CP RAIL ROGERS PASS PROJECT

RECLAMATION PROGRAM

David F. Polster

Polster Environmental Services
Revelstoke, B.C.

ABSTRACT

Work is currently underway on construction of a new 17.3 km surface grade and 16.5 km of new tunnels for westbound rail traffic on the CP Rail mainline between Golden and Revelstoke, B.C. Most of the work is being conducted in Glacier National Park. Detailed plans and contract specifications for the reclamation of approximately 150 ha of surface disturbance were developed with the objectives of controlling erosion, providing a permanent vegetation cover and reintegrating the disturbed lands with the surrounding terrain to reduce the visual impact of the project. The plans were based on results from two years of reclamation research and were submitted to Parks Canada and the Federal Environmental Assessment Panel established for the project. The plans were approved in a detailed agreement between CP Rail and Parks Canada. Stringent reclamation standards have been established for the project. Major reclamation work was initiated with construction in 1984 with an extensive program of soil salvage and use, seeding and woody shrub planting.

This paper details the planning process for environmental protection and reclamation on the project. Details of the implementation of the planned program, now in it's third year, are presented. The project provides a unique example of how engineering design and environmental design can be integrated to develop a program which is of benefit to all. Special reclamation techniques for stabilization and revegetation of steep slopes have been developed and are presented.

INTRODUCTION

The Rogers Pass Project is the largest single project undertaken by CP Rail since the completion of the transcontinental rail line in 1885. The project will complete the westbound grade reduction work which has been underway for the past 15 years. Adverse westbound grades will be reduced from the present 2.2 percent to 1 percent and an additional 34 km of double track will be constructed. This will allow CP Rail to significantly increase the number of trains moving through the Rogers Pass, thus increasing the capacity of this section of the line.

The project is being undertaken almost entirely within Glacier National Park. The sensitive nature of construction work within a National Park was recognized early in the development of the project and in February 1982, the Federal Minister of Environment requested the establishment of an Environmental Assessment Panel to review "...the environmental and related social impacts of the proposed Rogers Pass Development Project." (Environmental Assessment Panel, 1983). A detailed formal agreement was reached between Parks Canada and CP Rail which set forth the conditions under which the project would proceed. Specifications for the standards of environmental protection were included in the agreement as were standards for the reclamation of disturbances created by project implementation.

Major work on the project was initiated in the spring of 1984. Construction on all aspects of the project except the Shaughnessy tunnel which is the shorter of the two tunnels, was started at that time. By the end of the 1984 construction season, most of the clearing for the project facilities had been completed and a portion of the new grade had been built. The east and west heading of the Mount Macdonald, or long tunnel, were advanced to the point where construction at the faces could proceed over the winter. Reclamation work was conducted on the completed portions of the project and on sites where the temporary facilities would remain in place for the duration of the project.

Major reclamation work completed in 1984 included the landscaping of the construction camps which had been erected, seeding of completed portions of the cuts and fills along the surface route, and the planting of woody shrubs. The 1985 construction season saw the completion of the major bridges along the surface route, completion of most of the major earthworks along the new grade, and the initiation of work on the ventilation shaft for the Mount Macdonald tunnel. Again, reclamation work was scheduled to closely follow the completion of construction activities, and by the end of the season, a significant portion of the new surface grade had received reclamation treatments. This year will see the laying of track on 13 km of the surface grade, the hole through two of the tunnels, and completion of the overburden excavation for the ventilation shaft.

This paper presents an overview of the planning process which lead up to the initiation of construction. Details of the planning for minimizing and mitigating impacts on the environment

are presented. The second part of the paper outlines how the plans have been implemented with particular attention to the reclamation program as this is the major means of mitigating the adverse effects of the terrain disturbances.

PROGRAM PLANNING

Planning for the Rogers Pass Project was initiated in the mid 1970's when it became apparent that the existing capacity of the rail line would be reached. Sigificant increases in the need to transport bulk commodities such as wheat, coal, sulphur and potash to ports on the British Columbia coast were forecast at that time. Load forecasts were examined by the Canadian Transport Commission, and in March 1982, the Railway Transport Committee of the CTC approved the project. Concern for the environment, particularly in Glacier National Park, lead Parks Canada to request that the Minister of Environment establish an Environmental Assessment Panel to review the project and to make recommendations on how the project could proceed. Two sets of hearings were conducted by the panel, the first of which was held in the spring of 1982 and focussed on those aspects of the project which could be undertaken during the 1982 construction season. The panel also identified those aspects of the project for which more information was required. This information was to be collected during 1982 and early 1983 and a second set of hearings were scheduled for June, 1983.

