Michel Creek locations and the groundwater seep, located directly below the proposed mine area. It is likely that any water quality impacts from the mine can be detected most clearly from the groundwater seep samples. The Michel Creek samples allow for upstream/downstream sampling of the most significant watercourse in the area. The intermittent creek is located slightly south of the mining area, and is therefore unlikely to show indications of mining-related water quality problems in the future. However, the samples should provide data on the chemistry of surface-flowing water in the vicinity of the site.

The water chemistry suite consists primarily of nitrogenous compounds, phosphorous, and metals. Nitrogen compounds (nitrate, nitrite, ammonia) are a by-product of explosives used in blasting. Nitrogen is of concern at the site for two reasons:

- i. As noted in Mr. McDonald's letter, Michel Creek is sensitive to nitrogen inputs due to its naturally high phosphorous load. Nitrogen and phosphorous, when found in sufficient concentrations (and correct proportions), often lead to significant algal growth in streams; and,
- ii. Ammonia and nitrite are toxic to aquatic organisms in relatively low concentrations. Nitrite, the more toxic of the two, is not usually of concern in well aerated streams, as it is quickly converted to the much less toxic nitrate in the presence of oxygen.

As noted above, analyses of phosphorous (in this case, orthophosphate) are being conducted due to the sensitivity of Michel Creek to algal growth.

Metals are a concern at mine operations due to their toxicity and the possibility of their leaching into surface water and groundwater. Leaching can be a significant problem if there is contact between acid-generating waste rock and water (under oxygenated conditions). The results of the water analysis suggest that the water in the area has some acid-buffering capacity, as all samples are alkaline with a pH between 8 and 8.5.

2.1.2 RESULTS

Table 1 presents the results of the three samples collected to date. Samples were scheduled for collection near the end of each month. The first samples were collected on May 30, 1995, when freshet was underway, but before the large flood of June 6/7. Samples were not collected in June or July, but the program was recommenced in late August, with samples scheduled for collection near the end of each month.

Complete analyses of results will be presented in the final report. However, some brief comments on the results to date are appropriate.

pH: all samples were somewhat alkaline, with pH values ranging from 8 to 8.5. As noted above, this indicates some acid-buffering potential.

Nitrogen compounds: nitrate, nitrite, and ammonia levels were all very low. Due to an oversight in the analytical request forms, the analysis of ammonia was omitted in the last two sampling periods. This oversight will be corrected in future work.

Metals: concentrations of metals were generally well below the Freshwater Aquatic Life guidelines (Nagpal, 1994), and many of the metals were below detection limits in all samples. Total zinc concentrations were found to be just slightly below the freshwater aquatic life guidelines in some samples. In the October Michel Creek upstream and

downstream samples, total iron concentrations were near the 0.3 mg/L freshwater aquatic life guideline. The relatively high concentrations of zinc and iron are not unusual - in Piteau's experience slightly elevated levels of these two elements are relatively common in the area. No detections of cadmium were made in the samples. However, in the August samples detection levels were above the required 0.0005 mg/L. Appropriate detection levels were reached in the October samples.

2.1.3 FUTURE WORK

Monthly water quality sampling is to continue throughout the winter and spring at the Michel Creek and groundwater seep sites. The program design of BC MELP called for a full 12 months of background sampling. It is therefore anticipated that the current sampling program will be continued until the end of July, 1996.

The photographs of algal growth on rocks in Michel Creek were not taken in the summer of 1995. Therefore, algal growth photographs will be taken through the summer of 1996.

2.2 HYDROLOGY

The hydrologic analyses required for the program include the estimation of the 1 in 10 year and 1 in 200 year flood events for the watercourses within the mine development area. Given the short time frame (less than one year) prior to initial mine development, it is not useful to install hydrometric measurement stations on the site. Rather, it is necessary to establish peak flow estimates based on the hydrology of nearby gauging stations.

For this interim report, runoff equations are used which originate in a 1983 report conducted for the nearby Corbin Creek drainage (Hydrocon, 1983). Once final estimates of streamflow for the 1995 flood are available, an updated regional analysis will be performed. The inclusion of this data in the flood frequency analysis is important, since preliminary estimates of peak instantaneous discharges on Michel Creek suggest that the flood was a very rare event, with a return period of approximately 180 years (Hal Coulson, 1995).

Based on the Hydrocon analysis, the peak instantaneous flows are given by the following equations:

$$Q_{10} = 0.41 \text{ A}^{.89}$$

$$Q_{200} = 1.07 A^{.81}$$

where,

Q is the runoff in m³/s, A is the drainage area in km².

For the analysis of runoff, three areas were identified. Mining is to occur within the bounds of the clearing identified as "Area B" in Figure 2. The area above this is identified as "Area A", and represents potential runoff into the pit, or flow which will have to be diverted around active mining. Area C lies below the pit, and represents a area which is likely to be disturbed by roads, etc.

Table 2 contains estimates from each of the three areas. The runoff volumes for even the 200 year event are relatively small, with the total runoff from the all three areas combined estimated to be only 0.5 m³/s. It is likely, furthermore, that the estimates of Table 2 are too high, as infiltration in the vicinity of the clearing appears to be substantial (Gerry Reeves, pers. com.)

2.2.1 FUTURE WORK

A regional analysis of mean daily and peak instantaneous flows will be conducted, taking into account the recent high flows in the Michel Creek area.

3. REFERENCES

- Coulson, Hal. August 18, 1995. "Elk River Flood Study 420". Water Management Branch, Ministry of Environment, Lands and Parks, Victoria (e-mail report).
- Hydrocon, 1984. "Corbin Creek Conveyance Selection, Byron Creek Collieries, Corbin B.C.".

 Report prepared for Esso Minerals, Calgary, Alberta.
- McDonald, L, May 11, 1995. "McGillivray Mining Environmental Impact Assessment Terms of Reference (Baseline Water Quality Assessment)". Letter to Doug Martin from Les McDonald of BC MELP.
- Nagpal, N.K., 1994. "Approved and working criteria for water quality 1994". Water Quality Branch, Ministry of Environment, Lands and Parks.