In a preliminary report released in April, 1982, the panel recommended that construction could proceed at the east and west portals of the Mount Macdonald tunnel, and that an access road could be constructed along the surface route to facilitate collection of survey and geotechnical information needed for the detailed design of the new grade. Further information was required on the alternative locations for the ventilation shaft as the originally proposed site was found to represent an unacceptable intrusion in the National Park setting. Details of the reclamation of the new grade were also required. The panel found that the establishment of a work camp within the National Park would not seriously impair the quality of the Park as long as the camp was planned to harmonize with the Park setting. A system of committees was proposed to oversee the environmental and social aspects of the project and suitable personnel were to be hired.

A considerable amount of detailed information was collected and analysed during the period between the first and second set of hearings. A thorough survey of the new alignment was made. Cross sections of the terrain on either side of the new grade were surveyed and input into a computer. This allowed a variety of different alignments to be analysed with a minimum amount of tedious drafting work. Volumes of cut and fill could be calculated on the different alignments using the computer. In addition, perspectives of the grade from different viewing locations could be generated. A detailed visual analysis of the new grade was conducted from the perspective of visitors to Glacier National Park. Refinements to the alignment were made to minimize the visual impact of the grade. A significant number of retaining walls were incorporated in the design for the grade to

minimize the need for large cuts and fills. The landscape architect, reclamation planner, and design engineers worked together to produce a design for the new grade which minimized the impact of the project on the Park environment.

Cutting of an access trail along the surface route provided a means by which soil scientists and reclamation planners could assess the materials which would later be exposed in the cuts and fills. A detailed survey of the soil material was carried out to determine the revegetation potential of the different materials. This information was later incorporated into a plan for the salvage and utilization of the higher quality growth media. Selected locations along the access road and at the portals of the Mount Macdonald tunnel were seeded to test the revegetation potential of the different materials in the field. Table 1 shows the seed mixes used for the trials conducted in connection with the project. In addition to the trials conducted along the new surface grade, reclamation trials were established on the cuts adjacent to the bridge which had been constructed over Mountain Creek in 1977. This site is south facing, and is composed of glaciofluvial gravels, sands and silts. It was selected to represent the worst possible conditions for plant growth which could be expected along the new grade. Reclamation trial sites were selected to represent the widest possible range of conditions which might be experienced when the project was constructed. Sites ranged from shot rock at the East Portal to a boggy section along the new grade. Results of the trials were analyzed and incorporated in the plans for the reclamation of the new grade. The reclamation trials were designed as operational trials in that they sought to achieve some useful reclamation while at the same time providing an indication of the effectiveness of various species and techniques. Details of the reclamation trials were presented at the Ninth Annual British Columbia Mine Reclamation Symposium (Polster, 1985), and will not be repeated here.

Reclamation plans were developed as the major means of mitigating the adverse impacts of the project on the physical as well as the visual environment. The reclamation plans were formulated to meet the following objectives:

* Revegetation of exposed erodible materials to minimize erosion and subsequent water quality degradation.
* Amelioration of the visual impact of cuts and fills through the use of vegetation.
* Establishment of a self-sustaining vegetation cover which is compatible with the naturally occurring vegetation in the area.
* The use of native species which occur in the area, where this does not compromise the other objectives.

The reclamation plans were developed with a three phase approach to achieving these objectives. The emphasis of the first phase of the reclamation program is the development of a suitable substrate for vegetation growth. Detailed soil surveys were conducted and areas of available top dressing and areas requiring top dressing were delineated. The second phase of the reclamation program was designed to provide immediate erosion protection and

Table 1: 1982 Species Trials

GRASS AND LEGUME SPECIES	WOODY SPECIES PLANTED
Alsike Clover	Oregon Grape
Sainfoin	Alder
Crown Vetch	Juniper
Pubescent Wheatgrass	Kinnikinnick
Tall Fescue	
Birdsfoot Trefoil	
Kentucky Bluegrass (Troy)	
Canada Bluegrass (Rubens)	