JA4167/REPORTÉINOVERMO, DOC

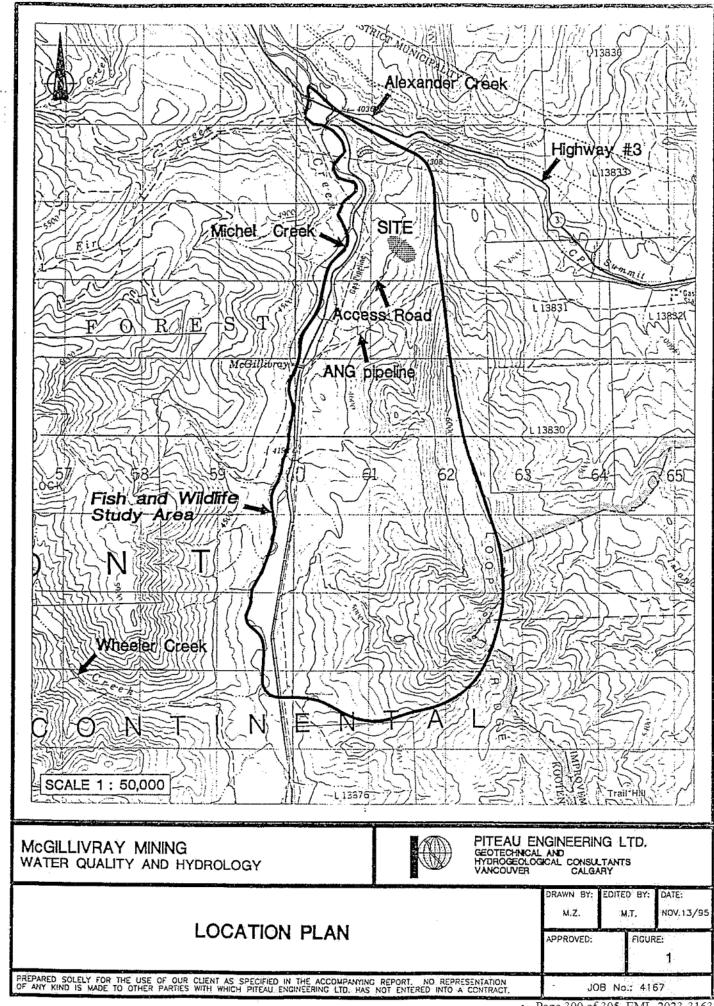
TABLE I SURFACE WATER CHEMISTRY

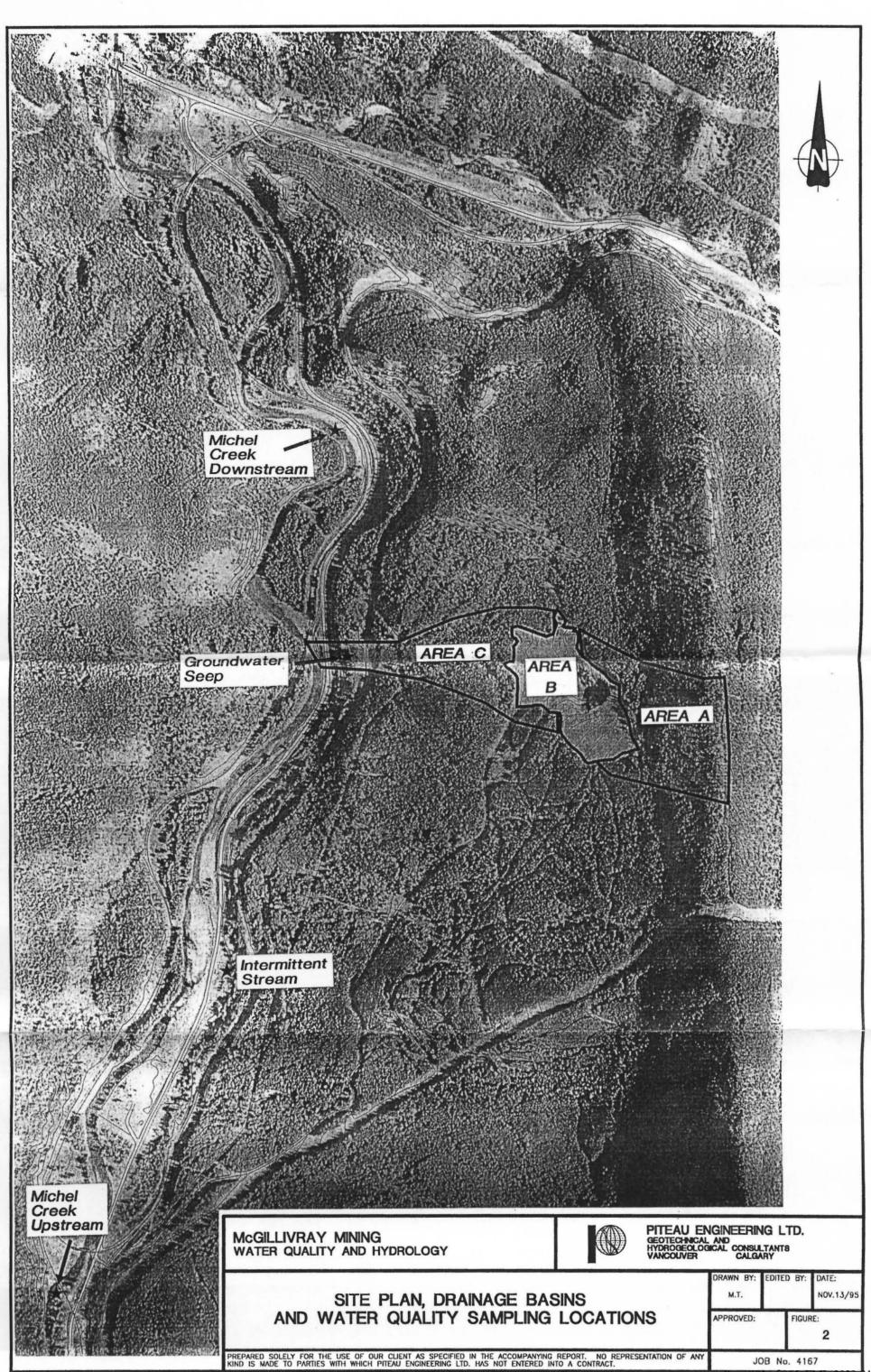
Locator	Date	pH (units)	Ec (umhos/cm)	TSS (mg/L)	NO3 as N (mg/L)	NO2 as N (mg/L)	Tot. Amm. N (mg/L)	TKN (mg/L)	Ortho P (mg/L)	Aluminum:T (mg/L)	Arsenic:T (mg/L)	Barium:T (mg/L)	Beryllium:T (mg/L)	Boron (mg/L)	Boron:T (mg/L)	Cadmium:T (mg/L)	Calcium:T (mg/L)	Chromium:T (mg/L)	Cobalt:T (mg/L)	Copper:T (mg/L)	Iron:T (mg/L)	Lead:T (mg/L)	Lithium: (mg/L)
GROUNDWATER SEEP	5/30/95	8.41	893		0.003	< 0.003	0.02	0.023	0.034														
	8/28/95	8.34	298	4	0.015	< 0.003	0.02	0.07	0.057	0.02	< 0.2	0.15	0.003	< 0.01	-0.01	-0.003	120	0.000	0.000	0.001	0.17	0.00	0.005
	10/12/95				< 0.003	< 0.003		0.22	0.012	0.02	VO.2	0.13	0.003	0.03	<0.01 0.03	<0.003 <0.0002	120 184	<0.002 0.006	<0.003 0.004	<0.001 0.004	0.17	<0.02 <0.02	0.005
INTERMITTENT CREEK	5/30/95	8.36	456	5	0.025	< 0.003	< 0.01		0.032														
	8/28/95	8.38	476	1	< 0.003	< 0.003	40.01	0.17	0.109														
MICHEL CREEK DOWNSTREAM	5/30/95	8.38	122	205	0.041	< 0.003	< 0.01		0.065														
	8/28/95	8.22	868	3	< 0.003	< 0.003	20.01	0.12	0.12														
*	10/12/95	0.22	000	,	0.048	0.003		0.2	0.031	0.2		0.08	<0.001	0.01	0.01	<0.0002	34.5	< 0.002	0.003	< 0.001	0.3	<0.02	0.002
IICHEL CREEK DOWNSTREAM DUP	5/30/95	8.06	125	186	0.045	< 0.003	<0.01		0.067														
	10/12/95				0.044	0.007	40.01	0.2	0.029	0.27		0.09	< 0.001	0.03	0.03	<0.0002	34.5	<0.002	0.003	<0.001	0.01	<0.02	< 0.001
MICHEL CREEK UPSTREAM	5/30/95	8	122	107	0.04	< 0.003	0.02		0.055														
	8/28/95	8.32	290	1	0.024	< 0.003		0.07	0.062														
	10/12/95				0.051	< 0.003		0.21	0.032	0.23		0.08	< 0.001	0.03	0.03	< 0.0002	32.9	<0.002	< 0.003	0.001	0.31	<0.02	0.001
TRIP BLANK	5/30/95	6.74	0.5		< 0.003	<0.003	< 0.01		0.007														
	10/12/95				< 0.003	< 0.003		< 0.05	< 0.003	< 0.01		< 0.01	< 0.001	< 0.01	< 0.01	< 0.0002	< 0.01	< 0.002	< 0.003	< 0.001	< 0.01	< 0.02	< 0.001