SPRING TRIALS GRASS AND LEGUME SPECIES MIX

SPECIES	PERCENT BY WEIGHT
Creeping Red Fescue (Boreal)	8.74
Hard Fescue (Durar)	7.26
Kentucky Bluegrass (Troy)	0.98
Streambank Wheatgrass (Sodar)	22.12
Crested Wheatgrass (Fairway)	18.16
Orchardgrass (Chinook)	0.73
Timothy (Climax)	19.33
Alsike Clover (Aurora)	9.21
Alfalfa (Rambler)	7.17

FALL TRIALS GRASS AND LEGUME MIX

SPECIES	PERCENT BY WEIGHT
Creeping Red Fescue (Boreal)	13.20
Orchardgrass (Chinook)	8.00
Timothy (Climax)	36.50
Perennial Ryegrass (Tetraploid)	29.20
Alsike Clover (Aurora)	13.10

to aid in the amelioration of the visual impact of the cuts and fills. This phase consists of seeding the disturbed sites to a cover of grasses and legumes. Two seed mixes were formulated for this purpose. Table 2 shows the composition of these mixes. The third phase of the reclamation program is the establishment of a cover of native trees and shrubs similar to those found in the undisturbed sites adjacent to the construction areas. A survey of the native vegetation patterns along the grade was conducted and planting plans for trees and shrubs were formulated on the basis of this survey. The trees and shrubs to be planted on the disturbed sites are native to Glacier National Park. Specifications for the growth and supply of woody plants were developed with the intent of having sufficient stocks available. Seed and/or cuttings for these plants were collected in Glacier National Park or the surrounding area to ensure genetic compatability with the undisturbed vegetation. The cover of trees and shrubs will form the final cover on the disturbed sites.

A program of reclamation maintenance was planned for in the reclamation plans. This program includes the touch-up seeding of sites where the inital seeding failed to catch, replanting if the density of the trees and shrubs fall below the established standards, and repair of slopes where slope stability problems appear. The program of maintenance will help to ensure that the final reclaimed areas are fully satisfactory.

Plans for the protection of the environment were formulated in concert with the detailed designs for the project. The protection of air and water quality as well as protection of vegetation adjacent to the construction areas were addressed in plans for the project. Preliminary plans were presented to the Environmental Assessment Panel while the more detailed plans were formulated and incorporated in the formal agreement between Parks Canada and CP Rail which was recommended by the Panel. Environmental standards were set for air and water quality and for noise associated with construction. Monitoring for compliance with the standards has been conducted by CP Rail on a regular basis, and by Parks Canada as spot checks.

Contract specifications were developed for all aspects of the work. The environmental protection standards were incorporated in the contract specifications. This meant that those who were going to be doing the actual work would be responsible to ensure that the standards for environmental protection were adhered to.

Standards for wastewater from the tunneling operations were included in the tunneling contracts, while specifications for the protection of air quality were included in the contracts for those contractors who would be operating concrete batch plants or had other operations which might impair air quality. The grading contractors were responsible for the control and protection of surface waters. In addition, development of suitable rooting media and final preparation of the surface of cuts and fills was made the responsibility of the grading contractors.

Contract specifications for the revegetation of the disturbances created in connection with the project were prepared.

Table 2: Grass and Legume Seed Mixes For Rogers Pass Project

SPECIES (Variety)	PERCENT BY SPECIES COMPOSITION	PERCENT BY WEIGHT
Dry Sites Mix:		
Creeping Red Fescue (Boreal)	15	10.32
Hard Fescue (Durar)	10	7.27
Kentucky Bluegrass (Troy)	5	1.14
Streambank Wheatgrass (Sodar)	10	27.20
Crested Wheatgrass (Fairway)	10	20.55
Orchardgrass (Chinook)	10	8.54
Timothy (Climax)	15	4.93
Alsike Clover (Aurora)	20	11.28
Alfalfa (Rambler)	5	8.77
Moist Sites Mix:		
Creeping Red Fescue (Boreal)	15	11.41
Kentucky Bluegrass (Troy)	5	1.26
Orchardgrass (Chinook)	10	9.44
Timothy (Climax)	15	5.45
Redtop	10	0.96
Slender Wheatgrass (Revenue)	10	29.95
Alsike Clover (Aurora)	20	12.45
Alfalfa (Rambler)	15	29.08

Again, the standards set in the agreement between Parks Canada and CP Rail were included in the specifications for the revegetation contract. The revegetation contract was set up so that there was a significant hold back of funds until the standards were reached. Standards for revegetation success are given in Table 3.