Locator	Date	Magnesium:T	Manganese:T	Molybdenum:T	Nickel:T	Phosphorus: T	Potassium: T	Selenium:T	Silicon:T	Silver: T	Sodium:T	Strontium: T	Sulphur:T	Titanium:T	Uranium:T	Vanadium:T	Zinc:T
		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
GROUNDWATER SEEP	5/30/95																
	8/28/95	26.8	0.008	< 0.003	< 0.005	0.1	0.7	< 0.04	4.5	0.004	2.4	0.127	57.4	< 0.003	<0.5	< 0.002	0.018
	10/12/95	40.5	0.014	< 0.003	< 0.005	<0.1	1.1	0.0002	5.98	< 0.002	2.4	0.195	101	< 0.003	<0.5	< 0.002	0.029
INTERMITTENT CREEK	5/30/95																
	8/28/95																
MICHEL CREEK DOWNSTREAM	5/30/95																
	8/28/95																
	10/12/95	8.3	0.018	< 0.003	< 0.005	<0.1	0.5	0.0002	2.11	< 0.002	1.3	0.089	6	0.005	<0.5	0.003	0.008
ICHEL CREEK DOWNSTREAM DUP	5/30/95																
	10/12/95	8.3	0.018	< 0.003	< 0.005	<0.1	0.6	0.0003	2.37	< 0.002	1.3	0.09	6	0.004	<0.5	< 0.002	0.009
MICHEL CREEK UPSTREAM	5/30/95																
	8/28/95																
	10/12/95	8	0.016	< 0.003	0.005	<0.1	0.6	0.0002	2.25	<0.002	1.3	0.084	5.8	0.003	<0.5	0.002	0.008
TRIP BLANK	5/30/95																
	10/12/95	< 0.01	0.001	< 0.003	< 0.005	< 0.1	< 0.02	< 0.0002	< 0.02	< 0.002	< 0.01	< 0.002	< 0.2	< 0.003	< 0.5	< 0.002	0.002

TABLE 2: ESTIMATED FLOOD DISCHARGES FROM THE BULK SAMPLE AREA

Area	Description	Area (km²)	Maximum Mean Daily (m ³ /s)	Discharge
			10 year return flow	200 year
A	Above the clearing	0.118	0,061	0.189
В	Clearing	0.084	0.045	0.144
С	Below the clearing	0.108	0.057	0.176
Total		0.31	0.163	0.509





Page 301 of 305 EML-2023-31638



PROVINCE OF BRITISH COLUMBIA

Environmental Protection

MINISTRY OF ENVIRONMENT LANDS AND PARKS

MEMORANDUM

205 Industrial Rd. G, Cranbrook, B.C., V1C 6H3 Ph: (604) 489-8515 Fax: (604) 489-8506

May 11, 1995

File: 44500-20/McGillivary Mining

To: Doug Martin

Senior Habitat Biologist

McGillivary Mining - Environmental Impact Assessment Terms of Reference

The following are terms of reference for a baseline water quality assessment in advance of application for a Mine Development Certificate. Without knowing the details of the transition of this project from current MDC process to the Environmental Assessment Act, when it is proclaimed, I am sure that this assessment will satisfy our requirements regardless. The Company should commence this sampling as soon as possible in order to capture important freshet data that, if missed, cannot be collected again for a year.

The groundwater seepage by the CPR tracks below the proposed pit will be the most likely place that any explosive residual nitrogen would appear. It is important to gather some data on the current quality of this seepage to compare against the quality during Phase II, production mining, should this occur. Monthly samples over one year should be adequate. If this seepage flows through a culvert under the tracks, or via some surface drainage, it would be useful to measure the flow when possible, at the same time as water quality sampling.

At the same time and frequency as the seepage samples, a site above and below on Michel Creek should be sampled for the same parameters. I realize they only plan to operate during non-winter months but any seepage losses will continue after active mining is shut down for the season. The Michel Creek sites we discussed were at the rail loop (upstream) and just upstream of Alexander Creek (downstream).