PROJECT IMPLEMENTATION

Major construction work on the Rogers Pass Project was initiated in the spring of 1984. Clearing was conducted over most of the surface route, and grading was initiated. Work at the two portals of the Mount Macdonald tunnel entailed the establishment of facilities for tunnel construction and tunneling. Water treatment facilities were established at both portals. Work at the ventilation shaft site during 1984 consisted of construction of an access road to the site and construction of a large retaining wall to hold the slope above the shaft site. Environmental protection measures such as the provision of stream diversions around bridge construction sites were implemented with the construction. Environmental protection during the 1984 season focussed primarily on the protection of watercourses, careful control of slash disposal fires, and protection of vegetation adjacent to the construction lands. Erosion control structures were installed at the end of the construction season in areas where erosion posed a threat. These consisted of temporary settling ponds, erosion bars, installation of culverts and ditches and the placement of straw bale sediment traps at strategic locations. No significant erosion of materials off the construction lands occurred during spring break-up in 1985.

The reclamation program was initiated with construction in the spring of 1984. Salvage of top dressing for later use on completed sites was the first priority. Top dressing salvage zones, as defined by the preconstruction soil survey, were marked in the field. In many cases it was possible to strip the soil materials from one area and place it on a completed area without having to rehandle the material. Soil stockpiles were developed at selected sites where needed. Top dressing was applied to cuts and fills where the native material was unsuitable for plant growth. In most cases materials were considered unsuitable because of the lack of nutrient and moisture retaining fine particles. Care was taken in the salvage of top dressing to include as much of the organic duff as possible. Soil stockpiles were seeded to a grass and legume cover if they were to remain in place long enough for the seeded cover to establish.

A portion of the grade had been completed by the fall of 1984, and a program of grass and legume seeding and shrub planting was conducted. A total of about 16 ha were seeded, including 8 ha along a powerline which had been built from Revelstoke to the project area. A total of 20,882 shrubs were planted in the fall of 1984 on the completed portions of the grade. Landscaping of the construction camps which had been established for the project was also undertaken in 1984. Sod was laid around the buildings and large trees were transplanted to the camp areas. The landscaping at the camps was conducted as part of the measures which were implemented to make the camps fit into the National

Table 3: Standards For Reclamation On The Rogers Pass Project

For Initial Cover:

(1) Seeding and fertilizing shall result in a minimum of 10 healthy established plants per sqaure yard (0.836 sq. meters) averaged over 100 square yards with an average canopy cover of not less than 80% including detritus, but excluding rock or other non-erosive surface, within any 10 yard by 10 yard area, except where by virtue of woody species growth the cover of seeded grasses and legumes is reduced and the cover provided by the woody species is equal to or greater than the amount of the reduction in grass and legume cover.

(2) Performance tests will be conducted jointly by Parks Canada and CP Rail after three years of growth during which time no fertilizer has been applied.

For Woody Species Cover:

(1) Planting of woody species shall result in a stocking of woody species which is not less than 75% of the stocking rate for the site shown on the approved reclamation plans.

(2) Survival rate by percentage species composition shall not vary from the planted percentage species composition by more than 20%.

(3) Growth rate of the stock shall not be less than 20% of the growth rate of the surrounding undisturbed native vegetation based on a measure such as leader growth extension.

(4) The growth rate shall be measured after two consecutive growing seasons without fertilization.

Park setting.

The 1985 construction season saw the completion of a significant portion of the new grade. In many cases, the cuts and fills along the new grade were advanced to a point where reclamation activities could be conducted on the completed portions. Seeding with grasses and legumes was conducted in the early spring, late summer and late fall. A total of about 50 ha were seeded during the 1985 season. Planting of conifer trees was introduced to the program of woody species planting. A total of over 230,000 woody plants were established on the disturbed sites. Excessively dry, hot weather during the summer of 1985 resulted in the need to water the stock which had been planted. Provision for the watering of planted stock had been allowed for in the contract specifications for the revegetation contract. A hydroseeder was used to transport water to the sites being reclaimed. Watering was conducted during the early mornings and late evenings to avoid excessive evaporation during the days. A loss of about 3 percent of the stock which was planted in 1985 was attributed to the hot, dry weather. This loss would have been far greater had watering not been conducted.