The following is a list of parameters to be analyzed and minimum requirements for Minimum Detection Limits, ie. lower than these but not higher:

<u>Parameter</u>	Required MDL (mg/L)
nitrate nitrite ammonia orthophosphate Metals scan *	0.02 0.005 0.005 0.003
cadmium	0.0005

chromium	0.002
selenium	0.002
zinc	0.005

* most labs provide an TCP metals scan of around 30 elements, the scan should contain those metals listed with at least the MDC's shown (for some of these MDC's the lab may have to do a specific analysis. All metals are to be analyzed in the total form (no field filtration). If any of the samples are turbid they should also be analyzed for total suspended solids.

As we have discussed, Michel Creek receives significant quantities of natural phosphorus which make it particularly sensitive to nitrogen discharges. It would be useful if the Company could begin to establish a permanent photographic record of the algal growth on the rocks at the downstream site on Michel Creek. Photographs of a large boulder from the site should be taken before and after freshet and again in late August. Light conditions should be kept a constant as possible. Field notes are also useful. I can discuss the details of this with the proponent or consultant at a later date.

In addition to the sampling program outlined above the Company should develop a year by year prediction of the amount of explosive (ANFO and gel forms) that is expected for the life of the mine. I believe Mr. Reeves is familiar with the explosive use/nitrogen residual models developed by Pommen and by Ferguson and Leask.

If you or the proponent have any questions, contact myself or Mark Strosher.

Les McDonald, RP Bio

Senior Impact Assessment Biologist



Province of British Columbia

Environment

205 Industrial Road G Cranbrook, British Columbia V1C 6H3 Telephone: (604) 489-8510

(604) 489-8506

MINISTRY OF ENVIRONMENT, LANDS AND PARKS AND MINISTER RESPONSIBLE FOR MULTICULTURALISM AND HUMAN RIGHTS

File: 43450-30/McGillivary Mining

July 17, 1995

GS Reeves Associates International Ltd. 89 Ridgemont Dr. Fernie, B.C. VOB 1M2

Attention: Mr. Gerald S. Reeves

Dear Sir:

Re: <u>Proposed Baseline Water Ouality Monitoring for</u>
<u>McGillivary Coal Mine Project</u>

The following is confirmation of discussions held at our meeting on July 17, 1995. I have reviewed the water quality monitoring program proposed by Piteau Engineering Ltd. for the baseline environmental study for the Environmental Assessment Act project application and have the following recommendations and suggestions.

- * The two sites on Michel Creek need only be sampled monthly from March to November inclusive for nutrients and suspended solids, with an additional mid-winter sample in January. Enough information on metals levels can be obtained by sampling for them in March, May, and September.
- * The intermittent creek can be sampled as specified when it is flowing.
- * The groundwater seep should be sampled monthly for all parameters as specified. As we discussed I recommend a sand point pipe be installed in the appropriate location (above the impervious strata). This will serve as a permanent sample location and minimize the influence of changing micro-site location on water quality over time.
- * For quality assurance, three blanks and duplicates spaced evenly over the one year program should suffice for all parameters.
- * For algal growth, only the photographs are necessary. Rising nitrogen levels in the seep, and ultimately Michel Creek will indicate the need for more effort in this area.

I have taken the liberty of listing the acceptable analytical minimum detection limits for the important parameters below:

Parameter	Minimum Detection	Limit (mg/L)
Nitrate (as N) Nitrite (as N) Ammonia (as N) Orthophosphate Non-filterable Residue total cadmium total chromium total selenium total zinc	(TSS)	0.005 0.005 0.005 0.003 4.0 0.0001 0.002 0.001

If any part of the aforementioned needs clarification please give me a call.

Yours truly,

Les McDonald, RP Bio

Senior Impact Assessment Biologist

LM/lm

c.c.: Doug Martin