Special reclamation techniques were applied to several sites. Live pole drains, where bundles of living cuttings of willow and cottonwood were buried in trenches at sites where seepage was resulting in the failure of the slopes, were established at several sites. The live pole drains provide a conduit for the moisture to flow from the slope without saturating the soil materials and causing slope failures. The system worked well, and by the end of the summer new shoots were apparent on the installed drains. Soil binding spray was used on several slopes to aid in the establishment of vegetation. The soil binding spray was used on two rock cuts where particularly weak rock was encountered. The spray held the fine rock particles and seed in place and allowed the seed to germinate and grow without being washed from the slope. The rock cuts were established at a slope of about 51 degrees. Establishment of vegetation on these slopes will aid in the amelioration of the negative visual impacts of these cuts as well as helping to hold the rock in place. Soil binding spray was also used on constructed slopes of the ventilation shaft access road. These slopes were constructed of a fine textured sand which proved to be highly erosive. The soil binding spray held the soil and seed in place and allowed a sod to form. Living cuttings were driven into the slope in the fall to help to hold the sod in place. These are growing and will form a dense brush cover on the slope. Further use of live pole drains, brush layers and soil binding sprays was made this spring. Several areas of instability were treated with live pole drains, and brush layers, and additional rock cuts were seeded using the soil binding spray.

The special reclamation techniques used on the Rogers Pass Project have been developed to compliment the planned program of reclamation for the project. The use of soil binding sprays and various bioengineering techniques are effective at providing a vegetation cover on particularly difficult sites. The effectiveness of these measures depends on the appropriate use of

the system. These special techniques are expensive compared to standard reclamation methods but, compared to engineering solutions, the costs are significantly less. Acceptance of these special techniques will ensure their further use in the future.

REFERENCES

Environmental Assessment Panel. 1983. CP Rail Rogers Pass development, Glacier National Park. Final report of the Environmental Assessment Panel. August, 1983. Federal Environmental Assessment Review Office. Hull, Quebec. 36 pp.

Polster, D.F. 1985. CP Rail Rogers Pass project reclamation program. *In* Restoring the land. Proceedings of the Ninth Annual British Columbia Mine Reclamation Symposium. B.C. Ministry of Energy, Mines and Petroleum Resources, Mining Association of British Columbia and Coal Association of Canada.

CLRA
ACRSD

CANADIAN LAND RECLAMATION ASSOCIATION

ASSOCIATION CANADIENNE DE REHABILITATION DES SITES DEGRADES

ELEVENTH ANNUAL MEETING

LAND REHABILITATION:
Policy, Planning Systems and Operational Programs

June 3 - 6, 1986

University of British Columbia
Vancouver, B.C.

CANADIAN LAND RECLAMATION ASSOCIATION

ASSOCIATION CANADIENNE DE RÉHABILITATION DES SITES DÉGRADÉS

BOX 682 - GUELPH, ONTARIO, CANADA - N1H 6L3

ISSN 0705-5927

ELEVENTH ANNUAL MEETING

LAND REHABILITATION:
Policy, Planning Systems
and Operational Programs

June 3 - 6, 1986

University of British Columbia
Vancouver, B.C.

CANADIAN LAND RECLAMATION ASSOCIATION

Box 682, GUELPH, ONTARIO
CANADA N1H 6L3

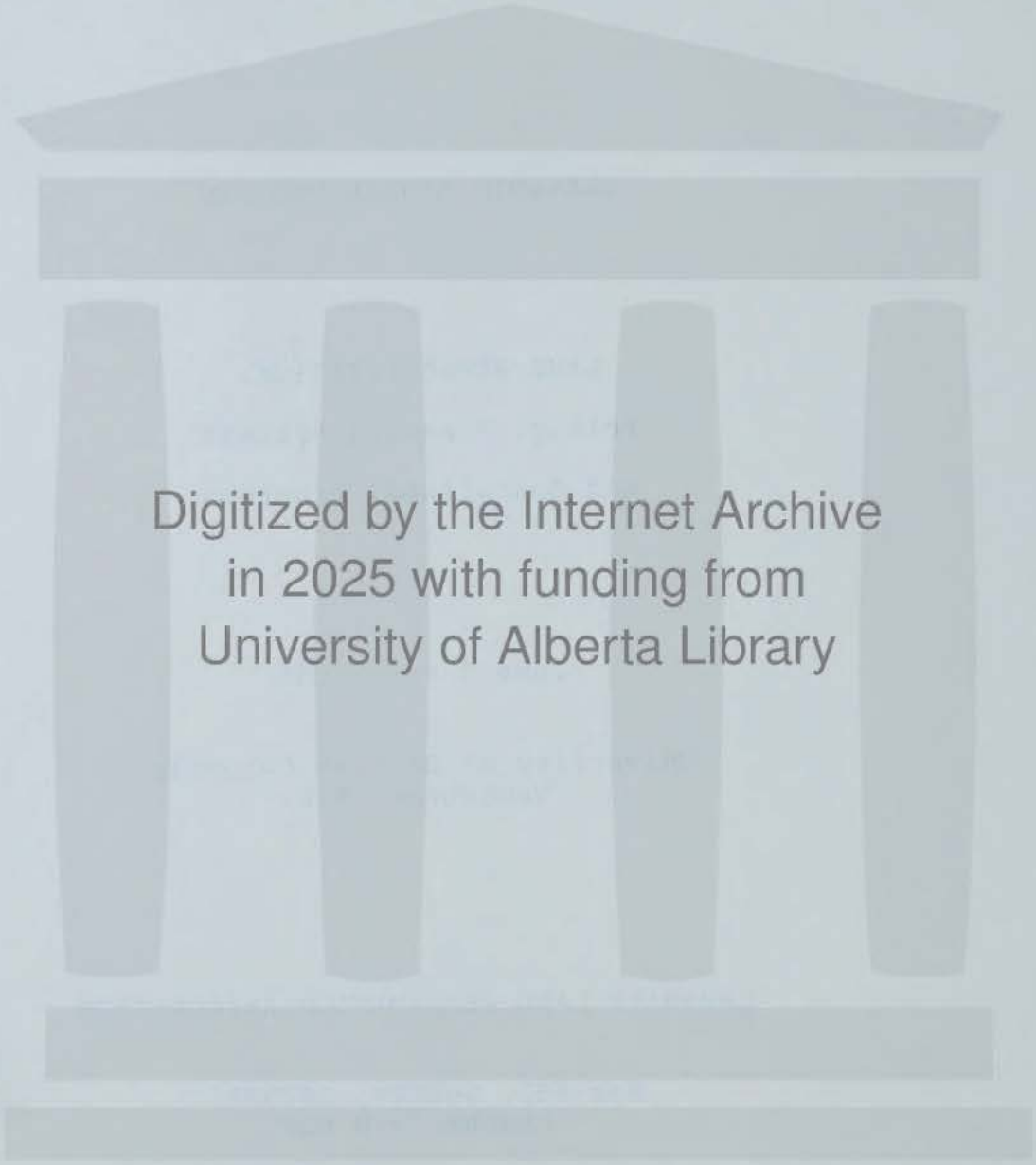

TABLE OF CONTENTS

FOREWORD

The British Columbia Chapter of the Canadian Land Reclamation Association was formed in 1985 to provide a local public forum for the exchange of information and experience in land rehabilitation. Comprised of professionals from a wide range of backgrounds and interests, this organization pulled together quickly to host the 1986 Annual Meeting. The diverse membership in the B.C. Chapter was realized in a program that expanded the scope of the conference to include many fields that have not been represented in past programs. The quality of presentations and range of topics kept audience participation at a spirited level. It is our hope that we have initiated a trend to widen the scope of the annual meetings so as to not focus on traditional mining or energy development issues.

I wish to thank all speakers and attendees for making this first formal function of the B.C. Chapter a success. The enthusiastic support of chapter members in the planning and administration of the conference demonstrated a strong desire for a quality meeting. This drive bodes well for the future of our chapter.

A great deal of effort went into the publication of the proceedings of the 1986 Annual Meeting. Care was taken to accurately reproducce all papers, however minor errors may have escaped the review process. We hope that this will not detract from the information presented by the authors.

May the CLRA and all local chapters continue to grow and function as a focal point for land rehabilitation.